

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

**Bradford Non-Lethal Weapons Research Project  
(BNLWRP)**

**Research Report No. 7**

**Neil Davison  
Nick Lewer**

**May 2005**

# **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 questions 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.brad.ac.uk/acad/nlw/research\\_reports/](http://www.brad.ac.uk/acad/nlw/research_reports/)

- 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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## Acronyms

ACLU	American Civil Liberties Union
ACPO	Association of Chief Police Officers (England and Wales)
ACPOS	Association of Chief Police Officers Scotland
ADS	Active Denial System
AEP	Attenuating Energy Projectile
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.)
ATL	Advanced Tactical Laser
ATM	Anti-traction materials
BNLWRP	Bradford Non-Lethal Weapons Research Project
BTWC	Biological and Toxin Weapons Convention
BW	Biological Weapons
CR	Dibenz(b,f)-1:4-oxazepine
CS	Ortho-chlorobenzalmalononitrile / tear gas
CW	Chemical Weapons
CWC	Chemical Weapons Convention
DE	Directed Energy
DIA	Defense Intelligence Agency (US DOD)
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.)
ECBC	Edgewood Chemical and Biological Center (U.S. Army)
EMDT	Electro-Muscular Disruption Technology
ERF	Emergency Reaction Force
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
ICRC	International Committee of the Red Cross
IPCC	Independent Police Complaints Commission
JAG	Judge Advocate General
JNLWD	Joint Non-Lethal Weapons Directorate (U.S.)
KE	Kinetic Energy
LIPC	Laser Induced Plasma Channel Technology
LRAD	Long Range Acoustic Device
MCCM	Modular Crowd Control Munition
MPA	Metropolitan Police Authority
MPS	Metropolitan Police Service
MWD	Military Working Dog
NATO	North Atlantic Treaty Organisation
NCIS	National Criminal Intelligence Service (U.K.)
NDIA	National Defense Industrial Association
NFDD	Noise Flash Diversionary Device
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
NTAR	Non-lethal Technology and Academic Research Symposium
OC	Oleoresin Capsicum
OFT	Office of Force Transformation (U.S. Military)
OOTW	Operations Other Than War
PADS	Portable Active Denial System
PAVA	Synthetic Oleoresin Capsicum (OC)
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
RGES	Running Gear Entanglement System
SMBI	Stress and Motivated Behavior Institute (U.S.)
TACOM	Tank-automotives and Armament Control (U.S. Army)
TAPM	Taser Anti-Personnel Munition
TUGV	Tactical Unmanned Ground Vehicle
UAV	Unmanned Aerial Vehicle
VLAD	Vehicle Lightweight Arresting Device
VMADS	Vehicle Mounted Active Denial System
XREP	Extended Range Electronic Projectile

# 1. INTRODUCTION AND COMMENTARY

## Introduction

The length of this Bradford Non-Lethal Weapons Research Project Report No.7 again reflects the interest related to non-lethal weapons from academics, research institutes, policy makers, the police and the military.

A number of reports, particularly concerning the Taser electro-shock weapon, have been published from these sectors since our last BNLWRP Report No.6 in October 2004. Some, such as the Amnesty International (U.S. and Canada) have again raised, and stressed, the concerns about the safety of the weapon and the number of deaths associated with its use. Others, such as the Joint Non-Lethal Weapons Human Effects Center of Excellence (HECOE), *Human Effectiveness and Risk Characterization of the Electromuscular Incapacitation Device – A Limited Analysis of the TASER*. (March 2005) concluded that the Taser was relatively safe, but that further research was needed into potential bio-effects, and for continual development into a safer weapon. Reaction to these reports was mixed. Some US legislators called for limitations on the use of Tasers, more accountability, and the detailed recording of incidents in which they were used.<sup>1</sup> Others called for a ban on their use until more testing was carried out regarding their potentially harmful effects. A number of US police forces stopped the use of Taser, slowed down the deployment and ordering of the weapons, reviewed their rules of engagement and reporting, and revisited their operational guidelines. The International Association of Chiefs of Police (IACP) published the *Electro-Muscular Disruption Technology (EMDT). A Nine-Step Strategy For Effective Deployment*. (April 2005) as a response to these growing concerns. Certain elements of the media, especially *The Arizona Republic*<sup>2</sup> and others, took a hostile view of what they considered the scandal of the number of deaths and associated serious injuries caused by the Taser. Taser International challenged allegations that their weapon was directly responsible for these deaths and quoted reports, such as the Madison Police Department report (February 2005), the study by McDaniel, W & Stratbucker, R & Nerheim, M & Brewer, J. *Cardiac Safety of Neuromuscular Incapacitating Defensive Devices* (January 2005), and the *U.K. DOMILL Statement* (March 2005) to support their view. The controversy continues.

Other than Tasers, there are still few reports of the newer non-lethal technologies actually being deployed in operations. The exception to this is the Long Range Acoustic Device (LRAD), which is now in widespread use in Iraq. Little additional information has appeared regarding the ‘active denial’ weapon we have described in previous reports.

## Torture

We have previously highlighted the misuse of non-lethal weapons for torture, particularly as described by the Amnesty International (AI) Report in 2003.<sup>3</sup> As the next section will describe, Tasers are reported to have been used by some U.S. soldiers to torture detainees in Iraq. We urge police and military authorities to keep improving accountability and record keeping of who is issued with Tasers, and when, where, and how they are discharged. Linked to this is good training and education and, as the AI November 2004 Report<sup>4</sup> urges, law enforcement agencies should ensure that officers are trained to use force in accordance with the (UN) Code of Conduct for Law Enforcement Officials and the Basic Principles on the Use of Force and Firearms by Law Enforcement Officials.

## New BNLWRP Publications

We have recently published a paper: Lewer, N & Davison, N. 'Non-Lethal Technologies – An Overview'. *Disarmament Forum*, January 2005, No.1, pp.36-51. A book is to be published by Routledge in the Summer 2005 [Lewer, N (Ed) *Non-Lethal Weapons: Developments and Deployments. A Soft Power Approach To Conflict Resolution?*], which will contain the papers presented at our non-lethal seminar 'New Non-Lethal Weapons Technologies: Implications for British Policing' held at Bradford in November 2004, plus invited authors writing on non-lethal weapons in South Asia, military applications, concerns over biochemical incapacitating weapons, and perspectives from international humanitarian law.

## Use of NLWs in prisoner abuse

It is now evident that the Taser has been used to abuse prisoners in Iraq by at least one group of US soldiers.<sup>5</sup> In December 2004 the American Civil Liberties Union (ACLU) obtained a memo under a Freedom of Information request detailing abuses by US Special Forces soldiers at 'Temporary Holding Facility' for prisoners near Baghdad airport. The June 2004 memo written by the Director of the US Defense Intelligence Agency (DIA) detailed complaints by DIA personnel at the facility about abuses carried out by soldiers from Task Force 6-26. According to the memo the DIA interrogators saw: "Prisoners arriving at the Temporary Detention Facility in Baghdad with burn marks on their backs. Some have bruises, and some have complained of kidney pain."<sup>6</sup> The memo also states that one DIA interrogator "...witnessed TF 6-26 officers punch a prisoner in the face to the point the individual needed medical attention."<sup>7</sup> On 8 December 2004 Lawrence Di Rita, US Principal Deputy Assistant Secretary of Defense for Public Affairs, was asked at a Department of Defense news conference about the incidents described in the memo and he described the results of the subsequent investigation:

Based on the results of this specific investigation, four individuals received administration [sic] punishments for excessive use of force. In particular I'm advised that it was the *unauthorized use of Taser*.<sup>8</sup> [emphasis added]

Di Rita was questioned further:

Q: Larry, you said that four of these people had received administrative punishment for what you believe was inappropriate use of the Taser.

DI RITA: I am given to understand that was one of the specific charges or one of the specific transgressions.

Q: Would you agree with critics who would say that the inappropriate use of a Taser would be tantamount to torture?

DI RITA: I have nothing to say on that. I just don't know. I mean, I don't know that I would agree with that.<sup>9</sup>

So, whilst it has not been positively corroborated, there are strong suggestions that a Taser caused the burn marks observed on the prisoners' backs. Taser strikes are known to leave small burn marks on the skin particularly if discharged repeatedly on the same spot.

This incident raises questions about the use of the Taser elsewhere in Iraq. In a November 2004 report Amnesty International noted that:

While few details have been provided about the use of Tasers by US military forces, one of the units deploying them in Iraq in 2003 was the 800th Military Police Brigade, accused of grave abuses in Abu Ghraib prison.<sup>10</sup>

Pepper spray is another NLW commonly used in US prison camps, particularly during ‘cell extractions’ by teams known as the ‘Emergency Reaction Force’ or ‘Immediate Response Force’. The British lawyer representing a Libyan citizen (who is also a UK resident) held at Guantanamo Bay described the abuse he suffered there, as reported by *BBC News*<sup>11</sup> and *The Times*<sup>12</sup> in February 2005:

They held both of his eyes open and sprayed pepper spray into his eyes and later took a towel soaked in pepper spray and rubbed it in his eyes," he said.

He said one of the officers then pushed his finger into the detainee's right eye, which left him "totally blind" in that eye.<sup>13</sup>

Also in February 2005 the *Associated Press* described a report from US Southern Command, who were reviewing videotapes of the ‘Immediate Response Forces’ at Guantanamo Bay. According to *AP* the report authors described one video clip that “...captured a platoon leader taunting a detainee with pepper spray and repeatedly spraying him before letting the reaction team enter the cell.”<sup>14</sup>

Upon their release several of the UK citizens held at Guantanamo Bay accused their captors of abuse and mistreatment, which involved the use of pepper spray. A statement written by Shafiq Rasul, Asif Iqbal and Ruhel Ahmed included the following:

...if you said you didn't want to go to interrogation you would be forcibly taken out of the cell by the ERF team. You would be pepper-sprayed in the face which would knock you to the floor as you couldn't breathe or see and your eyes would be subject to burning pain. Five of them would come in with a shield and smack you and knock you down and jump on you, hold you down and put the chains on you. And then you would be taken outside where there would already be a person with clippers who would forcibly shave your hair and beard. Interrogators gave the order for that to be done; the only way in which this would be triggered would be if you were in some way resisting interrogation, in some way showing that you didn't want to be interrogated. Or if during interrogation you were non-cooperative then it could happen as well.<sup>15</sup>

A statement by another Briton, Tarek Dergoul, quoted in an October 2004 Human Rights Watch report included the following description:

If I refused a cell search MPs would call the Extreme Reaction Force who came in riot gear with plastic shields and pepper spray. The Extreme Reaction Force entered the cell, ran in and pinned me down after spraying me with pepper spray and attacked me. The pepper spray caused me to vomit on several occasions. They poked their fingers in my eyes, banged my head on the floor and kicked and punched me and tied me up like a beast. They often forced my head into the toilet.<sup>16</sup>

A recent US Department of Defense draft publication “Joint Doctrine for Detainee Operations”, dated 23 March 2005<sup>17</sup> describes most recent policy on use of force in ‘detainee operations’ and sets out a ‘force continuum’ with 5 levels from no force for compliant prisoners (Level 1) to lethal force for prisoners attempting to kill or inflict serious injury

(Level 5). Non-lethal weapons are advocated for use at several points on this ‘force continuum’. At Level 3, if prisoners are actively resistant, which is defined as “does not follow orders and offers physical resistance but does not attempt to inflict harm (e.g., bracing or pulling away; attempting to flee)”<sup>18</sup>, then “hard controls” are authorized. These are described as:

Used when escort positions fail and the level of force required escalates. Have a slightly greater possibility of causing injury. (e.g., pressure points, joint locks, oleoresin capsicum (OC) spray, electronic stun devices.)<sup>19</sup>

An annex of the report on ‘Riot Control Measures’ notes: “The use of pepper irritant can be a valuable non-lethal tool.”<sup>20</sup> If prisoners attempt to hit or bite a guard (Level 4) then “defensive techniques” are authorised which include “empty-hand strikes and blocks, baton strikes and blocks, nonlethal munitions, military working dogs (MWDs).”<sup>21</sup> At Level 5 lethal force is authorised as a last resort:

Used to prevent death or serious injury to self or others; to prevent the theft, damage or destruction of resources vital to national security or dangerous to others; to terminate an active escape attempt.<sup>22</sup>

According to the document this level of force may include using a firearm or “non-lethal weapons directed at vital points of the body.”<sup>23</sup>

Some commentators have argued that abuses committed in military prison camps have been similar to those occurring at prisons in the USA.<sup>24</sup> The two articles from the *New Republic* and the *New York Times* followed a videotape broadcast in April 2004 from a young offenders prison in California that showed pepper spray used to subdue two inmates, following which a prison guard hit one of the prisoners 28 times whilst he was sitting on top of him on the floor. Furthermore, even though the prisoner was not moving or resisting, another prison guard then fired at him using a Pepperball gun.<sup>25</sup>

In his recent book, *The Men Who Stare At Goats*, Jon Ronson draws connections between military intelligence, ‘psychological operations’, interrogations in Afghanistan and Guantanamo Bay, and non-lethal weapons. He argues that the purpose of using flashing lights and loud music or noises during these interrogations is more profound than sleep deprivation and stress, suggesting that the aim is to incapacitate prisoners through effects on the brain.<sup>26</sup> A number of e-mails highlighting concerns expressed by FBI personnel over military interrogations at Guantanamo Bay, (released by the US Government and published by the American Civil Liberties Union [ACLU] ), describe the use of strobe lights and loud music during interrogations.<sup>27</sup> Non-lethal weapons developers have looked at the use of stroboscopic optical devices to induce the ‘bucha effect’,<sup>28</sup> which is defined as “high intensity strobe lights which flash at near human brain wave frequency causing vertigo, disorientation, and vomiting.”<sup>29</sup> A December 2004 NATO report on NLWs, *Non-Lethal Weapons and Future Peace Enforcement Operations*, noted that a “Laser with stroboscopic radiation” could be used as a non-lethal weapon: “A stroboscopic effect of frequency between 7 and 12 Hz can provoke severe discomfort and nausea in a group of persons.”<sup>30</sup> Once again there is potential for non-lethal technologies to be misused for torture.

## Medical Ethics

In the December 2004 issue of the *American Journal of Bioethics* Jonathan Moreno, Professor of Biomedical Ethics at the University of Virginia, draws attention to ‘Medical Ethics and Non-Lethal Weapons.’<sup>31</sup> His article reiterates the ethical issues surrounding the involvement of medical professionals in non-lethal weapons development, as previously discussed by Robin Coupland of the International Committee of the Red Cross.<sup>32</sup> Moreno makes the following recommendation:

From NLWs to the treatment of terrorists, it is time for a respected, independent entity such as the Institute of Medicine (IOM) to commission a study of these emerging challenges to medical ethics in the context of terrorism and national security.<sup>33</sup>

The *New Scientist* published an editorial in March 2005 detailing research in the US to develop a Pulsed Energy Projectile (PEP) directed energy weapon<sup>34</sup> (see the Directed Energy section of this report), which raised serious ethical concerns over the research:

There is something chilling about turning research intended to ease suffering into a weapon that can be used to hurt people. Nociceptors, nerve cells that convey pain in the body, have been studied by researchers trying to relieve chronic pain. It emerged this week that a group working for the Pentagon is using that knowledge to turn the tables: to maximise the pain caused by a non-lethal weapon called Pulsed Energy Projectile (PEP). So it is no surprise that pain researchers have reacted in horror to the plan.<sup>35</sup>

This research was presented at the November 2004 Non-Lethal Technology and Academic Research (NTAR) Symposium at the University of New Hampshire, a forum where researchers, who are funded by the Joint-Non Lethal Weapons Directorate (JNLWD) through the Non-Lethal Technology Innovation Center (NTIC), present their results.<sup>36</sup>

Another example from the NTAR conference of medical research being channelled into weapons development is based on a new technology developed by the Center for Bioelectrics, which is a joint venture between the College of Engineering and Technology at Old Dominion University, Virginia and Eastern Virginia Medical School. The Air Force Research Laboratory (AFRL) funds the Center. Potential benefits of the new technology are described on the Center for Bioelectrics’ web site:

Bioelectrics refers to the use of pulsed power, or the application of powerful electrical pulses, for extremely short periods of time, to manipulate biological cells, tissues and/or organisms. Researchers at the Center for Bioelectrics are testing the use of these high-intensity electrical surges to remove diseased or unwanted cells or groups of cells, such as tumors. Use of this technology in medicine and biology is the first of its kind in the world. The biomedical applications, based on ultrafast pulse-cell interactions, have extraordinary potential to treat persons with cancer, cardiovascular disease and other conditions.<sup>37</sup>

However the US Air Force’s interest in the technology is less altruistic. Part of the research effort, which was jointly presented at NTAR 2004 by the Center for Bioelectrics and the AFRL, addresses “Neuromuscular Disruption with Ultrashort Pulses”<sup>38</sup>. The purpose of the research is to find a way of using the technique to cause electrical incapacitation in humans for use as a non-lethal weapon.<sup>39</sup>

The Stress and Motivated Behaviour Institute (SMBI) brings together researchers from the Neuroscience and Medicine departments at the New Jersey Medical School.<sup>40</sup> Their research

investigates the neurobiological basis of stress and anxiety with a view to contributing to the understanding of stress related physical and mental illness, and with a particular focus on Gulf War Syndrome and women's mental health. In addition it is examining the relationship between stress and learning, memory and coping. However, the SMBI is also investigating the military applications of its research and seeking to help develop non-lethal "suppressive means" for the military and police.<sup>41</sup> Indeed the SMBI was originally set up in 2002 with a grant from the US Army's Armament Research, Development and Engineering Center (ARDEC) at Picatinny, New Jersey with the main purpose of studying "target suppression".<sup>42</sup> ARDEC describes itself as the US Army's 'Center of Lethality' and conducts advanced weapons development.<sup>43</sup> One of SMBI's current weapons development projects is the use of infrasonic acoustic frequencies to cause incapacitation, which they have been testing on rodents.<sup>44</sup> The Director of SMBI is clear in the role he sees for the SMBI:

...serving two mutually supportive purposes: 1) provide ARDEC and DoD with neurobehavioral expertise, 2) organise collaborated efforts toward understanding stress-related mental and physical illness.<sup>45</sup>

Given the contrast between the stress inducing goals ("target suppression") of the Army in terms of weapons development and the stress relieving goals of treating illness, these two purposes appear more mutually exclusive than mutually supportive and certainly raise serious medical ethics concerns.

### **NATO Report on NLWs**

In December 2004 NATO's Research and Technology Organisation, published the first of several technical reports. Entitled *Non-Lethal Weapons and Future Peace Enforcement Operations* it was prepared by the Studies, Analysis and Simulation Panel (SAS).<sup>46</sup> The report is based on a multi-national exercise conducted in November 2003 that investigated the types of NLWs which may be useful for NATO peace enforcement operations in the period 2000-2020. Participants developed six scenarios that "...provided the foundation for an assessment of which basic capabilities would be of highest likelihood, impact, and NLW relevance in the 2020 timeframe." (Unfortunately the Annex giving the full analysis of the scenarios is NATO Restricted.) The capabilities seen as a requirement for 'future peace enforcement operations' were as follows:

- Deny persons from accessing an area.
- Rescue individuals/groups.
- Deny ground, air and sea vehicles from accessing an area.
- Neutralise ground vehicles.
- Protect facilities and equipment.
- Neutralise infrastructure and facilities.
- Neutralise communications.<sup>47</sup>

Five NLW technologies were identified as being most useful for use in accomplishing these tasks:

- RF devices.
- Rapid barriers (acoustic, electro magnetic, mechanical).
- Anti traction.
- Stun devices.
- Nets.<sup>48</sup>

The report argues, “These and other non-lethal technologies can be used in combination with each other to increase effectiveness and resistance to countermeasures and could be made scalable from non-lethal to lethal” and predicts that future systems will be “...more compact, lighter and hardened and will possess increased target range, area of effect and target discrimination capabilities.” In order to ‘match technology development with NATO’s future requirements’ the authors recommend investment in R&D programmes focussed on these five technologies. They note that two distinct paths are available in terms of integrating NLWs and that there are differing views as to which is most desirable: “Either lethal and non-lethal capabilities can be integrated (at the system and/or unit levels) or these capabilities can be kept separate.”

The report also gives timely consideration to associated legal and political issues. It notes the obligation of States to assess the legality of new weapons and warns,:

The existence of NLWs should not be construed as to lessen the requirements of the principle of discrimination.<sup>49</sup>

The issue of escalation, often dismissed by some advocates of NLWs, is also discussed in the report. The authors acknowledge that although the use of NLWs can provide a means to de-escalate violence their introduction “...may lead to an increase in the resort to the use of force, thus increasing the risk of escalation.” They recommend that further research be carried out on this issue. Another important issue the report touches on is the misuse of NLWs, and it concludes that NLWs are not necessarily non-lethal in their own right and that “depending on the context and circumstances, some may be misused for illegal purposes”. The report also draws attention to the issue of proliferation, recommending that:

The NATO member states should protect against the proliferation of NLW technology for illegitimate purposes through their inclusion in existing export control regimes, adequate reflection within other arms control mechanisms, and through education to promote their responsible use.<sup>50</sup>

One of the major recommendations of the report is further work to determine whether the Law of Armed Conflict adequately addresses the use of NLWs. It advises that NATO member states should “...work towards a common understanding regarding the application of existing treaties and conventions to NLW.” The report advises that increased data collection sharing on the human effects of NLWs is needed for an adequate assessment of the legality of new weapons. However, the authors are wary of further restrictions on NLW and argue that “...it will be important that nations participating in NATO operations remain vigilant against the development of specific legal regimes which unnecessarily limit the ability to use NLWs.” The report also contends that NLWs will not become a substitute for lethal weapons, and that their availability does not mean that there is any legal obligation to use non-lethal force when lethal force is authorised. There is some debate over whether this legal position will hold with the further development of NLWs but the authors of this report maintain that “...there is not foreseeable reason why this may change in the future.” Another recommendation given in the report is for increased transparency. The authors note that in order to gain acceptance from the public and NGOs for NLW use that “...it is essential to provide information and give opportunities for constructive debate.”

Although the NATO report recommends five technologies for R&D investment (RF devices, rapid barriers, anti traction, stun devices, and nets) there is consideration of a number of other ‘technologies of interest.’ This section of the NATO report discusses the advantages and

disadvantages of a variety of anti-materiel and anti-personnel NLWs. Anti-materiel weapons discussed are: RF devices (to degrade electronics); lasers (high-power lasers to destroy and low-power to dazzle); chemicals (slippery foams, sticky foams, super-adhesive substances, super-caustic substances, graphite powders); biologicals (bacteria to degrade materiel); and barriers (rapid barriers, nets/entanglements, and tyre puncturing systems). Anti-personnel weapons addressed are: microwave systems (skin heating), lasers (skin heating or dazzling), chemicals (RCA's and incapacitating agents), acoustic technologies (psychological and physical effects), barriers (rapid barriers, nets, and airbags), kinetic munitions (blunt impact), stun devices, vortex generators (acoustic and shock waves), paint and dyes (for marking), as well as combined systems.

We would like to highlight our particular concern about two of the technologies of interest described in the report. Firstly, under anti-materiel technologies of interest, there is discussion of biological weapons:

Microbial agents (enzymes, bacteria) may be used to immobilise vehicles, inactivate equipment with rubber or plastic parts, or destroying storages. The specific targets could be rubber, plastic and other petroleum products. The function of the targets would be compromised or destroyed.<sup>51</sup>

The Biological and Toxin Weapons Convention (BTWC) prohibits the development, production, stockpiling or acquisition of biological agents and delivery systems for offensive purposes. This is widely acknowledged to cover the entire class of weapons including such anti-materiel agents.<sup>52</sup> It is therefore concerning that, even though the NATO report includes the BTWC in its discussion of relevant legal instruments and does not advocate the development of these agents specifically, biological weapons are still considered as a 'technology of interest'.

Secondly, centrally acting chemical weapons are considered and described as 'technologies of interest'. The report states that chemical non-lethal weapons for use against people may include:

Non-lethal chemical technologies [that] could act on: - The central nervous system by calmatives, dissociative agents, equilibrium agents. ... - The nervous system by convulsives.<sup>53</sup>

The reports' discussion of legal issues in relation to the Chemical Weapons Convention (CWC) notes:

The CWC prohibits chemical weapons, including those that cause temporary incapacitation. Therefore, non lethal chemical weapons seemingly are prohibited. However, the use of a chemical agent for law enforcement including domestic riot control purposes is a non-prohibited purpose.

Such weapons are not recommended for specific R&D attention, perhaps because of these restrictions, but we remain concerned over the potential development of these centrally acting chemical weapons and their continued consideration as technologies of interest despite their profound effects and lethality (see our previous reports particularly BNLWRP Report No. 5 and our recent *Disarmament Forum paper*<sup>54</sup>). These chemicals are distinct from the group of riot control agents (i.e. CS, CN, OC, and PAVA), which are sensory irritants acting locally, and cannot be classified as such.

The report can be downloaded from the NATO Research and Technology Organisation web site at: <http://www.rta.nato.int/>

Other NATO reports include: *SAS-035 Non-Lethal Weapons Effectiveness Assessment*, which was published in 2004 but is NATO Restricted; and *HFM-073 Human Effects of Non-Lethal Technologies* from the Human Factors and Medicine Panel (HFM), which is now due to be published this year (2005). The follow-on work from SAS-035 is *SAS-060 Non-Lethal Weapons Effectiveness Assessment Development and Verification Study*, which is expected to continue until 2007.<sup>55</sup>

### **FN303 Death in Boston**

Just after our last report was published in October 2004 there was a fatal incident with the FN303<sup>56</sup> gun in Boston, US.<sup>57</sup> Following Boston's victory over New York in a baseball match thousands of people were out on the streets celebrating. There was some violence and vandalism. The commander of police operations in Boston authorised the use of the FN303 launcher with OC-containing kinetic projectiles. The projectiles were fired into the crowd and a 21 year-old woman, Victoria Snelgrove, was killed when one of them hit her in the left eye. Several other people were injured by other projectiles fired from the FN303 guns.<sup>58</sup> Following the incident Boston police suspended the use of the FN303 and there were reports that they would switch to a different lower power pellet gun.<sup>59</sup> Seattle Police Department also announced they were suspending the use of the FN303.<sup>60</sup> A group professors, lawyers and students gathered signatures for a petition calling for an immediate ban on the use of all less-lethal weapons in Boston.<sup>61</sup> A commission has been set up to investigate the incident, which has yet to report its findings.<sup>62</sup> It has emerged that the commander of police operations that night was not certified to use the FN303 gun<sup>63</sup>, and some have argued that the death could have been avoided if the officers had been trained in the use of the weapon and had used it correctly.<sup>64</sup> Other reports have questioned the accuracy of the FN303 and its suitability for use in crowd control situations, citing tests by Israeli police who identified accuracy problems.<sup>65</sup> According to the *Boston Globe* the commission investigating the death is seeking independent testing of the weapon.<sup>66</sup>

### **US Department of Defense R&D**

In November 2004 the Joint Non-Lethal Weapons Directorate (JNLWD), US Marine Corps published a Broad Area Announcement (BAA) seeking to fund new research and development efforts for non-lethal weapons.<sup>67</sup> It describes the areas of focus for US military R&D in this area:

- Human effects of non-lethal directed energy exposures, to include physiological and behavioural responses. (examples include high power microwaves (HPM), pulsed and continuous radiofrequency radiation (RFR), laser radiation, and laser induced plasma stimuli)
- Emerging Directed Energy Weapons (DEW) that have non-lethal applications – specifically counter-personnel, counter-material, and counter-capability missions (example include novel HPM, RFR [radiofrequency radiation], laser, and laser induced plasma sources)
- Advanced Materials that either provide or enhance non-lethal capabilities (examples include advanced anti-traction materials; engine suffocates, electrical and mechanical foulers, malodorants, thermobarics, NL nanoparticles; rigid foams/materials, morphing materials, and NL payload delivery systems or payloads for long range remote engagement; and other NL reactants)
- Human effects relating to percussive and continuous sounds, incoherent light sources, and overpressures that alone or in combination would provide operational capabilities while minimizing

adverse health effects (examples include exposure-response relationships resulting in glare and flashblindness, or behavioural responses resulting from aversive sounds.) Also includes establishing either safety thresholds or probability relationship for adverse health effects for these stimuli.

- Development of long-range acoustic and ocular technologies and devices that support operational requirements while minimizing adverse health consequences.
- Development of long-range, extended duration, wireless electro-muscular incapacitation technologies or devices (include characterization of human effect and safety issues, miniaturization and advanced technology issues, and precision targeting)
- General science and technology efforts to explore new NLW technologies and payloads
- Studies/Analyses to address technology-specific legal/treaty/public acceptability issues associated with: (1) extended duration incapacitation; (2) long-range precision engagement of threat weapon systems (counter-material); and (3) precision long-range engagement of threats (combatants vs operating in complicated operational environments such as within crowds).
- Studies/Analyses to identify and research repeatable, universal, & effective technologies to stop vehicles/vessels at a distance and extended duration incapacitation of humans.
- Development of compact millimeter-wave (MMW) and HPM NLWs; (for example, portable active denial systems (PADS) and small remotely or hand-delivered high power microwave electronic attack systems for counter-material mission and with minimal collateral damage to adjacent electronic systems or critical infrastructures.
- Investigations into the human behavioural and psychological responses to new NLW stimuli.<sup>68</sup>

The intention of funding new research efforts is cited as an attempt to overcome existing limitations of non-lethal weapons such as: range, accuracy, effectiveness, universality of effect, safety, weight and size. According to the Marine Corps web site as of February 2005, an initial review of proposals submitted under this announcement has been completed, and the Marines are waiting for release of their budget before funding those selected.<sup>69</sup> The budget for funding these proposals will be “approximately \$8.2 million for FY05, \$8.4 million for FY06, \$7.4 million for FY07, \$16.8M for FY08 and \$16.8 million for FY09.”<sup>70</sup>

In February 2005 the Department of Defense submitted its proposed FY 2006 budget to Congress. The budget for the non-lethal weapons programme seems set to stay around \$44 million per year for FY 2006 and FY 2007.<sup>71</sup>

The US Air Force Research Laboratory Human Effectiveness Directorate co-ordinates the DOD’s work on the human effects of non-lethal weapons. In March 2005 they announced funding of \$24.9 million to “...conduct innovative research on the effects of directed energy technologies and Non-Lethal Weapons (NLW) on humans and animals.”<sup>72</sup> Research will seek to characterise the physiological and psychological effects of NLWs on individuals and groups. The research has now reoriented towards ‘effects-based’ design of weapons and, according to the announcement:

The ultimate goal of such research is to develop a fully articulated theory, with supporting predictive models that will facilitate the inducement of desired behavioral effects in individuals and groups through the use of NLWs.

Specific areas of research for NLWs listed in the document include:

- Toxicology**, including Riot Control Agents (RCAs), industrial by products, combustible materials and their byproducts
- Blunt Trauma**, including dermal penetration and perforation, insult to soft tissues, organs, and skeleton
- Acoustic/Auditory, Ocular/Visual, Dermal/Haptic, Olfactory**: including sensory degradation and physiological damage, effects on attention and intention, and complex behaviour such as decision-making and communication
- BioElectrics**: including modelling current flow through the body, bioeffects on organs, central nervous system, vascular and neuromuscular and endocrine function
- Central Nervous System (CNS)**: including neurotransmitters, myelination, inhibition
- Individual vs Collective Behavior**: including interaction between social and cultural theories of collective behavior and NLWs
- Interaction between multiple Human Effects**: including modeling physiological effects as a result of multiple application of same NLW, or application of multiple NLWs, modelling of motivational, emotional, and cognitive processes as a function of above multiple applications of NLWs, extension of such modelling to predict behaviour or individuals and crowds.
- Database**, construction and maintenance of a comprehensive database on Human Effects research as applicable to NLWs<sup>73</sup>

With regard to directed energy NLWs research will concentrate on the following areas:

- Identify novel uses of directed energy as a weapon against biological targets or as a non-lethal weapon. Research leading to prototyping of directed energy devices and the assessment of biological vulnerabilities and protection
- Investigate the biological effects of novel weapon technologies
- Conduct bioeffects research to provide optimal parameters to system designers
- Determine the effects of electromagnetic and biomechanical insults on the human -body
- Identify synergistic effects of using combinations of non-lethal weapons<sup>74</sup>

## US National Institute of Justice R&D

The National Institute of Justice (NIJ) made two recent announcements seeking ‘concept papers’ for new research on non-lethal weapons. In December 2004 a solicitation covering *Less-Lethal Pursuit Management Technologies* called for proposals on:

- Developing new technologies to incapacitate personnel.
- Developing means to deliver effectively less-lethal force independent of range or environment.
- Acquiring, recording, and analyzing less-lethal device-induced injury data.
- Developing improved technology to manage high-speed vehicular pursuits.<sup>75</sup>

A February 2005 solicitation addressed *Outcomes of Police Use of Force*:

NIJ is interested in research that will enable law enforcement personnel to make informed decisions and create sound policies regarding use of force. We seek outcome evaluations of specific use of force technologies and/or strategies. NIJ is particularly interested in the relative likelihood of injury to officers, suspected offenders, and bystanders in situations where the police do or do not have access to less-lethal weaponry. Proposed research might evaluate the efforts of specific police departments and/or study the results of introducing less-lethal technologies. Applicants should seek to answer the question of how less-lethal technologies change the dynamics and outcomes of police use of force (from personal, physical confrontation to the use of firearms).<sup>76</sup>

In October 2004 NIJ also published a lengthy report detailing the types and manufacturers of non-lethal weapons currently available to the US Department of Defense: *Department of*

## **US Department of Homeland Security R&D**

The US Department of Homeland Security (DHS) is also seeking to fund the development of new non-lethal weapons through the Homeland Security Advanced Research Projects Agency (HSARPA). The objective stated in the January 2005 solicitation, *Innovative Less-Lethal Devices for Law Enforcement Technology Areas*, is to “Develop and demonstrate innovative less lethal devices for use by law enforcement officials that are inexpensive, safe, lightweight, man portable, and easy to use.”<sup>78</sup> According to the announcement they are particularly interested in:

...radio frequency (RF), dazzlers (lasers or bright lights), or untethered electro-muscular disruptor devices. Combination of modes should also be considered to enhance the effectiveness of the device.<sup>79</sup>

## **2. FOCUS. Conference Report: Non-Lethal Defense VI**

The theme for the Non-Lethal Defense VI conference held in Reston, Virginia from 14-16 March 2005 reflected the US Department of Defense's current preoccupation: 'Non-Lethal Weapon Options in the Global Fight Against Terrorism'. The programme, which was sponsored by the Joint Non-Lethal Weapons Directorate (JNLWD), focused on the US military's Joint Non-Lethal Weapons Program. Presentations and fora covered current use of NLWs in Iraq and elsewhere, desired capabilities and future developments, human effects, and NLWs in homeland security. The conference, a meeting place for representatives from the military and the arms industry, was squarely aimed at articulating the military's 'capability gaps' and encouraging industry to further technological development in the field. Our attendance provided an opportunity to gauge current military thinking on non-lethal weapons. What follows is a discussion of some of the main themes that arose during the course of the two and a half days.

According to the organisers presentations from the conference will be available in due course at: [www.dtic.mil/ndia/2005nonlethdef/2005nonlethdef.html](http://www.dtic.mil/ndia/2005nonlethdef/2005nonlethdef.html)

### **Confronting the Critics**

Public relations continues to be a big issue for those working in and around the US Joint Non-Lethal Weapons Program, the majority of whom feel that they have been unfairly criticized by the media and other independent observers. The consensus is that the media 'just don't get it' or 'are missing the point'. This was a theme that was revisited many times during the course of the conference with speakers and panellists repeatedly asked for their opinions on how they might start to win the public relations battle. John Alexander, a retired Colonel in the US Army and long-time non-lethal weapons advocate, opened proceedings with a combative presentation that attempted to negate all concerns that have been raised in relation to NLW development. His approach reflected the frustrations felt amongst those working on NLW development who feel their work has a revolutionary quality. He argued that there was no evidence that NLWs would reduce the threshold for initiation of conflict and that the relatively low investment in NLWs precluded arms racing. He rejected the idea that NLWs could be used to facilitate torture, arguing that it was the intent of the user rather than the technology that determined its use or misuse. He admitted that NLWs could cause some deaths or serious injuries but asked 'compared to what?' and argued that recent concerns voiced over Taser in the US showed that critics such as Amnesty International 'must have an agenda'. He accepted that NLWs can be used as a precursor to killing but suggested that this is 'not such a bad idea' in some cases, citing the example of the Moscow theatre siege in 2002 when the hostage takers were shot and killed while unconscious from the effects of an incapacitating agent. He added that the issue of chemical and biological weapons should be revisited for non-lethal weapons purposes arguing that international law prohibiting their development is 'outdated'. He went on to argue that concerns over the use of NLWs to suppress dissent are unnecessary since such suppression can already be carried out with lethal force. Finally he dismissed concerns over insufficient data about the human effects of NLWs. Addressing the issue of population groups who may be more susceptible than others to certain weapons (e.g. effects of electrical weapons on drug users or those with heart disease) he assured us that 'blind deaf midgets with Parkinson's disease aren't likely to commit crimes'.

Over lunch on the first day of the conference a representative from the Office of the Assistant Secretary of Defence for Public Affairs discussed strategies to counteract critical viewpoints of the non-lethal weapons programme in the media. She encouraged those present to keep repeating a positive message particularly when there was a negative story published, and not to shy away from commenting. If there was negative coverage about an important programme that could be derailed by the general public or congress then they would ‘really go after them’, she said. She indicated that officials would give increased information access to ‘bread and butter military journalists’ as opposed to the ‘60 minutes type journalists’ in return for more positive coverage. She also advocated a strategy of targeting military analysts working for various news media and getting them on message. She admitted, however, that they ‘still don’t know how to handle the bloggers’.

The irritation voiced at the conference, particularly with regard to media coverage that paints non-lethal weapons in an entirely negative light or that is simply inaccurate, is understandable. However, the evangelical zeal with which some advocate these types of weapons systems, combined with an all-consuming operational focus on a “global war on terrorism”, do seem to encourage a kind of group tunnel vision that can lead to the dismissal of legitimate concerns raised by outside observers, as exemplified in John Alexander’s opening presentation. Perhaps the best course of action, and a more constructive approach, as suggested by a representative from Human Rights Watch during a question and answer session, would be for the US military and others to fully engage with their critics in a more transparent manner on these important issues.

### **Funding the Next Breakthrough**

Another major theme of the conference was funding. Several speakers and panellists from the military made it clear that the Department of Defense (DOD) was not going to find extra funds for new NLW technology development, especially given the costs of current operations in Iraq and Afghanistan. They called on industry to invest in developing new systems assuring them that their products would be purchased if they help fill the military’s current ‘capability gaps’. For industry, however, this is a riskier strategy and they seek investment from the military to enable technology development. Lieutenant General Jan Huly, Deputy Commandant for Plans, Policies, and Operations, US Marine Corps, stated that one of the main barriers to progress was that companies do not see financial opportunities in NLW development. He assured industry representatives that there would be money available to purchase useful new systems, but maintained that DOD would not be able to fund the effort to develop these new technologies. The lack of investment due to this situation is a major inhibitory factor in the further development of non-lethal weapons. It is worth noting, therefore, that despite all the discussion of non-lethal weapons they are still a very small part of the military machinery.

### **Current Operations**

There has been little publicly available information on the use of non-lethal weapons in Iraq and Afghanistan, and so discussions of current operations provided some insight. It seems the major use of NLWs has been in prison camps (see below) but they have also been used in other operations, particularly in protecting convoys and in stopping vehicles. According to panellists in a session on ‘Current Operations’ the most effective NLWs used in Iraq have been the FN303, the Taser X26, and the Vehicle Lightweight Arresting Device (VLAD) or X-Net. One of the US military’s main concerns in Iraq is the use of improvised explosive

devices (IED) against vehicle convoys, and so soldiers try to stop people or crowds getting close to the vehicles. The Taser has been used for this purpose and reportedly the laser sight is sometimes sufficient to deter people from approaching. At vehicle checkpoints, in addition to the VLAD, bright lights have been used to dazzle drivers, but the dusty conditions have limited their effectiveness. The use of a green 'veiling glare' laser device is being investigated. Apparently the Mobility Denial System (MDS), a spray system of super-lubricant material to deny movement of people and vehicles, will be fielded next year.

One panellist said that the key to successful use of NLWs was training, confidence in use and rules of engagement. A number of other speakers emphasized the importance of training. One US Army advisor on NLWs, describing training of soldiers with the Taser, said that training programmes articulated the difference between incapacitation and torture in order to prevent abuses. The Taser was only fielded by certified people, which he said had prevented misuse. Unfortunately the weapon has been misused in Iraq. As we have already noted in the Introduction and Commentary section of this report, in December 2004 it emerged that four US Special Forces soldiers were disciplined for excessive use of force on prisoners specifically relating to unauthorized use of the Taser. Interestingly the panellist cautioned that companies should think twice about making such non-lethal weapons available for purchase over the Internet since their use cannot be controlled if they are obtained in this way. In theory an individual soldier could purchase a Taser over the Internet and then take it with them to Iraq.

#### *Camp Bucca, Iraq*

A military police Master Sergeant recently returned from Camp Bucca, now the main prison camp operated by the US military in Iraq, gave a presentation on the types of non-lethal weapons used there. He described a riot which occurred at Camp Bucca in January 2005, during which time prisoners had used slingshots to hurl rocks at troops. After the use of non-lethal weapons had failed to bring the situation under control, troops opened fire with lethal weapons killing four prisoners.<sup>80</sup> The speaker said that non-lethal weapons are used in various situations including as a 'punishment tool' if prisoners do not comply with the rules of the camp. The camp itself consists of a series of large compounds, each guarded by two 30-foot towers and a perimeter. Prisoners are housed in a series of 25 x 30 foot tents, each holding 25-30 people. The size of each compound and the height of the guard towers means that range is the main limiting factor to the utility of NLWs from the point of view of the military police. Weapons used at the camp include the 12-gauge shotgun with non-lethal munitions, OC canisters, M203 grenade launcher with various munitions, X26 Taser, Modular Crowd Control Munition (MCCM), and the FN303 system.

The speaker described the use of the various weapons and gave his opinion on their utility. Regarding the 12-gauge shotgun non-lethal munitions the military police found that beanbag rounds were most effective because they delivered the 'most punch'. However their range was limited and so prisoners learnt to avoid areas of the camp which were in range of the weapon. The M84 flash-bang grenade<sup>81</sup> is used to distract people and was normally thrown from the towers, or used by the Extreme Reaction Force (ERF) when they enter a compound. These grenades were reportedly effective, but the speaker described how they were used too frequently and so the prisoners learnt to turn their heads and cover their ears. He said the most effective weapon for use in the prison camp was the M203 grenade launcher<sup>82</sup>, which is a 40mm system mounted under the M16 assault rifle and fires the M1006 sponge round<sup>83</sup> and the M1029 area round<sup>84</sup> amongst others. Apparently, it was the only weapon that had

sufficient range to reach all parts of the compound from the guard towers, and was more powerful than other weapons therefore leading to what he described as ‘increased compliance.’ The M1006 is a plastic round with a sponge tip that is fired at an individual from 10-50 metres, and the M1029 disperses a number of rubber balls for use against small groups of people. Both small OC canisters and large OC ‘foggers’ were used, OC being described as effective during the transfer and escort of prisoners. OC sprayers were also used for area denial to keep prisoners away from the perimeter fence, but effectiveness was dependent on the weather. If sprayed at a large crowd it was only be effective against the people at the front. Reportedly a ‘water truck’ with hose was also used to spray prisoners and was deployed when temperatures got below freezing. The Modular Crowd Control Munition (MCCM)<sup>85</sup>, a variant of the claymore land mine but filled with rubber balls, was also used for perimeter security, although it could not be permanently deployed because the heat would melt the rubber balls inside. Wardens improvised by mounting the MCCM on the front of humvee vehicles from which they could be fired at groups of prisoners. Apparently the X26 Taser was used to ‘maintain compliance during close detainee operations’ including escorting prisoners. Reportedly it was not as effective in winter because the barbs could not penetrate the additional clothing worn by prisoners. (Taser Inc. subsequently developed a longer barb version of the cartridge that overcame this problem). The FN303 has also been subsequently deployed to Camp Bucca and the speaker remarked that he had heard good reports of its because of the longer range than the shotgun. The speaker summarised that non-lethal weapons had been effective at ‘conditioning a response’, but that it was important from their point of view for the guards to use multiple weapons and rounds so that prisoners could not predict what was being used and employ countermeasures. The M203 grenade launcher had been most effective due to its long range and effectiveness at ‘keeping people down’ for a significant amount of time. However, it appears that the M203 launcher was not available to military police during the riot (described above) when they resorted to lethal force. Apparently the policy with non-lethal munitions is to fire a point (individual) round first before using an area round to avoid affecting surrounding prisoners.

Non-lethal weapons appear to have been used in a variety of situations, from escape attempts and riots, to punishment for not following the rules imposed at the camp. It seems one of the main punishments at the camp is withdrawal of cigarettes from an individual or group and that NLWs have sometimes been used to enforce these restrictions i.e. to prevent other prisoners from throwing them theirs. Given the widespread availability and use of non-lethal weapons in prison camps such as Camp Bucca it is paramount that their use is carefully monitored to prevent the type of abuses described in the introduction to this report.

### **Desired Capabilities**

Colonel David Karcher, Director of the Joint Non-Lethal Weapons Directorate (JNLWD) of the US Marine Corps, gave an overview presentation of the non-lethal programme’s direction. He said that the work of the JNLWD was primarily (80%) focused on counter-personnel weapons and 20% on counter-materiel. He argued that non-lethal weapons are becoming more important given the increasing number of urban operations, asymmetric threats, and situations where civilians are mixed with combatants. He said they are useful for various protection tasks including facility security, crowd control, checkpoint security and maritime security. He also contended that NLWs were particularly relevant given the ‘3-block war’ where soldiers have to move from intense combat to peacekeeping to humanitarian assistance situations and need alternatives to lethal force. According to Col Karcher successful uses of NLWs had been seen in Kosovo with sponge rounds, the M203

grenade launcher against prisoners in Iraq, the Vehicle Lightweight Arresting Device (VLAD) or X-Net used in Afghanistan and Haiti, and the Running Gear Entanglement System (RGES) used by the US Coast Guard. However, the main thrust of his presentation was looking towards the future. He expressed concern that available non-lethal weapons were mostly limited to short-range blunt impact munitions and stressed the need for technological development. He said that 'near-term' non-lethal weapons would include the mobility denial system (super lubricants), Taser anti-personnel mine, 66mm non-lethal grenades, extended range stun projectile, MK19 short range munition, airburst non-lethal munition (ANLM), and non-lethal weapons for the Tactical Unmanned Ground Vehicle (TUGV). However, his long-term vision for NLWs was focused on directed energy weapons. In his view, long-range electrical ('electro-muscular disruption') weapons as well as new riot control agents and malodorants would also be developed.

The advantages of directed energy weapons, Colonel Karcher argued, would be speed of light effects at ranges up to 10km, rapid targeting with no outmanoeuvring, precision engagement, controlled effects from 'deny to destroy' (i.e. non-lethal to lethal), low cost per shot, and unlimited ammunition. The first use of a directed energy weapon by the military may well be the active denial system and that in the future we could expect a handheld active denial system, laser induced plasma (LIP) weapons, and the advanced tactical laser (ATL). During a session on 'desired capabilities', panel members agreed about the great potential of 'speed of light' directed energy weapons and articulated a need for selectable or scalable weapons 'from non-lethal to very lethal'; extended range weapons (beyond small arms range of 350m), and weapons to assist in protecting convoys and stopping vehicles. An ideal vehicle stopping system would be one that could be quickly deployed and would work beyond 50 metres. There was also agreement amongst the panellists that malodorants have 'huge potential' although the legal implications were noted (see below). Overall the desires expressed for the future of non-lethal weapons were to move from stopping vehicles and incapacitating people in the short term, to determining intent from a distance in the long term. When asked to describe his ideal non-lethal weapon system for use in controlling prisoners, the military police representative from Camp Bucca said that it would be a system where you could 'dial-up' the range and velocity. When asked if he was 'king for a day' what were the minimum and maximum lengths of incapacitation he would want from a NLW he replied, 'minimum 5 minutes, maximum 2 hours.'

Martin Hubbard from the Defence Science and Technology Laboratory (DSTL), UK Ministry of Defence mentioned the imminent introduction of the Attenuating Energy Projectile (AEP) in the UK (see the Kinetic Energy weapons section of this report). He described the main foci of UK non-lethal weapons research and development as: non-lethal barriers, underwater diver acoustics, anti-traction materials (slippery and adhesive), vortex ring gun, and crowd behaviour studies. He noted that the UK also has a directed energy programme but that this is not focused on non-lethal weapons as such.

## **Legal Issues**

### *Chemical Agents*

Legal issues surrounding the use of chemical agents by the military was another theme discussed at the conference. David Koplow, Professor of Law at Georgetown University, remarked during a panel session: 'If you are thinking of developing a chemical non-lethal weapon go see a lawyer.'

## Riot Control Agents

Some advocates of the wider use of riot control agents have not made a secret of their contempt for the Chemical Weapons Convention (CWC), which prohibits the use of RCA's 'as a method of warfare' and only makes an exception for 'law enforcement purposes' (i.e. public order / riot control). Their frustrations were evident on a number of occasions during the conference. One panellist said he was not convinced about the utility of airburst munitions because 'the policy people can't agree on what we are allowed to put in them'. Although many may support US Secretary of Defense Donald Rumsfeld's desire to be able to use riot control agents such as CS in military combat operations, it is, fortunately, unlikely that lawyers would sanction this breach of international law. Hopes of an amendment to the CWC are also in the realms of fantasy, as pointed out during another panel session by David Koplow. Nevertheless, the military use of riot control agents for public order/riot control in law enforcement situations is permitted by international law, and the promise of 'new riot control agents' in Colonel Karcher's presentation suggests interest in the further development of sensory irritants. The DOD's Human Effects Center of Excellence (HECOE), which oversees human effects assessment for non-lethal weapons, is currently assessing PAVA, the synthetic version of OC or pepper spray, for use as a wide-area dispersal RCA. Beyond PAVA, which is commonly used by police forces, one panellist alluded to possible 'technological leaps' in terms of riot control agents.

## Incapacitating Agents or 'Calmatives'

Might these references to 'new riot control agents' and 'technological leaps' mean continued interest in so called 'calmatives' or narcotic incapacitating agents?<sup>86</sup> Interestingly, when asked about 'calmatives', a lawyer from the Marines Office of the Judge Advocate General said that it was 'more likely than not that the Chemical Weapons Convention prohibited these types of weapon systems'. Given this position, the question remains as to whether the US military has continued efforts to develop such centrally acting incapacitating agents – that is those which act on the central nervous system causing disorientation, unconsciousness and more serious effects, and which are distinct from locally acting irritants (i.e. RCAs). They may justify continued research and development in terms of use for law enforcement purposes and hopes of discovering the combination of a compound and a means of delivery that mitigates the dangers of death from respiratory depression. Ultimately there may be an attempt by the military to re-brand centrally acting 'calmatives' as 'new riot control agents' even though they do not share the characteristics of RCAs, which are defined by their irritant effects on mucous membranes and skin.

The last official indication in the US of actual research in this area was the 2003 National Research Council report on non-lethal weapons, which stated that calmatives were "under study by ECBC [Edgewood Chemical and Biological Center] after lull in R&D for 10years"<sup>87</sup> and recommended further research arguing that they "...offer strong potential as effective NLWs."<sup>88</sup> More recently there has been support for such weapons development from some quarters. In February 2004 a US DOD Defense Science Board report stated: "Calmatives might be considered to deal with otherwise difficult situations in which neutralizing individuals could enable ultimate mission success."<sup>89</sup> In December 2004 a report from NATO's Research and Technology

Organisation described such centrally acting chemical weapons as technologies of interest:

Non-lethal chemical technologies could act on: - The central nervous system by calmatives, dissociative agents, equilibrium agents. ... - The nervous system by convulsives.<sup>90</sup>

However as we have noted in previous reports, the authors of a Council on Foreign Relations report on non-lethal weapons, also from 2004, were aware of the wider implications and did not recommend such weapons development:

Nonmilitary research in biology and medicine will lead to understanding that can greatly facilitate the development, production, and use of lethal and largely nonlethal chemical and biological agents. But NLW-focused research will hasten the day that such materials are available not only to the United States but also to those who would use them against us.<sup>91</sup>

For a detailed discussion of the legal issues and other areas of concern surrounding this type of weapons development see our recent article in *Disarmament Forum*.<sup>92</sup>

### Malodorants

The issue of malodorants is a complicated one. They have commonly been grouped together with CS and OC as riot control agents, making their use in combat prohibited by the CWC. However, with increasing interest in their potential utility for area denial as well as crowd control, the debate over how to classify them has intensified. JNLWD backed research has sought to find odorous substances that are effective but neither defined as *incapacitating* nor *sensory irritants*, as described in a presentation to the Non-Lethal Defense conference five years previously, in 2000<sup>93</sup>. These criteria are significant because they are the main descriptors of riot control agents such as CS and OC. Ostensibly the focus of malodorant development, as described by another speaker, has been on eliciting a 'psychological response', which may be sufficient to affect crowds of civilians if not motivated adversaries. Characterising malodorants in this way is a strategy for avoiding restrictions on their use under the CWC - if the malodorant chemical mixtures developed are defined as toxic chemicals, however, this distinction will be irrelevant as they will be covered by the CWC. It emerged at the conference that these treaty compliance issues are currently being discussed, and the lawyer from the Marines Office of the Judge Advocate General gave his opinion that malodorants are probably not covered by the CWC.

### *Other Legal Issues*

Another interesting legal issue that was frequently raised at the conference related to the implications of wider NLW deployment for use of lethal force. The representative from the Marines Office of the Judge Advocate General (JAG) maintained that if, under the rules of engagement, a soldier is authorised to use force then legally he may use either lethal or non-lethal force, and there is no commitment to the use of non-lethal force initially or in particular situations. However, David Koplow from Georgetown University felt that the law was unlikely to 'hold' on this issue. He predicted that in the future NLWs would indeed raise the threshold for use of lethal force. On the issue of definitions Koplow remarked that the term non-lethal should be disposed of, and we should just call them weapons. This is a position that has long been taken by the International Committee of the Red Cross (ICRC) who have

argued against creating another category for this weaponry, maintaining quite correctly that these are still weapons.

## **Human Effects**

Another panel at the conference addressed issues related to the human effects of non-lethal weapons. The three main bodies concerned with this are the Human Effects Center of Excellence (HECOE), Human Effects Review Board (HERB), and the Human Effects Advisory Panel (HEAP). The HECOE is the oversight body of DoD experts and the 'repository of knowledge on human effects'. The HERB is a group of military medical officers who review human effects issues. Finally the HEAP is a non-governmental panel of academics hosted by the JNLWD-sponsored Institute for Non-Lethal Defense Technologies (INLDT) at Penn State University to provide review. Other organisations involved in the process include the Army and Air Force research laboratories, the Edgewood Chemical and Biological Center (ECBC), numerous universities and also some companies. Much human effects data is classified, and so further critical evaluation from outside these close knit circles is not possible. The DoD maintains that controlling the information about human effects is necessary since releasing the data would make them (a) vulnerable to an opponent using the weapon, and (b) the development of countermeasures. However, panel members stated that there are peer-reviewed publications in the open literature on 'associated stimuli' relating to some of the non-lethal technologies such as the Active Denial System for example. The HECOE recently released an unclassified version of their human effects study of the Taser (see Electrical Weapons section of this BNLWRP report). The HECOE has developed a Human Effects Risk Characterization (HERC) Framework for assessing each non-lethal weapon, and current work includes an evaluation of the FN303 OC round. ECBC are assessing the aerosolization of the OC round, and HEAP is conducting an epidemiological study of Taser associated deaths, which will include using a database held by the Los Angeles Sheriffs Department (LASD). The LASD are producing a report using data from 1995-2004 on 21,000 uses of NLWs which will, according to Sid Heal from the LASD, be available in April 2005.

The Chair of the HERB remarked on a move towards 'effects based weapons design' drawing from the various human effects models that have been developed. This includes the Advanced Total Body Model (ATBM)<sup>94</sup> for blunt impact munitions, and models for RCAs, directed energy, electro-muscular incapacitation (EMI), and multi-sensory devices. Apparently one current effects based research effort is an investigation into the use of light to cause nausea and incapacitation.

## **Homeland Defence/Security**

According to Thomas Kuster, US Deputy Assistant Secretary of Defense for Homeland Defense, we can expect to see an increasing impetus for deployment of non-lethal weapons for homeland defence in the US. He said that Northern Command (NORTHCOM) and Pacific Command (PACOM) who are responsible for protecting the US mainland from attack, would soon be asked to set out their requirements for NLWs. He assured the audience that he would be advocating NLWs 'along the corridors of the Pentagon.'

With regard to law enforcement, Joe Cecconi who runs the US Department of Justice (DOJ) non-lethal weapons development effort at the National Institute of Justice (NIJ), explained that NIJ was carrying out behavioural and physical sciences research in this field. NIJ are

currently funding development of the ring airfoil projectile (RAP), a projectile that may carry OC or malodorants.<sup>95</sup> They are also looking at the modification of military directed energy weapons technologies for law enforcement use. According to Cecconi, the requirement is for a portable directed energy weapon with 50ft range, of shotgun size, and a 3” diameter area of effect. Raytheon are currently working on a portable version of the Active Denial System (ADS) to this effect. Other research efforts include the development of a pulsed laser weapon to produce a ‘flash-bang’ effect which would use a similar technology to the military’s Pulsed Energy Projectile (PEP). This is being researched by Sterling Photonics. In general Cecconi said that the law enforcement community needed shorter-range, more portable, and cheaper NLW systems than the military. With regard to homeland security the NIJ has almost finished a report looking at the use of various non-lethal weapons in airport security, and are also looking at the potential use of NLWs in the event of quarantine situations, which may follow contamination of a city or town with chemical, biological or radiological material.

### 3. TECHNOLOGIES,<sup>96</sup> POLICY AND ASSOCIATED ISSUES

This section (a) highlights non-lethal technology developments, weapons usage, and policy related issues since Report No. 6 was published in October 2004, 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.<sup>97</sup>

#### 3.1. KINETIC ENERGY

##### Impact Munitions

###### *National Institute of Justice Report*

An October 2004 National Institute of Justice (NIJ) report entitled *Impact Munitions Use: Types, Targets*<sup>98</sup> accepts a significant knowledge gap, that is the availability of ‘systematic information on the circumstances under which impact munitions have been used or the physical effects they have on people in the field’. Impact munitions are described as being:

....designed to stun or otherwise temporarily incapacitate a suspect or dangerous individual so that law enforcement officers can subdue and arrest that person with less injury or death for themselves and others. Impact munitions include foam rubber projectiles, wooden dowels, and small bean bags that are usually fired from 12-gauge shotguns or 37/40-millimeter gas launchers.<sup>99</sup>

A key factor, which determined the type and severity of injury caused by impact munitions was identified as the distance between the subject and where the munition was fired. When fired from under 10 feet broken bones were the most likely serious injury to occur. From the 969 projectiles fired during the 373 incidents studied in the report, 8 fatalities were recorded as a result of being hit by impact munitions, and 2 further deaths resulted from officers who mistakenly used lethal rounds thinking that they were firing impact munitions. Interestingly the report notes that 6 people died when hit by munitions fired from ‘less than 30 feet’. Details are also given of target profiles (psychological and emotional, physical location, age, gender, whether armed and ethnic identity), the number and type of munitions fired at each person, and where struck on the body. Bean bags, followed by plastic baton rounds were the most commonly utilised munitions, and most munitions impacted on the abdomen (34%), with the chest (19%), legs (15%), arms (14%) and back (11%) also being hit. From the data only 2% of impacts were on the head, and 1% on the groin and neck, but the report noted that:

...impacts to the head produced a greater proportion of non-fatal serious injuries than other areas struck. Of the 19 head impacts reported, 14 resulted in a laceration, bone fracture, or penetration wound.<sup>100</sup>

Five out of the six fatalities from impact munitions in the study were hit in the chest, the report cautioned that:

...in deadly force encounters, law enforcement personnel are generally trained to aim for the “center of mass.” This is often the chest or abdominal area of the target. These are also the areas most often hit by impact munitions. The chest and abdomen have been successfully targeted the vast majority of the

time, but users of impact munitions should be aware that individuals struck in these areas are also more susceptible to serious injury or death, especially at close ranges.<sup>101</sup>

The report concluded that:

- (a) the availability and use of impact munitions in situations when suspects were armed reduced the use of deadly force;
- (b) whilst less-lethal munitions are not 100% effective, they cause fewer casualties and deaths than lethal munitions;
- (c) improved training is required. One issue highlighted is the need for lethal and non-lethal munitions to be clearly distinguishable so that officers can, for example, clearly identify lethal and non-lethal shotgun shells;
- (d) greater awareness that impact munitions can cause serious injury or death, especially at close range;
- (e) more research and development is needed;
- (f) some newer munitions such as pepper balls, sponge rounds, advanced bean bags show promise in increasing accuracy and reducing injury.
- (g) more data information sharing between agencies, researchers, law enforcement officers and correction agencies is needed.<sup>102</sup>

### *Plastic Baton Rounds in the UK*

UK Police Forces have used plastic bullets on several occasions during situations of domestic violence, siege and attempted self-harm. In South Yorkshire police fired a plastic baton round for the first time to incapacitate a man who was attempting suicide.<sup>103</sup> Police in East Yorkshire shot and killed a man, apparently armed with a sword of some description, who had been driving the wrong way down a road after baton rounds failed to stop him approaching police.<sup>104</sup>

### *Attenuated Energy Projectile (AEP)*

As we have reported elsewhere the AEP was developed by the Defence Science and Technology Laboratory (DSTL), the Police Scientific Development Branch (PSDB) [Now Home Office Scientific Development Branch (HOSDB)], and others as a safer and more accurate replacement for the L21A1 plastic baton round.<sup>105</sup> As described in the *Patten Report Recommendations 69 and 70 Relating To Public Order Equipment* (January 2004)<sup>106</sup>

.....development efforts for the AEP concentrated on techniques that would provide energy absorption by deforming the body of the AEP. This has the effect of transmitting less energy to the target compared. with a rigid projectile (because some of the kinetic energy would be used in AEP deformation). This crushing of the AEP body would also reduce the rate of onset of the impact force and reduce the magnitude of the peak force, both of which have been shown in human impact to reduce the severity of injuries. The outcome of attenuating the energy is a reduction in the peak force.

The AEP contains an 'air pocket', which enables this effect.

Objections to the AEP came from organisations such as the Children's Law Centre (CLC) and Save The Children UK (SC) in Northern Ireland who pointed out that the UN Committee on the Rights of the Child in October 2002 recommended the withdrawal of plastic bullets as a means of riot control in Northern Ireland. A similar recommendation was proposed by the UN Committee Against Torture in 1999. The CLC and SC argued that the AEP, like the L21A1 did not meet the domestic and international child rights standards as described in Articles 3, 6, 12 and 19 of the UN Convention on the Rights of the Child. As of August 2004 no child impact assessment of the AEP had been conducted or considered to assess the

potential injury or death to children. On 24<sup>th</sup> March 2005 the Northern Ireland Policing Board agree in principle to the introduction of the AEP for the Police Service of Northern Ireland (PSNI), provided that Chief Constable Hugh Orde could show that he had fully consulted with all relevant bodies, including the province's Childrens Commissioner Nigel Williams. SDLP members of the board voted against the AEP.<sup>107</sup>

On 4<sup>th</sup> April 2005 Caroline Flint, the U.K. Parliamentary Under-Secretary of State for the Home Department announced that the AEP was being issued to police forces in England, Wales and Northern Ireland. The existing L21A1 baton round was to be withdrawn once personnel had been trained in the use of the AEP. Operational deployment of the AEP was to begin on 21 June 2005. The Ministerial statement noted that "although there will be a reduced risk of serious injury or death when the AEP is used, that risk has not been completely eliminated. Where a round inadvertently strikes the head, the risk of serious and life threatening injury from the AEP will be less than that from the L21A1 baton round, which already has a low risk of injury." Every incident when the use of the AEP occurs will be reported routinely to the Independent Police Complaints Commission (IPCC) and to the Office of the Police Ombudsman for Northern Ireland and copied to the policing board. Similarly if it is fired by the Army in Northern Ireland details must be reported to the Special Investigation Branch of the Royal Military Police (SIB RMP) and the Independent Assessor of Military Complaints Procedures (IAMCP).<sup>108</sup>

### *Injuries to Eyes by Plastic Bullets*

A paper by Florian Sutter<sup>109</sup> investigating eye injuries received from hard plastic bullets by 5 patients caught up in rioting in Switzerland, between December 2000 and May 2001, concluded that:

The projectiles of hard plastic bullet shotguns used for riot control in Switzerland show a considerable risk of injury to vulnerable body parts such as the head, neck and eyes. From our clinical observations and theoretical calculations we conclude that, from an ophthalmic/medical point of view, independent of political bias, this weapon is potentially harmful. *Perhaps its use should be reconsidered during times of peace* [our emphasis] Furthermore, the risks of shotguns compared to single shot guns should be taken into account for the development of sub-lethal weapons.

Like the NIJ report described above, Florian notes the significantly increased risk of serious injury when munitions were fired at distances of less than 10 metres. The particular munition that Swiss police use consists of:

....35 hexagonal PVC cylinders of 11g each, wrapped in a plastic foil and fired from a shotgun. After leaving the weapon with a muzzle velocity of 200m/s, the plastic foil ruptures and the projectiles reach their target as buckshot. At an operational distance of 20m these projectiles are scattered randomly over a surface area of 2m in diameter.

As Florian points out, due to the scatter of these bullets, it is impossible to avoid hits to the head and neck.

### *US Military Requirements*

The US Army continues to purchase non-lethal kinetic energy options. These include M1029 Crowd Dispersal Cartridges of design consisting of an aluminium case containing 48 rubber balls .48 inches in diameter, and weighing 1.3 grams each as submunitions. These will be

compatible with the 40mm M203 grenade launcher attached to M16A2 or M4 series of rifles. Quantities ordered are: for FY05 (38,106), FY06 (56,000), FY07 (65,000), FY08 (71,000) and FY09 (65,000).<sup>110</sup>

### *Ring Airfoil Projectile (RAP)*

The US National Institute of Justice (NIJ) has continued funding of a programme to develop a ring airfoil projectile system (as described in BNLWRP Report No. 4). The current focus is development of a multi-shot launcher<sup>111</sup> for which NIJ awarded funding of \$350,000 to Vanek Prototype Co. in August 2004.<sup>112</sup> The most recent patent for this system was filed at the end of January 2005.<sup>113</sup>

### *Other Developments*

Pepperball Technologies, which produces the Pepperball system of frangible projectiles (containing PAVA or other payloads) that are fired from a compressed air launcher, announced a partnership with hand-gun maker Beretta for wider distribution of the Pepperball system and joint product development.<sup>114</sup> Another hand-gun manufacturer, Smith & Wesson, also announced recently that it was considering entering the market for non-lethal weapons.<sup>115</sup>

A company called Pursuits Automatic Weapons recently announced a new automatic weapon that fires plastic projectiles.<sup>116</sup> They look like machine guns but use compressed gas to fire multiple plastic balls (either 4.5mm, 6mm, or 8mm). According to the company's website they can fire 90 rounds per second.<sup>117</sup> The company is marketing the gun to police in the US for crowd control.

### **Water cannon**

Police in Tayside (Scotland, UK) were investigating the purchase of 3 water cannon from Belgium in anticipation of civil disorder during the G8 Summit of world leaders at Gleneagles in July 2005.<sup>118</sup> If used, this would be for the first time on the UK mainland.

## **3.2. BARRIERS AND ENTANGLEMENTS**

The recent NATO report on NLWs recommended further research and development of rapid barriers for use in stopping vehicles or denying access to individuals or crowds:

The barrier system is seen as an excellent means of deterring the passage or channelling of crowds, or light or soft skinned vehicles and would be an appropriate means of rapidly erecting a manned barricade.<sup>119</sup>

### 3.3 ELECTRICAL

#### Taser

There has been continuing extensive comment and publications related to the Taser weapon over the last six months. We have covered the key issues and debates associated with this stun device in previous BNLWRP Reports, and readers are referred to these for information and analysis. What we will do in this section is signpost the events, reports and developments since our last Report in October 2004.

#### *Taser Acquisition*

More than 6,000 law enforcement agencies around the world have now purchased the Taser<sup>120</sup>. An increasing number of UK Police continue to equip their firearms officers with the M26 Taser, whilst also testing the newer X-26 version. In the UK, West Midlands Police authorised firearm officers were equipped with Taser M26 weapons from March 2005<sup>121</sup>, but they will also remain armed with Heckler and Koch weapons for lethal firepower. Other UK police forces considering arming officers with the Taser include Burnley, Gloucestershire, Cumbria, and Greater Manchester.<sup>122</sup> Experience of Taser use with UK Police Forces has, to date, been generally favourable. Officers believed that “the stun gun’s selling point is that it ‘bridges the current gap’ between low level uses of force, such as CS spray and baton rounds, and using a firearm”.<sup>123</sup> Only minor injuries were reported as a result of its use, and many police are in favour of its wider use. Singapore National Police Force has bought 126 Taser X26 stun guns.<sup>124</sup>

Korean Air received permission from the US Transportation Safety Administration to install Taser stun guns on its flights in and out of the U.S. Previously United Airlines were to equip their aircraft with Tasers, but the deal fell through after the airline went bankrupt in December 2002.<sup>125</sup> The South Korean National Police Agency began evaluation of the Taser X26 in November 2004 and placed an order for 100 weapons.<sup>126</sup> In Australia a six-month trial of the Taser X26 for use on domestic and international flights in Australia was announced by the Federal Justice and Customs Department. They would also be considered for use by Australian Federal Police serving in countries including Papua New Guinea.<sup>127</sup>

#### *Recent reports on the Taser*

In BNLWRP Report No.6 (October 2004) we reviewed the issues and controversies related to the growing concern about the harmful effects of the Taser. We will not repeat these here, but rather highlight the findings of a number of reports that have been published over the last few months which continue the discussions on these issues. These include (in order of publication date):

- a) British Columbia: Office of The Police Complaint Commissioner. *Taser Technology Review and Interim Recommendations*. OPCC File No.2474. September 2004.<sup>128</sup>

The report studied 4599 incidents when the Taser had been used, 49 of which contained information describing medical complications (it also notes the way in which this information was collected and supplied by the Taser company, and that the data used by the report team does not constitute its endorsement). These were:

Various (respiratory/circulatory): 23  
Death with Firearms (police or suicide): 4  
Death Other (respiratory/circulatory): 4  
Pregnant Subject: 2  
Urination followed exposure(s): 9  
Defecation followed exposure(s): 6  
Urination & defecation followed exposure: 1

Noted is the fact that of the 4372 suitable field uses, only 1.12% ended with any form of (reported) medical complication, and only 0.09% were associated to an in custody death. The report also contains data supplied by the Edmonton Police Service (EPS) and information from the Victoria Police Department (VPD). A section reviews the medical literature on the Taser and these include studies by Sgt Scott Grenfell of the Victoria (Australian) Police (2003), Joseph Heck of the Casualty Care Research centre, Henderson, Nevada (2004), Joseph Stratbucker for Taser Inc., the report of a public presentation from medical experts organised by Orange County Sheriff's Office in Florida (2004), and the U.K. DOMILL statement (2004). A section examines incidents of sudden and unexpected deaths within the context of Taser use, and talks about 'Excited Delirium' death proximal to restraint stating that causes are multifactorial – attributing them to the use of a Taser (just because it is used) is, it is argued, too simplistic. Finally this report makes several interim recommendations under the headings: standardised training; mandatory reporting; acquisition of new Taser technology; excited delirium training; restraint protocols.

A useful set of references are included at the end of the report, although frustratingly does not include all those mentioned in the text.

b) Amnesty International. *United States of America. Excessive and lethal force? Amnesty International's concerns about deaths and ill treatment involving police use of tasers.* Amnesty International, London, November 2004 (AI Index: AMR 51/139/2004)<sup>129</sup>

In a comprehensive report detailing reported harmful effects and consequences of the Taser weapon and the continuing concerns about potential health risks, the AI Report called on law enforcement agencies to suspend the use of electro-shock weapons until more rigorous testing had been carried out. The wide ranging conclusions and recommendations include: suspending all transfers and use of Tasers and other electro-shock weapons pending an independent and rigorous enquiry into their use and effects; law enforcement agencies should ensure that officers are trained to use force in accordance with the (UN) Code of Conduct for Law Enforcement Officials and the Basic Principles on the Use of Force and Firearms by Law Enforcement Officials; police training must include elements concerning human rights and torture; departments using Tasers should restrict their use to situations where the alternative would be the use of deadly force; operational use should include a prohibition (except as a last resort to lethal force) against certain groups including pregnant women and children; repeated and prolonged shocks to be avoided unless absolutely necessary; medical assistance to be provided immediately to shocked persons; strict reporting and monitoring to be put in place by all departments using the Taser; restrictions and controls to be placed on sales of these weapons to the public.

In response to this the Association of Chief Police Officers (ACPO) in the UK stressed that 'the Taser is only used by specially trained police firearms officers in circumstances in which the use of conventional weapons would otherwise be authorised' and that it had been

‘rigorously scrutinised and evaluated during its trial period’.<sup>130</sup> Taser International rejected the report saying that it ‘fails to adequately describe the overwhelming body of evidence supported by independent scientific and medical experts that have studied current Taser technology and its use’.<sup>131</sup>

Comment: On 1<sup>st</sup> April 2005, AI again highlighted the number of Taser associated deaths in the U.S. and Canada noting that Taser related deaths in the two countries had reached 103 (figures for between June 2001 and March 2005). Out of these 103 incidents:

Amnesty cites that the weapons have been mentioned 17 times (out of 103) by medical examiners who have said that the TASER played a role, could not be ruled out, or could not determine the exact role the TASER played.<sup>132</sup>

AI repeated its claims that Taser International, Inc has been misleading the public and law enforcement about the number of lives ‘allegedly saved by Tasers’. Whilst supporting the development of non-lethal alternatives to firearms, AI USA states: “However, it has been difficult to engage in an honest debate about Taser usage when the truth seems to be as elusive as an independent, comprehensive medical study supporting claims that Tasers are generally safe.”<sup>133</sup> AI USA highlight continuing cases of electro-shock weapon abuse including excessive and unwarranted use on children, people who are restrained, emotionally distressed people, and those who are physically disabled. The organisation challenges the statistics and figures given by Taser on how and why their weapons are being used.

- c) Meslow, C & Houghland, S. *Taser Deployments and Injuries: Analysis of Current and Emerging Trends*. Institute for Technological Innovation and Research, Florida Gulf University, December 2004.

Meslow studied Taser usage in Orange County between 2000-2003, and concluded that there were fewer injuries related to Taser use than for police dogs, batons and pepper spray. He also thought that the three fatalities linked to Taser use in Orange County could not be directly attributable to the weapon.

- d) McDaniel, W & Stratbucker, R & Nerheim, M & Brewer, J. ‘Cardiac Safety of Neuromuscular Incapacitating Defensive Devices’. *Pacing and Clinical Electrophysiology*, Vol.28, No.1, January 2005, ppS284-S287.

Using adult domestic pigs, the study investigated the risk of the induction of ventricular fibrillation (VF) by neuromuscular incapacitation (NMI) devices. It concluded that the safety index for an NMI discharge was significantly and positively associated with weight. Discharge levels for standard electrical NMI devices have an extremely low probability of inducing VF. The NMI device used in the research was designed to match the waveform characteristics of the Taser X26.

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

This comprehensive report builds on a previous PSDB report *Evaluation of Taser Devices* published in July 2002. The following section is taken directly from the most recent report (2005) by David Wilkinson as detailed above.

## “Management Summary”<sup>134</sup>

PSDB has been tasked, by the Home Office, the Association of Chief Police Officers (ACPO) and the Northern Ireland Office (NIO), with carrying out an evaluation of less lethal technologies. Along with these organisations, Her Majesty's Inspectorate of Constabulary (HMIC), PSDB, the Policing Board of Northern Ireland and the Ministry of Defence (latterly through the Defence Science and Technology Laboratory) formed a Steering Group to guide this evaluation.

The ACPO Working Groups on Police Use of Firearms, Self Defence and Restraint and Public Order produced a joint Operational Requirement (OR) for a less lethal tactical option. PSDB's evaluations have been directed at providing a complete and accurate scientific and technical response to that requirement.

Taser devices were extensively examined by PSDB and a report, PSDB Evaluation of Taser Devices<sup>1</sup>, was published in July 2002. As a result of that report and the medical statement provided by the DSAC Subcommittee on the Medical Implications of Less-lethal Weapons (DOMILL) ACPO decided to go ahead with an operational trial in five forces in the UK using the Taser International M26 Advanced Taser with the support of Home Office ministers. Some areas for further testing of the M26 had been highlighted in the DOMILL statement and a new taser, the Taser International Taser X26, had become available. The ACPO Working Group on Police Use of Firearms asked for this new taser to be evaluated by PSDB. This report contains the following new information:

- The laser in the sighting system has been classified as 3R according to the British laser safety standard BS EN 60825-1. Although this class exceeds the internationally agreed maximum permissible exposure (MPE) values (1mW), because of the safety factors in MPE values, they are unlikely to cause eye injuries for accidental exposures but intentional viewing must be avoided. However, the M26 does not currently comply with the standard's labeling requirements.
- There is a low risk of the taser affecting medical equipment in a dangerous way.
- Further work commissioned by PSDB, and to be published in the supplement to this report, has indicated that there is no significant risk of affecting the flight-critical systems of aircraft in flight.
- There is a significant risk of ignition if a taser is fired at a target that has been previously sprayed with either CS or PAVA incapacitant spray. CS spray is more likely than PAVA spray to ignite but PAVA solvent burns with a blue flame that is difficult to see in bright light conditions.
- The residual medical concerns over the M26 taser raised by DOMILL have been investigated by the Defence Science and Technology Laboratory (Dstl). The information provided was reviewed by DOMILL and contributed to their second statement on the M26, which is included in the appendices of this report. It concludes that the risk of life-threatening or serious injuries from the M26 Taser is very low.

Throughout the testing and the handling trials covered in this report, and when compared to the Operational Requirement, *the X26 taser performs marginally better than the M26 in most areas.* However:

- The M26 is approximately half the cost of the X26;
- Of the eleven X26 units supplied to PSDB, discounting the two that were used in drop-testing, seven broke down under no more duress than repeated usage in a 6-month period. These X26 units were early production models and PSDB received 20 replacements and tested them repeatedly over a month-long period. None broke down entirely during the test but two units' pulse repetition rates slowed significantly (thus reducing the power being delivered). This shows an improvement over the previous units but should not be regarded as definitive reliability testing.

When the medical implications of the use of the X26 were examined by DOMILL it was concluded that “The risk of a life-threatening event arising from the direct interaction of the currents of the X26 Taser with the heart, is less than the already low risk of such an event from the M26 Advanced Taser.” DOMILL also noted that if the X26 is more effective than the M26 in stimulating skeletal muscle, as claimed, then there will be a greater likelihood of head injury after contact with surfaces due to the less controlled fall. However, the risk of serious head injury is still considered to be low.”

- f) McBride, D & Tedder, N. *Efficacy and Safety of Electrical Stun Devices*, Potomac Institute for Policy Studies Report, Number 05-04, Potomac Institute for Policy Studies, 901 N. Stuart Street, Suite 200, Arlington, VA 22203, U.S. March 2005. <sup>135</sup>

The conclusions (taken directly from the report) are:

1. Based on the available evidence, and on accepted criteria for defining product risk vs. efficacy, we believe that when stun technology is appropriately applied, it is relatively safe and clearly effective. The only known field data that are available suggest that the odds are, at worst, one in one thousand that a stun device would contribute to (and this does not imply “cause”) death. This figure is likely not different than the odds of death when stun devices are not used, but when other multiple force measures are. A more defensible figure is one in one hundred thousand.
2. No federal regulative body has asserted oversight of current non-lethal stun technology. As a result, there is insufficient guidance for public and private management. One result of this deficiency is that there are currently no broadly accepted engineering standards in this field. We believe that the establishment of industry-driven, government-endorsed standards will contribute significantly to better understanding of this technology domain. We expect better understanding will in turn help shape market (demand and supply) dynamics for products. Competition may also contribute to an increase in the community’s self-management of safety issues.
3. We strongly recommend that additional research be conducted at the organism, organ, tissue, and cell levels. The mortality figures cited could conceivably reflect inaccuracies in reporting or perhaps there are other factors, such as efficient and effective medical care availability. Moreover, the vast majority of targeted individuals have been relatively young males. The community needs to understand the specific effects of varying electrical wave forms on relevant organic matter of all body types in the immediate time frame of stun application, and in the downstream time course as well, to include possible psychiatric and other non-lethal effects.

Like the British Columbia Report, mention is also made of the ‘excited delirium syndrome’ (p.13). General findings of the report can be found in a press release dated 29 March 2005. <sup>136</sup>

- g) The Joint Non-Lethal Weapons Human Effects Center of Excellence (HECOE). *Human Effectiveness and Risk Characterization of the Electromuscular Incapacitation Device – A Limited Analysis of the TASER. Part 1: Technical Report. Part 2: Appendices.* March 2005.

This is a lengthy technical report drawing from a wide range of sources. It concludes that the M26 and X26 Tasers are generally effective for their intended use. However, they may cause several unintended effects, albeit with estimated low probabilities of occurrence. The ‘Risk Characterization Summary’ can be found on pps.73-75. The following is the abstract of the report:

#### Abstract <sup>137</sup>

A Human Effectiveness and Risk Characterization (HERC) for Electromuscular Incapacitation (EMI; also referred to as Electromuscular Disruption (EMD) when describing the intended effect of the TASER® products) devices has been conducted in an effort organized by the Human Effects Center of Excellence (HECOE). This HERC reflects the results from a three-workshop process with sequential workshops held for data gathering and sharing, peer consultation, and independent external review of the HERC document. This HERC included two EMI devices manufactured by TASER International, the M26 and X26 TASERs®.

Probability estimates as well as data gaps and uncertainties were characterized for intended and potential unintended effects of the devices. The intended effect of the TASER is electromuscular disruption. During EMD, the individual experiences tetany and is temporarily incapacitated. Key potential unintended effects that were evaluated as part of the process included ocular injury from dart strikes, seizures, ventricular fibrillation, or

fall injuries. Numerous other potential effects were evaluated during the process, but these were not further assessed because they were of limited severity (e.g., minor lacerations) or their occurrence was not supported by the available data (e.g., cancer or reproductive effects).

Information developed in the dose-response and exposure assessment was integrated to provide quantitative or qualitative estimates of effectiveness and risk probabilities. The likelihood of various effects were determined, based on an analysis of the TASER International Database (scrubbed to minimize false positives); the probability of inducing a complete EMD ranges from 74% to 52% depending on distance to the target. Severe unintended effects are likely to be of low probability. Probability estimates were up to 0.04% for eye strikes and 0.15% for fall injuries depending on distance to the target.

Ventricular fibrillation (VF) is not expected to occur in an otherwise healthy population, although experimental data are too limited to evaluate probabilities for susceptible populations or for alternative patterns of exposure. No cases of VF have been reported in training or field exposure conditions.

Several key data gaps were identified in the data evaluation. These gaps include the biological basis for TASER effects, appropriate dosimetry, and the impact of environmental and scenario dependent variables on the induction of effects. Available experimental-only data are too limited to adequately quantify possible risks of VF or seizures, particularly in susceptible populations. Limitations in the exposure and incidence data for some infrequent events and the need to rely on a database of case reports compiled by TASER International also generate uncertainty in the results.

Overall, the results support the conclusion that the M26 and X26 TASERs are generally effective for their intended use. However, they may cause several unintended effects, albeit with estimated low probabilities of occurrence.”

- h) Defence Scientific Advisory Council (DSAC) Sub-Committee On The Medical Implications of Less Lethal Weapons (DOMILL). *Statement on the comparative medical implications of use of the X26 Taser and the M26 Advanced Taser*. Dstl/BSC/BTP/DOC/803, 7 March 2005.<sup>138</sup>

The DOMILL statement recommended (Rec 25) that the Home Office should continue to provide DOMILL with reports outlining the circumstances of every use of the M26, the post incident medical assessments undertaken by the Forensic Medical Examiner (FME), and the clinical consequences noted by the FME or clinical staff. This audit should include the X26 Taser if this system is made available for use. DOMILL should be advised as soon as practical of any primary or secondary injury that could be classed as life-threatening, unexpected, or potentially leading to disability. (Rec 26) DOMILL should be advised of any changes in (a) the specification or performance of the M26 and X26 Taser devices; (b) the guidance to users and training practices; (c) the policy and practice of deployment, use and audit.”

Comment: On 22<sup>nd</sup> March 2005 the Home Office authorised chief police officers to make the X26 Taser available to authorised firearms officers in similar within the context of similar regulations and operational requirements as those in place for the M26.

- i) International Association of Chiefs of Police (IACP). *Electro-Muscular Disruption Technology (EMDT). A Nine-Step Strategy For effective Deployment*. IACP, Alexandria, Virginia, April 2005.<sup>139</sup>

This briefing report stresses the need for caution when using EMDT or stun guns. Guidelines are suggested as a framework for developing what IACP think are safe and sensible deployment and management plans for stun guns. It is hoped that a balance between the risks and benefits of using such weapons can be achieved. “The IACP Executive Brief offers a

step-by-step guide to aid law enforcement agencies in selecting, acquiring and using EMDT. It is intended to help law enforcement agencies develop policies, procedures, and training curricula that are responsive and relevant to the communities they serve". The nine stages are: (1) Build the leadership team; (2) Place EMDT on the use-of-force-continuum; (3) Assess the costs and benefits of using EMDT; (4) Identify roles and responsibilities for EMDT deployment; (5) Engage in community outreach; (6) Develop policies and procedures for EMDT; (7) Create a comprehensive training programme for EMDT deployment; (8) Use a phased deployment approach for EMDT; (9) Assess EMDT use and determine next steps.

Other reports:

- j) A US Air Force, Department of Defense study of the Taser weapon found evidence of heart trauma in a pig that had been subjected to repeated shocks from such a weapon. The study revealed a jump in the enzyme Troponin T which indicates heart injury, and also acidosis.<sup>140</sup> But other medical experts questioned this interpretation of the Air Force findings.<sup>141</sup>
- k) Forest Science Research Center, Minnesota State University. Forest Science News, Issue #8, 12 December 2004.<sup>142</sup>
- l) Wahl, V. *Taser Report*. Madison Police Department. 24<sup>th</sup> February 2005.<sup>143</sup>

#### *Comment on Reports*

Whilst reports (such as those above) continued to be published in the media<sup>144</sup> and by government and non-governmental organisations, the police and military, and by academic researchers, reaction to these was mixed. Some US legislators called for limitations on the use of Tasers<sup>145</sup>, and more accountability and a detailed recording of the incident when they were used. Others called for a ban on their use until more testing was carried out regarding their harmful and potentially harmful effects. A number of US police forces either stopped the use of Taser, slowed down deployment and ordering of the weapons, and reviewed their rules of engagement and reporting.<sup>146</sup> The Taser company challenged claims that their weapon was directly responsible for the reported deaths and quoted reports, such as the one produced by the Madison Police Department (February 2005), to support their view.

#### *Ongoing Research*

Research on electro-muscular disruption technology (EMDT) funded by the US National Institute of Justice includes (i) Wake Forest University Baptist Medical Centre has received \$104,071 from the National Institute of Justice to study the effects of non-lethal weapons (including Tasers, rubber bullets and bean bag munitions) and to record injuries caused by their use. The epidemiological study will document the injuries sustained by 750-900 patients said William Bozeman, Associate Research Director and Assistant Professor of Emergency Medicine at the Centre<sup>147</sup>, and; (ii) at the University of Wisconsin Madison researchers will use pigs to investigate links between heart attacks and the use of Taser stun guns. To explore links between the application of electromuscular shocks and other related causes, three groups of pigs will be used – one given cocaine, one given cocaine and then shocked, and one group just shocked. The research is funded by the U.S. Justice Department.<sup>148</sup> For details of other EMDT research access the NIJ website.<sup>149</sup>

## *US Domestic Marketing Expansion*

Resistance to marketing stun guns to the public grows from police forces and civil rights organisations. For example, Indiana Police were hoping that safety concerns would spur efforts to ban the weapons from further public availability.<sup>150</sup> Taser say that over 100,000 private citizens have already purchased their products, and that the new Taser consumer model X26C is less powerful than the police version so would be safer. It would cost about \$1,000. Taser currently sell three models to private citizens the Taser M18, M18L and X26C.<sup>151</sup> To help monitor sales Taser has employed CheckPoint to run criminal checks on private purchasers of its stun guns.<sup>152</sup> Meanwhile Taser signed a deal with one of the largest firearm and accessory distributors in the U.S., Davidson's Inc, to act as the exclusive distributor to Federal Firearms Licence (FFL) holders for the X26C Citizen defense System for a period of one year.<sup>153</sup>

In our previous report (No.6, October 2004) we drew attention to our concerns over the wider availability of electric stun devices and other non-lethal weapons, which are increasingly finding favour with criminals for use in robberies and assaults. (Also see section below, 'Criminal Activities')

### *Military*

Taser has developed the X-Rail System, which attaches a Taser X26 stun gun to rifles. Earlier models were developed for use by the military in Iraq and Afghanistan.<sup>154</sup>

### *Training, Guidelines and Policy*

Taser has used police officers for private training and sales promotion of their weapon within police departments. The American Civil Liberties Union (ACLU) of Northern California argue that it is not always clear who the officer is working for - as a police officer or as someone who is paid for by Taser International. ACLU say that 'the potential conflict of interest is huge'. Previously a senior officer with the Minneapolis Police department had resigned whilst being investigate for working for Taser with official departmental approval.<sup>155</sup> Responding to calls for more regulated training, Attorney General Peg Lautenschlager said that the Department of Justice, through its Training and Standards Bureau had plans to name an advisory committee which will examine Taser use and make recommendations on state wide standards to the Law Enforcements Standards Board which sets training standards for police.<sup>156</sup> The International Association of Chiefs of Police also called on local police departments to review their safety guidelines.<sup>157</sup> Some critics pointed to evidence that since being equipped with Tasers police were more likely to resort to the use of force – the case of Cincinatti was quoted in one report.<sup>158</sup> Officers were also increasingly using Tasers as 'compliance tools' to avoid chases and physical confrontations – for example to make someone obey orders at a traffic stop.<sup>159</sup>

## **Other Electrical Systems**

### *US Military*

The US Army ARDEC has also issued a solicitation notice for development of an electrical non-lethal projectile<sup>160</sup> that will provide an electrical area stun effect to temporarily incapacitate a small group of belligerents, as opposed to an individual. They wish to develop

a wireless projectile with a range of approximately 100 metres, launched from the 40mm M203 grenade launcher. The system is envisaged to particularly support the US in future urban policing and combat situations.

US military use of electrical stun devices continues to build. For example: US RDECOM Acquisition Center issued a solicitation notice for three types of electrical stun devices for Military Police use - stun baton, small contact stun device and a prison worn stun device (PWSD).<sup>161</sup> Amongst other characteristics this 'PWSD' is to have remote wireless activation capability from a distance of up to 25 metres. Such electric shock belts are used in the US prison system during the trial or transportation of some prisoners and have long been criticized by Amnesty International:

To be effective, it relies on the wearer's fear of the severe pain and humiliation that could follow activation. Such fear is a leading component of the mental suffering of a victim of torture or cruel, inhuman or degrading treatment which is banned under international law.<sup>162</sup>

Electric-shock belts are listed together with gallows, guillotines, electric chairs, and gas chambers in Annex II of the EU Torture Regulation, which is currently being negotiated. Export of all this equipment on Annex II will be banned by the proposed EU regulation.<sup>163</sup> Annex III items, which will include all other electrical stun devices "...including but not limited to electric-shock batons, electric shock shields, stun guns and electric shock dart guns (tasers)" as well as tear gas, OC and PAVA sprays will be licensable. Regarding ongoing EU negotiations on Annex III, recent written evidence to the UK House of Commons by the Foreign Office stated:

The UK has been attempting to persuade other Member States to accept the same strict control on these goods that the Government applies at a national level. This is proving difficult, as a number of Member States do not currently control the export of some of the items in Annex III.<sup>164</sup>

### *US Patents*

Details of patents new US patents for electrical weapons can be located on the US Patent and Trademark Office website<sup>165</sup>. A 'non-lethal electric apparel weapon', which can be used as an offensive or defensive weapon, consists of internal high voltage electrodes concealed in everyday clothing and which are activated by physical contact with the target. The retractable, non-lethal high voltages 'stun sword' is another high voltage stun device which is described as being unique with its 'fully retractable, yet non-injurious "blade", and its ability to deliver the pulse along the length of the "blade" as well as at the tip to a target at a distance far beyond arms length'. The non-lethal 'exoskeleton stun weapon' is contained within a glove worn on the hand.

### *Other*

Stinger Systems continues to develop a dart projectile stun gun.<sup>166</sup> Taser had initiated a litigation battle with Stinger Systems over claims of false advertising and reporting misleading patent information. Another company, Law Enforcement Associates Corporation also manufactures a stun pistol

We have followed the development of the Laser Induced Plasma Channel (LIPC) technology from Ionatron Inc in previous BNLWRP reports. In January 2005 Ionatron demonstrated its

Portal Denial System for U.S Government customers. The system is designed to stop people in a corridor or at outside vehicle checkpoints with a non-lethal electrical discharge.<sup>167</sup>

The U.S Department of Justice, Bureau of Prisons has issued a further solicitation notice regarding an 'electrical stun lethal fence system' with non-lethal/lethal capacity with the ability to operate in the following modes: non-lethal only, lethal only, non-lethal 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> attempt then automatically convert to lethal.<sup>168</sup> The system they have chosen is made by DeTekion Security Systems.<sup>169</sup>

### **Criminal Activities**

There is continued activity in importing illegal stun weapons into the UK. This is reflected in the increasing number of such weapons being intercepted at points of entry into the country. In the UK a six-fold rise in stun gun smuggling was reported by Customs officers and the National Criminal Intelligence Service. In 2004, 672 stun guns were recovered, up from 120 eight years ago.<sup>170</sup> In another case, a stun gun (which could also spray CS gas) was found at Heathrow airport during a routine X-Ray baggage detector test. Such a weapon could be used by terrorists. The plastic based Taser gun is difficult to detect, especially when disassembled into component parts.<sup>171</sup> Elsewhere 40 stun guns, disguised as torches, were seized by customs officials at Sydney Airport<sup>172</sup>, and in Singapore at the Parcel Post Section, Immigration and Checkpoints Authority 50 stun batons, 50 stun guns, 25 stun pens, and 200 pepper sprays were seized.<sup>173</sup>

### 3.4 ACOUSTIC

#### *United States*

We have described the Long Range Acoustic Device (LRAD) manufactured by American Technology Corp. in previous reports. According to some reports there are now approximately 200 LRAD units in Iraq on Navy ships, with the Marines and Army troops. For example, in Iraq the 3rd Infantry Division and the US Army 44th Engineering Battalion took delivery of a number of LRADs, to be of help with providing crowd control and security for the Iraq elections in January 2005, and in other operations involving area denial and clearing of buildings. Some LRADS have been equipped with a 'Phraselator' that allows messages in different languages to be broadcast over the LRAD.

#### *Israel*

Reports of two systems being developed by the Israel Defence Forces have appeared recently in the media. A cannon shell which reproduces the noise made by a live shell when fired, but does not use an explosive charge has been developed. It has potential use in deterring people from climbing onto tanks and in defence of IDF positions. Another system called 'The Shout' is also reported to be under development. This is an 'acoustic cannon' mounted on Sufa light armoured vehicles that aims a narrow high frequency sound beam at people to incapacitate them. Freinberg reports that the IDF's Medical Corps has tested the system and stated that it causes no permanent damage.<sup>174</sup>

### 3.5 DIRECTED ENERGY

#### Active Denial System (ADS)

Raytheon completed a prototype of the Active Denial System (ADS) towards the end of 2004, which will now be evaluated by the US military.<sup>175</sup> It has been speculated that the ADS may be deployed to Iraq as soon as 12 months from now, but there has been no confirmation of plans as yet. John Alexander, a retired US Army Colonel and well-known figure in the field of non-lethal weapons, gave his prediction to *Bloomberg* in December 2004: “There isn’t a doubt of do we or don’t we ... This one is a done deal. The only questions left are how many and how soon.”<sup>176</sup> In a February 2005 interview with *The American Reporter* Alexander predicted that it would be used for ‘flank defence’ of the military controlled Green Zone in Baghdad.<sup>177</sup> It may indeed be closer to fielding after the military assessment this summer. However the impression given at the recent NDIA Non-Lethal Defense conference in March 2005 was that additional support for the system from higher-up in the Pentagon would be required before a decision to deploy it in Iraq. According to the most recent JNLWD newsletter there will be a public display of the system later this year.<sup>178</sup>

Although developed for the military the ADS is seen as a potential addition to domestic policing weaponry. The outgoing Director of the US Department of Defense’s (DOD) Office of Force Transformation (OFT) suggested that it could be used for border control<sup>179</sup> and Raytheon are working on a smaller ‘tripod mounted’ version, Portable Active Denial System (PADS), for police forces.<sup>180</sup>

The US Air Force Research Laboratory (AFRL) who originally developed the technology announced in October 2004 that “A revolutionary pain-generating technology is making steps to go airborne, transitioning from a ground vehicle to an airplane.”<sup>181</sup> They awarded a \$7 million contract to a company called Communications and Power Industries to develop a lighter power source for the ADS weapon so that it can be mounted on plane. The power source for the vehicle-mounted version is being designed by Princeton Power Systems and Science Applications International Corporation (SAIC).<sup>182</sup>

#### High Power Microwave (HPM)

In our last report (No.6, October 2004<sup>183</sup>) we noted that the AFRL Directed Energy Directorate was seeking proposals to develop new high power microwave (HPM) weapons. The \$49.9 million five-year contract for the Directed Energy Technology Applications and Research (DETAR) programme was awarded to Science Applications International Corporation (SAIC) in January 2005 as described in their press release:

Under the terms of the contract, the SAIC team will develop new technologies and do applications research and development in pulsed power and HPMs, with a focus on transitioning important non-lethal technologies from the AFRL to end users in the Department of Defense and other federal agencies.<sup>184</sup>

In past reports we have described several devices employing high-power microwaves (HPM) to stop vehicles. Eureka Aerospace is developing one system that we have not mentioned previously with funding from the US Navy.<sup>185</sup> Apparently the company will have a prototype of this device later this year.<sup>186</sup>

## Lasers

In February 2005 *Defense Daily* reported that the US DoD Office of Force Transformation (OFT) is advocating the development of a tactical laser system that would be ready for field-testing within two years. According to the OFT official quoted in *Defense Daily* a system that combined relatively low powered lasers with relay mirrors may provide this capability:

The capabilities of the redirected energy system would depend on the distance from the target, but the hope is to get at least 100 watts per square centimeter. At 300 or 400 watts per square centimeter, the laser could drill through the hood of a vehicle, disabling a car or other "soft targets" seen in Baghdad, according to Forsythe. [OFT official]<sup>187</sup>

Such chemical lasers, including the Advanced Tactical Laser (ATL) mentioned in previous reports, cannot really be classed as non-lethal due to their evident destructive power. They could certainly cause serious injury or death if used against humans. However, the US military has presented them as non-lethal weapons in terms of their anti-materiel uses, such as in the example above of disabling a vehicle. Weapons developers anticipate that such laser weapons may be able to be variable in their effects from lethal to non-lethal. This is an issue of concern that we have discussed in previous BNLWRP reports (see Report No.5, May 2004) and which is becoming increasingly relevant with further integration of lethal and non-lethal weapons systems.

### *Pulsed Energy Projectile (PEP)*

A contract recently unearthed by The Sunshine Project under a Freedom of Information (FOI) request sheds some light on efforts to develop a Pulsed Energy Projectile (PEP) weapon. The weapon has been developed by Mission Research Corporation in partnership with the Joint Non-Lethal Weapons Directorate (JNLWD). In BNLWRP Research Report No. 5 (May 2004) we noted that the JNLWD had set aside \$3.2 million for further development of the PEP in 2005, including assessment of the human effects. Just over \$500,000 was awarded to researchers in a yearlong contract signed in July 2004 to assess *Sensory Consequences of Electromagnetic Pulses Emitted by Laser Induced Plasmas*. The contract with the Office of Naval Research, as part of the Joint Non-Lethal Weapons Program,<sup>188</sup> was won by the Neuroscience Division at The University of Florida College of Dentistry<sup>189</sup> and includes a subcontract to the College of Optics and Photonics at the University of Central Florida.<sup>190</sup>

Although heavily redacted in parts the contract 'Statement of Work' gives some insights into the development of this weapon and its perceived utility. The first part of the introduction reads:

Recent advances in directed energy weapons technology suggests that scalable, non-lethal to lethal force systems may be possible. Such a system would be useful in many environments. Two systems currently under development, active denial and pulsed energy (ADS and PEP) offer mainly complimentary capacities that could address multiple tasks... [REDACTED]. The full capability of these directed energy systems (DE) are still being explored. At their current stage of development, each system has clear non-lethal (ADS) and lethal (PEP) capacities suitable to the above tasks. Our experiments will examine the feasibility of using the plasma derived EMP to induce pain suitable to disarm and deter individuals or form barriers to the movement of large hostile groups. If successfully deployed, PEP could complement ADS in situations in which the latter is ineffective, less effective or prone to countermeasures. Many of the countermeasures that might be envisioned against ADS... [REDACTED] ...offer opportunities for PEP targeting (via plasma induction or ablation of the

defense). Despite these potential advantages, certain special capabilities and features of ADS offer advantages over PEP in many scenarios. Therefore, the systems are complimentary.

The efficiency and lethality of PEP weapons systems are straightforward. The non-ballistic, instantaneous properties of DE make precise targeting a straightforward matter of line of sight. Terrific amounts of energy can be delivered over great distances with pinpoint accuracy.<sup>191</sup>

What is clear from the Statement of Work is that, although the researchers aim to assess the non-lethal applications of the PEP, this laser-induced plasma (LIP) technology can deliver sufficient energy to cause serious injury or death. As mentioned later on in the contract, “When appropriately configured a PEP could serve both lethal and non-lethal applications.”<sup>192</sup> The PEP works by producing a laser-induced plasma (LIP) at the surface of the victim. Its proposed usage has been described in a 2003 National Academies report on NLWs commissioned by the Office of Naval Research:

PEP would utilise a pulsed deuterium-fluoride (DF) laser designed to produce an ionised plasma at the target surface. In turn, the plasma would produce an ultrasonic pressure wave that would pass into the body, stimulating the cutaneous nerves in the skin to produce pain and induce temporary paralysis.<sup>193</sup>

However the panel that produced the report were not convinced by its potential as a non-lethal weapon, partly due to tests where it had been shown to burn off clothing when fired at a test dummy. Referring to both the PEP and the Advanced Tactical Laser (ATL) they argued:

The evidence presented to the committee supporting claims of the viability of both these concepts for non-lethal weapons use was not convincing. The directorate [JNLWD] is urged to reassess its investments in these programs.<sup>194</sup>

The objective of the work contracted by the Office of Naval Research to the University of Florida is to assess the potential of using Laser-induced plasmas (LIP) to cause pain by activating nociceptors in the skin. Nociceptors are part of the peripheral nervous system that sense pain and transmit this information to the central nervous system. They are defined as:

a receptor for pain caused by injury to body tissues; the injury may be from physical stimuli such as mechanical, thermal, or electrical stimuli, or from chemical stimuli such as the presence of a toxin or an excess of a nontoxic substance. Most nociceptors are in either the skin or the walls of viscera.<sup>195</sup>

As described in the contract, the work undertaken will use *in vitro* sensory cell preparations to assess whether the PEP can act as a non-lethal weapon by activating the nociceptors to cause pain without damaging the cells, to find out the threshold at which the PEP does cause damage to the cells, to determine which type of laser and ‘pulse parameters’ are most effective, and to determine whether the degree of activation of the nociceptors (and therefore amount of pain caused) using the PEP can be varied. The latter point is notable since there is a clear aim in the military to develop this weapon as one of variable intensity or ‘scalability’ both within the bounds of non-lethal if indeed this is found to be viable and upwards to lethal applications.

The ‘anticipated deliverables’ set out in the contract Statement of Work provide an overview of the work being undertaken:

- a. Experiments will define whether a PEP has NLW capacities by demonstrating the feasibility of nociceptor activation *in vitro*
- b. Experiments will point to the optimum pulse parameters to evoke peak nociceptor activation

- c. Experiments will define the limits of tolerance for PEP exposure (onset of cell trauma)
- d. Definition of the optimal parameters and tolerance for PEP exposure might point strongly toward development of one laser system over another (micro-, nano-, femtosecond)
- e. Experiments will demonstrate the scalability of a PEP to act as an NLW and scalability within the NLW continuum (i.e., moderate to intense nociceptor activation)
- f. Experiments will determine the relative utility of laser targeting... [REDACTED] ...to produce the desired, scalable sensory impact
- g. If outcomes point strongly to one laser system over another, this will have implications for power and weight requirements and logistical support
- h. Methodologies will be established to study [REDACTED] motor systems or investigate possible countermeasures

Both lead researchers on this contract reported on their research to the Non-lethal Technology and Academic Research Symposium (NTAR) in November 2004. One presentation features in the Human Effects section of the programme and was entitled *Transduction and Encoding of Pain by Nociceptors*<sup>196</sup> and the other was given in the Advanced Technologies section entitled *Propagation and Interaction Effects of High Intensity Femtosecond Laser Beams in the Atmosphere*.<sup>197</sup>

The *New Scientist* published an article condemning this research in March 2005. It cited the research contract detailed above and raised concerns over the abuse of the weapon for torture and the potential for adverse long-term physiological and psychological effects.<sup>198</sup> (See the 'Introduction and Commentary' section of this BNLWRP report for further discussion)

### 3.6 RIOT CONTROL AGENTS & MALODORANTS

#### Riot Control Agents (RCAs)

##### *CS and PAVA in the United Kingdom*

In late 2004 the Police Scientific Development Branch (PSDB), UK Home Office published a report on CS and PAVA entitled: *Comparison of CS and PAVA: Operational and Toxicological Aspects*.<sup>199</sup> The aim of the report, as stated in the summary, is to assist the police in choosing which incapacitant to use and inform health practitioners on the effects of their use. The report's authors do not draw a conclusion on whether one incapacitant should be used over the other:

It is intentional that this report does not contain a conclusion. PSDB recognise that there are benefits and disadvantages of each spray and as different forces have different operational needs it is better that the decision regarding which incapacitant to deploy is made locally rather than as a national standard. It is conceivable that there may be a place for both within certain forces for use in different operational situations.<sup>200</sup>

*Table 1* below summarises some of the main differences between CS and PAVA cited in the report. The statements from the Department of Health Committees on Toxicity, Mutagenicity and Carcinogenicity of Chemicals in Food, Consumer Products and The Environment (COT) for CS (1999) and PAVA (2002) are included as appendixes to the report along with an updated statement on PAVA from November 2004. The latter was produced due to gaps in available data. The Committees reviewed new data on mutagenicity, skin sensitisation, and reproductive toxicity, which did not show any adverse effects, and concluded:

The available information, both from the toxicity data in experimental studies, and experience in use, indicates that the low exposures arising from the use of PAVA incapacitant spray would not be expected to be associated with any significant adverse health effects. However we recommend that monitoring of experience-in-use be continued.<sup>201</sup>

Whilst the Home Office appears satisfied that the use of incapacitant sprays does not present any undue risk to those at the receiving end, there is still concern over safety and health effects particularly with regard to CS. As we noted in our last report a study in the September 2004 *Emergency Medicine Journal* found that the specific CS sprays used by the police may cause more adverse and long-lasting effects than other sprays, and the authors recommended that a detailed study be carried out to establish the potential adverse effects of UK police CS sprays.<sup>202</sup> Others have drawn attention to the recommendation in the 1999 COT Statement for follow-up studies on the effects of CS.<sup>203</sup> The final conclusion of that Statement reads:

The Committee considered that further information needs to be obtained on the effects of CS spray in humans. In this regard it was noted that systematic studies in volunteers to investigate the toxicity of CS spray may present insurmountable difficulties. The Committee thus recommended that follow-up studies be carried out on individuals treated for the immediate effects of CS spray in order to obtain data on whether delayed effects occur. Information should also be collected in these studies relating to the previous medical history of the individuals involved, particularly with regard to respiratory or cardiovascular disease, or treatment with neuroleptic drugs.<sup>204</sup>

Table 1: PSDB Comparison of CS and PAVA <sup>205</sup>

	<b>CS</b>	<b>PAVA</b>
<b>Level of Incapacitation</b>	Always some effect. Acts on a range of senses. Stops people more quickly than PAVA due to affect on breathing. Risk of affecting bystanders	Primarily affects the eyes causing severe pain (far greater than CS). People suffer more than with CS. Mixed results, sometimes person carries on fighting. Can also irritate the throat.
<b>Factors Influencing Effectiveness</b>	Normally some effect if CS hits a person. Reduced need for accuracy. Reports of it being ineffective against some people with mental conditions or under the influence of drugs	Must enter the eyes to be effective but only a small amount required. Increased need for accuracy. Person can protect themselves by covering their eyes
<b>Speed of Action</b>	Can be delay of 20-30 seconds for full effects but some effects immediate. Longer delay in open air than confined spaces	Normally instantaneous provided it gets into the eyes. Delay if person wearing glasses. Reports of no effects with some people
<b>Recovery Time</b>	Recovery starts after 15 minutes (sooner than with PAVA) but full recovery can take longer. Most effects gone after 1 hour but some people take 12-14 hours to fully recover	Effective for longer with 'eyes closed and extremely painful'. Recovery usually quick once it starts although reports of people crying for hours afterwards
<b>Use in Confined Spaces</b>	Effective in confined space with less need for accuracy. Will also affect police officers in the vicinity	Favoured over CS because of lower cross contamination. Prisoner in a cell can be sprayed without marked affects to others
<b>Use Against Groups of People</b>	'Ideal' because it affects all in the vicinity.	More difficult as it needs to get into the eyes of each person. Drawn sooner than CS due to increased need for accuracy.
<b>Use Against Dogs</b>	Generally ineffective	Effective deterrent
<b>Effects on Officers as a Result of Use</b>	Some effect in many situations. Most significant indoors or at close range	Lesser effect on people in the vicinity but can irritate the throat and the skin
<b>Compatibility with Taser</b>	Significant risk of ignition if Taser used on person who has been sprayed	Also risk of ignition although not as likely as CS. Blue flame produced is hard to see and could result in officer being unaware that a person is on fire
<b>Compatibility with Other Police Equipment</b>	Solvent used, MIBK, can have a detrimental effect on some plastics	Solvent used, ethanol and water, has no effect
<b>Decontamination of People</b>	Verbal reassurance. Move to fresh air. Do not rub eyes. If recovery does not occur within 15-20 minutes copious cool water should be used to flush out remaining CS from the face	Verbal reassurance. Move to fresh air. Do not rub eyes. If recovery does not occur within 15-20 minutes copious cool water should be used to flush out eyes
<b>Decontamination of Vehicles and Buildings</b>	Ventilation and water.	Ventilation
<b>Training and Familiarisation</b>	Exposure to CS during training available. Emphasis on dangers of positional asphyxia and acute behavioural disorder	As for CS

A report in the December 2004 issue of the journal *Anaesthesia* comprised a case study about postoperative complications due to CS spray exposure that had occurred some 10 hours earlier. The report concluded:

In summary, anaesthetists should be aware that patients exposed to CS spray may be at risk of airway problems hours after exposure. The attending staff may also be at risk of secondary exposure and should take appropriate precautions.<sup>206</sup>

In November 2004 the Association of Chief Police Officers (ACPO) published a document giving guidance for police use of CS sprays.<sup>207</sup> One point in the guidance relates to the use of CS against crowds at public order events:

Such action on the part of an officer may have a profound impact on crowd dynamics with obvious implications for public safety and public order. The spraying of CS in these circumstances may lead to widespread cross contamination causing panic or even hysteria. Similarly, the use of CS spray in crowded public areas may cause significant cross contamination and another use of force option may be more appropriate. The decision to use CS spray against a person in these circumstances must be capable of subsequent justification and the closest scrutiny.

The document points out that the spray “should not be used at a distance of less than 1 metre unless the nature of the risk to the officer is such that this cannot be avoided”. It also notes that use against a person with a firearm should be carefully considered:

Since the spray may only cause temporary incapacitation, its use against a subject armed with a firearm may not be appropriate. Where a subject actually has hold of a firearm the effects of the spray may cause them to fire indiscriminately. However, if the firearm is merely close to hand the spray may be useful in preventing subjects actually arming themselves.

Leicestershire Police recently replaced their CS spray with a PAVA spray since they consider it a safer and more effective alternative according to a BBC News report.<sup>208</sup>

According to a 2004 report by HM Inspectorate of Constabulary for Scotland, *A Thematic Inspection of Personal Protective Equipment in the Scottish Police Service*, CS spray was used 403 times in 2001/02 and 382 times in 2002/2003. These figures include occasions when CS spray was drawn but not discharged.<sup>209</sup>

*CR in Northern Ireland in the 1970's.*

Documents released this year under the new freedom of information legislation show that the irritant agent CR (Dibenz(b,f)-1:4-oxazepine) was authorised for use in prisons in Northern Ireland from 1973 in the event of mass escape attempts. The use of CR during riots at Long Kesh prison (later renamed the Maze) in October 1974 has long been alleged. Former prisoners are planning legal action against the British Government claiming that the use of CR in Long Kesh, which was dropped from helicopters, caused a high incidence of cancers and lung problems with over 50 prisoners having died or become ill.<sup>210</sup> A former prisoner at the Maze was quoted in *The Observer*:

‘I’ll never forget it, there were grown men screaming for their mothers,’ he said. ‘We’d all had experience in CS gas, which was easy to avoid, but this was something different, you couldn’t get away from it. I felt like I was on fire. They just decided to experiment on us like we were guinea pigs.’

CR is more potent than CS but it is less toxic (i.e. the lethal dose is higher than it is for CS). However a toxicological review of RCA's from 2001 notes that the effects on the eye and skin caused by CS are 'of shorter duration, less severe and more variable' than CR.<sup>211</sup> The review concludes that use of such compounds (RCA's) is not without risk despite their low toxicity:

The risk of toxicity increases with higher exposure doses and prolonged exposure durations. Pulmonary, dermal and ocular damage may occur on exposure to high concentrations of these substances, particularly on exposure to DM or CN. Furthermore, it is best recognized that exposure to riot control agents in enclosed spaces may produce significant toxic effects irrespective of the riot control agent in question.<sup>212</sup>

With regard to long-term effects of CR the reviewers note that there is little information relating to the cancer-causing potential: "The carcinogenic potential of CR is unknown because very little research has been conducted to ascertain the ability of CR to produce neoplasia or long-term effects."<sup>213</sup>

#### *Assaults Against Civilians in Darfur, Sudan*

In Darfur, Sudan in November 2004 the government security forces carried out an assault against people at the El-Geer refugee camp who had been forced out of their villages by the pro-government Janjaweed militia. The militia have been accused of genocide in the region killing 100,000 and displacing over two million people.<sup>214</sup> A BBC journalist witnessed the police attack on the refugee camp in the middle of the night and saw tear gas grenades fired around the camp, including into areas where women and children were sheltering. The police proceeded to bulldoze the camp in front of UN officials and African Union peacekeepers present in clear breach international humanitarian law.<sup>215</sup>

#### *Assaults Against Civilians in Zimbabwe*

In September 2004 Amnesty International called for a 'full independent inquiry' into the use of excessive force by the Zimbabwe Republic Police to evict people living in Porta Farm shantytown on the outskirts of Harare. The police fired tear gas directly into people's homes, reportedly causing ten deaths.

Hundreds of residents have complained of chest and stomach pains, nose bleeding and other ill-effects since the tear gas incident. Doctors who examined some of the Porta Farm residents, following the events of 2 September, believe that those most seriously affected by the tear gas were particularly vulnerable due to pre-existing illnesses such as tuberculosis.<sup>216</sup>

The Zimbabwe police denied that any deaths occurred during the attacks.<sup>217</sup>

#### *Other Uses of Tear Gas*

In February 2005 Haitian police fired tear gas and then bullets into a crowd of people at a demonstration in Port-au-Prince.<sup>218</sup> In March 2005 Turkish police used tear gas to break up a demonstration by women in Istanbul and then kicked and beat protesters with truncheons.<sup>219</sup> In March 2005 Kenyan police used water cannons and tear gas to disperse protestors at the Parliament's opening ceremony.<sup>220</sup> Also in March, police in Ecuador fired tear gas at the Congress building when opposition party members refused to leave the chamber.<sup>221</sup>

## *French Military*

The French military intervened in the Ivory Coast in November 2004 after an attack by the Ivory Coast's air force on French peacekeepers. The French retaliation was followed by large-scale rioting, looting and attacks against French citizens. The French military used tear gas against rioters in some residential areas.<sup>222</sup>

A recent Sunshine Project report on *Biological and Biochemical Weapons Related Research in France* includes information on French manufacturers of RCA delivery systems.<sup>223</sup> Etienne Lacroix Tous Artifices S.A. is thought to be the major French company in this area. The report describes the GALIX system, a vehicle mounted 80mm launcher system developed in partnership with *GIAT Industries*, which can fire a variety of munitions including those with a CS payload. The range of GALIX ammunition was shown in a presentation to the NDIA '2003 Mines, Demolitions and Non-Lethal Conference and Exhibit':

GALIX 4: SELF PROTECTION AMMUNITION  
GALIX 6: IR DECOY  
GALIX 7: ILLUMINATION ROCKET  
GALIX 13: MULTI-BAND SMOKE SCREENING AMMUNITION  
GALIX 15: CS GAS AMMUNITION  
GALIX 17: SMOKE SCREENING TRAINING AMMUNITION  
GALIX 18: SELF PROTECTION PRACTICE AMMUNITION  
GALIX 19: STUN AMMUNITION<sup>224</sup>

The Sunshine Project report also described a system called the SIMULTITOX, which is a grenade that disperses aerosols used for NBC training purposes. However, their research uncovered its potential for use as a weapon:

At a June 2004 weapons exposition outside Paris, we presented ourselves as a foreign aid organization interested in purchasing 'non-lethal' weapons for use in refugee camps. We were told by a salesperson from Etienne Lacroix that, if we are interested, the SIMULTITOX could easily be provided with a payload of "non-lethal" chemical agents such as malodorants.<sup>225</sup>

Other French companies described in the Sunshine Report include SAE Alsetex, SNPE, and SMA.<sup>226</sup> SAE Alsetex produces two launching systems that fire CS grenades: the Cougar 56mm system and the smaller Chouka 56mm system, which is used by the French police. The company also produces a variety of CS grenades, projectiles, and sprays.<sup>227</sup> Verney Carron produces the Flash-Ball gun, used by the French police, which fires a variety of ammunition including CS filled frangible projectiles.<sup>228</sup>

## *Irish Military*

*The Times* reported that the Irish Department of Defence is considering giving soldiers "...less lethal weapons, including pepper spray pellets, for use when they are providing back-up to gardai [Irish Police Force]." <sup>229</sup> According to the article the Garda emergency response unit (ERU) have recently been given less-lethal weapons including pepper spray projectiles and beanbag rounds for use in hostage and siege situations but assert that they will not be used for crowd control purposes. The military would only use such weapons when providing support to specific police operations.<sup>230</sup>

## *US Military*

The 2004 Annual report for the US Army's Edgewood Chemical and Biological Center (ECBC) noted that their Research and Technology Directorate had:

Redeveloped the production base for the riot control agent included in the M7A3 CS grenade in order to allow production to move forward on time after more than 15 years out of production.<sup>231</sup>

It seems then that ECBC will manufacture the CS pellets for the 58,200 M7A3 grenades the US Army was seeking a manufacturer for in July 2004.<sup>232</sup> As we noted in our previous report (BNLWRP Report No. 6) the announcement seeking a manufacturer described the M7A3 as "... a CS filled burning type grenade used to control counterinsurgencies and other tactical missions." These stated uses are particularly concerning because they are prohibited by the Chemical Weapons Convention (CWC), which only permits use of riot control agents for 'law enforcement including domestic riot control purposes'.

## *Danish Police*

*The Copenhagen Post* reported that the National Board of Health in Denmark has approved pepper spray for use by Danish police. Several forces will test it before it is more widely adopted.<sup>233</sup>

## *Criminal Use of Pepper Spray*

In our last report (Research Report No. 6, October 2004) we drew attention to the criminal use of non-lethal weapons, particularly pepper spray and stun guns, in robberies, assaults and other attacks. In the *Table 2* below we have listed some recent reports extracted from the media of criminal use of pepper spray. This list is provided by way of example and is not intended to be a comprehensive.

We had not previously noted the apparent use of pepper spray by some of the hijackers of aircraft on 11 September 2001. The 9/11 Commission Report, published in Summer 2004, described reports of its use on two of the planes. Regarding American Airlines Flight 11, which was flown into the North Tower of the World Trade Center in New York, the report noted:

The hijackers quickly gained control and sprayed Mace, pepper spray, or some other irritant in the first-class cabin, in order to force the passengers and flight attendants toward the rear of the plane. They claimed they had a bomb.<sup>234</sup>

Regarding United Airlines Flight 175, which was flown into the South Tower of the World Trade Center, the report noted:

The hijackers attacked sometime between 8:42 and 8:46. They used knives (as reported by two passengers and a flight attendant), Mace (reported by one passenger), and the threat of a bomb (reported by the same passenger).<sup>235</sup>

Table 2: Selected recent media reports of crimes committed using pepper spray

Report	Country	Headline
12 Oct 04	USA	“Pepper-spraying thugs hit again”, <i>NapaNews.com</i>
17 Nov 04	UK	“Pepper spray attack on city bus”, <i>BBC News</i>
29 Nov 04	USA	“Pepper spray scare at toy store”, <i>NEWS.com.au</i>
7 Dec 04	USA	“Gunman uses pepper spray to escape in Wal-Mart heist”, <i>Associated Press</i>
10 Dec 04	Japan	“Robbers on the run with 140 million yen”, <i>IHT/Asahi.com</i>
1 Feb 05	USA	“Police: Assistant attorney general mugged”, <i>Orlando Sentinel</i>
17 Feb 05	USA	“Storeowner, Customers Pepper- Sprayed By Robbers”, <i>WSOCTV.com</i>
22 Feb 05	Canada	“Man pepper-sprays B.C. RCMP officer, steals cruiser”, <i>CBC News</i>
16 Mar 05	USA	“Pepper Spray Used in Robberies at ATMs”, <i>The Seattle Times</i>
17 Mar 05	USA	“San Jose Girl, 12, Assaulted with Pepper Spray”, <i>CBS 5 News</i>
24 Mar 05	USA	“Robber Uses Pepper Spray in Holdup”, <i>WLBT 3 News</i>
28 Mar 05	USA	“Pepper Spray Used In Robbery”, <i>Leesburg2Day.com</i>

### *Pepper Spray in US Schools*

There have been further reports of release of pepper spray as a ‘pranks’ by school children in the US. For example: “Girl Releases Pepper Spray at D.C. School”<sup>236</sup>; “30 treated for pepper spray; 2 teens charged” [High School in Boston]<sup>237</sup>; and “Pepper Spray Sends 18 Students to Hospital.”<sup>238</sup> This is likely due to the ease of availability of such sprays in the US where, unlike the UK, it is legal for citizens to carry them.

School children in the US have also been on the receiving end of the pepper sprays carried by police in schools. When fights broke out at a dance for 11-15 year olds in Omaha, security guards and police intervened with pepper spray.<sup>239</sup> At a school in Michigan a police officer reportedly used pepper spray on a 14-year-old girl who would not leave the cafeteria when requested and swung her arm at the police officer. The officer was apparently cleared of any wrongdoing by a police department investigation.<sup>240</sup> At a high school in Indianapolis a police officer sprayed pepper spray in the air to disperse a sit-in protest by students.<sup>241</sup>

### *Pepper Spray Gel*

Mace, a company that produces a variety of OC (pepper) sprays and whose name has for a long time been synonymous with such irritant sprays, has recently announced a new product. It is a sticky gel that apparently ‘sticks to the face like glue’. The company claims it is ‘hotter than other pepper sprays on the market’ and has a range of 25 feet. They are marketing it to the general public as Mace Gel and to the police and military as Pepper Gel.<sup>242</sup>

### *New Zealand*

A New Zealand MP is proposing an amendment to the law that would allow citizens to use pepper spray or mace in self-defence.<sup>243</sup>

## Malodorants

The Sunshine Project recently obtained a 1997 research proposal by the US Army Edgewood Research, Development and Engineering Center (ERDEC) [now Edgewood Chemical and Biological Center (ECBC)] entitled *Odorous Substances*. The document proposed development of malodorants delivered by microcapsules:

First, develop a comprehensive matrix of distinctive odors related to specific populations, religious beliefs, and/or geographical areas. ... Next, find a chemical compound or mixture of chemicals that duplicated the most important of those odors as nearly as possible. Finally, develop encapsulation methods and a prototype hand-held delivery system for delivering those chemicals during various scenarios.<sup>244</sup>

The idea set out in the proposal was to develop a malodorant that was effective against any population around the world. Work in this area was subsequently taken forward and in 2003 the National Research Council report on NLWs noted that there had been efforts to characterise the effectiveness of odorous compounds, which could be used in combinations to "...address cross-cultural differences in effectiveness."<sup>245</sup> (For more information see BNLWRP Research Report No. 4, December 2003<sup>246</sup> and the 'Conference Report' section of this report - Report No. 8).

### 3.7 BIOCHEMICAL INCAPACITATING AGENTS

The British Medical Association released a report in late 2004, by Professor Malcolm Dando (co-Director of the BNLWRP and Director of the Bradford Disarmament Research Centre), entitled *Biotechnology Weapons and Humanity II*, which addressed the implications of advances in biotechnology for new biological or biochemical weapons.<sup>247</sup> Chapter 5 addresses ‘The Spectre of Future Malign Applications’ and includes a section on ‘non-lethal’ weapons, describing the potential for interference with receptors in the brain to impair cognitive function or induce anxiety and depression. The report warns of shortsightedness in focussing on the potential for use of new biochemical agents for hostage rescue situations and the like:

...it is not satisfactory to discuss only hostage rescue scenarios when looking to the future implications of current interest in incapacitants. We have to consider not just the friendly forces being equipped with non-lethal options, but also the future interrogator and the future torturer able to induce depression or euphoria or enhance pain by the use of drugs discovered in the future. We also have to remember that any capabilities which evolve may also become available to a future dictator or terrorist.<sup>248</sup>

Dando notes that the development of new biochemical weapons agents under the cover of non-lethal weapons development poses the greatest threat to the prohibitions of Chemical Weapons Convention (CWC) and the Biological and Toxin Weapons Convention (BTWC):

If we permit the growth and influence of institutions within military of police forces in major states which are dependent on the development and use of new chemical agents, it is difficult indeed to see where the process will end.<sup>249</sup>

#### *Sunshine Project Research*

A 1994 research proposal put forward by the US Air Force Wright Laboratory was recently obtained under Freedom of Information by the Sunshine Project. The document, entitled *Harrassing, Annoying and “Bad Guy” Identifying Chemicals*, proposed three categories of chemical-based weapons including “Chemicals that attract annoying creatures to the enemy position...”, “Chemicals that make lasting but non-lethal markings on the personnel”, and “Chemicals that effect human behaviour so that discipline and morale in enemy units is adversely effected.”<sup>250</sup> The latter category, which is relevant under this section of our report, included an unusual suggestion: “One distasteful but completely non-lethal example would be strong aphrodisiacs, especially if the chemical also caused homosexual behaviour.” Unsurprisingly it soon came to the attention of the media: “US military pondered love not war”, *BBC News*, 15 January 2004; “Pentagon sexes up the battle. But ‘Gay Bomb’ goes bust in the lab”, *Boston Herald*, 15 January 2004. The Joint Non-Lethal Weapons Directorate (JNLWD) told *Fox News* that the proposal was never acted on or considered for further development.<sup>251</sup> However, as the Sunshine Project noted in a recent news release,<sup>252</sup> US interest in the development of more profound incapacitating agents has continued. (for further discussion of these issues see previous BNLWRP reports, particularly No. 5, May 2004 and our recent article in *Disarmament Forum*<sup>253</sup> as well as the ‘Conference Report’ section of this BNLWRP report).

The recent Sunshine Project report (mentioned above under the RCAs section), *Biological and Biochemical Weapons Related Research in France*, includes an assessment of French interest in this area.<sup>254</sup> The report points to military research investigating the behavioural

and cognitive effects of various psychoactive and anaesthetic compounds. The report authors argue that the level of interest is not wholly justified for chemical defence purposes but note:

It must be emphasized that we could not find a single document by French researchers that explicitly indicates an official objective to develop calmatives, convulsants or other incapacitants as ‘non-lethal’ chemical weapons.<sup>255</sup>

### 3.8 COMBINED TECHNOLOGIES

The recent NATO report on NLWs (December 2004) notes that the use of combined technologies can 'reinforce the effect on an anti-personnel NLW. Examples given in the 'technologies of interest' section of the report are:

Kinetic and acoustic (the vortex):

- A sizeable vortex generator could theoretically move objects or people. This system would require very much energy, and produces a very great but poorly directional sound effect;
- A small vortex generator gun could convey chemical products for anti-personnel applications (Marker, tear-gas, malodorous) and anti-equipment (powder of carbons).

Laser with stroboscopic radiation:

- A stroboscopic effect of frequency between 7 and 12 Hz can provoke severe discomfort and nausea in a group of persons.

Different types of laser:

- The joint use of two laser sources could permit a reversible modification of vision and a local increase in target temperature.<sup>256</sup>

A police department in Illinois has initiated a pilot programme to test the utility of the Cobra StunLight,<sup>257</sup> which is a combination flashlight and pepper spray dispenser produced by Shield Defense.<sup>258</sup>

### 3.9 DELIVERY SYSTEMS

#### Non-Lethal Munitions

In our last report (No.6, October 2004) we referred to the US military's development of a next generation assault rifle called the XM29:

A recent article in the New York Times described a dual lethal/non-lethal prototype rifle under development, called the XM29, that can fire either conventional bullets or 20mm non-lethal rounds containing rubber balls or pepper spray for example. The user can 'toggle' between the two functions.<sup>259</sup>

Although non-lethal 20mm munitions are planned it is important to note that the XM29 is primarily a lethal weapons system, firing both conventional bullets as well as 20mm airburst munitions with high explosive, thermobaric (fuel-air explosive), or flechette (multiple nail-like metal projectiles) payloads.<sup>260</sup> A related XM25 system will fire the 20mm airburst munitions only.<sup>261</sup> This development programme was formerly known as the Objective Individual Combat Weapon (OICW).<sup>262</sup> As regards the non-lethal aspect of the programme, 20mm airburst munitions containing CS were tested in 2002.<sup>263</sup> Earlier, in 2001, a variety of possible payloads had been suggested "Counter Personnel: Markers, Taggants, Incapacitants, Malodorants, OC/RCA, Stingball Grenade, Fuzed Blunt Injury; Counter Materiel: Markers, Taggants, Anti-traction."<sup>264</sup> The range of the system is reportedly around 250m.<sup>265</sup> The development programme for the non-lethal variant has now been renamed 'Airburst Non-Lethal Munition' (ANLM), which is funded under the Joint Non-Lethal Weapons Program<sup>266</sup>, with development work overseen by US Army's Tank- Automotives and Armament Control - Armament Research, Development & Engineering Center (TACOM-ARDEC) at Picatinny Arsenal, New Jersey. A recent contract from 2004 for design improvements to the ANLM describes the purpose of the development effort: "The ANLM program is expected to produce a family of long range precision non-lethal munitions."<sup>267</sup>

The US Army is also taking the lead in development of larger calibre non-lethal munitions with various payloads such as the 40mm MK-19 non-lethal 'telescoping projectile' and the 81mm Non-lethal Mortar Cartridge (see previous BNLWRP reports). The largest non-lethal munition under development is a 155mm 'cargo round' adapted to carry a liquid payload called the XM1063.<sup>268</sup> To give some idea of the size and range, this munition is based on the 155mm M864, which carries 72 grenades at ranges of up to 28km.<sup>269</sup> The Army plans to test a prototype of the XM1063, which will have a 'liquid payload dissemination system', at ranges of 15km or more, during 2005. A 'vehicle area denial payload' comprising nanoparticles is also planned.<sup>270</sup> There is no indication as to the exact composition of either the anti-personnel or anti-vehicle payloads, although the September 2004 contract announcement noted that "Payload agent effectiveness includes engineering support and test hardware support for payload agent concentration, area coverage, and payload agent effectiveness testing at the Army Edgewood Chemical Biological Center", and so the anti-personnel liquid payload will certainly be some kind of chemical agent.<sup>271</sup> Whether this is CS, PAVA or a malodorant, observers have questioned the suitability of such a large, long-range munition for 'law enforcement purposes', which is the only exemption permitted for the use of RCAs under the Chemical Weapons Convention (CWC). One potential liquid payload (anti-personnel or anti-materiel) that would not fall under the CWC would anti-traction materials i.e. slippery substances (see Mobility Denial System (MDS) in previous reports).

General Dynamics Ordnance and Tactical Systems has won a contract to support initial testing of this munition. The contract document, obtained by The Sunshine Project, provides an overview of the current work:

The NLOS [non line-of-sight] Cannon Artillery Projectile Team of the Munition Systems and Technology Division at ARDEC is currently engaged in an effort to develop a 155MM Non-Lethal artillery projectile in order to support NLOS Future Combat Systems requirements. Advanced concept Non-Lethal payload designs for the 155MM M864 projectile have recently been developed and are planning to be tested at Yuma Proving Grounds for preliminary structural evaluations.<sup>272</sup>

Another research proposal document recently obtained by the Sunshine Project is from 1998 that proposed adaptation of the US Army's M56 Coyote Smoke Generator, used for producing obscuring smoke on a battlefield<sup>273</sup>, to incorporate irritants such as OC into the smoke:

People will be incapacitated, not able to efficiently function, if they can not see. People who can not see will find it more difficult if breathing becomes uncomfortable in addition to not being able to see. The Army's new HMMWV mounted M56 multi spectrum smoke and obscurants generator is capable of creating clouds of air born incapacitating materials.

According to an *Associated Press* report the Israeli Army has ordered the vehicle-mounted VENOM system, which can fire a variety of 40mm munitions including tear gas and smoke grenades.<sup>274</sup> The system has also been tested by the US Marines (as noted in BNLWRP Report No. 6).

## **Non-Lethal Landmines**

The Taser Anti-Personnel Munition (TAPM) was demonstrated to the US Army towards the end of last year according to the Joint Non-Lethal Weapons Directorate's most recent newsletter: "TAPM was able to sense and engage moving targets at ranges up to 21 feet with a Passive IR Sensor instead of triplines."<sup>275</sup> The system uses the same cartridges as the Taser gun and was also demonstrated with an extended range (25ft) cartridge.<sup>276</sup>

## **Unmanned Vehicles**

### *Unmanned Ground Vehicles*

The US Army plans to deploy 18 armed Talon robots to Iraq in April this year, fitted with lethal automatic weapons and controlled via a laptop computer.<sup>277</sup> Over 100 Talon robots, made by a company called Foster-Miller, are already used in Afghanistan and Iraq for other tasks including surveillance and bomb disposal.<sup>278</sup> According to the Foster-Miller web site:

TALON robots can be configured with M240 or M249 machine guns or Barrett 50 caliber rifles for armed reconnaissance missions. A prototype system was delivered to the 3/2 Stryker brigade for evaluation, and successful testing was performed by the brigade in Kuwait in December 2003. Additional prototypes have been manufactured and are currently undergoing system safety certification by the U.S. Army. Alternative weapons, including 40 mm grenade launchers and anti-tank rocket launchers, continue to be evaluated by the U.S. Army.<sup>279</sup>

However, we may see these or similar systems used for crowd control purposes in the future, since they have been adapted for use with a variety of weapons with 'lethal and non-lethal

payloads' including a 12 gauge shotgun and a 40mm grenade launcher, both of which can fire non-lethal projectiles.<sup>280</sup> The Gladiator Tactical Unmanned Ground Vehicle (TUGV)<sup>281</sup> is being developed as a 'tele-operated/semi-autonomous' platform for both lethal and non-lethal weapons for future use by the Marine Corps. (see BNLWRP report No. 6 for more information on planned crowd control uses of this system). The US Marine Corps recently awarded a \$26.4 million contract to Carnegie Mellon University and United Defense Industries to produce 6 prototype Gladiator systems by July 2007.<sup>282</sup>

Andros robots, produced by Remotec<sup>283</sup>, have been used by some police departments in the US for several years for non-lethal weapons delivery.<sup>284</sup> In addition to their use for bomb disposal they can be fitted with a variety of weapons including a 12-gauge shotgun, an SL-6 non-lethal launcher, a 'high intensity light assembly', and a riot control agent gas dispenser. Recently police forces in Florida<sup>285</sup> and Virginia<sup>286</sup> purchased some of these robots.

The National Center for Defense Robotics, which describes itself as "...an independent non-profit organization formed for the purpose of advancing the transition of key enabling, agile robotics technologies into various, defense-related unmanned systems, vehicles, devices, systems, applications, and other platforms"<sup>287</sup> recently funded a project at Carnegie Mellon University's National Robotics Engineering Consortium to "develop performance-based guidelines for lethal and non-lethal "weaponized robots."<sup>288</sup>

## 4. BIBLIOGRAPHY UPDATE

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## 5. CONFERENCES

### Forthcoming Conferences

*3rd European Symposium on Non-Lethal Weapons*  
European Working Group on Non-Lethal Weapons  
10-12 May 2005  
Stadthalle Ettlingen, Germany  
<http://www.non-lethal-weapons.com/sy03index.html>

### Recent Conference Proceedings and Presentations

*Non-Lethal Defense VI*  
National Defense Industrial Association (NDIA)  
14-16 March 2005  
Hyatt Regency, Reston, VA, USA.  
Presentations will be published online at:  
[www.dtic.mil/ndia/2005nonlethdef/2005nonlethdef.html](http://www.dtic.mil/ndia/2005nonlethdef/2005nonlethdef.html)

*Non-lethal Technology and Academic Research Symposium (NTAR) VI*  
15-17 November 2004  
Graylyn Conference Center, Winston-Salem, NC, USA

The annual Non-lethal Technology and Academic Research (NTAR) Symposium was held in November 2004. NTAR is the forum organised by the Non-lethal Technology Innovation Center (NTIC), University of New Hampshire, a centre that was set up by the JNLWD to identify new NLW technologies. The NTAR annual conference is the forum where grantees report on their research funded by JNLWD through NTIC. We did not attend the conference but presentations given there, which covered topics including human effects and advanced technologies, are available online at:  
<http://www.unh.edu/ntic/Conference%20Schedule%202004b.htm>

*New Non-Lethal Weapons Technologies: Implications for British Policing*  
9 November 2004  
Bradford Non-Lethal Weapons Research Project, Centre for Conflict Resolution, Department of Peace Studies, University of Bradford, UK.  
<http://www.bradford.ac.uk/acad/nlw/conferences/bradford2004.php>

This seminar brought together thirty experts with policy, operational, manufacturing, and academic experience to discuss key issues concerning non-lethal weapons, and their use by British police forces. Whilst presentations and discussions covered a range of topics, the seminar focused on the Taser electroshock weapon which is increasingly being deployed by police (and military forces) around the world. Differing perspectives and experiences of the Taser weapon including policy, operational, medical, social, and human rights implications, were discussed. The timing of this seminar was most appropriate since it followed an announcement from the Home Office, in September 2004, permitting the Taser weapon to be

deployed more widely in England and Wales for use by authorised firearms officers. Prior to this, between April 2003 and August 2004, the Taser was on operational trial with five police forces in the UK. With a corresponding potential increase in the use of the Taser, there will be a growing public awareness of its use and effects.

The seminar started with presentations from the BNLWRP team (Dr Nick Lewer, Professor Malcolm Dando, and Mr Neil Davison) which provided an overview of non-lethal technologies that highlighted key issues and technologies; signposted areas of concern relating to tensions with arms control conventions, and; raised ethical questions about the use and abuse of non-lethal weapons. Mr. Colin Burrows QPM then described the work of the 'UK Less Lethal Steering Group', led by the Northern Ireland Office in consultation with the Association of Chief Police Officers (ACPO), which has published a series of reports describing the research programme to find alternatives to the plastic bullet round, including electrical and other kinetic energy weapons. Assistant Chief Constable Ian Arundale of West Mercia Constabulary described the introduction of the Taser weapon to police forces in England and Wales, a process that he has overseen in his capacity as Chairman of the ACPO 'Working Group on Police Use of Firearms', and Assistant Chief Constable Peter Davies from Lincolnshire Police (who participated in the initial Taser trial) then provided examples of operational experience with the Taser. Dr. Anthony Bleetman, a Consultant in accident and emergency medicine at Birmingham Heartlands Hospital who has been involved in the evaluation of the bio-medical effects of electronic weapons, summarised the medical issues surrounding the use of the Taser and its effects on the body. Finally, Dr. Brian Rappert from the University of Exeter gave a critical appraisal of the evaluation and consultation processes by which non-lethal weapons are assessed in the UK, as well as discussing broader issues relating to police use of force.

*2<sup>nd</sup> International Policing Conference 2004: Safety and Security in a High-Tech World*  
1-3 November 2004  
Adelaide, Australia

This conference included presentations related to non-lethal weapons some of which are available to download:

<http://www.ipc2004.com/downloads.shtml>

*Technologies for Public Safety in Critical Incident Response Conference and Exhibition 2004*  
National Institute of Justice  
27-29 September 2004.  
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Included presentations on non-lethal weapons available at:

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