



**PATTEN REPORT RECOMMENDATIONS 69 AND 70
RELATING TO PUBLIC ORDER EQUIPMENT**

**A RESEARCH PROGRAMME INTO ALTERNATIVE
POLICING APPROACHES TOWARDS THE
MANAGEMENT OF CONFLICT**

This is the Third Report prepared by the Steering Group led by the Northern Ireland Office, in consultation with the Association of Chief Police Officers

December 2002



PHASE 3 REPORT

CONTENTS

<u>Chapter</u>	<u>Headings</u>	<u>Page Numbers</u>
	Foreword by Jane Kennedy	1-2
1.	Introduction	
	A. The background to the third Report	3-4
	B. Feedback on the phase 2 report	5-6
	C. An overview of this report and critical issues for consideration	7-9
2.	The Management of Conflict	
	A. Introduction	10-11
	B. Conflict resolution and policing with the community in Northern Ireland	11-23
	C. Public disorder – illustrative examples in Northern Ireland and elsewhere	23-26
3.	The International Context	
	A. Introduction.	27-28
	B. The International Law Enforcement Forum 2002 at Pennsylvania State University	28-34
	C. The Less Lethal Technologies Symposium	35
	D. European Connections	35-36

<u>Chapter</u>	<u>Headings</u>	<u>Page Numbers</u>
4.	Water Cannon	
	A. PSDB evaluation	37-39
	B. The announcement of 18 July, the DOMILL interim statement and the NI Policing Board statement	39-43
	C. Subsequent developments	43-44
5.	Tasers	
	A. PSDB evaluation	45-79
	B. The medical evaluation	80-85
6.	Impact Rounds	
	A. PSDB evaluation	86-89
	B. The medical evaluation	90-93
7.	Dstl Programme on the Development of Less Lethal Technologies	
	A. Introduction	94-95
	B. Technical progress	95-109
8.	Distraction Devices, Malodorants, Tranquillisers, CS and CN Smoke	
	A. Distraction/disorientation devices	110
	B. Malodorants and tranquillisers	110-111
	C. CS and CN smoke (known as “tear gas”)	111-112

<u>Chapter</u>	<u>Headings</u>	<u>Page Numbers</u>
9.	Developments in Transparency	
	A. Introduction	113
	B. The first review of the L21A1 round	113-114
	C. Guidelines on the use of baton rounds by the Armed Forces in Northern Ireland	114-115
	D. The use of the L21A1 at a range of less than 20 metres	116-118
	E. The report published by the Police Ombudsman for Northern Ireland in May 2002	118-119
	F. Reports of four separate discharges of the baton gun in England and Wales in 2002	120-122
	G. The review of the Independent Assessor of Military Complaints Procedures in Northern Ireland	122
10.	Conclusions and Next Steps	123-124
	Glossary of Terms	125-126

FOREWORD BY JANE KENNEDY

In November 2001, the Steering Group produced a full report on the second phase of the research programme. The programme was set up to:

- establish whether a less potentially lethal alternative to the baton round is available; and
- review the public order equipment which is presently available or could be developed in order to expand the range of tactical options available to operational commanders.

Since then, the work has continued apace. On 18 July 2002, I announced that the Police Service of Northern Ireland were placing an order for six new vehicle-mounted water cannon. I believe this new equipment will provide the police in Northern Ireland with an important additional resource that will reduce the need for other responses to public disorder, such as baton rounds. But they are not a direct alternative to the baton round.

I am grateful to the Steering Group, and to the many contributors to the programme, including those in government service, the police, academics and other experts, for their sustained commitment.

I know from my own involvement with the work, and from my international contacts, that this programme is more detailed and more wide-ranging than any other. For that reason, it is disappointing that, as this report makes clear, there is no off the shelf, commercially available, effective and acceptable alternative to the baton round at this time. I welcome the continuing assessment of systems that are judged to have potential.

But I also welcome the decision that the Group has taken to initiate an in-house development programme, supported by experts in academia and industry. I recognise that this will not be a quick process. If it were, others would have got there already. And exacting standards have rightly been set in initial areas such as range, accuracy, effectiveness and safety. Independent medical evaluation is playing a key role in the whole programme. And the human rights and acceptability issues set out at length in the phase 2 report¹ are still fundamental.

I want to draw attention to another, unprecedented aspect of the programme, namely its transparency. This phase 3 report, like the previous two, is available on the Northern Ireland Office website (www.nio.gov.uk). Government Ministers and the Steering Group are putting a wide range of information into the public domain. In addition to the announcement on water cannon, we have reported to Parliament the medical statements on the use of the current baton round at ranges of less than 20

¹ “Patten Report recommendations 69 and 70 relating to public order equipment – A Research Programme into Alternative Policing Approaches Towards the Management of Conflict”. Phase 2 report, 30 November 2001. www.nio.gov.uk/policing.htm.

metres and after the review of its use after one year. This is important to inform the wider debate.

I welcome too the initiative of members of the Steering Group in forging closer ties with counterparts in North America and elsewhere. Managing conflict, whether public disorder or violent individuals, is a role for virtually all law enforcement agencies. It is right that the focus should not just be on particular technologies, but on developing an integrated and community-oriented approach to the management of conflict. This report contains both an important account of the approach developed by the Police Service of Northern Ireland, and the international context.

I hope that this report will also be carefully studied by interested parties. As before, comments are being sought on it. It poses some important issues for consideration by those who have a contribution to finding the way forward. I will be keenly interested in the views of the Northern Ireland Policing Board and others.

I commend this report and will continue to take a close personal interest in the further stages of the programme.

CHAPTER 1: INTRODUCTION

A. The Background to the Third Report

1. This is the third report of the Steering Group set up to take forward recommendations 69 and 70 of the report of the Independent Commission on Policing for Northern Ireland (the Patten report) which was published in September 1999.
2. Recommendation 69 stated that “An immediate and substantial investment should be made in a research programme to find an acceptable, effective and less potentially lethal alternative to the Plastic Baton Round (PBR).”
3. Recommendation 70 stated that “The police should be equipped with a broader range of public order equipment than the RUC currently possess, so that a commander has a number of options at his/her disposal which might reduce reliance on, or defer resort to, the PBR.”
4. In summer 2000, the Secretary of State for Northern Ireland set up a UK-wide Steering Group to lead the research programme. The Group has comprised representatives from Her Majesty’s Inspectorate of Constabulary, the Home Office, the Association of Chief Police Officers, the Ministry of Defence, the Northern Ireland Policing Board, the Police Scientific Development Branch (PSDB) of the Home Office, the Defence Science and Technology Laboratory, the Police Service of Northern Ireland, and was chaired by the Northern Ireland Office. Since the summer of 2002 the Association of Chief Police Officers Scotland has also been represented on the Steering Group. It was given the following Terms of Reference:

“Objective

To establish whether a less potentially lethal alternative to baton rounds is available; and to review the public order equipment which is presently available or could be developed in order to expand the range of tactical options available to operational commanders.

Task

In the light of the recommendations in the Patten report for a research programme to find an acceptable, effective and less potentially lethal alternative to the Plastic Baton Round, and for the [RUC] to be equipped with a broader range of public order equipment, to provide advice to the Secretary of State for Northern Ireland in a report as follows:

Phase 1 (defining operational objectives and literature review)

Define the operational objective against which less potentially lethal weapons must be tested.

- *Prepare a literature review of less potentially lethal weapons available or under research.*
- *Examine the literature review against the operational objective.*

Phase 2 (evaluating the literature review, preparing business case and directing further research as necessary)

- *Formulate proposals for further research on less potentially lethal weapons which would benefit from further research and which have the potential for successful transfer to the operational field, setting out the timings and the costs of that research.*
- *Prepare business case.*

Phase 3 (research)

- *As directed under Phase 2, conduct further research, evaluate performance and safety, and establish deployment costs.*

Phase 4 (operational objectives and public order equipment)

- *Define operational objectives for public order equipment.*
- *Prepare a report on the tactical deployment of a range of public order equipment in Northern Ireland, covering as wide a range of equipment as possible."*

5. The phase 1 report was published in April 2001² followed by the phase 2 report published in November 2001. Both reports were tabled in Parliament, distributed to a wide range of interested parties and are available on the NIO website or from the secretary to the Steering Group. (Also in November 2001 PSDB published a report entitled "Less Lethal Technologies – Initial Prioritisation and Evaluation".) This report similarly will be published on the Northern Ireland Office website, be tabled in Parliament, and be distributed to a wider range of interested parties. Comments on its contents and views on the way forward will be welcomed. Written comments should be sent to:

The Secretary to the Steering Group
Room 4.12, Block B
Castle Buildings
Stormont
BELFAST
BT4 3SG

or by e-mail to pateam@nics.gov.uk

² "Patten Report recommendations 69 and 70 relating to public order equipment – a paper prepared by the Steering Group led by the Northern Ireland Office", April 2001.

B. Feedback on the phase 2 report

6. The phase 2 Report was published on 30 November 2001. Copies were sent to a wide range of interested parties, including the Policing Board, all the main political parties in Northern Ireland, bodies such as the Human Rights Commission, and some of the pressure groups known to have an interest in the subject. In addition, the report was published on the Northern Ireland Office website. Copies were also sent to a number of overseas interested parties, including police forces and academic institutions. It was also tabled in Parliament on 30 November 2001.

7. Chapter 1 of that report made clear that “comments on its contents and views on the way forward will be welcomed”.

8. In the event, the feedback was limited. Meetings were held by the Northern Ireland Office Minister of State, Jane Kennedy, with representatives of the Social Democratic and Labour Party (SDLP) and the Human Rights Commission. In addition, written comments were received from Amnesty International, British Irish Rights Watch, the Committee on the Administration of Justice, and Dr Brian Rappert.

9. Two of these comments emphasised the importance of human rights issues, and the need to ensure that less lethal weapons were used in accordance with United Nations guidance and other international law. None of the organisations chose to advocate any individual alternative item of equipment, or to propose a specific alternative to the baton round.

10. There was recognition for the efforts made by the Steering Group to seek input from a wider field of human rights organisations. Commentators welcomed the fact that the Chief Constable of the PSNI submits a report to the Police Ombudsman for Northern Ireland after every discharge of a baton round and her subsequent investigation.

11. It would not be practical to include in this report the text of the written comments, in full, but the following points were also amongst those made:

- Greater emphasis should be placed on the planning of operations where force may be used;
- The use of force must be regulated by law, controlled by more senior officers, and be subject to guidelines and principles;
- There should be appropriate biomedical evaluation;
- The Himsworth recommendations should form a baseline for future decisions about weapons involving a chemical component;
- The Steering Group might want to consider the impact that recommending the adoption of a particular weapon, for example an electrical incapacitation device, might have on usage in other countries.

Presentation to the Northern Ireland Policing Board on 4 April 2002

12. On 4 April, the Acting Head of Operations Department in the Police Service of Northern Ireland and the Chairman of the Steering Group gave a presentation to the Northern Ireland Policing Board entitled “Managing Conflict and Responding to Violence – a Less Lethal Perspective”.

13. The presentation began with the international perspective, and a consideration of the use of force. In terms of the legitimacy of the use of force, it was argued that a strict legal test was not enough, issues of morality and ethics were also significant, as were personal, international and community perceptions.

14. In terms of understanding the causes of conflict, the use of force could bring early resolution or it could perpetuate conflict. It was very important that interventions should be designed to impact on the conflict, not to perpetuate violence.

15. In its approach to the work, the Steering Group had taken as fundamental baselines:

- The Human Rights perspective, including:
 - legality;
 - the United Nations principles on the use of force and firearms;
 - the essential criteria of necessity and proportionality;
 - the audit framework set out in the Phase 2 Report, which included strategic, ethical, operational and societal factors.

- The ACPO Operational Requirement which included:
 - accuracy;
 - distance;
 - effectiveness;
 - safety and training.

- The Operational Needs Analysis (again set out in the Phase 2 report).

16. The work of the research programme up to that point was described to the members of the Policing Board in considerable detail, including the assessment of water cannon. It was explained that the research programme was set in the context of alternative policing approaches towards the management of conflict.

17. Consistent with the key themes in the Patten report of human rights-based policing and policing with the community, the importance of strategic and local partnerships was stressed. So too was the need to consider conflict resolution and conflict management across a time line which was not simply event specific.

18. The presentation was referred to in a subsequent press statement issued by the Policing Board.

C. An overview of this report and critical issues for consideration

19. This is the third report by the Steering Group. It is published approximately one year after the second report. As this document shows, much work has been undertaken in the intervening period. Precise costs are not available, but are estimated to be of the order of a further £2 million.

20. Tangible developments – as this report sets out in detail – have occurred; to cite but one example, PSNI have placed an order for six vehicle-mounted water cannon, on an agreed UK-wide specification (as described in chapter 4).

21. However, the search for an existing, safe and effective alternative to the current baton round (the L21A1 introduced as a result of a programme initiated in 1997, well before the Patten Commission) has not yet identified any suitable round, despite an extensive review and evaluation of commercially available and near market products.

22. The Steering Group is aware that in Europe, North America, and elsewhere, a wide range of commercial products, including impact and chemical delivery rounds, is used. Often the only testing for safety and medical purposes is that reported by the manufacturer which we do not believe is a sufficiently thorough test for the acceptance and deployment of use of less lethal options. The criteria are set high in the United Kingdom – the accuracy threshold (described again in detail in chapter 6) and the independent medical evaluation are exacting by any standard. The Group does not consider it could credibly recommend at this stage any existing commercial round as they have not yet been shown to have met our criteria. One impact round – a 12 gauge sock round – is being further evaluated against medical (and effectiveness criteria); but its range limit of 25 metres is a significant limitation. Moreover the sock round is fired from a shotgun; there may be issues relating to the use of conventional firearms to fire a less lethal projectile in a public order situation.

23. Against this background, with the agreement of the Steering Group, the NIO has commissioned a Dstl programme of research supported by parties in academia and industry into the two technologies that are judged to hold the most promise:

- (a) an Attenuating Energy Projectile (AEP) that will have a reduced injury potential compared to the L21A1, specifically to the head;
- (b) a Discriminating Irritant Projectile (DIP) that will deliver a cloud of sensory irritant in a discriminatory manner to an individual.

24. The research requirements for the two rounds are – for the first time – set out in full, in chapter 7. The programme has already completed its first stage, and the progress so far is recorded in chapter 7. If it is taken forward, it can be neither quick nor cheap. It is likely that it would take a further 18-24 months of concentrated research before a finalised specification could be put out to industry for a competitive procurement exercise. And it would cost of the order of a further £2 million, at a time when prioritised expenditure on one project may result in reprofiling or even delay in

taking forward other issues. This is an issue on which the views of interested parties will be welcomed.

25. A related issue, dealt with in chapter 8, is the scope for use in public order situations of CS that is not targeted against one individual. Of course, CS, or colloquially 'tear gas', or CN (which is not approved for use in the United Kingdom) are already widely used in just this way by many law enforcement agencies in Europe, Canada, America, South Africa and elsewhere (as set out in the table in chapter 5 of the phase 2 report). However CS has not been used in this fashion in Northern Ireland since the early 1970s and not in England since the mid-1980s (though it is understood some police forces in England and Wales have retained the capability). Moreover, an improved CS pyrotechnic delivery system has been developed over the past few years (not as part of the Patten research programme). The question arises, as to whether those responsible should facilitate the use of this technology in Northern Ireland, as in England and Wales. Again the views of interested parties would be welcomed.

26. It is essential to understand that the issues go much wider than the choice or development of technology and equipment alone. The feedback on the phase 2 report, while limited, rightly reinforced the emphasis in the earlier publications on the human rights conventions and legislation, the acceptability framework through medical evaluation, and the need for clear guidance, good planning, consistent training and subsequent evaluation.

27. The phase 2 report, at chapter 2, set out at some length the ACPO conflict management model. Since then, the PSNI has further developed, in the context of implementing the Patten Report, its approach to policing with the community and partnership problem-solving.

28. Chapter 2 of this report therefore explains in some detail the PSNI approach to the management of conflict. The chapter also contains a description of some public order incidents in Northern Ireland and overseas during the past year.

29. The Steering Group has taken a lead in publicising the issues and indeed the progress of the programme. At a public conference in Manchester this autumn, speakers gave detailed accounts of the operational needs assessment summarised in chapter 2 of the phase 2 report, and of the whole medical evaluation process. Discussions were held with senior managers from the French National Gendarmerie, and representatives from countries as diverse as Switzerland and New Zealand.

30. Then, in October, members of the Group attended an in-depth two-day conference hosted by Pennsylvania State University in the US. A special focus was placed on three important areas:

- (a) information sharing;
- (b) gaps in critical areas such as capability and medical evaluation;
- (c) the potential for developing common standards.

31. These are all areas which the Steering Group is addressing, indeed helping to lead the way. Chapter 3 is devoted to the international context for the development of alternative approaches to the management of conflict, including a summary account of the deliberations at the Pennsylvania State University forum.

32. Finally, to assist with transparency, this report brings together in one place a number of elements relating to the current baton round. While reiterating that the inception of the £1.65m programme for its development preceded the Patten Report by two years, the usage of that round in Northern Ireland, and now England and Wales, forms part of the context against which the current research programme must be judged. These matters are covered in chapter 9, including the summary of the report published by the Northern Ireland Police Ombudsman in May 2002.

33. Chapter 10 is a short conclusion to the report, focusing in particular on some outstanding issues and next steps.

34. The information contained in this report is correct to the best of the Steering Group's knowledge at 30 November 2002.

CHAPTER 2: THE MANAGEMENT OF CONFLICT

A. Introduction

1. The phase 2 report set out, in a similarly prominent position, the demands on the police and officers in managing conflict in the community. It set out a disorder model and a conflict management model that were largely generic approaches adopted by ACPO as a whole. That chapter then went on to look at specific instances of public disorder in the United Kingdom.
2. The next – and main – section in this chapter sets out at some length the Police Service of Northern Ireland approach to conflict resolution and policing with the community in Northern Ireland. Before turning to that, it may be helpful to bring out some important aspects of the development of the approach of police generally to potentially violent situations.
3. Individual police officers patrolling, either armed or unarmed, require to have a means beyond the traditional police baton of protecting themselves and intervening as necessary in violent situations. Increasingly it has become the norm for police officers to carry incapacitant sprays; in addition there has been a trend in the US and Canada for officers also to be equipped with tasers. However, alongside such equipment, an equally vital investment has been in situational awareness, managing human interaction skills and defusing conflict. This has necessitated a reappraisal of the core skills and training required for officers, which has moved towards annual reaccreditation, in what are often referred to as conflict resolution skills, and recertification in the use of specific equipment.
4. There has also been a sea change in the way such equipment is carried and, when necessary, brought forward for use. The rationale is to negate the threat of violence. It also has the effect of putting the aggressor on notice that unless they comply, force may be used. For example, police truncheons were traditionally carried in a concealed baton pocket and only drawn as a last resort; they are now overtly worn and operational police uniforms including wet weather clothing have been redesigned to give officers easy access. In addition, officers are trained to make a pre-emptive display of readiness to use such equipment eg the racking of a three-piece baton. This approach has been audited against human rights principles and equates with modern international best practice.
5. The philosophy which underpins this approach to one on one interactions has been developed across the whole spectrum of managing conflict and responding to violence which, at the upper end, involves serious public disorder. Key areas of carry over have included ensuring (a) that officers, both at command and operational levels, are trained and accredited in dealing with disorder and public order tactics, (b) that when deploying into serious public disorder officers are dressed with flame retardant overalls and helmets and have appropriate equipment, and (c) officers have the capability to take pre-emptive action to defuse violence. Moreover officers are being trained in conflict management resolution skills relevant to community disorder and tension. This approach is set out in the following section.

6. It may be helpful to note that there are three ACPO manuals dealing with the spectrum of initial interventions in violent situations; these are the ACPO:

- Manual of Guidance on Police Use of Firearms (which can be located at www.westmercia.police.uk/mogpufdefault.htm);
- Manual of Guidance on Keeping the Peace, dealing with issues of public order; and
- The Personal Officer Safety Manual.

7. The PSNI are fully represented on the ACPO sub-committees responsible for developing and updating each of these manuals.

B. Conflict resolution and policing with the community in Northern Ireland

Introduction

8. Managing conflict in the community places heavy demands on any police service and its officers. These demands are felt particularly so in Northern Ireland. This core-policing task encompasses many functions, from negotiation right through the conflict spectrum to the application of force.

9. Whilst the focus of the research led by the Steering Group has been on technological issues, it should be emphasised that seeking alternative approaches to managing conflict is not just about a search for technological solutions. It is also encompasses other less tangible areas such as Policing with the Community, Conflict Resolution and Community Safety. In this chapter three concepts are examined and outlined as to how they are being developed in Northern Ireland, however many of the concepts are drawn from existing practice and academic research in the UK as a whole, and further afield. The overriding principle is that investment in the development of processes and models to resolve conflict should reduce the need for the subsequent management of conflict, but this investment cannot lie solely with the police service.

10. Within the UK the different constitutional arrangements and local government structures between England and Wales and Northern Ireland underpin the different approaches to Community Safety and Multi-Agency Partnerships. In England and Wales the Crime and Disorder Act places responsibility on unitary and district councils to form a partnership with other organisations in the community to develop a multi-agency approach to reducing crime, whereas in Northern Ireland no such formal arrangement yet exists (though see paragraphs 51 and 57 below).

11. Recognising tensions in communities and assessing the risk of disorder are two vitally important areas of policing. The policing of disorder in its many forms presents considerable challenges to the police service. Whilst it is tempting to focus on the response to serious disorder, this is only part of the picture. Research has shown that unchallenged low level disorder and anti-social behaviour, can blight local communities and have a disproportionate effect on the quality of life for

individuals. This is an area that is covered in depth in Her Majesty's Inspectorate of Constabulary (HMIC) Thematic Inspection Report on 'Keeping the Peace'³.

12. It is important to develop public order policing in 'synergy' with community policing to reduce the negative impact should the former have to be resorted to. At the heart of effective public order policing must be an understanding of the complexities of communities and the position of police officers within them. To do this, police officers at all levels need to be part sociologist, part psychologist and part political scientist. Sometimes, they also need to be social workers. Police officers need to work with communities, not only understanding the dynamics of that community but to work as problem solvers and facilitators⁴ in conjunction with other statutory and voluntary groups. At times the police are required to enforce basic human rights, or to uphold determinations of the Parades Commission or the courts. They may also have to act as defenders and protectors of individuals, communities, business premises and property.

13. Community consultation and awareness can help the public understand that public order policing is a tool used for the benefit of the community and not against the community. It should be noted at the outset that disorder is a problem that cannot be resolved by the police alone. By working with the community and other statutory agencies, it can best be tackled through adopting a partnership approach.

Conflict Resolution/Conflict Management

14. Resolution can be defined simply as the processes and activities necessary to prevent the tensions arising from disagreements, and frustrations becoming violent. Van Ryckegem and Hendrickx⁵ explain conflict resolution as the way in which a conflict is handled by tackling the roots of the problem. This implies an analytical approach to identify not merely the conditions that create an environment of conflict and the structural changes required to remove it, but more importantly the promotion of conditions that create co-operative relationships. Burton⁶ calls this, from his work on conflict theory, 'Provention' (pro-active-prevention).

15. Unresolved, dormant conflicts are continually moving and changing and the potential for violence is always present. Conflict management is the avoidance of violence and unnecessary use of force through the efficient guidance of conflicts on one hand and effective handling of public gatherings (parades, protest rallies, demonstrations, etc) on the other. Prevention is a part of Conflict Management.⁷ In other words this means, the effective management of early low level disorder (early intervention) and the effective handling of larger gatherings and protests at their outset.

16. To understand such a complex area of policing, an insight of the experiences of others is helpful. In Belgium the philosophy of public order policing is well

³ HMIC Thematic Inspection Report 'Keeping the Peace-Policing Disorder' 1999

⁴ 'Community Policing and Public Order.' Dominic Bryan

⁵ Conflict in Society: Policing in Partnership. 2000

⁶ Burton 1990

⁷ Conflict in Society: Policing in Partnership 2000. Ryckegem and Hendrickx

documented. It is based upon the concept of, “something to be done with and for the community”.

17. This philosophy is articulated by Van Ryckegem and Hendrickx in a 4-point model:

- (i) *Provention*
- (ii) *Prevention*
- (iii) *De-escalation*
- (iv) *The Police as a Learning Organisation.*

18. This model can be transposed to local policing needs, whilst at the same time building upon current service policy and guidelines.

(i) Provention

19. PSNI view ‘Provention’ as pure conflict resolution and may be described as the proactive or pre-emptive stance taken against disorder. It can include areas such as assessing the risk of disorder through intelligence led policing, analysis of tension indicators and communication with the community. In provention the role of the police is as a warning or advisory function.

20. Very often the root cause of the tensions underlying the potential conflict is beyond the control of the police, for example, social conditions, housing, political or ideological beliefs. In this respect the police may simply be the early warning station but unless frameworks exist to bring these early warnings to the attention of agencies that can tackle the root causes then disorder may be the inevitable consequence. This requires statutory agencies and voluntary support groups to work in partnership with the police and with each other.

Intelligence Led Policing

21. The proactive use of information and intelligence has been central to crime reduction and crime prevention. The application of these principles to policing disorder has been developed within the ACPO conflict management model and is very applicable within the Northern Ireland situation. It is essential that such systems continue to develop and evolve. The potential sources from which to obtain information and intelligence are numerous and the police must ensure they do not limit or disregard any potentially new or different approach to gathering intelligence in accordance with service policy.

22. Although important, intelligence led policing is not only about the proactive gathering of intelligence. It is a very effective tool for analysing and interpreting ongoing tensions within and between communities and the potential outcomes. This tool is ‘local knowledge’ and it exists at all levels in the policing organisation.

23. In District Command Units Community Beat and Response officers acquire local knowledge quickly through their daily interaction with the community. Supervisors and Commanders also establish links with community leaders and influencers and will understand how the often complicated relationships will be

affected and how best they can be involved in trying to resolve issues. The police service have, over many years of the troubles in Northern Ireland, recognised the benefits and the sensitivities of negotiating with influential people in the communities. The challenge is in harnessing this local knowledge and combining it with other sources of intelligence in such a way that it is used to effectively reduce or resolve tensions.

Tension Indicators

24. Knowing in advance that tension within or between communities is growing and disorder may be the likely consequence gives police the chance to work with partners to minimise or reduce the risk. A good tension indicator system, properly managed, allows police the time to apply a problem solving approach and deploy resources on their own terms rather than responding to an avoidable situation with many resources in an expensive unplanned way. There is guidance for forces on the development of a system of tension indicators to help predict the possibility of serious public disorder.

Communication with the Community

25. An important element in all aspects of policing is the ability to communicate easily and regularly with the community. This applies equally at an organisational level with its network of meetings, systems and processes as well as the daily personal interactions between officers and the public. When tension rises in the community effective communication channels at all levels are essential and must be two-way. The impact of personal contact between a respected and trusted officer such as a Community Beat Officer and an influential community leader (formal or informal) cannot be overlooked.

26. Police action must be communicated back to the community through a range of channels, so that public reassurance is achieved. In the event of serious and sustained disorder it is essential that these communication channels remain open. In Northern Ireland the District Policing Partnerships under recommendation 27 of the Patten Report will increase local community involvement in policing and make local police accountable to the local community.

27. One example of the importance of communication between the police and the community is on the use of the recently established Tactical Support Groups (TSGs) or other similar public order units. TSGs are a valuable resource and response for dealing with disorder bringing additional skills and experience to a particular situation. The deployment of these units can be open to misinterpretation and can impact on relationships between local police and their communities. It is vital therefore that local police commanders properly brief these units so they are fully aware of local issues and sensitivities, and the rationale for their deployment is understood and supported by the local community.

28. PSNI have been associated with a number of local initiatives to keep communities informed and assist in communications during periods when tension high, particularly in the lead up to contentious parades. These include:

- Leaflet drops to the affected community
- The provision of mobile phones to community leaders
- Working with parade organisers and communities to ensure representatives of the organising body marshal parades
- The education and briefing of organisers about their responsibilities, legal issues and police response.

(ii) Prevention

29. Prevention is a mixture of conflict resolution and conflict management. The core aim of prevention is the avoidance of what Waddington refers to as ‘flash points’. The flash point of an incident is the action, which precipitates, or triggers, escalation.⁸ If a public order event is visualised on a time axis ie before, during and after, the period before the flash point is known as conflict resolution. At a point during the event when a flash point is reached, conflict resolution gives way to conflict management and from this point the police objective is one of de-escalating the conflict. Prevention may be described, as the physical measures taken to prevent disorder before and up to escalation.

30. Preventative measures may include:

- High visibility policing
- Closed Circuit Television (CCTV)
- Contingency planning
- Evaluating competing demands and rights
- The erection of semi-permanent barriers between opposing communities
- The use of portable barriers as obstacles and screens.

31. These are intended purely as examples to illustrate the point and are by no means an exhaustive list of measure.

High Visibility Policing

32. ‘Hot Spot’ management is a tried and trusted method, where resources are focused in particular areas to tackle disorder. This is a labour intensive process but can be effective in engaging the community, breaking the chain of events and targeting known offenders to stop disorder breaking out.

Closed Circuit Television

33. In Northern Ireland Closed Circuit Television (CCTV) has been deployed in a number of interface areas between communities. It has a prevention role in that it may have the effect of deterring the less determined individuals from carrying out

⁸ D.Waddington et al.1989

attacks on the opposing community, and making it more difficult and risky for the determined individual. The presence of the cameras can enhance community safety and confidence.

34. CCTV also fulfills a prevention role in that it may provide early warning of 'flashpoints' where tensions are about to manifest themselves in violent activity. If actively monitored experienced operators can spot the build up of activity that may precipitate an attack and can deploy resources to resolve the situation early. It is also useful to review the video evidence so that claim and counter claim as to which community started the trouble can be resolved.

Planning

35. An essential element to minimise and manage the risk of disorder is planning for the unexpected or the 'what if?' scenario. Partners should be considered when formulating such plans. Such plans should also include the post events aspects of disorder. These are vital to ensure a plan is effective and commands the support of partners and the community. It is essential that these areas are planned and thought through in detail, eg how will the investigation be managed? Who in the community will be contacted and involved in the return to normality?

36. To be effective, police contingency plans must be current, tested thoroughly at frequent intervals and regularly updated. Additionally, personnel, particularly operational commanders, must have ownership and a sound working knowledge of the plans. The absence of an effective contingency plan will not only hinder the response to disorder, but may also attract negative publicity and leave police vulnerable to civil litigation.

Evaluating Competing demands and rights

37. Too often the police are faced with the competing demands of opposing sections of the community. For example, the rights of marchers must be balanced against the rights of those wishing to protest against them. In this, as in many other areas of human rights law, there is an unavoidable conflict between competing claims. Neither the right to parade nor the right to protest are absolute. In the avoidance of flashpoints, police officers have to make decisions in accordance with Human Rights legislation. The effective discharge of this responsibility is much more difficult when the circumstances surrounding incidents change from peaceful to violent or there is a threat of large-scale violence. However fair and reasoned decisions should have the respect of reasonable persons in both communities or opposing factions.

The Erection of Semi-Permanent Barriers Between Communities

38. There are many examples of 'good fences making good neighbours' in Northern Ireland. Conflict can be prevented and managed through measures such as the erection of crowd control barriers or semi-permanent 'peace-lines'. In parts of Belfast high walls and fences divide opposing communities. In other areas the same result has been achieved by more aesthetic means, but in both cases this has been necessary to prevent violence between the communities until such times, as their

differences can be satisfactorily resolved. In the meantime the divisions give communities respite from what would otherwise be the constant fear of attack.

39. The use of portable barriers or obstacles to keep opposing groups temporarily apart or to deny access into specific areas has been a successful tactic in Northern Ireland. Armoured Landrovers and protected Police Support Unit vehicles have been utilised as short-notice barriers to screen one group from another. The military in Northern Ireland, working in support to the police service, have provided a range of screens and physical obstacles that can be erected and dismantled quickly. These have appeared in various guises from low level civilian type fencing to fortress like crowd control obstacles, on television screens and in newspapers across the world, particularly during the Drumcree period.

(iii) De-escalation

40. When a flash point is reached police tactics and strategy must be set in place to de-escalate the disorder (conflict management). Central to this is the return to normality and the police investigation.

Return to Normality

41. The strategic aim of any police response to disorder is to return the affected community or location to normality. What is defined as normal will vary from one area to another. The early involvement of other agencies at the strategic and operational level is an essential element in co-ordinating this return. Tactical options found in the ACPO Manual of Guidance on Keeping the Peace provide flexible responses to assist in defusing tension and aid the return to normality. However statutory agencies such as those responsible for road maintenance, street lighting or the removal of burnt out vehicles also have a part to play by responding quickly at the opportune time. This requires strategic agreements of partnerships.

Investigation of Disorder

42. Persons involved in disorder commit a range of criminal acts and as such the police have a duty to investigate and make offenders accountable. Large-scale disorder should be followed by a criminal investigation led by a Senior Investigating Officer (SIO), supported by a team of investigators, to bring offenders to justice. Successful prosecutions help communities retain confidence in their police, deter future offences and are an important element in the police response to disorder. For example, activities surrounding the 2002 Drumcree protest in Northern Ireland saw the police take swift action in the identification, arrest and charging of suspects. Similar strategies have been employed throughout the UK following major outbreaks of disorder. This pro-active approach attracts much publicity and is acknowledged as good practice.

(iv) The Police as a Learning Organisation

43. The learning cycle is critical to the achievement of successful operational outcomes. The learning cycle may be described as 'Conflict Evaluation'. PSNI are moving to characterise themselves essentially as a learning organisation. Thorough

evaluation of many aspects are fundamental and steps which have (or have not) been taken regarding prevention, prevention and de-escalation, must be considered in an integrated manner. The police must learn from both positive and negative experiences, otherwise they will be severely criticised. Included in the learning cycle are how the police plan for disorder, how they train officers and how management is trained. PSNI hold an annual structured debrief following each of the summer marching seasons which informs the service of what went well and what did not and involves officers and support staff at all levels.

Training

44. Training to deal with disorder in all its forms is an integral part of being a police officer, from simple communication skills to officer safety training through to level 1 and 2 public order training, all have a role to play in minimising and managing disorder. The public look to the police to respond to disorder quickly, efficiently and safely. Training is current, relevant and constantly updated. It allows officers to develop and practise command and operational skills in a safe and controlled environment.

Management Training (Command Training)

45. There is recognition within the police service of the pressures of being in command at large-scale disorder situations. It is a very visible and often lonely position, where accountability for all operational decisions including those made in fast time remains with the commander. Building on the findings of various inquiries, including the Scarman and Taylor reports ACPO introduced a series of national Public Order Command courses based on the role orientated command structure of Gold – Silver - Bronze. Good leadership skills and an in-depth knowledge of how to deal with public disorder are essential for commanders. The nature of situations they are called upon to operate in means they must be innovative, flexible, resourceful and decisive.

Policing with the community

46. The philosophy of community policing has been recognised in many parts of the world as a valid approach to improving community safety and this also applies to policing in Northern Ireland. PSNI are in the process of implementing a comprehensive strategy entitled 'Policing with the Community in Northern Ireland'. Its mission is 'In Partnership making Northern Ireland Safer'. A common link can be made with the Belgian philosophy of using public order as a tool for the community and not against the community.

47. The traditional components of public order are: public tranquillity, security and health. One of the core functions of policing with the community must be to achieve this state of tranquillity. That is why it is argued that community policing and policing disorder are inextricably linked. It follows therefore that the two should develop in

synergy, each complementing the other, rather than competing. Both these areas are at the heart of the 'Keeping the Peace' Thematic Inspection.⁹

48. A major objective of Community Policing is to establish an active partnership between the police and the community through which crime, service delivery and police community relations can be jointly analysed and appropriate solutions can be designed and implemented. This however requires that the police should consciously strive to create an atmosphere in which potential community partners are willing and able to co-operate with them.¹⁰ Hence the most important aspects of community policing are:

- Service delivery
- Partnership
- Problem Solving
- Accountability
- Empowerment.

49. The same five principles are used within the South African Police Service.

Service Delivery

50. Service delivery must reflect the concept that the police exist to serve the community and that the various needs of local communities must be taken into account to enable the delivery of a professional, community-centred service that is effective, efficient, appropriate and accountable.¹¹ The emphasis on community involvement does not detract from a police officer's duty to comply with standard investigative procedures.

Partnership

51. The Police (Northern Ireland) Act 2000 provides legislative guidance on the establishment of District Policing Partnerships. These partnerships are representative of the community, to reflect local needs and concerns. The main objective of the partnerships is to determine, through consultation, community needs and policing priorities and to promote police accountability, transparency and effectiveness. The process for establishing District Policing Partnerships is now well advanced. The first meetings will be held in the New Year. They will undoubtedly have an important contribution to make in this area. District Policing Partnerships will also work closely with the local Community Safety Partnerships that are also being set up (see paragraph 57 below).

52. Community consultation has been identified by HMIC as best practice in keeping the peace. Community Police Officers work at grass roots level in communities across the world listening to and working with the community. These

⁹ HMIC Thematic Report 1999

¹⁰ Policing with the Community in Northern Ireland

¹¹ Policing with the Community in Northern Ireland

officers provide an excellent point of focus in helping quell conflict and are a perfect example of partnerships at their basic level.

Problem Solving

53. Problem Solving is the process of studying crime and disorder issues, usually in geographical areas, so that responses can be identified and implemented to address the causes of those issues. Problem solving is central to conflict resolution and conflict management. The SECAPRA problem-solving model has been adopted to meet Northern Ireland's needs.

54. The SECAPRA model is illustrated as:

- Security/Safety Health issues concern all people involved and the possibility/risk of disorder etc must be addressed;
- Ethics All objectives must be appropriate and lawful with Human Rights being a central tenet of policing;
- Community/Client Police must understand the needs, demands and expectations of the community;
- Acquire/Analyse The collection and analysis of data are essential for example to confirm the existence of the problem and identify responses;
- Partnership Establish and maintain partnerships, with the community, statutory bodies and internally;
- Response To protect the community and prevent further crime by enforcement or referral to appropriate partners;
- Assessment Continually assess the situation and consult with partners and the community for feedback.

Empowerment

55. To address community safety issues it is important to create a sense of joint ownership amongst members of the community and the police. As noted earlier in this chapter, disorder is a social issue and one that cannot be resolved by the police alone. This can be done through raising community awareness of issues affecting community safety. Operationally, Community Beat Officers should be empowered to determine their own local priorities and set their own objectives within the overall policing plan and in consultation with the community.

Accountability

56. Mechanisms through which the police can be held accountable to the community already exist in Northern Ireland both at individual and at organisational level. Closely linked to accountability must be transparency. Returning again to the Belgian concept of public order policing "done with the community for the

community,” it could be argued that accountable, structured relationships enable the delivery of a public order intervention to be viewed within a ‘social contract’ type relationship as democracy at work.

Community Safety

57. Community Safety has been identified by the Government as a vital strategic initiative for the future. The Criminal Justice Review published in 2000 recommended that a community safety strategy be developed for Northern Ireland and statutory obligation be placed on public bodies to work together in this important area. This has become legislation with the Justice (Northern Ireland) Act 2002. Community safety is about making communities safer places to live and improving the quality of life for local people by working together with them, and other agencies to find solutions to local problems.¹² It provides essential linkage between ‘Crime and Disorder’ and again is central to the HMIC Thematic Inspection ‘Keeping the Peace.’

58. The key elements to improve the quality of life in communities are:

- Reducing crime
- Reducing the fear of crime
- Tackling anti-social behaviour.

59. The purpose of community safety is to prevent, reduce or contain the social, environmental and intimidatory factors which affect people’s right to live without fear from crime and which impact upon the quality of life. It includes preventative measures, which contribute to crime reduction and tackle preventing anti-social behaviours.¹³

60. Common themes for successful community safety will depend on:

- (i) Effective local partnerships
- (ii) Consulting, motivating and involving
- (iii) Problem solving approach
- (iv) Tailor-made packages.

Effective local Partnerships

61. Partnerships should include the police working along side other statutory agencies to assess what needs to be done. Community safety has traditionally been the concern of many organisations but the core responsibility of few.

Consulting, motivating and involving

62. As already noted, consultation with the community could take many forms, depending upon the time and resources available. Defining or auditing problems

¹² Policing with the Community in Northern Ireland

¹³ Community Safety Centre, Implementing Community Safety and Crime

effectively will involve consulting the community. Young people are the most frequent offenders and also significantly the greatest number of victims of crime. It is vital therefore to listen to the experiences of as broad a range of the community as possible.

Problem-solving approach

63. Again as already explained, the use of a problem solving model such as SECAPRA will assist in defining problems and putting structures in place to resolve them.

Tailor-made packages of measures

64. Single steps are rarely enough to reduce crime and disorder. What is needed is an across the board approach which may include initiatives such as CCTV, and environmental design initiatives.

65. Used effectively CCTV systems can help prevent disorder. It can sometimes take time for their presence and effectiveness to bed in. Quite often those involved in disorder are oblivious or blind to the presence of the cameras. It is only through the adequate and timely follow up actions of police that their success can be measured. Again the success depends upon community consultation and support.

66. Environmental design initiatives employed at the planning stage of housing development can be effective in reducing crime and disorder. For example, giving advice on lighting and the layout of alleyways can have a profound effect on quality of life issues.

67. Neighbourhood community safety strategies recognise a right to live in safety. As defined by the Community Relations Council the strategies should provide, “a living environment in which all our traditions can live in safety with mutual respect”. By involving themselves in Community Safety initiatives through the ‘Policing with the Community’ strategy, PSNI are developing public order policing in synergy with community policing and adopting an alternative approach towards the management of conflict. This approach is not dependent upon technology and has the overriding aim of tackling the root causes of tensions before violence occurs. It does however require other agencies to work in partnership with the police and each other, in a ‘joined up’ approach to resolve issues and reduce tensions that are often outside the control of the police service.

Conclusion

68. Crime and disorder within society adversely affect the public’s quality of life, reduce opportunities for economic and social regeneration and violate people’s freedoms and rights. Crime and disorder reduction is therefore a major role for the police.¹⁴

¹⁴ ACPO Manual of Guidance on Keeping the Peace

69. The task of policing disorder is not new to the police service. Disorder in its many forms has been a feature of policing for generations. The public expectation of police ability to tackle disorder and anti-social behaviour has grown considerably in recent years though, placing additional demands on resources.

70. Tackling disorder and anti-social behaviour requires a co-ordinated response. If real success and long term solutions are to be found this issue must not be tackled in isolation. The importance of community consultation therefore cannot be over-emphasised.

71. The concept of community policing is that of a police service firmly embedded in society. Within society the police are just one of many partners. As partners they search for and help to prevent the causes of conflict (conflict resolution). They are also partners in conflict management in how they handle public gatherings and related events. In the avoidance of flashpoints, the police negotiate and mediate towards de-escalation. Finally during the evaluation of conflict, the police are partners in a learning cycle.

72. The enhancement of a Community Safety Strategy based upon Policing with the Community can help achieve the Management of Conflict. It follows very closely then that these two issues must develop in synergy with Public Order Policing to achieve the society we deserve.

73. As indicated the Management of Conflict is not just about the search for technological alternatives to dealing with conflict. It encompasses a whole raft of issues central to which is community involvement. It is accepted that the police cannot resolve conflict alone. The assistance of the community and other statutory agencies is necessary in order to succeed. All are considered equal partners that work together to make communities safer places to live.¹⁵

C. Public disorder – illustrative examples in Northern Ireland and overseas

74. Again in 2002, the police in Northern Ireland have had to deal with serious public disorder. This is characterised by violent protest, the act of rioting, criminal damage, looting, or the use of weapons of offence. As a result, during 2002, up to 27 November, 255 baton rounds had been discharged by the PSNI and 85 by the Army.

75. Rioting has mostly been confined to “interface” areas in Belfast, with several periods of sustained unrest around January and during the summer. Particularly at “interface” areas in North and East Belfast, small incidents can soon spiral into serious and sustained rioting owing to the history of tension in the area, as discussed in the case study below.

¹⁵ Policing with the Community in Northern Ireland

Ardoyne

76. The period of 9-10 January 2002 saw severe disorder in North Belfast. Over this two day period, police officers were attacked with fireworks, missiles, petrol bombs and acid. Forty-eight police officers were injured and four civilians received gunshot injuries from rioters or paramilitaries. Six vehicles were hijacked and set alight. ACC McQuillan said that “there were clear indications of the rioting being orchestrated”. One incident demonstrates how a spontaneous outbreak of violence can lead to severe and sustained rioting.

Background

77. The Ardoyne area is an “interface” area, with a long history of sectarian unrest. During 2001, there had been a bitter dispute in the area about access to the Holy Cross Girls’ Primary School. By January 2002, the tension had abated somewhat as a result of negotiation between the two communities. On the afternoon of 9 January, two women had an argument outside the gates of the school. Police arrived at the scene soon afterwards. By 3pm, a large hostile group had gathered.

Escalation

78. The riots began with the throwing of bricks and bottles. Rioters then set fire to a police vehicle. Towards the evening, after a brief lull, crowds began to gather again and started throwing petrol bombs and fireworks at the police. Some rioters attempted to push burning vehicles towards the police. The rioting continued into the night, with evidence of the crowd being directed by men using “walkie-talkies” and whistles. Rumours circulated that a gunman was in the area, but the situation began to calm until by 2.00am the area was mostly quiet. That evening fourteen officers were injured.

Police Response

79. An Acting Assistant Chief Constable authorised the issue of baton guns at about 3.15pm. However, by about 5.20pm the situation seemed quieter and so the authority to use them was withdrawn. Police attempted negotiation with the crowd and enlisted the help of local representatives, with no positive result. The situation deteriorated and so the baton rounds were again authorised for use. Public verbal warnings of their deployment were given more than once. Nine baton rounds were discharged, hitting eight people. The Ombudsman reported that their use had been justified, reasonable and proportionate, and there had been no breach of the guidelines for their deployment.

Drumcree

80. For the past few years, there have been demonstrations at Drumcree Church, just outside Portadown, in protest at the decision not to allow the Orange Order to march back from the church along the nationalist Garvaghy Road. On 7 July this year, rioting broke out shortly after Orange Order leaders handed a letter of protest to the ACC. Thirty one officers were injured.

81. The police had been prepared for some disturbance and had put in place a range of measures, with the objective of letting the parade pass off peacefully. Around 1000 officers and a similar number of soldiers were positioned in the area. A 7ft high steel barrier had also been constructed across a bridge barring access to the Garvaghy Road.

82. Trouble started with protesters throwing stones, bricks, boulders and logs at police lines. Police moved against protesters as the attacks continued. The crowd then broke through the lower barrier on the bridge. As police attempted to move protesters back in order to reinforce the barrier with an adapted steel shipping container, they came under sustained attack and responded with three baton rounds.

83. Later in the day two water cannon were used against rioters. Towards evening, around two hundred protesters were left on the hill. As police deployed ready to make arrests the crowd quickly dispersed. Four people were arrested and charged with riotous behaviour.

International incidents

84. Of course, the PSNI are not the only police force to have to deal with major public order situations. The phase 2 report detailed a number of instances of serious public disorder, several of them overseas. Since then there have been numerous reports of other countries' experience of serious public disorder that have resulted in the use of crowd control measures by the security forces. Some headline examples included: the World Summit for Sustainable Development in Johannesburg in August 2002 when police were reported to have used "tear gas and concussion grenades"; and the deaths of twenty-two people in riots in Argentina in December 2001. Police were reported to have used "tear gas, rubber bullets" and mounted charges to control rioters.

85. As a result of its work, the Steering Group has become much better informed on a wide variety of community disturbances in North America and elsewhere ranging from the domestic to serious disorder, which have resulted in the discharge of significant quantities of different types of munitions.

86. An account of public disorder in Canada illustrates the range of responses adopted by other police agencies. In November 2001, around 2000 protesters assembled in Ottawa to demonstrate against the meetings of the G-20 group and the International Monetary Fund at the Government Conference Centre in the city. The activists were protesting against a range of issues including globalisation and corporate dominance.

87. The police had only three weeks to prepare for the conference, as Ottawa was only appointed as the host city at the last minute. During those three weeks, the police made efforts to contact some of the groups planning to protest at the G-20 meeting, including a session mediated by a Professor at a local university. The police reaffirmed support for the right of peaceful demonstration while letting it be known that violence would not be tolerated. They also sought legal opinion on their proposed strategies. Information leaflets on the effects of "tear gas" and other crowd control measures were distributed and placed on the police website.

88. The large visible presence of “riot” police in helmets with shields was due in part to concern that protesters planned to target uniformed officers deployed single or in small groups relatively unprotected.

89. On Friday 16 November, around 300 protesters demonstrated in the city centre. Most of the protests were peaceful, but some businesses such as McDonald’s had their windows smashed and other damage was caused. Riot police with shields and dogs (in a protective role) were used to direct the crowd although there was no physical confrontation. Police were reported to have used a “dispersion blast”. (This has been described by a police officer as a type of tear gas deployment in which the CS is carried in a talcum type powder and discharges directly from the launch platform up to 10 feet. A distraction device, similar to a concussion grenade, would be used for extracting a ringleader from a crowd.)

90. On the Saturday morning, again the protests were mostly peaceful. Armed officers isolated and arrested several protesters suspected of having taken part in the anarchist disturbances the previous day. Batons and police dogs were used. Later in the afternoon, a group of protesters attempted to breach the barricades around the conference centre. The police were reported to have responded with tear gas, water hoses, pepper spray, bean bags and “rubber bullets”. (In practice the bean bags were tail stabilised ‘sock’ rounds fired from a 12-gauge shotgun.) Two water cannon trucks were also on standby. Gradually the crowd, who were largely peaceful, thinned and dispersed.

91. After the conference was over, the Ottawa Police Service reported to the Police Services Board. They also held a review of the G-20 security operation and published an after-action report, which included consultation with the wider community.

92. In Dublin, there was serious public disorder on 6 May 2002. The police were reported to have used batons to disperse a crowd of around 250 people who had earlier staged a rally as a “reclaim the streets” lobby. Newspaper articles reported that twelve people were taken to hospital. It was subsequently reported that no provision was made to have the Garda Public Order Unit on stand-by in case riots broke out.

93. In an anti-globalisation protest in Sydney, Australia on 14 November 2002, a journalist was seriously injured by a police horse. A reporter said she was unintentionally caught when a police squad was snatching a suspect from the crowd. The demonstration was reported to have been ‘outlawed’ by the police. Owing to the protests, the police had ringed off the site where the Ministers were meeting.

94. In Belgium, water cannon are regularly deployed, and used to defuse disorder at football matches. In May 2002, they were also used to push back a crowd of demonstrators armed with petrol bombs and stones. Different police services in Belgium have access to CS or CN smoke (both known as “tear gas”), and some local forces are known to have acquired impact weapons in the past. But again, recording of usage is not centralised.

CHAPTER 3: THE INTERNATIONAL CONTEXT

A. Introduction

1. As the previous reports of the Steering Group have demonstrated, we are not alone in the search for acceptable, more effective and safer systems for managing conflict. Table 3 on pages 49-50 of the phase 2 report set out the wide variety of approaches in over twenty other countries, in Europe, North America and elsewhere. Of these, most use batons and chemical incapacitant sprays for dealing with violent individuals. An increasing number use electrical incapacitant devices such as taser, or blunt impact munitions such as bean bags (containing lead shot) fired from pump action shotguns and 37/40mm baton rounds in dealing with subjects armed with edged and other potentially lethal weapons.

2. In respect of serious public disorder the most common escalation of force rises, in the first instance, to chemical irritants such as CS, CN or OC discharged either from portable hand held canisters (of a similar size to fire extinguisher) or in the form of a pyrotechnic smoke grenade (commonly but incorrectly referred to as tear gas). Many use water cannon, and a significant number use impact rounds fired from a 12 gauge shot gun or a baton gun. In nearly every one of those countries, some or all police officers routinely carry firearms. PSDB is now developing a fuller database that will identify the technologies adopted by law enforcement agencies in a wide range of countries.

3. The Group noted with interest the announcement by the Irish Minister for Justice, Mr Michael McDowell, in November 2002, that the Garda Siochana are to be equipped with three new less lethal weapons. He said that, at the request of the Garda Commissioner, he had authorised the introduction of certain less lethal weapons by the Garda Emergency Response Unit for use where it was necessary to avoid the use of firearms. The Garda authorities had studied a wide variety of devices before proposing a number as appropriate.

4. In a subsequent answer in the Dail, the three systems were described as follows:

- *bean bag shot – this is effectively a bag filled with shot fired from a shotgun so that it does not penetrate the body but delivers a blow with the intention of temporarily incapacitating the person;*
- *pepper spray device – this is a special aerosol projector which is designed to deliver a directional pepper spray to a distance of 25-30 feet; and*
- *ferret pepper spray shot – this is a shotgun cartridge device that is intended to penetrate a door/window and deliver pepper spray inside.*

5. There is considerable international interest in less lethal weapons among police services. In the past year there have been several conferences and similar exchanges. This chapter highlights three. A conference on less lethal weapons organised by Jane's this autumn (and chaired by a former member of the Police

Service of Northern Ireland) attracted delegates from Holland, Italy, Germany, France, Switzerland, Ireland, New Zealand, the USA, Canada, Singapore, and others. The discussion further underlined that the key issues are not just which technologies or individual weapon systems work, but the nature of the context for their use, including the legal and human rights framework, guidance, training and accountability arrangements.

6. Speakers and delegates at the conference included members of pressure groups. One speaker from a national civil liberties group who stressed that testing of systems should be thorough and public, professed himself to be reasonably impressed and satisfied with testing in the United Kingdom. He emphasised too the need to ensure consistent training standards. Technology, he said, is “value neutral” but can be a distraction from root causes of violence. He concluded “if safeguards are in place, less lethal weaponry provides a basis for civil liberties groups and police to work together”.

7. Another speaker was the leader of the less lethal or “minimum force options” programme at Pennsylvania State University in America. He argued forcefully for the development of a more common approach and standards. Members of the Patten Commission had themselves visited the Institute for Non-Lethal Defence Technologies at the University and the Patten Report paid tribute to the University’s work, along with that of the National Institute of Justice in Washington. During the past year, closer ties have been forged between the Steering Group and individual agencies in the United Kingdom and the two American institutions. Representatives from the University and the National Institute of Justice attended meetings of the Steering Group in 2002.

B. The International Law Enforcement Forum 2002

8. It was agreed that a dedicated forum should be established, meeting at Pennsylvania State University. The International Law Enforcement Forum (ILEF) 2002 on 29 and 30 October was attended by some forty delegates invited by the University from the United Kingdom, the United States of America and Canada (including representatives from the FBI and RCMP). (The opportunity to attend was also provided for representatives of another European country.) The delegates included expert practitioners, senior police officers, policy-makers, medical experts, academics and others with expertise to contribute.

9. In particular, they looked at three key cross-cutting themes:

- the gaps in critical areas such as capability, and medical evaluation;
- how better to share information;
- the scope for developing common standards.

10. There were four main strands to the work:

- (a) current operational and technological limitations;

- (b) less lethal weapons effectiveness and medical issues;
- (c) acceptability criteria, public policy and legal issues;
- (d) less lethal tactics and procedures.

11. The delegates were split into two groups, and addressed a series of probing questions under each of these headings. It is the intention of the organisers to produce a published record of the forum. As that will inevitably follow the publication of this report, a summary of the main points emerging from the forum has been included in this chapter.

12. It soon became apparent that there was much common ground between the approaches adopted by the law enforcement agencies in the various jurisdictions. There was agreement that up to now, it had been too much left to manufacturers to try to identify weapon systems that might be of value and then to bring them to the market. The American delegates agreed that it would be worthwhile to work up a generic statement of needs. (The operational requirement published in the phase 2 report in November 2001 is one firm foundation in this regard.) There was consensus on the main uses of less lethal weapon systems (as set out below). On the other hand, the larger North American law enforcement agencies placed a greater emphasis than their United Kingdom counterparts on a layered approach; this means giving police commanders a wide range of less lethal weapons, to deploy if required. For example, in planning for potential serious disorder in Washington DC earlier in 2002, the police had deployed on the ground:

- large physical barriers;
- individual OC sprays;
- longer range OC projectors;
- 37/40mm impact projectiles;
- CS and CN ('tear gas' in reserve).

13. In one Canadian instance of major public disorder, non-discriminatory CS had been fired after a public warning, followed up by discharges of Arwen baton rounds.

14. The San Diego Sheriff's Department is equipped with the following less lethal systems:

- (a) 12-gauge bean bag rounds;
- (b) 12-gauge stinger rounds;
- (c) 12-gauge rubber projectiles;
- (d) 37mm wood or foam rubber batons;

- (e) 37mm bean bag rounds;
- (f) 40mm wood or foam rubber batons;
- (g) sting ball and stinger grenades.

15. It was noted too that there seemed to be a growing convergence between the legal framework against which the use of less lethal weapons was judged. In the US, civil rights legislation was broadly equivalent to the Human Rights Act in the United Kingdom. There were also cultural similarities, as well as differences. Clearly the fact that in North America police officers are routinely armed means that using less lethal weapons is ostensibly less controversial than in Britain where the police have traditionally been unarmed. For the most part there were no political issues associated with the use of less lethal weapons in North America, although the disturbances associated with the civil rights protests in the 1960s and the Rodney King affair in Los Angeles had left a legacy. As a result the use of police dogs at public order cordons was considered unacceptable particularly in Southern States. Large-scale public disorder in North America tended – though not invariably – to involve people coming into a neighbourhood with the intent to cause trouble. This differed from the regular pattern in Northern Ireland where the police role is so often ensuring that opposing crowds are kept apart, frequently at the interface between the streets in which they live.

(i) Current operational and technological limitations

“What will be used over the next three years is what’s out there now.”

16. This session was asked to identify the most likely scenarios for using less lethal weapons. The group identified five of which two were public disorder:

- (a) public disorder with a specific threat (eg petrol bombs which one US practitioner said were rarely encountered but would be likely to be responded to as a lethal threat);
- (b) public disorder involving crowd control, which also required a less discriminatory low injury potential system to aid area denial and dispersion of a violent crowd;
- (c) single aggressors armed with blunt/edged/improvised weapons;
- (d) a violent disturbed person or one under the influence of alcohol or drugs;
- (e) a barricaded suspect, perhaps with a hostage.

17. There was consensus that there was unlikely to be a “one solution fits all” approach. Indeed the American and Canadian police officers described their range of less lethal equipment for deployment as the circumstances required. (It was noted that some North American agencies were still using wooden skip fired (ie ricochet)

rounds.) In the US, legislation allowed for a senior police officer to declare an assembly unlawful and order the crowd to leave. If they did not, use of tear gas or OC would be considered.

18. It was agreed that accuracy was an essential issue in all situations. This included the ability not only to strike the identified aggressor but to minimise the probability of upper body strikes or impacts on unintended persons. Both intrinsic and practical accuracy were important. It was generally felt that the L21A1 provided an accuracy standard to be matched. The US police officers pointed out that when less lethal weapons were deployed and used, there was nearly always an associated lethal 'over watch' ie another officer alongside with a live round capability. The US and Canadian police officers made clear their desire for a more accurate and consistent baton round than any now on the commercial market.

19. The group recommended that an agreed set of operational parameters or guidelines should be developed by a joint working group. These would provide flexibility to support different applications in different scenarios. It was also felt to be important to understand better crowd behaviour (see later in this chapter).

(ii) Less lethal weapons effectiveness and medical issues

"In the US we don't tend to test enough, in the UK you test too much."

20. This session focused largely on effectiveness and medical issues to do with the use of less lethal weapons. It was agreed that while it was not practical to define less lethal quantitatively, there was scope to define serious injury potential drawing on the abbreviated injury scale (an updated version of which is due out shortly).

21. It was agreed that generally on many existing systems there was insufficient data about both effectiveness and medical outcomes. One could not rely on manufacturer's claims. It was unanimously agreed by both groups that a single figure of kinetic energy was not an appropriate measure – there were several other factors that had to be taken into account.

22. There was some debate about the objective. It was agreed that there were various alternative effects – pain was one, as was incapacitation, and – potentially – distraction. But psychological issues were also important – "perception is reality" as one delegate put it. While it would be preferable to design weapons in the future that did not rely on achieving compliance through pain – achieving compliance was the goal. It was important to identify vulnerable groups and understand the potential effects. There was a discussion on the limitations of modelling and on the difficulties of gathering data.

23. It was agreed that a working group should be set up to agree on common approaches and to explore the scope for better data gathering. It was noted there was limited information currently available in the US on these issues, although the FBI had just launched a questionnaire to elicit information from senior police officers (including international students) being trained at Quantico which could be a useful input. Both the University and PSDB were also developing databases that should provide valuable information to practitioners.

24. Although the article was not directly quoted during the forum it is interesting to note the following passage by Jorma Jussila¹⁶:

“No instrument of force is 100 per cent effective each time it is used. The response of a human being depends not only on physiological but also on psychological conditions. Therefore the only available comparisons of various weapons are generalisations. When a police organisation considers adopting a certain type of instrument it must check medical databases and consult experts to make sure that all research reports and risks involved are known.”

(iii) Acceptability criteria, public policy and legal issues

“In Canada, by law, small police departments are required to have a containment capability, including extended-range impact weapons and chemical weapons.”

25. Some of the conclusions of this group have already been noted in paragraph 13 above. The different approaches to accountability in the different jurisdictions were also noted. In the US, they tended to be more of a post facto nature such as challenges in the courts. While the International Association of Chiefs of Police (IACP) had promulgated a model policy on the use of force, the policies adopted by the over 19,000 law enforcement agencies could differ significantly. In Canada, a more legislative approach was taken, requiring individual police departments to ensure an appropriate capability. It would be open to a small department to buy in the capability from a larger neighbour with greater expertise. The unique nature of the accountability arrangements in Northern Ireland, with the roles of the Policing Board and the Ombudsman were noted with interest. There was some discussion of the value of applying the audit framework that had been developed by the Steering Group and set out in the phase 2 report. It was agreed that it was important to make information proactively available to the public, including guidance, although there were likely to be aspects such as tactics and procedures that would not be released unless it became essential. This group again endorsed the need for a small task force to look at common standards for operational requirements.

(iv) Less lethal tactics and procedures

“It’s interesting that we’re going across the ocean to get the information we should have here.” (US Delegate)

26. This group looked at issues such as training and guidance. It noted that in the US a much higher proportion of all police officers were trained in the use of less lethal weapons, albeit sometimes not to such a high standard. In America, a wider range of weapons could be used by more junior officers without recourse to senior commanders. It was felt that the UK’s formalised process of Gold, Silver and Bronze command structures (role rather than rank based) improved less lethal weapons usage in pre-planned or protracted situations. Again, it was agreed there was a need

¹⁶ From “The Future of Non-lethal Weapons” edited by Nick Lewer, published by Frank Cass, October 2002

for better information, quicker, about the effect of using less lethal weapons. It was important that officers at all levels did not have unrealistic expectations of their effectiveness.

27. It was agreed that there was real value in an international forum to exchange and explore law enforcement agencies' tactics, techniques and procedures. The formation of such an organisation, perhaps also bringing in European representation, was strongly recommended.

28. One common feature to be identified by delegates at both the Jane's and ILEF conference was the case for a better understanding of crowd behaviour. There was recognition that public disorder could arise from a variety of sources, each of which had potentially different characteristics:

- after success or failure at a sporting event;
- 'commodity' riots eg with a focus on looting and vandalism;
- social protests eg relating to trade union or anti-capitalism issues;
- opposition to other groups in the community on grounds of eg race or religion;
- alcohol or drug-induced.

(v) Crowd behaviour

29. One of the points to come out of the forum was the report of the Human Effects Advisory Panel (HEAP) set up through the Applied Research Laboratory at Pennsylvania State University published a report in January 2001 on "crowd behaviour, crowd control and the use of non-lethal weapons". The Panel included Dr Peter Waddington from the University of Reading.

30. The Panel's report concluded that the crowd was a process, not an entity. Gatherings had three phases:

- assembling process;
- temporary gathering;
- dispersal.

31. Assembling could be on an impromptu basis or by an organised mobilisation effort. Research has shown that routine personal needs can affect participation in protest events and riots. In a number of similar American riots some years ago, researchers found that riot events decreased at times when people ordinarily engaged in activities such as working, eating or sleeping. Most riots started after working hours and on weekends.

32. There was an earlier hypothesis referred to as DFA – deprivation, frustration and aggression. It was believed that individuals who were politically and/or economically deprived were more likely to “aggress” to reduce the frustration resulting from their deprivation. However the Panel’s report seriously challenges this hypothesis.

33. The Panel concluded that a new approach to crowd control was needed. They suggested the approach required a decision-making guideline which consisted of:

- pre-incident planning;
- background information and intelligence;
- encouraging relationships and ownership;
- acceptability – redefining what it means to win.

34. In the context of less lethal weapons, the report noted:

“Weapons acceptability depends on whom they are being used against. For example, strong policing tactics such as dogs and riot batons have been used against soccer hooligans in Europe without public outcry Acceptability also depends on when and where the weapon is used. In the US, law enforcement agencies readily use blunt impact weapons.”

35. The report concluded that more research was needed to address the unknowns of crowd behaviour. Issues that should be considered included:

- Why do people assemble?
- What determines the intensity of a gathering?
- What factors contribute to violent crowd behaviour? (Psychological, social, cultural, situational and law enforcement actions.)
- What crowd control techniques are most effective in preventing and stopping violent behaviour?

36. It will be noted that the PSNI approach to conflict management and resolution set out in Chapter 2 covers many of the issues identified by the Panel’s report and seeks to create a synergy between public order and community policing.

37. However the Steering Group is not aware of sustained research over time into public disorder in interface situations in Northern Ireland that would directly facilitate PSNI in further understanding how best to ensure that crowd control is not incompatible with community policing. It may be that this is an area which would repay further scrutiny, perhaps prompted by the Policing Board.

C. The Less Lethal Technologies Symposium

38. On 21 November 2002, PSDB hosted a Less Lethal Technologies Symposium at the Royal Society for the Arts in London. This was a closed event attended by approximately 150 invited delegates from a number of key agencies. Those attending included senior officers from almost every police force in the United Kingdom, the relevant ACPO policy portfolio holders and senior representatives from the Home Office, Northern Ireland Office, Northern Ireland Policing Board and Ministry of Defence.

39. Brian Coleman OBE, Director PSDB, and Paul Acres QPM, Chief Constable of Hertfordshire Constabulary, jointly chaired the symposium. The keynote address was given by Bob Ainsworth MP, Parliamentary Under Secretary at the Home Office. The Deputy Director of the National Institute of Justice in the US Department of Justice also spoke at the conference.

40. The purpose was to ensure delegates were aware of developments within the less lethal programme and to highlight the necessity to move forward together in regard to possible future deployments. The morning session provided an excellent opportunity for delegates to be updated on the progress of the scientific evaluation from the acknowledged experts. Proceedings in the afternoon were focused on a range of operational, policy and command issues; this included presentations and discussions around the use of baton rounds within England and Wales as a less lethal option in situations other than public disorder.

41. The Patten Report, and in particular recommendations 69 and 70, were highlighted as being key drivers for the search for less lethal technologies. In addition, the importance of the Alternatives to Baton Rounds Steering Group in providing co-ordination, direction and priorities for the work was recognised by the Minister and a number of other speakers.

D. European Connections

42. PSDB have recently become core members of the European Working Group on Non-Lethal Weapons (EWGNLW) and also continue to strengthen relations within Europe generally. As we have already seen in the US, there is little evidence from Europe of detailed evaluation of less lethal technologies or weapons against an operational requirement prior to their introduction. The working group have endorsed the UK methodology as being sound and are very interested in the results we are obtaining. It is further evidence that the UK is at the forefront of the evaluation of less lethal technologies and ensuring they meet the police requirements.

43. Police in Europe are generally armed, as they are in the US. This fact may explain why the public and governments in other countries are prepared to accept a less structured implementation of these weapons. The police in Great Britain are generally unarmed and any additional weaponry, even less lethal weaponry, may be seen as an increase in force available. In Europe and the US the introduction of less lethal options would be perceived more as an attempt to defer resort to firearms.

44. The European Convention on Human Rights has been part of the law in Europe for longer than the two years it has in the UK. We may be able to learn from European countries about how they have interpreted the Convention to apply to the introduction and use of these options. The contacts that are being made and that are already in place may prove invaluable in the future.

CHAPTER 4: WATER CANNON

A. PSDB Evaluation

(i) Introduction to the work of PSDB on all less lethal technologies

1. Since the NIO phase 2 report and the Home Office Police Scientific Development Branch (PSDB) report on prioritisation of less lethal technologies were published in November 2001, PSDB has continued to evaluate commercially available rounds and equipment from each of the five priority technologies against the police Operational Requirement for a less lethal tactical option. These five priority areas are:

- electrical incapacitation devices, particularly tasers;
- kinetic energy rounds;
- long-range chemical delivery devices;
- vehicle mounted and portable water cannon and;
- distraction and disorientation devices, particularly laser/light devices and noise generating devices.

2. Evaluation of the different technologies has progressed at different rates due to police priorities/resource considerations and the availability of commercial products and information relating to them.

3. A summary of each of the five priority technology areas is provided in Chapters 4, 5, 6 and 8, detailing the evaluations that have taken place and the current situation regarding each of the technologies. This provides an update on the testing that has been carried out and the results that have been obtained since the phase 2 report. PSDB has now completed its evaluation of taser devices, which has utilised a large proportion of the resources within the less lethal weaponry programme. The next chapter details the work that has been carried out on this class of technology.

4. When PSDB obtain information from a manufacturer relating to their product(s) that is not generally available to the public, this information must be treated in confidence. Similarly, the results that are obtained from testing such products are commercially confidential and so cannot be detailed here. As such, this report can only provide an overview of testing that has been carried out and general trends that have been observed. It cannot detail which specific products have produced particular results.

(ii) Vehicle Mounted Water Cannon

5. PSDB identified 15 manufacturers of vehicle mounted water cannon systems, a number of whom produce more than one model of water cannon. All manufacturers were invited to submit information about their products and five replied, providing specifications of their products. These manufacturers were then contacted again to determine whether they could meet the specifications set and were asked to provide estimates of costs and delivery times. In addition, they were asked if they could provide a vehicle for evaluation, initially for a period of six months.

6. In December 2001, PSDB supplied details of the interested manufacturers of vehicle mounted water cannon to the Steering Group, along with the specifications of the cannon that they manufacture. One model of vehicle was subsequently selected as being the most suitable. Further details are supplied in section C in this chapter.

(iii) Portable Water Cannon

7. PSDB has identified two suppliers of portable water cannon equipment and both companies were invited to submit their products for evaluation. Only one company submitted their equipment for evaluation by PSDB. A description of this equipment was detailed in earlier reports.

8. The equipment that was submitted was designed as a rapidly deployable fire-fighting tool, rather than as a less lethal option to be directed at human subjects. PSDB are unaware of any studies that have been carried out, by the manufacturers or any other organisation, to assess the effects that it is likely to have on the human body. Furthermore, as these systems were not designed to be used as a less lethal weapon, there is likely to be very little operational information available on their use, unlike the vehicle mounted systems, which have been used operationally for a number of years.

9. PSDB carried out initial testing of the equipment to assess characteristics such as range, accuracy, discriminant nature, handling issues, time to empty and refill etc. This testing was intentionally preliminary with the purpose of providing sufficient information on the performance of the system to allow the steering group to decide whether this merited further, more expensive evaluations, including a medical evaluation.

10. The evaluations have shown that the device is not suitable for use at distances greater than 15m due to problems with accuracy and dispersal of the water packet. At distances less than this, the device would need to be aimed high on the subject's body in order for the water packet to hit a lower body part, for instance the belt buckle area.

11. In addition to its limited accuracy, there are some other potential disadvantages to this system, such as its possible lack of effectiveness at distances greater than 10m due to the dispersal of the water packet. This was demonstrated during previous trials of the equipment by a UK police force. The equipment is also

quite heavy and bulky, which may cause problems during operational use, although it is intended to be portable and to be carried by one individual.

12. These results were presented to the Steering Group in September 2002, who agreed that the equipment did not merit further lengthy and expensive evaluations. Furthermore, given the intended purpose of this equipment, it was decided that it could not be considered as a less lethal option, but rather as a fire-fighting tool (note: no comments can be made here regarding its effectiveness and suitability for use in this role).

B. The Announcement on 18 July 2002

13. On 18 July 2002, the NIO Minister of State, Jane Kennedy gave the following answer to a Parliamentary Question:

“The Police Service of Northern Ireland, following discussion with the Northern Ireland Policing Board and ACPO, will shortly place an order for six new vehicle-mounted water cannon. It is hoped that the water cannon will be delivered before the summer of 2003.

This decision reflects the particular circumstances of Northern Ireland. It follows receipt of an interim statement, compiled by the independent DSAC Sub-Committee on the medical implications of less lethal weapons, on the medical implications of the use of vehicle-mounted water cannon in public order situations. The DSAC Committee is scheduled to complete the evaluation of vehicle-mounted water cannon before the systems enter service.

I have today placed a copy of the Sub-Committee’s statement in the Library of the House.”

14. A copy of the Sub-Committee’s statement follows:

“Interim statement on the medical implications of the use of vehicle-mounted water cannon in a public-order role

Background

15. *The role of the DSAC¹⁷ Sub-Committee on the Medical Implications of Less Lethal Weapons (DOMILL) is to provide the Secretaries of State for the Home Department and Northern Ireland with:*

- (a) *Advice on the medical implications of generic classes of less-lethal (LL) weapon systems (which includes biophysical, biomechanical, pathological and clinical aspects);*

¹⁷ Defence Scientific Advisory Council

- (b) *Independent statements on the medical implications of use of specific LL systems, when used according to the formal guidance provided to users;*
- (c) *Advice on the risk of injury from identified LL systems striking specific areas of the body, in a format that would assist users in making tactical decisions, and developing guidance to users to minimise the risk of injury.*

16. *This advice is in support of the UK Government's requirements arising from:*

- (a) *Recommendations 69 and 70 of the Patten Report into policing in Northern Ireland. (i) a research programme to find an acceptable, effective and less potentially lethal alternative to the Baton Round, (ii) provision of a broader range of public-order equipment to the police;*
- (b) *The desire of the Association of Chief Police Officers (ACPO) to have a wider range of options in conflict management scenarios, including those most commonly associated with self-defence and restraint, and the Police use of firearms.*

In summer 2000, the Secretary of State for Northern Ireland set up a UK-wide inter-departmental Steering Group to co-ordinate a programme to address both requirements.

17. *The second report of the Steering Group has described the various classes of LL weapon systems being evaluated to address the requirements. The report categorises the technologies according to the requirement for research and evaluation. Within Category A (devices which may be subject to research and evaluation immediately) are vehicle-mounted and portable water cannon.*

18. *DOMILL was invited to provide a statement on the medical implications of the use of vehicle-mounted water cannon in a public order role, by October 2002. At a meeting of the Steering Group on 20 December 2001, DOMILL was requested to provide an interim statement by February 2002; at a subsequent meeting of the Steering Group in January 2002, this deadline was extended to March 2002. An interim statement was required to facilitate the consideration of future water cannon use and in particular the proposal for purchase of water cannon for use by the Police Service of Northern Ireland (PSNI). This document is the interim DOMILL statement.*

Technical approach

19. *In view of the short time-scales necessary to inform the procurement process, the Steering Group was advised by DOMILL that the statement could only be considered expedient. It would encompass a review of published medical and technical data, and of official reports on operational use of water cannon by UK and some European police forces. The statement would not be able to address detailed technical assessments of water cannon output, or experiments using physical or computer models of human injury. These tests would be undertaken subsequently on the water cannon identified for purchase.*

20. *The review of the literature and the assessment of the reported technical performance of specific water cannon were undertaken on behalf of DOMILL by the Defence Science and Technology Laboratory (Dstl). Over 500 references and websites were reviewed. The documents and websites addressed the use of water cannon and injuries attributed to that use, the physics of water jets, and injuries reported from the impact of water in other scenarios, such as water sports. Dstl reviewed the technical specification of some of the water cannon used recently in Northern Ireland, Belgium and Germany, and the specification of the water cannon to be purchased for future use in Northern Ireland.*

Conclusions

21. *On the basis of the review of a diverse body of literature – little of which had direct, substantiated relevance to the medical consequences of the operational use of water cannon or its use in training – the following conclusions are offered.*

22. **Deaths:** *There was no evidence in the peer-reviewed journals, press, police or fringe literature reviewed that any person has been killed by the direct or indirect effects of the impact of a jet from a water cannon in operational use. This conclusion encompasses injuries directly from the jet impact (primary injury), penetrating or blunt impact injuries from debris and street furniture accelerated by the jet (secondary injury) and the impact of the accelerated human body against solid objects or the ground (tertiary injury).*

23. **Life-threatening injuries:** *In the world-wide literature, there was an extremely low incidence of injuries that could be classed as life-threatening attributable to, or actually caused by water cannon jets. The Belgian and German police authorities, and the Police Service of Northern Ireland (PSNI) have no reports of serious or life-threatening injuries to the public that could be attributed to the jet of the Belgian Mol CY NV MSB 18 or the German Ziegler water cannon. It should be recognised however that the use of force of any nature carries a risk of injury.*

24. *In public-order incidents in which water cannon may be deployed, it may be difficult to differentiate injuries arising directly from its use, or from other potential sources of trauma such as batons, kinetic energy projectiles, assaults or irritants. This clouded the review of all sources of published information on the use of water cannon, and will have implications for assigning injuries arising from future deployments and use, in the subsequent audit.*

25. **Water jet dynamics:** *The behaviour of free water jets is complex. Although the bulk properties of a jet of water can be calculated (mass flow rate; average jet velocity), it is extremely unlikely that the effective loading on the body could be calculated from first principles. The distribution of energy in the jet (and thus risk of injury) can be altered by ostensibly minor changes in pump/nozzle characteristics, with little overt effect on bulk output. This has three consequences:*

- (a) *the effective loads on the body must be determined experimentally;*

- (b) *all evaluations must be undertaken on operational equipment, not prototypes or rigs;*
- (c) *more than one example of each specific water cannon should be evaluated.*

26. **Future vehicle-mounted water cannon:** *It is currently considered unlikely that a water cannon built to the proposed specification of the PSNI would result in a notable change in probability or severity of injury (compared to that from existing water cannon), if used according to the extant PSNI guidance to users. This should not inhibit a review of the extant guidance to reduce the risk of injury from the currently deployed and future water cannon. In the light of the known complexity and variability of water jets, it is essential that the injury potential of the water cannon be verified experimentally.*

Recommendations

27. **Guidance to users and training:** *The impact of a high-pressure water jet from a water cannon is a high momentum event and may therefore lead to the displacement of the body. In certain scenarios (such as people close to solid obstacles), the potential for an increased risk of injury exists. Future guidance and training should reflect the risks arising from the displacement of people and objects.*

28. **Future assessment:** *DOMILL has been requested to deliver a final statement on the medical implications of the use of water cannon before their introduction. A formal technical plan for the experimental work to support the statement must await confirmation of the availability for testing of existing and future water cannon equipment. At this stage, it is envisaged that the scope of the programme may encompass:*

- (a) *measurement of the gross fluid output of both the Mol CY NV MSB 18 water cannon, and the new water cannon proposed to be procured by the PSNI;*
- (b) *definition of the biologically effective loading within the jets;*
- (c) *measurement of the contact velocity and acceleration of the head with a rigid object such as a wall or the ground;*
- (d) *measurement of the initial linear and rotational acceleration of the head/neck assembly following direct or sweeping interaction of the jet with the head, and with the torso;*
- (e) *the distribution of representative debris accelerated by the cannon directed to the ground, and the possibility of specific injuries such as ocular trauma;*
- (f) *the risk of primary injury to the torso and head assessed using computer or physical models.”*

The Policing Board statement

29. The announcement by the Minister that six water cannon were to be purchased by the PSNI was welcomed by the Policing Board.

30. The Chairman of the Policing Board, Professor Desmond Rea, said in a statement published on the same day:

“The Policing Board fully supported the proposal by the Acting Chief Constable to purchase the water cannon and I am pleased that approval has now been given to proceed.

“We recently saw the successful deployment of water cannon to deal with public order situations in Belfast and Drumcree. Whilst we understand water cannon is not effective in all situations, we believe it is a positive first step.”

31. Commenting on the use of public order equipment more generally, Professor Rea said,

“Clearly, the Policing Board would much prefer to be in a position where the police did not have to resort to the use of public order equipment. However, the recent serious violence and disorder which has been witnessed in Belfast and other parts of the province has reinforced the need for police to have equipment available to them for dealing with such incidences.

“Protecting and ensuring the safety of police officers and innocent members of the public in disorder situations is a difficult task but there is a duty of care to do so and the Policing Board is committed to this.

“The Policing Board has a responsibility to monitor police performance in public order situations and there are stringent guidelines in place for police use of public order equipment.

“It is essential that the public has confidence in how the police deal with public order situations. Ultimately though, it is the responsibility of protestors and the whole community to help prevent such instances of disorder occurring.”

C. Subsequent Developments

32. Following the announcement in July, a project team led by PSNI and including representatives from ACPO (England and Wales) and PSDB was set up to take forward the procurement of the water cannon. An outline water cannon vehicle specification was circulated to a number of manufacturers throughout Europe. The specification included a ballistically-protected cab. In the end only two manufacturers showed interest in the proposal, Ziegler and Somati (who are the manufacturers of the Mol equipment).

33. The project team visited the two manufacturers in June 2002 and scored each against an agreed set of criteria. In August 2002 a contract was negotiated with

Somati to supply 6 water cannon, at a projected cost of £3.5million. The first two vehicles are due to be delivered to Northern Ireland by the end of June 2003. The second pair are scheduled for delivery in October and the final pair in February 2004.

34. The water cannons being manufactured to the PSNI specification will be of similar size and appearance to the existing Belgian Federal Police vehicles, with the cab protected to the same standard as other PSNI vehicles. This is where the similarity ends. The PSNI vehicles will utilise the latest technology and will not rely on hydraulics to operate the cannons. The driving engine and pump engine configuration is significantly different from the existing models, as too will be the cab and controls.

35. Initial tests to assess the performance of specially designed instrumentation to characterise the water jet effects on the body were undertaken in early September 2002 by Dstl – the instrumentation was designed to determine the loads from the jet on defined contact areas. Subsequently, the test plan was written in accordance with the DOMILL guidance for the interim statement and addressed their specific recommendations. Experimental evaluation of the water cannon systems currently in use in Northern Ireland started in early October 2002. Dstl will carry out assessment of the systems purchased by the PSNI as soon as the water delivery systems are manufactured; this testing will be undertaken at the manufacturer's site. Any modifications required can be carried out before the vehicle is accepted and delivered. This is likely to take place in summer 2003. Any modifications necessary to the water delivery system or to the guidance to attenuate the risk of injury from the new vehicles will be undertaken before the issue of a final medical statement.

36. It is interesting to note that a team from the Royal Canadian Mounted Police (RCMP) visited the PSNI, witnessed the testing and met representatives from Somati, to follow up their interest in developing water projection systems. It seems likely that the RCMP will also introduce a further vehicle-mounted water jet crowd control technology in the near future.

CHAPTER 5: TASERS

A. PSDB Evaluation

1. Since April 2001 PSDB has carried out an in-depth evaluation of taser devices. A search of the market revealed that there are currently few manufacturers of such equipment although many companies produce other electrical devices such as stun guns and stun batons. Two companies that dominate in the US, Tasertron and Taser International, were the only two to submit products to PSDB for evaluation.

2. PSDB has now completed its evaluation of taser devices and the information contained here summarises its findings. The purpose of the evaluation has been to answer, as completely and accurately as possible within the available time, how well tasers meet the police Operational Requirement for a less lethal tactical option. The information gained is intended to provide information to allow the Home Office, ACPO, the Scottish Executive and ACPOS, and the NIO to make an informed and balanced decision about any possible use of taser devices within the UK.

3. The information contained in this report has been collated from a variety of sources in order to answer, as fully as possible, each of the points that relate to the performance characteristics of tasers. The information that has been gathered has come from four main sources:

- Information received from the manufacturers, generally relating to the various characteristics of each of the devices. Where necessary, this information has been verified or validated. A summary of the manufacturers and models evaluated can be found in the following paragraphs.
- Testing carried out by PSDB on the various models of taser to determine characteristics such as absolute accuracy, performance under ideal and extreme conditions and measurement of the electrical output. Much of this testing is detailed throughout the next part of this section.
- Handling trials carried out in March 2002, with the assistance of 64 officers. These trials involved the officers firing four different models of tasers at cardboard, human-sized targets. 16 different exercises were carried out in total, requiring the use of 1,253 taser cartridges. Each officer also filled in a questionnaire, which consisted of 17 different questions and an open comments section. A summary of these trials are given in the third part of this section.
- Information received from international contacts, based on their operational experiences of using tasers and evaluations prior to their introduction. This information includes data about many police officers who have been voluntarily subjected to the effects of the taser. Details on the international use of taser devices are given in the final part of this section.

4. This report addresses the scientific and technical aspects relating to taser devices. It deliberately does not address any policy considerations, such as whether tasers would be acceptable for use in the UK, nor many operational aspects, such as who should carry the devices, if they are to be deployed. These aspects need to be addressed by the appropriate bodies.

5. In considering the suitability of taser devices for use in the UK, it must be borne in mind that there is currently a ban on the export of electro-shock devices, including tasers, from the UK. This means that, under existing laws, although forces would be able to import the devices, they may be unable to export them again, for instance, to return a faulty weapon to the US manufacturer for repair.

Manufacturers and Models of Taser

6. The two major suppliers of tasers to the United States law enforcement sector are Tasertron and Taser International, both of whom submitted products to PSDB for evaluation. In many respects, the devices made by each of these manufacturers are very similar as they are essentially designed to do the same thing, however, there are some important differences that set the two apart. Details of these two companies and the models of taser that were evaluated are given below.

Tasertron

7. PSDB evaluated four different models of taser produced by Tasertron. These were the TE86, TE93, TE95 and TE95HP. Essentially, the TE95 model is identical to the TE86 except that it has fitted as standard a connection port for the laser sights. This has to be retrofitted at the factory, if required for TE86 models. The TE95HP model is also identical to the TE95, except that it has a higher power output. Figures 1 and 2 show the TE93 and the TE95/95HP models.

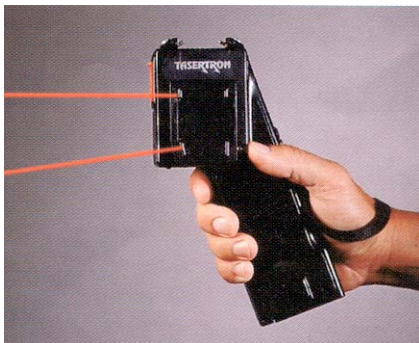


FIGURE 1: The TE93

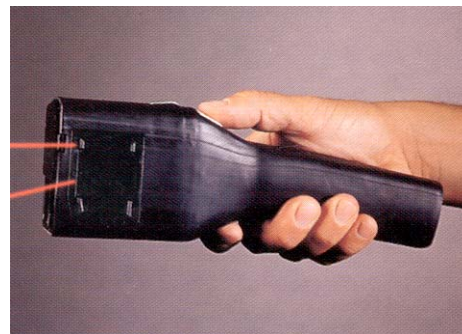


FIGURE 2: The TE95/95HP

Details of this company and its products can be found on their website at www.tasertech.com or www.tasertron.com

Taser International

8. PSDB evaluated three different models of taser produced by Taser International, the 34000 series, the M18 and the M26. The M26 is identical to the M18 except that it has a higher power output and also has a dataport connection.

The dataport records the date and time of previous firings of the taser. Figures 3 and 4 show the M18/M26 model and the 34000 series.



FIGURE 3: *The M18/M26*



FIGURE 4: *The 34000 Series*

Details of this company and its products can be found on their website at www.airtaser.com or www.taser.com

Taser Performance Characteristics

Introduction

9. The taser is a battery-operated device that generates a high voltage electrical current. A cartridge is attached to the front end of the weapon, which contains two barbs (the electrodes) each of which is attached to a coiled length of wire. When the device is fired the barbs are propelled towards the subject, pulling the wires behind them, and attach themselves to the skin or clothing of the targeted individual. When the barbs strike a person, a current can be sent down the wires and through the person's body between the two barb points. The electricity flows in a series of pulses (that can be heard as a series of 'clicks'). If the frequency of these pulses goes down, the effectiveness of the device will reduce. This can happen if the batteries are run down or in a very cold environment.

10. All tasers can be used in "probe" mode, meaning that they fire the barbs and their trailing wires out of the cartridge attached to the hand-held unit. In addition, some of the models can also be used in "touch stun" mode. This means that the electrical contacts on the hand-held unit can be pressed directly onto the subject. However, as the electrodes are only around 50mm apart, this mode of use is unlikely to provide the same incapacitation effect as when used in probe mode.

11. The different models of taser have different performance characteristics and some models perform better than others. A summary of the many important aspects of performance now follows, with details of the typical results that can be achieved with the different models of taser.

Accuracy

12. The absolute maximum range of any currently available model of taser that PSDB are aware of or have tested is 21ft (6.4m). This is the maximum length of the wires within the cartridge and cannot be exceeded. The barbs are positioned within the cartridge with a pre-defined angle of separation between them so they are closer together at shorter distances and further apart at greater distances. 15ft (4.6m)

cartridges are also generally available and some of these have a wider angle of separation between the barbs such that the barbs will be further apart at any given distance compared with the 21ft (6.4m) cartridges. 15ft cartridges may be preferred when the taser is used at closer ranges to ensure that a significant number of muscle groups are likely to be affected.

13. Tasers generally use projected laser sights to aid with the accurate placement of the barbs. Some taser models employ a single laser sight that is designed to show where the top barb will land on the target whereas other models use a dual sight to indicate where both barbs will land. Wider separation of the barbs on the target reportedly results in more effective incapacitation because the electricity affects more muscle groups. However, it is also essential that both barbs attach onto the subject's clothing or penetrate their skin, otherwise the circuit cannot be completed and the electricity will not flow through the target.

14. Figures 5 and 6 show the typical separation of barbs that can be expected when the taser is fired at various distances from the target. Figure 5 shows the results for 21ft (6.4m) cartridges and Figure 6 shows results for 15ft (4.6m) cartridges that have a wider angle of separation between the barbs than the 21ft cartridges. The point of aim in these tests was the centre of the chest area just above the nipple line (co-ordinates 0,0). These data were collected under ideal conditions, ie all tests were carried out indoors at room temperature, with no wind effect and with the taser clamped firmly onto a tripod.

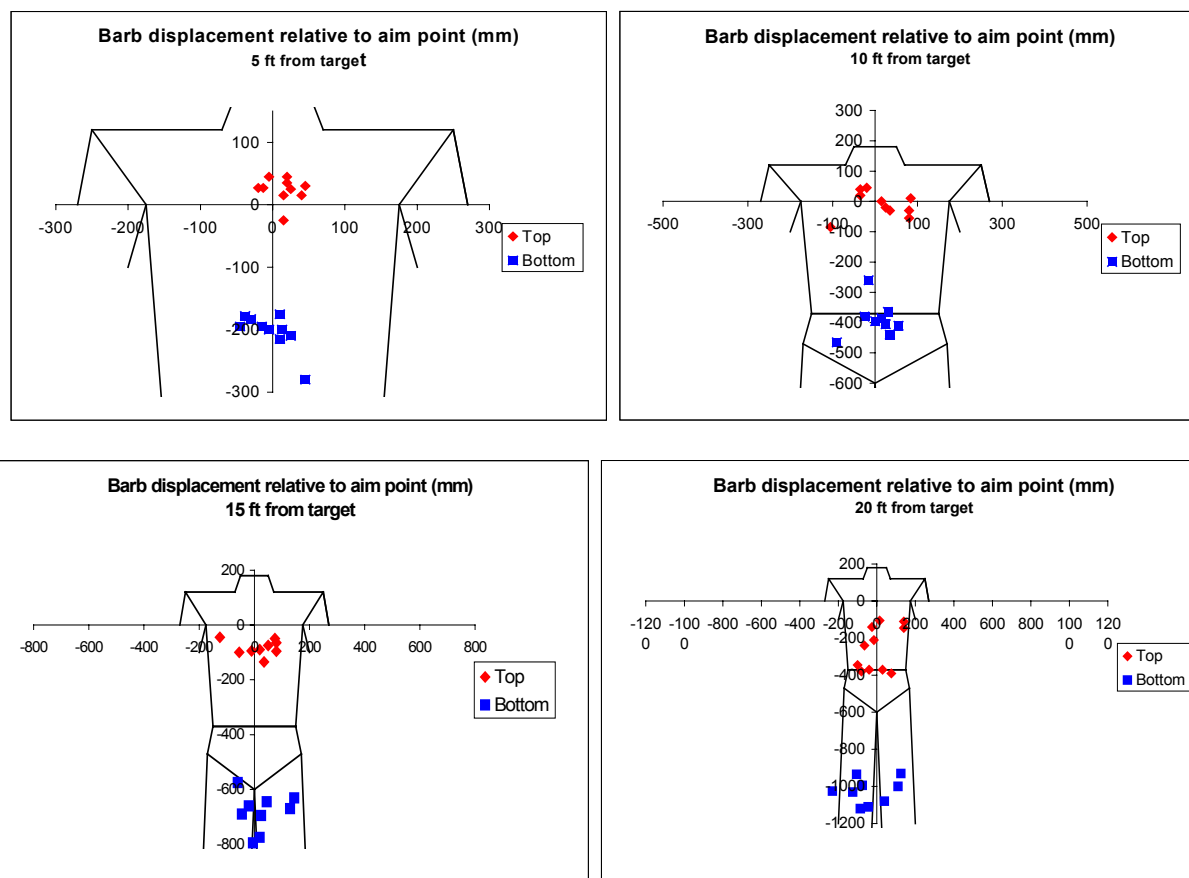


FIGURE 5: Position of Taser Barbs at 5ft (1.5m), 10ft (3.0m), 15ft (4.6m) and 20ft (6.1m) from the Target Using 21ft (6.4m) Cartridges

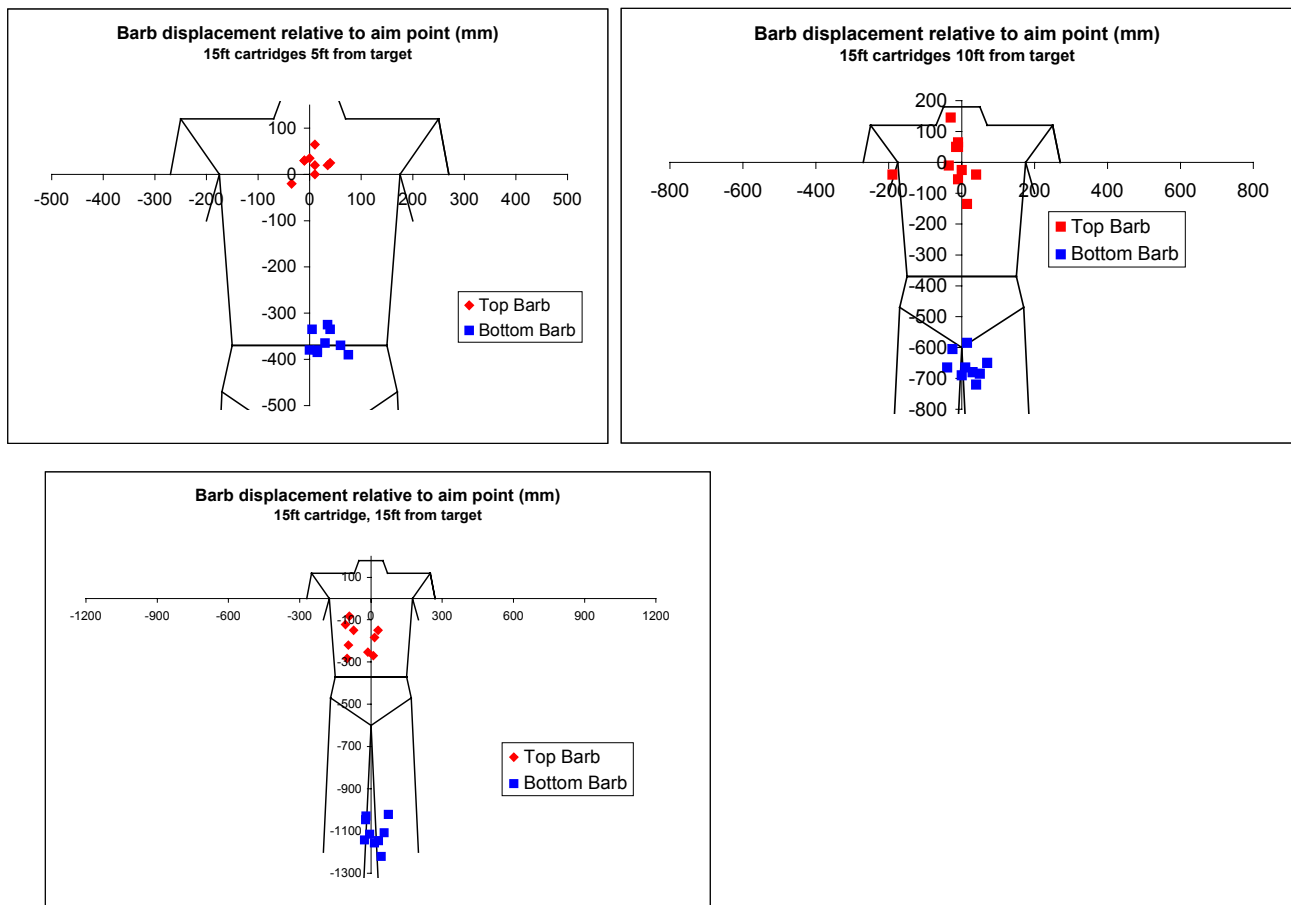


FIGURE 6: Position of Taser Bars at 5ft (1.5m), 10ft (3.0m) and 15ft (4.6m) from the Target Using 15ft (4.6m) Cartridges

15. It can be seen from these figures that the taser bars will not always strike the target in the area indicated by the laser sights despite the tests being carried out under ideal conditions. This is particularly so at distances greater than 15ft (4.6m) when the top barb tends to drop below the top laser sight. This chapter provides a summary of the accuracy that was achieved when different tasers were hand-fired at man-sized targets in a range of exercises during a series of handling trials.

Effectiveness

16. Effectiveness of the taser is influenced by a number of factors. These are outlined below:

(i) Effect

17. The effect that the taser generally has on a person is to make them fall down to the ground or to 'freeze' them in place while their muscles are contracting. This effect on the subject continues while the electricity is flowing. As soon as the electricity ceases to flow, however, the subject **may** make an immediate recovery. Generally, the subject is likely to be dazed and confused due to the severity of the effects and may not completely recover immediately. It is also possible that their muscles will be aching and they may feel lethargic. The manufacturers of tasers recommend that the officers approach the subject whilst the electricity is being

applied, rather than waiting for it to stop before advancing as this may be too late and the subject may have recovered. Video footage from the US shows that officers should be able to hold onto a subject while they are being tasered without receiving any of the electric current themselves, providing they do not touch the area between the two barbs, as in this case they may provide an alternative path for the electricity to flow along.

18. The taser will only be effective if both barbs are attached to the target, either through their clothing or via penetration of the skin. If only one barb is attached, the circuit will not be complete and the electricity will be unable to flow.

19. Some models of taser have a pre-timed continuous discharge of electricity that lasts for a fixed amount of time after the trigger has been pulled. If required, this can be stopped early by flicking on the safety switch. Other models will discharge electricity only for as long as the operator's finger remains on the trigger, or until the batteries are depleted or the taser breaks down. With all models of taser, it is possible to reapply charge to the subject repeatedly, providing both barbs are still attached to the person. If one or both barbs have become detached from the target, then a new cartridge will have to be fired (unless the device is used in touch stun mode).

20. It is worth noting that the taser can be effective without the need to actually fire a cartridge. The threat of use, and the use of the laser sights, may induce compliance in some cases. The visual effect of the taser, perhaps by demonstrating the arcing effects when the electricity is flowing (which results in a loud crackling noise and blue flashes) is also enough to deter some people. When used in this way, however, the taser must generally be unloaded. Some models of taser can also be used in 'stun gun' mode as previously noted. The section on international taser use, later in this chapter, provides some details on the effectiveness of these different modes of use from overseas operational experience.

(ii) Immediacy

21. Providing the taser unit works correctly and both barbs attach to the target, the taser can be a very rapidly acting device. The time to incapacitation of the subject is likely to vary depending on the power output of the taser used. In video evidence and reports from the USA coupled with statements from police forces there, the lower powered tasers appear to take a few seconds to control the subject, whereas the higher powered models appear to have an almost immediate effect.

22. One Canadian field study of a lower-powered taser found that, on average, the taser took between 3-5 seconds to control the subject, although in one case it took as long as 15 seconds. A further Canadian study of a higher-powered taser found that volunteers immediately and involuntarily fell to the ground on exposure to the taser, with an average total time to incapacitation of 3 seconds. Further details of these studies are given later in this chapter.

(iii) Subject Population

23. Taser devices are effective against a high proportion of the population, including those who are drunk, or who are suffering from the effects of drugs or a mental illness. The taser, although painful, does not rely purely on pain compliance to gain control of the subject, thus resulting in the high level of effectiveness. It has been speculated that the effect is caused by the disruption of neuromuscular control that may also be accompanied by disruption of the neurophysiological feedback required for maintaining posture, leading to disturbances in posture and balance.

24. Despite this, some people will be capable of fighting through the effects of the electricity. A very small proportion of people are capable of resisting incapacitation even with the highest-powered tasers currently available. Higher-powered tasers are likely to affect a greater proportion of the population than lower-powered units, although the low powered tasers have been used thousands of times operationally in North America in the last twenty years or so, including many successful uses against drunk and drugged individuals. Hundreds of police and other law enforcement officers, many in North America, have also experienced taser firings (usually by having the wires attached to their clothing as opposed to having the barbs fired at them).

25. Although a small proportion of people are capable of withstanding or fighting through the effects of the electricity, there are other more common reasons for the taser failing when used operationally. These are generally related to the taser unit, the cartridges, or insufficient training, rather than the ineffectiveness of the electricity and are detailed later in the chapter.

26. Overall, international studies have shown the effectiveness of the taser to vary from 50% to a reported 100% when used in probe mode (cartridge discharged at the subject a distance away), touch-stun mode (the taser terminals pressed into the subject's body at close quarters) or as a deterrent. This chapter gives a more detailed summary of the reported effectiveness and failures of tasers used operationally and against volunteers in each of these modes.

(iv) After-Effects and Injuries

27. The most intense effects of the taser last only for the duration that the electricity is applied, although the subject may feel dazed and lethargic for a short period afterwards and their muscles may be aching or tingling. In addition to the after-effects that may result from the high voltage electricity that has travelled through the subject's body, injuries can also be caused by:

- The taser barb penetrating the subjects skin

28. Each taser probe ends in an approximately 9mm long barb. These are capable of penetrating the skin when fired at a subject, although this may not occur in every case as the barb often attaches onto the subject's clothing. Injuries caused by the taser barbs penetrating the skin are usually minor. There is likely to be a small puncture wound accompanied by a slight redness of the skin around the wound, said to be similar to a bee sting, caused by the electrical current of the taser.

More serious injury could occur if the barbs were to strike a sensitive area, such as the face, eyes or genitals.

29. If the taser barbs penetrate the skin, they need to be safely removed afterwards. Police departments throughout the United States have different policies on the removal of barbs. Common practice requires medical personnel to assess the extent of any injury caused by the barbs. Any barbs that have struck a sensitive area (eg face, neck, and groin) may require to be removed by medical personnel either on-site or at a medical facility. A number of departments allow police officers to remove barbs from non-sensitive areas, others require that medical personnel remove all barbs.

- Blunt trauma secondary injuries

30. These could be caused by the tasered person falling after being subjected to the electricity. Other injuries may also result if they fall onto a dangerous material such as glass or a noxious substance, or if the subject is near the edge of a high building or other place where a fall could result in a more serious injury.

- Other injuries

31. These could include injury to the eye caused by the projected laser sight from the taser being directed into the eye. Injuries could also result due to ignition of a subject who is tasered whilst they have a flammable liquid on them or if they are in a flammable environment.

32. Taser manufacturers issue safety notices with their taser devices. Typical recommendations include:

- Do not taser anyone on a ledge, rooftop edge, elevator shaft or other area where a fatal fall is likely to occur.
- Never aim at the head or neck of a subject.
- Do not use the taser near flammable or explosive liquids or fumes.
- Do not use the taser on the following groups of people:
 - anyone with a dysfunctional heart
 - anyone connected to oxygen tanks or other life support systems
 - pregnant women
 - small children
- Do not fire the taser where temporary incapacitation could prove dangerous eg at someone who is swimming.

33. Tasers have been associated with a number of deaths in the United States, however in most of these cases it was judged by the coroner that the actual cause of death was likely to be drug misuse¹⁸.

34. This chapter provides details of some American and Canadian studies on the operational use of tasers. In the Seattle police study of 108 incidents involving tasers, it was found that in 68% of incidents subjects sustained either no injury or only puncture abrasions from the taser barbs. 13% of subjects suffered injuries subsequent to taser use; these were secondary injuries generally due to the subject falling as a result of being tasered. The study reported no major subject injuries occurred and no injuries were attributed directly to the taser itself. The other 19% of subjects suffered injuries that were unrelated to the use of the tasers and a further two cases involved the subject being shot by the police.

35. In the RCMP study¹⁹, the most serious confirmed injury involved one subject requiring two sutures after the barbs were removed. Another subject may also have suffered a broken nose during falling after being hit by the taser, although this is uncertain. In one instance, one of the barbs struck the lower lip of the subject although no problems occurred as a result of this. In both the field trials and the volunteer studies, a large number of first and second degree burns resulted from exposure to the taser's current. These burns were generally less than 3cm in size (said to be similar to a bee sting) and disappeared within 1-3 days if treated properly. Two subjects also indicated that they experienced testicular pain after being exposed to the taser. This was likely to be due to the way the person convulsed upon being hit with the taser and was not caused by the barbs striking the testicles.

36. The section of this report prepared by the Defence Science and Technology Laboratory (Dstl) provides more information on any after-effects and injuries relating to the use of tasers.

(v) Unintended Effects to Operator

37. The taser uses high voltage electricity (tens of thousands of volts), which obviously has the potential to create a hazard. If used correctly and with proper training, the chance of the operator receiving an unintentional effect from the device will be kept to a minimum. However, given the high stress situations in which these devices are likely to be used, there is the potential for the operator or their colleagues to become wholly or partially affected by the electrical discharge. This could happen for a number of reasons, such as:

- the operator placing their fingers in front of the cartridge when firing, or inserting the cartridge with their fingers over the front while the weapon is unsafe and could potentially discharge;

¹⁸ Kornblum RH, Reddy SK (1991). Effects of the Taser in fatalities involving police confrontation. *J Forensic Sci.* Vol 36, 434-448. For a rebuttal of some of the conclusions of this paper see Allen TB (1992). Discussion of "Effects of the Taser in fatalities involving police confrontation". Letter to Editor. *J Forensic Sci.* Vol 37, 956-958.

¹⁹ "The Conducted Energy Weapon Evaluation Project", Royal Canadian Mounted Police and Canadian Police Research Centre, 2001.

- the officer touching the wires of the circuit when it is live;
- the weapon accidentally discharging;
- use in a wet environment;
- the officer placing themselves between the barbs of the taser while electricity is flowing through the circuit;
- if the resistance between the barbs is too high (as occurs when one barb fails to attach) the electricity will arc from one wire to the other, or between the electrodes on the front of the taser unit. At these times, the presence of arcing so close to the officer presents a hazard.

38. While it is impossible to account for every situation or possibility, it is important to be aware of what could happen. Good training and a knowledge of the way electricity flows should avoid most of these accidental shocks to the officer occurring.

39. During the PSDB police handling trials of tasers, 10 participants out of the 64 that attended reported receiving an electric shock through their fingers while using the tasers, although none reported experiencing the full effects.

Ease of Operation

40. The taser is a small, hand-held unit that is designed to be used by one officer only and should be suitable for the majority of officers to use. The taser is generally operated either by pulling a trigger or pressing a button on the device. The ease of operation of the taser depends on the particular model being used since different models have different handling characteristics and some units are more difficult to operate than others. Generally, the fewer actions required during operation of the device, the easier it will be to operate. Some models are also rather big and bulky and others require a lot of pressure to activate the trigger, which can be a particular problem for officers with smaller hands.

41. With some models of taser, the laser sights are activated when the weapon is made 'live' (ie the safety is turned off). This projected laser sight is then continuous until the weapon is again made safe. With other models, a separate action is required to activate the laser sights. Once activated, the operator must keep their finger on the laser activation button otherwise the laser sights are turned off. Additionally, some models provide a continuous timed burst of electricity when the trigger/button is activated, while for others the operator must keep their finger on the button/trigger to allow the electricity to flow, as releasing this button will stop all discharge of electricity. This can be a particular problem as many officers may automatically take their finger off the trigger as soon as the barbs are ejected, although it should be possible to address this in training.

(i) Repeat Operation – Speed of Multiple Use

42. As both barbs need to strike the target in order for a taser to be effective, multiple shots may be necessary as one or both barbs may miss the target. The results section later in this chapter details the proportion of shots that resulted in one or both barbs missing the target during the taser handling trials. This has also been known to be a cause of failure for taser devices when used operationally.

43. Some models of taser have dual-shot capability, meaning that a second cartridge can be fired immediately after the first cartridge without the need to reload. Other taser models have only single shot capability and the cartridge needs to be replaced if a subsequent shot is needed. Different models of taser use different cartridges and the design of the taser and cartridge can affect how quickly and easily the taser can be loaded and unloaded, in full light and in darkness.

44. As mentioned previously, it is possible with all models of taser to reapply charge to the subject after the initial discharge has ended, providing both barbs are still attached to the person. If one or both barbs have become detached from the target, then a new cartridge will have to be fired unless the devices are to be used in touch-stun mode.

Environment

(i) Enclosed Spaces

45. Tasers are small, hand held devices that are relatively easy to handle and so may be suitable for using indoors or where space is limited, providing there is an unobstructed path for both barbs. There are no rebound effects from the barbs and, although there are no major contamination problems, the unpleasant smell and smoke from cartridges that use rifle primer as a propellant may build up. Tasers can also be used relatively close to the subject, although closer distances will result in less barb separation and therefore fewer muscle groups being affected, which can limit their effectiveness. The ease of operation of the different models of taser will affect how well each can be used in a confined space.

(ii) Low Light

46. The suitability of tasers for use in the dark or under low light conditions will vary depending on which model is used as this affects their ease of handling. The design of the cartridges and cartridge housing will also have an effect on how easy the taser is to load and unload under these conditions. For instance, if a cartridge can only be inserted into the taser in one particular orientation, this is likely to be more difficult to load in the dark than a cartridge that can be inserted in a number of orientations. Use of tasers in a dark environment was assessed at the taser handling trials. The results indicated that, providing an officer is confident in the handling and use of a particular model of taser, they should be able to use the taser under low lighting conditions.

(iii) Temperature

47. Tests were carried out at PSDB to evaluate any adverse effects caused when the tasers were subjected to temperatures of -20°C and $+50^{\circ}\text{C}$. At the higher temperature most of the taser models performed as normal, although one unit was incapable of firing at this temperature and the laser sights and battery indicator did not work. These problems were due to the taser unit itself, and not the batteries or cartridges as these were found to perform as normal.

48. At -20°C most taser models were adversely affected. The units became difficult to fire and the laser sights generally became diffuse, fragmented or dim. The power output was also greatly reduced due to the effect that the temperature had on the batteries. This effect was most severe with alkaline batteries, although rechargeable batteries were also adversely affected. The models that used lithium batteries were unaffected by this low temperature.

(iv) Wet Environment

49. If tasers are used in a wet environment, it is possible that the presence of water could affect the way the electricity flows. The conductivity of water varies depending on its purity; increasing purity results in decreasing conductivity. Impure water will therefore conduct electricity better than air, and its presence may provide an easier path for the electricity to take in some situations. In general, if a person is standing in a pool of water and both barbs are attached to their body or clothing, the water should have no effect and the current will flow through the subject as normal. If the subjects' clothes are soaked in water and both barbs are attached to their body or clothing, then there may be some reduced effectiveness of the taser as some of the electricity could pass through the clothing on the outside of the body, rather than it all passing through the subject's body.

50. These are just examples to illustrate the increasing uncertainty that exists in such an environment and to highlight some of the possible effects. The effects of the electricity in a wet environment have not been tested by PSDB. It is impossible to advise on what could happen in every situation. However it is important to realise how the electricity travels in order to try to work out what is likely to happen in a particular situation.

(v) Flammable Environment

51. If a taser discharge is applied to a subject who has a flammable liquid on them, such as petrol or strong alcohol, there is a chance that the solvent will catch fire and the subject and their clothing may be engulfed in flames. This is also a potential problem if the subject has already been sprayed with a police incapacitant spray (CS or PAVA) as the solvents currently used in these are flammable (methyl isobutyl ketone – MIBK - and 1:1 ethanol:water respectively). This has already happened on at least 2 occasions when tasers have been used operationally in other countries, when the taser has ignited subjects who were soaked in a flammable liquid. Flammable environments, such as petrol stations, may also present a potential hazard.

(vi) Electrical Equipment

52. As tasers arc, they produce large electro-magnetic fields and it is possible that some types of electrical equipment may be affected by their use. Such effects have occurred during testing of the tasers when, for instance, the firing of a taser has caused computer monitors to show lines on the screens, the programmable keyboard on a PC to lock occasionally, a calculator to switch itself on and a digital stopwatch to start and stop. This may be important operationally as there is a possibility that the fields could interfere with communications equipment, hospital equipment and other electrical devices.

Durability

53. The manufacturers of tasers are responsible for ensuring that the equipment produced is fit for purpose. They will offer a warranty on their products and suitable arrangements should be in place before purchasing equipment to ensure that any damaged or faulty equipment can be exchanged or replaced as necessary.

54. A taser device is generally made of plastic containing the electronic circuitry, batteries and connections. The laser sight, when present, is either an integral part of the unit or is connected to the top or side of the unit. In addition to this, a cartridge containing a primer, two lengths of coiled wire and two barbs, is also connected onto the unit. As such, there are many parts of the unit that could break during carriage and use depending on the conditions in which they are used.

55. PSDB carried out drop tests on the various taser models. This involved dropping the units and cartridges from a height of 2m onto a steel plate. Under such conditions, various types of damage occurred to the units when they were dropped, varying from the battery catch being released to the laser sights smashing or breaking off, or the taser subsequently ceasing to fire. The cartridges often dropped out of the taser unit and damage often occurred to the cartridges themselves when these were dropped. The damage to the cartridges tended to involve the barbs dropping out of the casing and the wires unravelling. In this case, the fault is obvious and should not result in a faulty cartridge being used operationally.

56. Throughout PSDB's evaluation of taser devices, including the handling trials, a number of problems became evident with some of the models tested. These problems included incompatibility of cartridges and taser units, faulty cartridges, sights and batteries, and unreliable taser units. In general, the problems encountered tended to suggest that the companies had either not tested all of their products and related equipment thoroughly enough, or did not have a sufficiently rigorous quality control procedure in place, particularly when they used parts that had been made by a contracted agency.

Security and Licensing

57. The taser is classified as a Prohibited Weapon under Section 5 (1) (b) of the Firearms Act 1968 and the acquisition and possession of these devices must be in accordance with this. Police forces or registered firearms dealers also need an import licence from the Department of Trade and Industry to import the units into the

UK. As mentioned previously, there is currently a ban on the export of electroshock devices, including tasers, from the UK. This means that although forces would be able to import the devices, they may be unable to export them out of the country again, for instance to return a faulty weapon to the US manufacturer for repair.

58. Given the nature of these devices, due consideration should also be given to their safe and secure storage. The tasers should be stored at room temperature to avoid any adverse effects caused by extremes of heat or cold.

(i) Audit Trail

59. Many taser units have unique serial numbers printed on them, either on a sticker or built in as an integral part of the unit. Additionally, one model of taser has a data recording system, which stores the date and time of previous firings of the taser. Any repeat firing will be stored as a new entry and use in stun mode is also recorded, as is a practice or warning firing. This data can then be downloaded to a compatible computer, which will display all of this information.

60. Some types of taser cartridges have a unique serial number attached to them. Additionally, some types of cartridge come with unique, small, confetti-like identification tags that are ejected when the cartridge is fired and scatter around the area nearby. Each tag has the serial number of the cartridge that has been fired printed on it.

61. Obviously, for any audit trail to be effective, it needs to be backed up by a suitable logging system within the force to record which officers have been issued with which tasers and cartridges.

Training

62. Training in the use of tasers tends to be offered at three different levels; operator training, instructor training and training for officers who train the instructors. The courses offered by the manufacturers generally last 4-16 hours, depending on the level of training required, and re-certification is usually required every 1-2 years. The courses involve a practical and a written test, with a minimum performance standard being required of the officers before they can pass.

63. The courses tend to involve training in the following areas:

- Firing and aiming of tasers
- Loading and unloading
- Safety checks
- Batteries and taser maintenance
- Barb placement and barb trajectory
- Practical firing exercises
- Barb removal
- Understanding of taser physiology
- Use of force
- Legal standards

- Specifications and operation of currently available taser models
- Different cartridge types
- Causes of taser failure

64. This training package is recommended by the US manufacturers of the taser devices and is not necessarily applicable in any possible UK context.

65. In the taser handling trials, the participants were given a 2-3 hour 'familiarisation' session with the tasers. This involved them being briefed on the various models and how to handle and use them safely and correctly, then firing one cartridge from each of the four models of taser. Each participant then fired 3-6 shots from each taser model throughout the various exercises. Following the handling trials, questionnaires were issued asking how confident they felt about using the devices after they had handled them during the preceding familiarisation training and exercises. The officer's confidence in handling the various weapons varied substantially depending on the particular model being assessed, with almost all officers feeling confident in the handling and use of one particular model and less than half being confident with the use of another model.

66. Tasers will not have any rebound effect or contamination problems, therefore indoor facilities should be suitable for training. If cartridges using rifle primer as the propellant are fired, however, a build-up of unpleasant smelling smoke can occur and suitable ventilation will be required. Safety precautions must be in place during training to avoid officers being accidentally exposed to electricity, barbs or the laser beam.

Costs

67. The average cost of a taser unit, including laser sights, is between £300 and £500. Each cartridge costs around £15. Other costs associated with the equipment include batteries and chargers, holsters, training aids, software (if necessary) and any additional optional extras, specific to particular models of taser. These prices are obviously subject to change at the discretion of the manufacturer.

Acceptability and Visual Effect

68. The issue of acceptability is a matter for the Home Office, the NIO and ACPO, although it is appropriate to mention it briefly here. Amnesty International have often expressed concerns about electrical devices (termed 'electro-shock weapons' by them) as they do not believe that sufficient health and safety data are currently available with regards to the effects of this type of device on the human body. They have asked that *'the stun belt should be immediately banned and the use of other electro-shock weapons such as stun guns, stun shields, and tasers should be suspended pending the outcome of a rigorous, independent and impartial inquiry into the use and effects of the equipment'*. The detailed study that PSDB has carried out on taser devices should also answer many of the technical questions that people have about them and any decisions made about their use will be based partly on the information that PSDB has gathered along with the outcome of Dstl's assessments.

69. Amnesty International are also concerned about the exportation of electrical devices to countries that may use them as a method of torture. Electrical devices have been used as a means of torture in a number of countries due to their ability to inflict extreme pain with little or no noticeable injury afterwards, and therefore potentially providing no evidence of their use. Amnesty International have therefore called for a ban on exports to any country where electro-shock torture has been committed or where torture is persistently reported. As mentioned previously, the UK has already banned the export or transshipment of a number of electrical devices from the UK, including electric batons, shields, stun guns and tasers. The presence of a dataport on one model of taser, which records the date and time of previous taser firings, will provide evidence that the taser unit has been used.

70. Different models of taser have different shapes and sizes. As described earlier, some models are shaped like firearms whilst others more closely resemble a flashlight or torch. Often, the firearm-shaped models can be altered to allow them to be differentiated from actual firearms by, for instance, being manufactured in a colour other than the standard black (such as red or yellow) or having coloured stickers to attach to the side of the unit.

Electrical Output

71. A series of tests were carried out at PSDB to determine the electrical output of all the available taser models in terms of waveform, current, voltage, pulse-width, energy and power. Measurements were also made of any changes which occurred to these when an air gap was incorporated into the circuit (as would be the case if a barb did not penetrate the skin of the target but instead attached onto their clothing). These tests were necessary not only to give PSDB a fuller understanding of a taser's output, but also to provide information to Dstl to help them assess the effects of the taser on the human body. The following is a summary of the tests and broad conclusions that can be drawn from the results.

72. A circuit was set up to measure the peak voltage across, and peak current passing through, the body. The circuit consisted of a potential divider connected between the barbs of the taser. Since the resistance of the body can vary, the taser output measurements were obtained for a wide range of resistances. In this experiment the total value of the potential divider ranged from approximately 47 to 4700 Ohms as these were the boundary values used in a similar, previous study²⁰.

73. Figure 7 shows an example of the output as seen on the oscilloscope and demonstrates several features that are common to the outputs of all makes and models of taser. This trace represents one whole 'click' or pulse of the taser. The initial spike is the high voltage point of extremely short duration at the start of the pulse. This can vary in size and width and appears to be the only part of the wave affected by the introduction of an air gap into the circuit. All models also have the subsequent small "spikes" and the period of "noise" seen at the end of the signal.

²⁰ "Electric Shock Devices and their Effect upon the Human Body", MN Robinson, CG Brooks, GD Renshaw, *Med Sci Law* (1990) Vol 30 (4) 285-300.

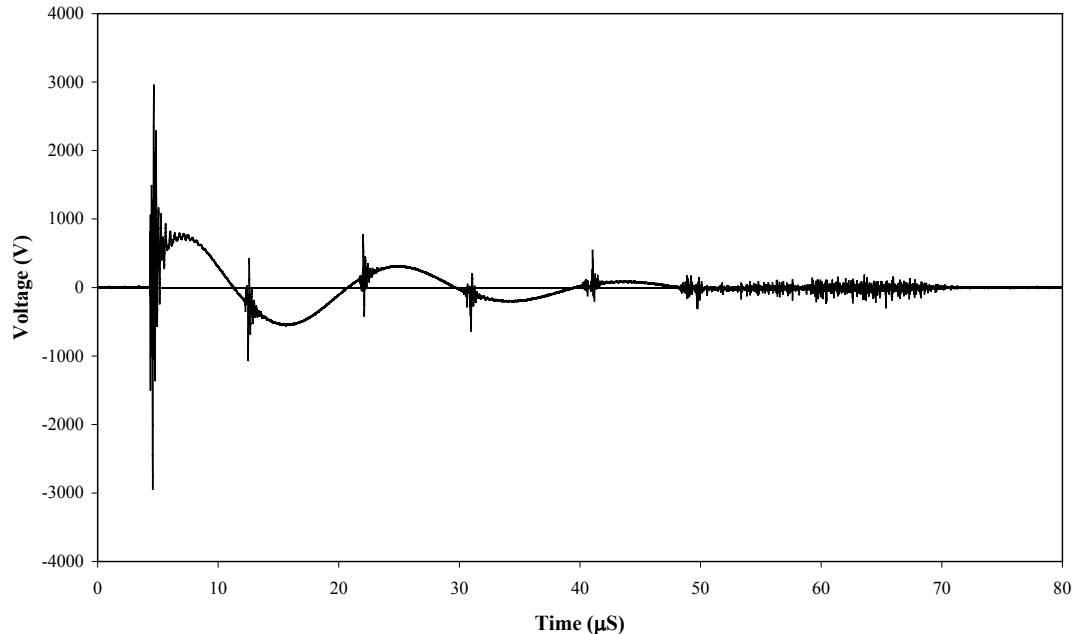


FIGURE 7: *Graph of the Actual Taser Output as Recorded by the Oscilloscope for a Total Resistance of 47Ω, Showing the Variation in Voltage Over Time for One ‘Click’ of the Taser.*

74. It was found that the voltage produced by the tasers increased with resistance and different taser models have different voltages and different power outputs.

75. An air gap was also introduced into the circuit to determine how far a barb could be from the body before the taser would lose its effect. Electricity in this case can overcome the resistance of the air and ‘arc’ across the air gap unless the size of the air gap is too great. The test took as its criterion the distance at which 50% of the pulses from the taser would not arc across the gap. The maximum effective separation was found to be 25mm and 35mm in two different models of taser. It should be noted that clothing materials would have resistances different from that of air so the thickness of clothing that would have the same effect may vary.

Taser Handling Trials

Introduction

76. In March 2002 PSDB held a three-day series of trials at its Langhurst facility in Sussex. The purpose of these trials was to assess the handling characteristics of different taser devices when fired by police officers in a range of situations. A number of exercises were devised to allow an assessment of the realistic performance achievable from tasers in general, and to allow a comparison to be made between the different models. A questionnaire was distributed to participating police officers to establish their views on each of the tasers used in the trials.

77. The trials involved the use of four different models of taser, these were labelled as A, B, C or D throughout. As explained earlier, specific results for the

different models of taser evaluated cannot be detailed here for reasons of commercial confidentiality.

Participating Officers

78. Each police force participating in the trials was asked to nominate three officers, from a selection of officer groups. The officer groups were general patrol officers, firearms trained officers, public order trained officers, CID officers, and covert/undercover officers. It was also specified that each officer nominated should represent a different length of service band, 0-5 years, 5-10 years, 10-15 years, 15-20 years, 20-25 years or 25-30 years. Each force was asked to provide at least one female officer (twenty-one female officers participated in the trials).

79. Each officer attended the trials for one morning or afternoon session and was given training in the use of the models of taser being used in the exercise. Training consisted of an introductory talk from a PSDB police adviser who had passed the manufacturer's training course followed by a practical introduction to the tasers, where officers were given the opportunity to fire one cartridge from each of the different models of taser.

80. After initial training, each officer took part in two exercises each of which involved firing 2 or 3 cartridges from each model of taser. After completion of the practical stages each officer was given a questionnaire for completion on the day of the trials.

Aim of Trials

81. The main aim of the trials was to assess the accuracy of the different models of taser when hand-fired by officers in a range of situations that might relate to those being faced operationally (note: these were not true scenario-based trials). The trials aimed to assess the performance of tasers as a whole and to identify important differences in the performance of the different models. The trials also aimed to address a number of other points regarding the operational performance of tasers, such as:

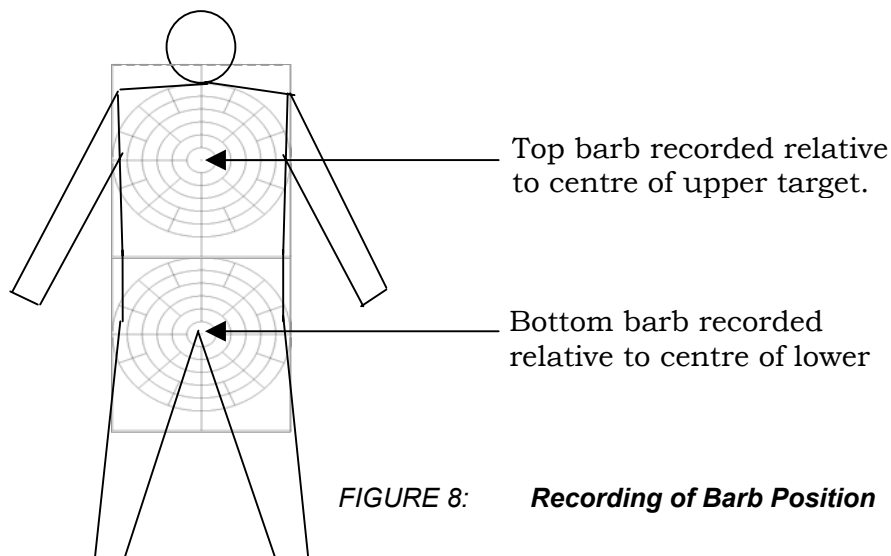
- (i) Ease of Operation: Is the option capable of being operated by one officer? Is it suitable for use by the majority of officers with appropriate training, regardless of physical size or gender? Does it rely on complex motor skills?
- (ii) Environment: Is the option effective in all operating conditions (eg weather, indoors/outdoors, lighting, temperature, etc) and in confined spaces?
- (iii) Mobility/Flexibility: Is the option effective against a moving target? Can it be easily transported to the scene of an incident, and portable at the scene?

- (iv) Repeat Operation – speed of multiple use: Are repeated applications of the option likely to be required? How feasible is such repetitive operation (by one officer/several)?
- (v) Specialist v General Use: Is the option appropriate for deployment in all officer roles, or only by specialists (eg dog handlers, Tactical Firearms Units, new team)?
- (vi) Training: What are the training periods associated with the option's deployment, both initially and in terms of refresher training? What training facilities are required?
- (vii) Durability: How robust is any equipment required for an option? Over what period can an option be said to be reliable – what checking is required?

82. Some of these points were addressed directly in the various handling exercises while others formed part of the questionnaire issued to participating officers.

Exercises

83. When firing the tasers the officers were instructed to aim at the upper torso with the sight for the upper barb such that both barbs should strike the body of the target. They were told to avoid the head and neck areas when firing. For each shot the position of the two barbs relative to the target were recorded as shown in Figure 11. The position of each barb was recorded as the section of the target into which it fell.



84. Examples of results recorded on targets are shown in Figures 9-11 (note, the grids were not present on the targets during the trials, the officers saw only the outline of a figure). These illustrate example results for Exercise X using Taser Y. The numbers in each section marked on the target indicate the total number of times that a barb landed in that section during the trial. Black numbers represent the top

85. For each shot it was recorded whether both barbs hit the target, both barbs missed the target or one barb missed. A successful shot required both barbs to strike the target. These results are represented in a bar chart as percentages as shown in Figure 15 (the percentage in each category is displayed on the relevant bar). Percentages have been used to facilitate the comparison of the results from the different exercises and between different tasers. However, it should be noted that different numbers of officers attempted each exercise (from 2 officers firing a total of 6 shots from each taser model for one exercise, up to 11 officers firing a total of 33 shots from each device for another exercise).

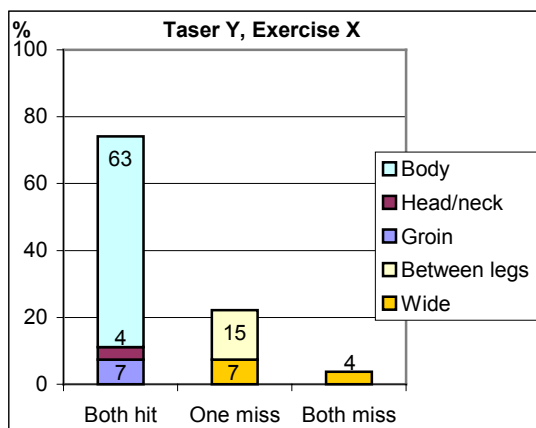


FIGURE 12: Example Hit-Miss Bar Chart

When both barbs hit the target it was noted when either of the barbs hit the head/neck area, causing potential injury, or the groin area. The bottom target was centred on this as an easy reference point and not as the preferred point of aim.

When one barb missed the target it was noted if this was wide of the target or between the legs. When both barbs missed the target it was noted if either of these passed between the legs.

The distinction was made between a barb passing between the legs or going wide as it was felt that in many real situations this might result in a hit on the legs.

86. Officers were timed throughout the various exercises to determine how long they took to draw, load, aim and fire the devices. The results are represented in bar charts as shown in Figure 13.

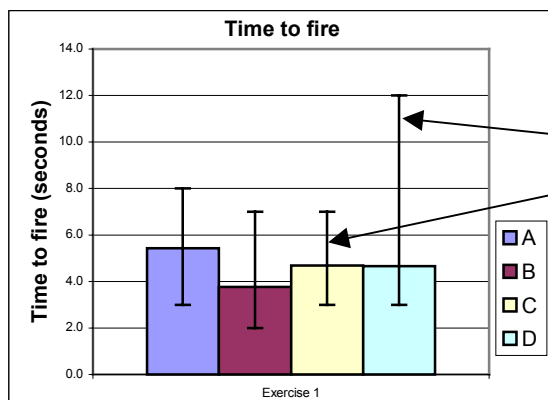


FIGURE 13: Example Time to Fire Bar Chart

Each bar represents the mean time taken to fire one shot for taser A (column 1), taser B (column 2), taser C (column 3) and taser D (column 4).

The vertical lines represent the range of times taken (minimum and maximum). Where the maximum time is considerably greater than the average it generally indicates one or two officers having particular problems with either loading or firing the device.

87. 16 exercises in total were enacted throughout the trials, including stationary and moving targets and firers, side-profile, prone and front facing targets, full light and low light conditions, etc. A total of 1,253 cartridges were fired by officers throughout the exercises (this does not include those cartridges fired during training). The different exercises are summarised in Table 1.

Shoot #	Position of Firer	Position of Target	Lighting	Status of Taser	Laser Sights Used?	No. of Shots
1	Stationary, Upright	Stationary, Face on	ON	Loaded, In holster	YES	Single (3)
2	Stationary, Upright	Stationary, Face on	ON	Unloaded, In holster	YES	Single (3)
3	Stationary, Upright	Stationary, Face on	ON	Loaded, In holster	NO	Single (3)
4	Stationary, Upright	Stationary, Face on	OFF	Unloaded, In holster	YES	Single (3)
5	Stationary, Kneeling	Stationary, Face on	ON	Loaded, Drawn	YES	Single (3)
6	Upright, Moving Forward	Stationary, Face on	ON	Loaded, In holster	YES	Single (3)
7	Stationary, Upright	Stationary, Lying on Floor	ON	Loaded, In holster	YES	Single (3)
8	Stationary, Upright	Stationary, Face on	ON	Loaded, In holster	YES	Multiple (3)
9	Stationary, Upright	Stationary, Face on	ON	Unloaded, In holster	YES	Multiple (3)
10	Stationary, Upright	Side Profile, Moving at high speed for 170cm	ON	Loaded, Drawn	YES	Single (2)
11	Stationary, Upright	Stationary, Lying on Floor	ON	Loaded, In holster	NO	Single (3)
12	Stationary, Upright	Face on, Moving at slow speed for 85cm	ON	Loaded, Drawn	YES	Single (2)
13	Stationary, Upright	Stationary, Side Profile	ON	Loaded, In holster	YES	Single (3)
	Shooting over 6ft barrier	Stationary, Face on	ON	Loaded, Drawn	YES	Single (2)
15	Shooting around 6ft barrier	Stationary, Face on	ON	Loaded, Drawn	YES	Single (2)
16	Stationary, Upright	Stationary, Face on	OFF	Unloaded, In holster	NO	Single (2)

TABLE 1: Summary of Exercises from Taser Handling Trials

Results

88. Figure 14 summarises the barb placement for all 1,253 cartridges fired throughout the taser handling trials. The graph shows the overall distribution of the barbs on the body for all of the exercises combined. These exercises involved stationary and moving targets; light and dark conditions; with and without the laser sights on the taser; upright and prone target; operator standing, kneeling and walking; full body and side profile of target. The results are combined for all participants and for all models of taser. All exercises were carried out at a distance of 13ft (4.0m) between the operator and the target.

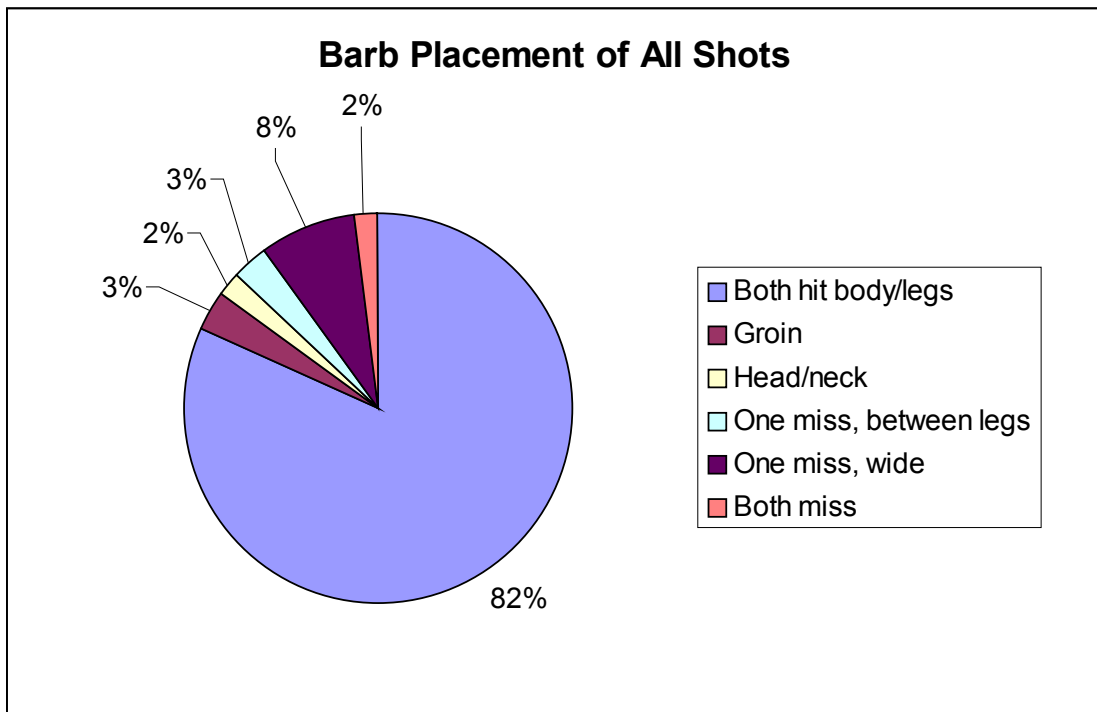


FIGURE 14: Distribution of Taser Barbs for All Cartridges Fired in Taser Handling Trials

89. Figure 14 illustrates that, for all the exercises combined:

- 82% of shots resulted in both barbs hitting the body of the target, but not hitting the head, neck or groin region;
- 5% of shots resulted in one barb hitting the groin, head or neck area of the body;
- 13% of shots resulted in one or both barbs missing the body and landing either between the legs or wide of the body.

90. A lot of other useful information has been gained from these trials, relating to the capabilities of tasers in general and the variation in performance of the different models.

Questionnaires

91. The participants completed a questionnaire after they had been trained in the use of each taser and had taken part in two exercises. The questionnaire consisted of 17 questions. A statement was given and the participants were asked to indicate for each of the different models whether they strongly agreed, tended to agree, tended to disagree or strongly disagreed with each statement or to indicate a “don’t know” response. The final two questions asked the participants to select the taser model they liked/disliked most. Space was also left for comments to be recorded for each question.

92. Figure 15 provides an example of the responses to one of the questions in the questionnaire.

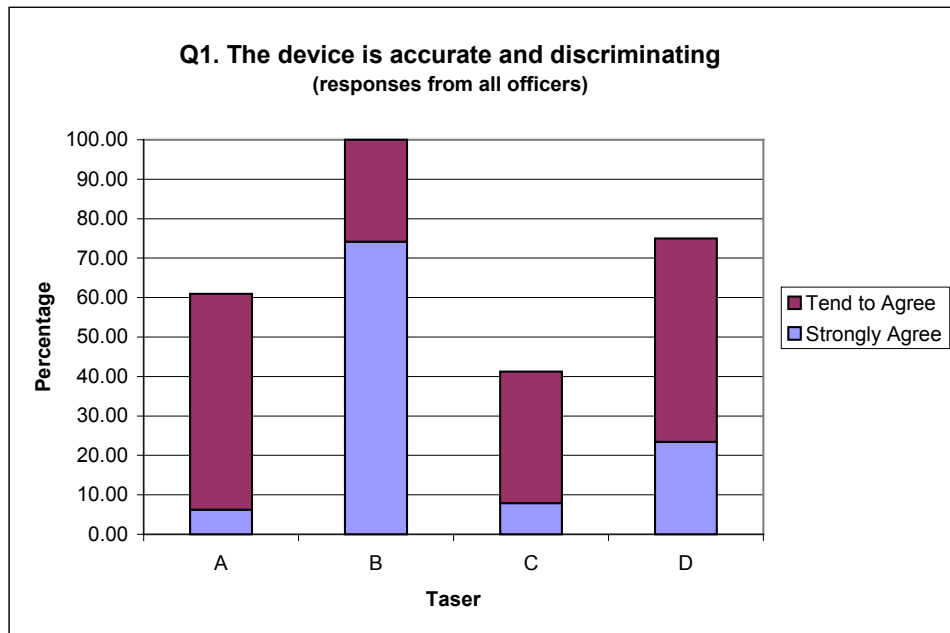


FIGURE 15: Responses From All Officers to Question 1

Conclusions

93. The trials were not intended to cover every possible operational scenario in which tasers could be used, instead the exercises focussed on a number of key areas.

94. The training provided at these handling trials was short and a number of issues arising during the trials, such as speed of reloading or aiming without laser sights, could be resolved with a more extensive training programme.

95. For questions involving unusual conditions, such as low lighting or moving targets, the officers who participated in the related exercises reported more favourably on the use of tasers compared to the other officers.

96. Throughout the handling trials the variation in the handling characteristics of the different models of taser became obvious. This affected the accuracy of the devices as well as the responses that the officers recorded in the questionnaires.

International Taser Use

97. This section describes the use of tasers internationally. Information has been gathered from a range of sources including manufacturers, police forces and corrections agencies in the United States and Canada, and from the press.

98. Taser manufacturers claim to be supplying tasers to over 1000 law enforcement agencies in the United States and Canada. It should be noted that there are more than 18,000 law enforcement agencies in the United States alone, 75% of these agencies have fewer than 50 officers. Many correctional agencies also use taser devices.

99. Two American airlines have also been reported in the press as purchasing tasers for use on their aircraft - United Airlines and Mesa Air. The airlines have not yet deployed tasers on their aircraft as they are still awaiting a decision from the Federal Aviation Authority as to the safety and legality of using the weapons in aircraft.

100. PSDB requested information from law enforcement and corrections agencies on the use of tasers in their force/department. Specific information was requested on what devices were used, how many are held by the department, which officers they are issued to, rate of use, success rate, details of any associated injuries or deaths and use of other electrical devices or less lethal technologies.

101. This section provides information on the use of taser devices by a number of police forces and correctional facilities in the US and Canada. Three case studies are also presented which provide information on the evaluation, introduction and use of taser devices by three separate police forces. The figures that are given for effectiveness, mode of use, types of incidents, etc. are those presented within the study reports and may not always add up to exactly 100%. Each force also presented different types of information in their study reports, so it is not always possible to compare aspects directly between the different forces. In addition, the forces have different ways of defining whether the use of the taser has been "effective", which makes it difficult to compare results directly.

Victoria Police Department, Canada

102. In December 1998, the Victoria Police Department in Canada became the first Canadian police force to use taser devices. They carried out a six-month field study with the Tasertron TE95 model of taser²¹. The main outcomes from this study are listed below:

- The taser was deployed 14 times in total. Nine incidents involved the barbs being fired at the subject, while in the other five incidents the use of the laser sights alone was sufficient to induce compliance in the subject;

²¹ Independent Evaluation Report of Taser and Air Taser Conducted Energy Weapons", D Laur, Victoria Police Department, September 1999. A full copy of this report can be found at: <http://222.airtaser.com/laur/report.html>.

- Of the nine incidents where the barbs were fired at the subject, four resulted in both barbs penetrating the skin, two involved one barb penetrating the skin and the other three involved the barbs penetrating the subject's clothing only;
- In one incident, the use of the taser was ineffective as the bottom barb missed the subject;
- On average, the taser took between 3-5 seconds to control the subject, although in one case it took as long as 15 seconds;
- In six of the nine incidents where taser barbs were fired, only one application of the taser was required. In the other three incidents, the subject attempted to physically resist the officers following the first application and a second application was required to gain compliance. None of the incidents required more than two applications of the taser and no incident involved the discharge of more than one cartridge;
- In several of the incidents, the police agency said that if the taser was not available the subject would have either killed themselves, or the officer would have had to resort to deadly force against the subject.

103. Victoria Police Department carried out a further study comparing the newer higher-powered TE95HP model from Tasertron with the lower powered TE95 model. Comparisons were also made with the Taser International M26 model, which the force has now started to use.

Royal Canadian Mounted Police (RCMP), Canada

104. In 2000/2001, the RCMP and the Canadian Police Research Centre (CPRC) jointly funded the Conducted Energy Weapon Evaluation Project (CEWEP)²². The purpose of this project was to assess the effectiveness and suitability of the chosen model of taser for use by Canadian police officers and to obtain information that could be incorporated into a training package specifically for Canadian police use of tasers. In the pre-trial assessment of available taser models, the M26 from Taser International was selected as the best option due to its shape and the presence of the dataport connection. This model was then subjected to further testing, including testing on human volunteers and field trials by the RCMP. The conclusion of the trials was that, although not 100% effective, the M26 was a suitable and effective use of force tool and it has since been adopted by the RCMP as a less lethal tactical option.

(i) Human Volunteer Trials

105. One part of the human volunteer trials was aimed at determining the effectiveness of the M26. The use of the taser was to be considered ineffective when the officer could cover a 5m distance and retain the dummy knife that they

²² As before.

were holding long enough potentially to injure the targeted officer. In these trials a total of 110 tests were conducted using 104 police volunteers. For most of the tests (85%) the probes were taped onto the volunteers body, whilst for the others, the probes were fired into the subject's flesh. The probes were placed in various configurations on different parts of the body and at different distances apart, varying from 10cm to 100cm. The main outcomes from this study are given below:

- An overall effectiveness rating of 89% was achieved;
- The taser was more effective when the probes were attached to the subject's back rather than their front or arms;
- Subjects who were tasered while already moving forward managed to travel further distances than those subjects who were stationary at the time of being tasered due to their inertia. The injuries received by a moving subject falling after being tasered were considered by medical observers to have the potential to be more serious than those received by an initially stationary subject;
- The subjects had different physiological responses to the effects of the electricity. No subject was immune to the effects and those not incapacitated were significantly debilitated. Some were affected much more than others and while some subjects experienced a lot of pain, others described more of a muscular dysfunction effect rather than pain;
- There were no serious injuries to the volunteers.

106. A second set of tests was aimed at determining whether a subject armed with a firearm would be capable of firing the weapon at a target. 19 volunteers took part in 22 separate tests, which involved the officer being armed with a firearm loaded with a blank bullet. They were instructed to fire the weapon at a pre-agreed target upon sensing the current from the taser or hearing the sound of the taser cycle. The main observations from this study are as follows:

- The subjects were able to discharge the firearm on eleven out of twenty two occasions and dropped the firearm on eight occasions;
- Two of the eleven subjects that discharged the weapon stated that this was involuntary and due to the muscular contractions caused by the taser;
- Of the other nine subjects that fired the weapon, eight were able to fire at the intended target. Ten subjects in total were able to point the firearm at the target.

107. A final set of human volunteer tests were carried out to compare the effectiveness of the M26 taser with OC spray (Oleoresin Capsicum – commonly known as pepper spray). These tests involved 18 officers being sprayed in the face with OC then having to complete a pre-assigned task. On the following day, the same 18 subjects were given a one-second exposure to the M26 and again had to complete the same task. The outcomes from this study were:

- All 18 subjects who were exposed to OC were able to complete their assigned tasks;
- No subjects were able to complete their assigned tasks when exposed to the M26 – they all immediately and involuntarily fell to the ground with an average total time to incapacitation of 3 seconds.

(ii) Field Testing

108. The RCMP carried out a 10-month field trial of the M26 to determine its effectiveness and suitability when used in an operational environment. A total of 284 RCMP members were trained in the use of the M26 and 44 tasers were available for use throughout the trial period. The officers involved in the trials carried the M26 during their day to day duties. The use of the taser was considered to be effective if it was capable of changing a subjects behaviour, eg from an aggressive or combative mood to a compliant one. The key points from this study are shown below:

- A total of 111 incidents involving 139 uses of the taser occurred (in 17 incidents there were multiple uses);
- 39.5% of incidents involved probe use (ie barbs were fired at the subject), 47.1% involved touch stun mode and 13.4% of incidents involved voluntary compliance of the person involved without the need to subject them to the electricity;
- The overall effectiveness rating was 86%. This consisted of 78.3% effective probe uses and 89.3% effective touch-stun uses. A taser use was considered effective even if the first barb missed or multiple shots were needed, providing the overall outcome was as desired;
- Ineffective uses were caused by clothing barriers, operator error (eg operator missed the target), low batteries or cartridge misfire or malfunction;
- On two occasions, none of the above effects occurred but the subject was still not effectively controlled by the electricity;
- 7% of cartridges that were used 'misfired'. The manufacturer has since introduced improved quality control measures to try to prevent these problems occurring again;
- Of those subjects that were involved in the incidents, 70 were under the effects of alcohol, 21 were under the influence of a controlled drug or substance and 26 were in some type of mental health crisis state (eg delusional, suicidal or had stopped taking prescribed medication). It is likely that some of the people were subject to more than one of these influences, so the total number of subjects cannot be gained from adding all three together.

Seattle Police Department, USA

109. Following the fatal shooting of a mentally ill man by Seattle police in April 2000, the Seattle Police Department began looking at how they could expand the availability of less lethal options for patrol officers. An internal study group was specifically set up within the force to look at this. The two less lethal options that they recommended were the M26 taser and a shotgun with 12 gauge sock rounds (though described as 'bean bag rounds in the Department's report). (The Department also purchased 130 less lethal shotguns for use in patrol operations.)²³
24 25 26

110. By the end of 2001, 158 M26 tasers had been issued to officers. 136 of these were deployed in patrol units, 14 in special units and 8 in SWAT vehicles. A 13-month field study using the M26 tasers was carried out from 1 January 2001 to 31 January 2002. In nearly 60% of incidents, the taser officer was among the first responding officers to the scene. The key points from this study are given below:

- A total of 108 incidents took place in which the M26 was used. Two of these resulted in the fatal shooting of the subjects by police officers;
- Tasers were used in the probe mode (ie barbs fired at the subject) about 60% of the time, in the stun mode 27% of the time and both modes were used 12% of the time;
- Verified taser contact was made with the subject in 86% of all incidents. Of these, a disabling or partially disabling effect was achieved 95% of the time;
- In 85% of all incidents and in 92% of the incidents where contact was verified, the taser was credited with controlling the subject or bringing the situation to a resolution;
- 59% of tasered subjects were impaired, often severely, by alcohol, drugs, or a mental illness or delusion;
- A quarter of the subjects were armed, most often with knives (15% of the armed offenders were armed with guns);
- Injuries to the subjects subsequent to taser use occurred in 13% of the incidents. These were generally caused by the subject hitting the ground when being tasered. No injuries were major and none was attributed directly to the taser itself;

²³ "A Less Lethal Options Program for Seattle Police Department", The Force Options Research Group, September 2000.

²⁴ "Use of Force by Seattle Police Department Officers" SPD Special Report, November 2001.

²⁵ "Less Lethal Weapons Options Community Workgroup Recommendations" Less Lethal Work Group, September 2000.

²⁶ "The M26 Taser Year One Implementation" SPD Special Report, March 2002.

- In 5% of incidents, there were officer injuries after taser deployment or directly related to its use. All injuries were minor.

Other Agencies

111. A number of other police agencies and correctional facilities provided limited information on their deployment and use of tasers. In terms of their deployment, tasers are generally issued to field patrol supervisors or carried in patrol cars in smaller police departments, with further units stored for use in detention facilities or for use in prisoner transportation. A number of larger departments are moving towards issuing a taser to all officers. In prison facilities the tasers are either carried by supervisors or held in a central location for use in incidents or for movement of high-risk prisoners.

112. The corrections departments contacted indicated that tasers were often used in conjunction with other forms of electrical device, such as hand held touch stun devices and electrified shields. A number of police departments also indicated that they used hand held stun devices in addition to the touch-stun features of the taser.

(i) Effectiveness Data

113. Sample data from a number of law enforcement agencies are given in Table 2. The data includes effectiveness information when the taser is used in barb mode and touch-stun mode. For some departments, separate information was not given for each mode of use.

Department	Model	Rate of Use	Effectiveness Probe Mode (%)	Effectiveness Stun Mode (%)
Police Department in California	M26 (previously used Tasertron 7W tasers)	5 in 4 months	100%	Less effective than barbs
Police Department in California	M26	-	100% On two occasions required a second shock from the same cartridge	-
Police Department in Arizona	M26	15 times / month	100%	50%
Sheriff's Department in South Carolina	TE95HP	-	100% 90% for detention centre staff	-
Sheriff's Department in California	M26	24 times in 4 months	92%	-
Prison Department in Nevada	TE95	Deployed once every 10 days, used once every 15-20 deployments.	95%	-
Sheriff's Department in Iowa	TE95HP	-	90% +	-
RCMP, Canada	M26	139 in 10 months	78%	89%
Police Department in California	M26	24 times in 9 months	79%	70%
Seattle Police Department, USA	M26	108 in 13 months	85% overall, 95% where probes struck target	-
Police Department in Louisiana	TE95HP	6-10 times / year	100% (when using 2 cartridges)	-
Victoria Police Department, Canada	TE95	14 in 6 months, including 5 without discharge	93% overall, 89% when barbs fired	-

TABLE 2: Effectiveness of Taser Devices

114. It is difficult to compare these results directly as different agencies have different ways of recording an 'effective' use. For instance some agencies will record a failure every time a barb misses the target, whereas another agency will look at the

overall result, regardless of how many cartridges needed to be fired or bursts of electricity were needed. Effectiveness rates may also include uses of the taser that did not involve firing a cartridge. A number of police departments reported that the laser sights were often an effective deterrent in themselves. Additionally, sparking of the taser to indicate the imminent use of an electrical device can also prove effective.

115. As an example, the Prison Department in Nevada noted that tasers are deployed once every 10 days with an effectiveness of 95%. Although tasers are deployed every 10 days, they are actually only fired once in every 15-20 deployments (ie approximately once every 6 months). When the taser is demonstrated by a spark test the majority of prisoners become compliant rather than have the taser used against them. The taser is used as a "show of force" reducing the need for actual force to be used in many situations. These figures are for maximum-security institutions, in lower-security prisons the tasers are rarely used except as a show of force.

116. Where the taser has been ineffective this is often due to failure of one or both barbs to strike the target rather than failure of the electrical discharge to incapacitate the subject. Possible reasons for failure are discussed below. Operationally, there have been incidents where individuals have not been fully incapacitated by the electricity and have recovered immediately after the current has ceased.

117. Effectiveness ratings in touch-stun mode vary more widely than those quoted for barb mode. When tasers are used in touch stun mode they do not have the same electrical effect on the body. The electricity will only act over a small area when used in touch-stun mode, causing pain and debilitation rather than complete incapacitation.

Reasons for Ineffectiveness

118. There are a number of reasons for the taser failing to induce compliance in a subject. Reasons for failure of the taser are discussed below.

(i) Clothing

119. Although the electrical current from the taser can arc across a certain distance of air-gap, there may be some situations where the thickness of the clothing worn by the subject exceeds this distance. This is especially important in cold climates where heavy jackets are frequently worn.

120. Additionally, if clothes are hanging loosely away from the body and the barbs attach to the clothing without penetrating the body, then the arc distance could again be exceeded. This will cause the circuit to be incomplete and electricity will not flow through the subject.

(ii) Battery Failure

121. Low battery charge can be caused either by the depletion of the battery through continued use or by very cold weather conditions, which can adversely affect their performance. Maintenance of taser equipment is vital to ensure that the taser

will be in good working order when required. One American Sheriff's Department highlighted battery failure and poor maintenance as a reason for failure of their previous taser units and another department noted battery failure as one of the primary reason for ineffectiveness. This usually occurred when the batteries had not been fully charged.

122. Different types of batteries have different performance characteristics. While rechargeable batteries can last for a greater number of uses than alkaline batteries, for instance, they will be ineffective if regular and appropriate recharging of them is not carried out. Cold conditions can also adversely affect different battery types to different extents.

(iii) One or Both Barbs Fail to Hit the Target

123. One or more barbs can fail to strike the target for a number of reasons including operator error, errors in the sighting system, cartridge failure, moving target and the target being out of range. Unless both barbs hit the target the electrical circuit will be incomplete and electricity will fail to flow through the subject.

(iv) Subject Fighting Through the Effects of Electricity

124. Even with the new higher-powered taser devices, some subjects are capable of fighting through the effects of the electricity, although this is a much less common cause of failure than many of the others listed here. The ability of a subject to withstand the electrical current effects will depend on their mental focus, the power output of the taser and the distance between the two barbs (hence stun guns tend to be less effective than tasers). A study by the RCMP using police volunteers found that the taser was more effective when applied to the back and legs than to the chest or arms.

(v) Operator Error

125. Examples of operator error may include failure to hold down the trigger to maintain the flow of electricity through the subject (on some models) or failure to operate the taser in the correct manner.

(vi) Deploying Too Close to the Target

126. The length of the connecting wires sets the upper limit of the range over which the taser is effective. The lower limit is set by the spread of the barbs. In order to incapacitate the subject the electricity should cover as many large muscle groups as possible. Use of the taser at ranges lower than three feet (0.9m) may not allow sufficient separation of the barbs to occur.

(vii) Taser or Cartridge Failure

127. Problems can occur with the taser unit itself during use, such as a mechanical problem or an electrical failure in the circuit. This can result in the trigger not being able to be depressed, or the electricity being unable to flow, for instance. Cartridge

failures have also occurred operationally, such as the barbs not ejecting from the cartridge when the taser is fired.

Conclusions

128. Tasers have a number of characteristics that may make them suitable for use by UK police forces. However, a major drawback to their effectiveness could be the maximum range of 21ft (6.4m) imposed by the length of the conducting wires, which is combined with an effective range of only 15ft (4.6m) for acceptable accuracy. Additionally, tasers are not 100% effective. This can be as a result of the electricity failing to incapacitate the subject, although other causes may be more likely. Main reasons for failure include one or both barbs missing the target, thick or loose clothing, battery failure, operator error, tasers deployed too close to the target, or the taser or cartridge failing.

129. Tasers are often effective without the need to fire the barbs. They can be used in stun mode as well as using the laser sights and/or sparking the taser in view of the subject before inserting the cartridge as a deterrent. In these cases the threat that the officer is about to use the taser may be sufficient to induce compliance.

130. Throughout testing and in the handling trials the variation in the performance and handling characteristics of the different models of taser became apparent. Although details of this are classified as RESTRICTED COMMERCIAL and so cannot be detailed here, they have been available to ACPO and Government.

131. PSDB's evaluations have deliberately only assessed the scientific and technical aspects of tasers. PSDB has not addressed any policy considerations or many operational aspects, such as the legal implications, acceptability (to both the police and the public), authority required to use, who should carry tasers if they are to be deployed and judgement issues. Likewise, PSDB has not assessed the medical implications of the use of tasers. This expertise has been provided by Dstl and details on this aspect of tasers are provided in their section of this report.

132. It has also been found that tasers can set fire to flammable liquids. Therefore, it is strongly recommended that the taser is not used against a subject who has already been sprayed with either CS or PAVA, both of which are currently contained within a flammable solvent (MIBK and 1:1 ethanol:water respectively), if it is possible to avoid doing so. Extreme caution must also be exercised when using it on a subject who is suspected of being covered in any other flammable solvent, such as strong alcohol (eg undiluted spirits) or petroleum spirit, or in a dangerous environment, such as a petrol station.

133. PSDB has now completed its evaluation of taser devices. This has highlighted the main advantages and the potential drawbacks to the use of tasers by the police service in the UK.

B. Medical Risks Associated with Tasers

Introduction

134. This section contains the full statement (less the preamble) prepared by the DSAC sub-committee on the Medical Implications of Less Lethal Weapons (DOMILL) on the medical implications of the use of the M26 Advanced Taser.

Evaluation of Tasers

135. Tasers are hand-held devices that propel two barbs at an individual. The barbs are intended to attach to the skin or clothing on the torso and/or lower limbs. A sequence of very short duration high voltage current pulses passes through wires connecting the device to the barbs. The current flows into the body and results in a loss of muscular control and in pain. Some models also enable direct contact of the taser hand-set to the surface of an individual; two closely spaced fixed electrodes pass the current pulses into the subject. This manner of application is usually classed as use in “stun” or “probe” mode; pain is the principal local physiological effect.

136. The Police Scientific Development Branch of the Home Office has undertaken an evaluation of a number of commercially available taser devices. The evaluation addressed barb accuracy and dispersion, the measurement of electrical output and reliability, a review of manufacturers’ claims and handling characteristics in a number of test scenarios. DOMILL also undertook a general review of the medical implications of the use of tasers.

137. On the basis of the objective technical and medical evaluations, and the policy underpinning the development of a broader range of options for conflict management in the UK, ACPO has proposed that an operational trial of the M26 Advanced Taser should take place. DOMILL was invited to provide this current statement for Ministers on the medical implications of the use of the M26 Advanced Taser in an operational trial.

Guidance on use by police of the M26 Advanced Taser

138. The policy and practice defining the training for use, deployment and operational use of a weapon system is central to an assessment of the medical implications of that use. The ACPO Guidance states that an operational trial would be limited to firearms officers in selected police forces. The M26 Advanced Taser would provide firearms officers with additional means of dealing with threats of violence in which conventional firearms and other less lethal tactical options may be deployed. Such options include batons, sprays of sensory incapacitant, and “empty hand” physical restraint.

139. Deployment and use of the taser would conform to the principles of guidance already laid down in the ACPO Manual of Guidance on Police Use of Firearms. The trial would be subjected to critical and independent review.

Technical approach for the assessment of medical implications of use

140. The milestones placed upon DOMILL by the Steering Group dictated the nature of the technical approach: a wide-ranging review of literature and preliminary analytical studies on the biophysical interaction of taser current pulses with the body. On behalf of DOMILL, the Defence Science and Technology Laboratory (Dstl) undertook a comprehensive review of information publicly available, and provided by manufacturers and police forces in North America. Over 800 references were acquired and reviewed. The review encompassed:

- (a) basic neurophysiological science to consider the mechanism of the interaction with excitable tissues;
- (b) peer-reviewed scientific and medical papers specifically addressing laboratory and operational use of tasers and stun weapons: electrical output, risks to personnel, analyses of medical issues observed in hospital facilities in individuals subjected to tasers, and the circumstances surrounding the deaths of personnel subjected to Tasers in the course of their arrest;
- (c) evidence on the risks provided by manufacturers: scientific, medical, use on volunteers and records of operational use;
- (d) the basis of the application of electrical safety standards and criteria to taser outputs;
- (e) newspaper reports of taser use and complications arising from use;
- (f) surveys of effectiveness and injuries observed and recorded by law enforcement agencies in the United States and Canada;
- (g) peer-reviewed papers on the hazardous effects of electric fields on physiology.

The review by Dstl was conducted by cardiac and nerve electrophysiologists, physicists and engineers specialising in the interaction of electrical energy with the body, and trauma specialists.

141. Dstl also undertook computer-based modelling of the interaction of taser pulses with the body. The primary purpose was to assess qualitatively the distribution of currents from tasers in the body, and to determine semi-quantitatively the changes in current magnitude and distribution for different barb separations and taser outputs.

142. DOMILL endorsed Dstl's approach and reviewed the substantial body of information compiled by Dstl. This statement is based on these data.

Classification of taser outputs

143. Tasers have been classed by users as “low-power” (5-7 watt) or “high-power” (14-26 watt). Tasers have been in use for over 20 years, principally in the US. Over most of this period, only low-power tasers were available, deployed and used. High-power tasers have been available and in use on volunteers and operationally for about two years; the M26 Advanced Taser is classed as high-power. Assessments undertaken by the PSDB showed that the principal differences in measured output between low- and high-power tasers were the pulse repetition rate and pulse duration; differences in peak current and voltage between devices were also noted. Dstl modelling studies showed that the magnetic field strength in the body (an index of current) was greater with the high-power tasers.

The evidence of hazard and risk from the M26 Advanced Taser

144. The body of manufacturers’ experimental evidence from biological models of the hazardous and intended effects of taser on excitable tissues is not substantial, particularly with regard to the M26; the peer-reviewed evidence is even more limited. The epidemiological evidence to assess the hazards associated with use of the M26 Advanced Taser is not as robust as that for the low-power models. However, the manufacturer’s database of over 1600 operational uses of the M26 and reports from law enforcement agencies in North America did offer some insight into the risks and nature of injuries.

Classification of injuries

145. Unintended adverse effects from the use of tasers may be classed thus:

- Primary: immediate or delayed consequences of electrophysiological phenomena resulting directly from the current flow in the body; it is surmised from the known effects of electric fields and currents on the body (for example, lightning, electric fence controllers) that the organ of principal concern is the heart;
- Secondary: physical trauma directly associated with taser use, principally injuries from the barbs and falls; the head is the principal area at risk;
- Coincidental: injuries received in the incident not directly related to taser use eg baton use, self-inflicted wounds, gun-shot wounds.

It is notable that in two surveys from law-enforcement agencies in North America, more than half of the number of people confronted with the M26 Advanced Taser were impaired by alcohol, drugs or mental illness. Some drugs and metabolic consequences of muscular activity are believed to increase the susceptibility of the heart to potentially life-threatening disturbances of rhythm (arrhythmias).

Conclusions

146. On the basis of the evidence, the following conclusions are offered on the medical implications of the use of the M26 Advanced Taser in an operational trial that may be undertaken within the terms of the ACPO Guidance provided to DOMILL.

147. **Deaths:** Over the period of use of low-power tasers, there have been a small number of deaths associated with a large number of operational uses. One paper discusses 16 deaths over a 4 year period in Los Angeles²⁷. Other factors such as pre-existing heart disease and drug use were implicated in these reported deaths. On the available evidence, DOMILL considers it extremely unlikely that a death from primary injuries has been caused by a low-power taser.

148. With regard to the high-power M26 Advanced Taser, the risk of death from primary injury is low and in common with low-power tasers, is certainly very much lower than that from conventional firearms. Deaths have been reported to be associated with (but not necessarily caused directly by) use of the M26. DOMILL is not aware of any deaths from primary injuries with this weapon, in both operational and volunteer use in North America.

149. The confidence of the opinion of a very low risk of death from future use of the M26 is not as high as that for the low-power devices. This uncertainty arises from the smaller numbers of historical operational uses, and the dearth of information on the potentially adverse electrophysiological effects of the higher current flow in the body, particularly in subjects who may have a predisposition to cardiac arrhythmias arising from drug use, pre-existing heart disease or genetic factors.

150. DOMILL is not aware of any deaths arising from the secondary consequences of taser use.

151. **Life-threatening and serious injuries:** The risk of life-threatening injuries and of other serious injuries such as the loss of an eye, is considered to be very low. The intuitive high risk of serious head injury from an uncontrolled collapse is not manifested in practice; most subjects apparently collapse in a semi-controlled manner.

152. The probability of impact of a barb on the surface of the eye is considered to be low. The impact of barbs on the head has occurred operationally; non-operational evaluation trials on targets have also resulted in head impacts. On the basis of trial data, it is probable that by employing the ACPO Guidance, fewer than 1% of upper barb impacts will hit the head. In the worst case of frontal application, the eyes are a small proportion of the presented area of the head.

153. The PSDB has shown in trials that the taser may cause combustion of flammable solvents on the subject's clothing. This may result in serious burns to the

²⁷ See footnote 18.

torso and head; the Guidance to Users must highlight and control the risk from flammable liquids such as petrol on the subject.

154. **Other effects:** Falls may result in abrasions, scratches, minor lacerations, swellings and areas of redness on the skin. Minor secondary trauma from the penetration of the skin by the barbs will occur; there is sufficient experience from North America to effect simple removal by UK medical professionals.

155. Some of the barb penetrations will exhibit small circular burns; areas of skin where current has entered the body from barbs retained in clothing may also exhibit burns. These burns are likely to resolve within a few days, without complications and the need for medical intervention.

156. DOMILL is not aware of any evidence that the taser would induce an epileptic seizure.

157. The M26 taser has a US laser classification that indicates that it is potentially hazardous for *intrabeam* viewing of its sighting laser. The classification according to British Standards and the potential to cause injury must be determined.

158. **Use on drug and cardiac-impaired individuals:** It is believed that drugs such as cocaine and pre-existing heart disease may lower the threshold for cardiac arrhythmias. Many of the 16 fatalities associated with use of the low-power tasers in the Los Angeles survey had also taken PCP (phencyclidine) prior to the incident. PCP is also thought to be pro-arrhythmogenic but is infrequently encountered as a substance of abuse in the UK.

159. There is no experimental evidence that the aforementioned pro-arrhythmic factors increase the susceptibility of the heart to low- or high-power tasers specifically, sufficient to cause an arrhythmic event. Nevertheless, there is sufficient indication from the forensic data and the known electrophysiological characteristics of the heart (and the effects of certain drugs on this) to express a view that excited, intoxicated individuals or those with pre-existing heart disease could be more prone to adverse effects from the M26 taser, compared to unimpaired individuals. The ACPO Guidance to Users reflects this view.

160. **Overall:** From the available evidence on the use of the device, the risk of life-threatening or serious injuries from the M26 Advanced Taser appears to be very low.

Recommendations

161. Research should be undertaken to clarify the cardiac hazards associated with use of the taser on individuals who could be considered to have a greater risk of adverse effects. The principal investigations should address:

- (a) accurate, quantitative estimates of the magnitude of the magnetic and electric field strengths from the M26 in potentially vulnerable parts of the body; this would require enhancement of the preliminary model

developed by Dstl. These data will focus the investigations in (b) and (c) below;

- (b) possible hypersusceptibility to taser currents arising from drugs commonly used illegally in the UK, acidosis and pre-existing disease; *in vitro* tissue models are available that could be used to address these issues;
- (c) the vulnerability of pacemakers and other implanted devices; this issue requires a more thorough review. Experimental studies to assess electromagnetic incompatibility issues are currently not warranted and should await the outcome of the review;

DOMILL does not consider it *essential* from a medical perspective that these studies are completed before approval is considered for the M26 Advanced Taser trial under the terms of the ACPO Guidance.

162. The output of the sighting laser of the M26 taser should be measured, classified according to British Standards and operated to reduce the risk from the ocular hazard.

163. Forensic Medical Examiners (FME) and appropriate clinical staff in the principal hospitals within the areas of the police forces participating in the trial should be briefed on the nature of the M26 Advanced Taser, clinical and operational experience from North America, and the presumed and known risk factors. Additionally, it is recommended that a paper be prepared addressing these issues and the wider policy underpinning use, for submission to an appropriate clinical journal.

164. At the end of any operational trial (or 6 months after commencement, whichever is earlier), the Home Office should provide DOMILL with a report outlining the circumstances of every use of the M26 Advanced Taser, the post-incident medical assessments undertaken by the FME, and the clinical consequences noted by the FME or clinical staff. 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.

165. DOMILL should inspect the M26 Training Programme Manual to advise on the specific medical risk factors declared in the document.

166. DOMILL should be advised of any changes in:

- (a) the specification or performance of the M26 Advanced Taser;
- (b) the guidance to users, and training practices;
- (c) the policy and practice of deployment, use and audit.

CHAPTER 6: IMPACT ROUNDS

A. PSDB Evaluation

1. There are a large number of impact devices available from a number of manufacturers. These are available in standard 37mm, 40mm and 12 gauge calibres as well as a number of rounds with a different calibre, which tend to have their own specific launcher. Many are also available for use at different distances, for example for close, medium and long range use. Some manufacturers will make a wide range of impact rounds in a range of calibres, energy levels and classes of munition while others may only make one or two.

2. As detailed in previous reports, impact devices have been split into specific classes depending on their makeup. These classes are bean bags, sock rounds, single flexible ball rounds, multi-ball rounds, fin-stabilised rubber projectiles, multi-baton rounds and single baton rounds. The previous reports provided further descriptions of these categories of impact rounds, detailing their properties and characteristics. Details were also provided on a study of these rounds in America, along with a description of the testing that PSDB had carried out and a summary of the results that had been obtained.

3. Approximately 50 manufacturers of impact rounds were contacted and invited to submit products for evaluation by PSDB. A number of them responded and 11 different companies submitted a total of 36 types of impact rounds for evaluation. The rounds that were submitted are categorised in Table 3 in terms of the calibre and class of round. The numbers given in brackets relate to those rounds that merited further testing.

Class of Munition	Calibre					Total
	12 gauge	37mm	37/40mm	40mm	Other	
Bean Bag	5 (2)	4 (1)	1	-	-	10 (1)
Sock Round	4 (2)	1 (1)	-	-	-	5 (3)
Single Flexible Ball Rounds	-	1	-	-	3	4
Multi-Ball Rounds	4	-	-	-	-	4
Fin-Stabilised Rubber Projectile	3 (1)	1 (1)	-	-	-	4 (2)
Multi-Baton Rounds	-	-	2	1	-	3
Single Baton Rounds	2 (1)	1 (1)	-	2 (2)	-	5 (4)
Other	-	-	-	-	1	1
Total	18 (4)	8 (4)	3	3 (2)	4	36 (10)

TABLE 3: *Impact Rounds Submitted to PSDB, Sorted by Calibre and Class of Munition*

4. During the testing of these rounds, data were collected on their velocity, kinetic energy and momentum. The mass of the rounds was also measured and the standard deviation in each of these parameters was calculated. Taken alongside the accuracy and orientation data, this gives a measure of the reliability and consistency of the rounds.

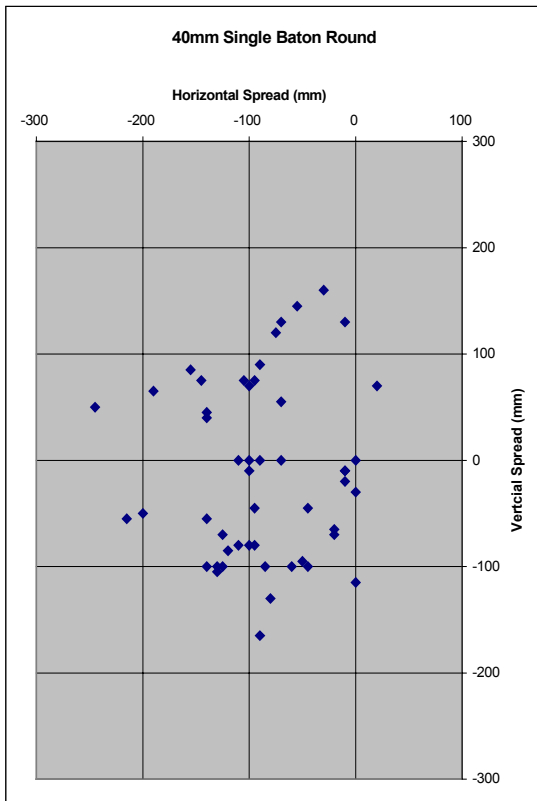


FIGURE 16: Spread of Rounds at 20m for a 40mm Single Baton Round

Figure 16 shows a typical example of the accuracy data that were obtained. This data relates to 50 40mm single baton rounds fired from a bench mounted 40mm launcher at a distance of 20m from muzzle to target. Table 4 details the values that were obtained for the velocity, kinetic energy and momentum of the rounds, along with the standard deviations for each.

Distance from Muzzle	Velocity (m/s)	Kinetic Energy (J)	Momentum (kgm/s)
2m (n = 50)	102 ± 2	167 ± 5	3.3 ± 0.1
18m (n = 50)	84 ± 3	114 ± 5	2.7 ± 0.1

TABLE 4: Velocity, Energy and Momentum Data for a 40mm Single Baton Round

5. Of the 36 rounds that were submitted for evaluation, only 10 have been found to meet the basic criteria for accuracy, ie to hit a 40cm wide x 60cm high target at 20m with a 95% probability of hit using a bench-mounted system, as well as having a suitable orientation on impact. The calibre and class of these rounds are shown in Table 3 as bracketed numbers. As these results have been obtained under ideal conditions, they only give an indication of the likely performance of the device and represent the absolute best performance that can be expected from the rounds. They do not take into account the inaccuracies that will result when the round is fired from a hand-held weapon or the sighting system within it weapon, which will affect the point of impact of the round at different ranges. These factors also have to be evaluated, however this can be time-consuming and costly and it is therefore necessary to concentrate on the products that are most likely to meet the Operational Requirement.

6. The most promising of the 10 devices were subjected to further testing, such as testing at extreme temperatures (-10°C and +40°C initially) and testing at extended ranges (up to 40m) to obtain accuracy and point of aim/point of impact data at these ranges.

7. None of the rounds tested (even the most promising rounds) came close to the performance of the L21A1 baton round in terms of both accuracy and momentum. Accuracy is a very important parameter as it affects the injury potential of the rounds (the more accurate the round and the system, the less likely it is to strike an unintended and vulnerable part of the target's body). Momentum is a

combination of the mass and velocity of the round and is likely to give an indication of the effectiveness of a round. Some rounds are more accurate than others (although not as accurate as the L21A1), while others have a higher momentum. None of the rounds tested had both of these aspects together at a level sufficient to match that of the L21A1.

8. As detailed in the earlier reports, square and rectangular bean bags and multi-ball rounds are no longer to be included in the testing because of inherent problems with these types of rounds. Further testing has also indicated that multi-baton rounds are likely to produce too great a spread of rounds at the distances required and hence are unlikely to be sufficiently accurate to meet the criteria set. Testing of a number of 12 gauge fin stabilised rubber projectiles has demonstrated that these rounds have a very low momentum, by virtue of the low mass of the rounds. It is unlikely, therefore, that this type of round would be considered to be as suitable as other rounds with a higher momentum. With 37mm and 40mm fin stabilised rubber projectiles, the presence of the rubber fin at the back of the round may present an additional hazard to the round if it rebounds and strikes the subject with the back end, rather than the front. As these rounds have a higher momentum than the 12 gauge versions, the potential for injury from this could be of concern, although this would need to be verified by a medical assessment of the round. This issue is also of concern for other rounds that have different shaped back ends, for instance rounds with back ends that are 'cupped'. When the back end has a smaller surface area, this can lead to increased energy density and potential problems with penetration.

9. In March 2002, PSDB recommended to the Steering Group that two of the impact rounds evaluated be submitted for a full medical evaluation. These rounds were a 12 gauge sock round and a 37mm single baton round and were chosen as having the best combination of accuracy, momentum, consistency and reliability of all of the rounds tested. Since that time, testing of the 37mm round has been postponed until evidence can be supplied by the manufacturer that they have completed the development of their round. Only one 12 gauge sock round has therefore been submitted to Dstl to carry out the testing necessary to allow a statement to be prepared by DOMILL on the medical implications of the use of this round, with the appropriate weapon system. The testing that has been carried out so far on this round and testing that remains to be done, is detailed in section B below.

10. PSDB will continue to evaluate new and previously untested impact rounds if they appear likely to have a better performance than those already being evaluated. A standard is also being developed for the evaluation of these types of round. This will essentially formalise the testing procedures that have been used so far into a single document, against which all rounds of this type can be evaluated. A test house will be identified and contracted to carry out this testing, which will be open to all manufacturers of this type of ammunition. Once the standard is finalised and a suitable test house has been identified, a standard method will be available to test all impact rounds to determine their performance characteristics and assess whether they meet the necessary criteria. This system will allow all products on the market to be tested, subject to the interest of the manufacturer, including any new rounds or rounds that have been altered and/or improved. It is likely that this testing will be carried out at some expense to the manufacturer.

B. The Medical Evaluation

Introduction

11. The evaluation by PSDB of commercial-off-the shelf (COTS) or near-market less lethal technologies that rely principally on impact for operational effect, identified two rounds that fulfilled the initial technical and operational criteria – a 12-gauge sock round, and a 37 mm energy-attenuating projectile. DOMILL was asked to formulate an independent opinion on the medical implications of the use of the two projectiles. The Defence Science and Technology Laboratory (Dstl) recommended to DOMILL a technical programme to acquire information on the accuracy and dispersion of the projectiles and the consequences of an impact to the torso and head. This information was required to underpin the statement by DOMILL. Dstl's outline approach – which proposed to use experimental firings, mathematical and physical models - was endorsed by DOMILL.

12. Initially, Dstl undertook a review of the performance specifications, manufacturing dimensions and tolerances, proof schedules and frozen design features of the two types of commercial ammunition. Dstl expressed concerns to the manufacturer and Steering Group regarding the maturity of the design for the 37mm projectile. Tests on the 37mm projectile have been suspended until the manufacturer can provide evidence that the design can be produced to well-defined parameters using large scale production techniques and processes. Experimental work and modelling on the medical implication of use of the impact rounds has, therefore, been confined to the 12-gauge sock round. The enquiries into the specifications of the 37 mm projectile led to a delay in the programme.

Objectives

13. The objectives of this medical evaluation programme are to:

- (a) provide a scientific basis for an independent statement from DOMILL to the Home and Northern Ireland Secretaries (and thence to the Defence Secretary) on the medical consequences of the operational use of the commercial less-lethal systems:
 - 37 mm energy-attenuating impact round (suspended);
 - 12-gauge sock round.
- (b) enable DOMILL to offer advice to Northern Ireland Office, Home Office and the Ministry of Defence on:
 - recommendations to Guidance to Users and modifications to the weapon system that would minimise the risk of serious injury in general, or to specific vulnerable groups;

- future research requirements and post-deployment reviews that would better inform DOMILL's opinions on the out-turn of casualties from the weapon systems.

Technical approach

14. The risk of injury from an impact projectile is dependent upon the hazard to specific vulnerable areas of the body upon impact, and the probability that the vulnerable areas will be struck. The assessment programme has two principal facets: (i) modelling to predict the risk of serious and life-threatening injury to the principal vulnerable areas – the head and thorax; (ii) firing trials, from clamped weapons and with trained firers, to determine the dispersion of the projectiles, and the estimated probabilities of projectiles striking these areas.

Firing trials

15. The measurement of the velocity and dispersion of the 12-gauge sock round from a clamped weapon has been completed for ranges of 2 m, 5 m, 10 m and 25 m. The large number of firings employed three examples of each gun, and three batches of ammunition. These data are being compared to the L21A1 baton round at the identified ranges. The trials also assessed the performance of the ammunition at various environmental temperatures.

16. The firings to determine the accuracy and dispersion in the hands of trained police officers were completed at the end of October 2002. Three police officers undertook the firings; the firing ranges, batch numbers and gun examples were identical to those used in the clamped weapon firings. These data will be used to develop zeroing procedures for the weapon system, and used to predict the probability of head and thoracic impact (for an aim point in the belt buckle area) on adults of average and small stature (stature determines the separation of the vulnerable areas from the aim point, which when combined with the measured dispersion of the projectile around the average impact point, enables the changes in probability of impact to vulnerable areas with stature to be calculated).

17. In the clamped weapon and manned firing phases, a total of 1410 sock rounds and 1370 L21 rounds were fired. Analysis of this large and unprecedented quantity of data on the sock round is still being undertaken, but it is evident at this stage that the variability of the velocity at muzzle of the sock round is greater than that of the L21A1 baton round, and that at all ranges (and particularly at 25m – just beyond the maximum range recommended by the manufacturer), the variability of the fall of shot on a target is greater than that of the L21A1. The consequences in terms of overall accuracy and the probability of impact to a vulnerable area have not yet been calculated.

Impact modelling

18. The initial phase of the work will address impact to the critical areas of the head and thorax. This was completed at the beginning of November 2002. The assessment of impact injury requires models that are appropriate to the rate of energy transfer. The models must also be able to address the interaction of a

complex, deformable projectile such as a sock round. The complex construction of this projectile and the lack of information on its dynamic properties precluded the use of existing mathematical models. The mathematical models could not be enhanced within the timescales available to Dstl and DOMILL, and therefore physical models are being employed. There are three activities in this phase:

- (a) **Incidence and nature of skull fracture:** A specific location on the scapula of a cow has mechanical properties similar to that of parts of the human skull. This model was used in the assessment of the L21A1 baton round. Bovine scapulae from the meat trade were struck with the sock round, and the severity and nature of the fracture assessed. These data were compared to the response with the L21A1 baton round. Initial analysis of the data has shown that given an impact to the head, there would be predicted to be a similar level of risk of fracture at very short ranges. However, the probability of an impact to the head is extremely low for both projectiles.
- (b) **Non-penetrating impact injury to the thorax:** Limited data has been provided by the manufacturer on the response of the Wayne State 3-rib impact model to impact by the sock round. Dstl has also employed its Behind Armour Blunt Trauma (BABT) rig to characterise the response of the lateral thoracic wall to impact by the sock round and L21A1. The BABT rig was originally designed to model the dynamic behaviour of the lateral thoracic wall of an anaesthetised pig behind armour plates hit by high-energy bullets. It may also be used for localised impacts of similar body wall deformation rates, such as some blunt projectile impacts. An array of laser beams senses the motion of the rear of the responding element representing the body wall (constructed from a rubber material). The resultant deflection/time profile is differentiated to determine wall velocity; accelerometers may also be embedded within the wall if necessary. The nature and severity of thoracic trauma may be assessed from these data.

The momentum of the sock round is less than that of the L21A1 baton round. Biomechanical principles would predict that the sock round would result in less deflection of the body wall; this was confirmed on the BABT rig. The reduced body wall deflection suggests that the sock round may be less effective than the L21A1 in delivering sufficient force from one impact to dissuade an individual from undertaking a malevolent act. The peak velocity of the lateral body wall was greater with the L21A1 baton round. On this basis, the L21A1 would have a greater degree of blunt trauma to the chest than the sock round. However, preliminary analysis of the data predicts that both projectiles would have a low risk of death from blunt trauma to the lateral chest. The hazards to the chest from kinetic energy projectiles are well known, and must be controlled by good accuracy and low dispersion (variability) of the particular projectile around the average impact point.

- (c) **Frequency of penetration of the body wall of the torso:** There have been a very small number of reports from operational use and

experimental studies, that sock rounds may penetrate the skin and subcutaneous tissues. The incidence of penetration is very low, and the experimental studies in the US fired the sock rounds at velocities higher than those from operational rounds. An index of the risk of penetration of tissues by a projectile is the available kinetic energy per unit contact area (Joules/mm²). At worst (very short range) this index for the sock round is approximately twice that of the L21A1 baton round. Experiments to determine the frequency of penetration of the skin and perforation of the body wall of the torso at very short range are underway.

19. The outcome of the three series of tests will be reported to DOMILL in the near future. DOMILL will provide an interim view on the risk of serious and life-threatening injury to the thorax and head from the sock round. The review will make recommendations on the requirement for additional work to clarify risks to these critical areas, and to other parts of the body, such as the abdomen. It is envisaged that if additional work is warranted, this will be completed by early spring 2003.

CHAPTER 7: DstI PROGRAMME ON THE DEVELOPMENT OF LESS LETHAL TECHNOLOGIES

A. Introduction

1. The previous chapter described the evaluation so far of the COTS (commercial off the shelf) systems. Reflecting the limited COTS options for energy-attenuating KE projectiles and a discriminatory long range chemical delivery device, additional research has been commissioned, principally by the NIO. The research will underpin the possible development by Government of weapon systems to directly address its operational requirements. This decision further addresses Patten's recommendation that there should be an immediate and substantial investment in a research programme to find an acceptable, effective and less potentially lethal alternative to the baton round.

2. Initiation of this research demonstrates a longer-term commitment to employ medical and engineering experts, within Government, academia and industry, to develop alternatives that have an auditable technical basis. It offers the opportunity to review afresh concepts for achieving the operational requirements of effectiveness and safety within the Strategic Audit Framework.

3. The technical and medical evaluation of a limited number of existing commercial off the shelf technologies is proceeding. The additional research commissioned by Government will offer greater options and benefits in the following areas:

- **Safety:** a knowledge of the biophysical processes of injury is essential in order to develop systems that will further reduce the risk of serious and life-threatening injury from KE projectiles (such as the baton round) or ensuring that any delivery system for a sensory irritant meets medical acceptability criteria. The Government has already invested in this capability within the MOD; the continued development of injury tools (models) based on this knowledge is pivotal to developing and refining technical options that meet safety requirements. Furthermore, the risk of injury is determined by the characteristics of the whole weapon system: cartridge design, sights, launch system, and also the policy and guidance underpinning its use. The technical design and quality assurance of the cartridge, projectile, contents and its launching system are critical facets and require rigorous specification, inspection and compliance. Government specified requirements can achieve this.
- **Effectiveness:** The systems can be designed to address specifically the performance requirements of the policy makers and users, whether that be expressed in terms of (say) safety, effect required or effective range. Users can be provided with what they need and not simply with what is available commercially.

- **Costs:** Developing concepts (that may ultimately be developed and procured) requires costly research initially, but there are cost savings in the longer term. Following development, the specification of a Technical Data Pack will enable Government to compete procurement within industry, thereby achieving significant savings in operational and training costs within the life of the weapon system. This approach also removes reliance on a sole supplier for provision and thereby reduces cost and ensures efficient supply. (A Technical Data Pack is a document providing all requirements and specifications for industry to manufacture a store, such as a cartridge containing a projectile.)

4. The Dstl is the Design Authority for the L21A1 baton round, a system that has been recognised as being designed to an exacting specification, in order to reduce even further the risk of serious and life-threatening injury from the baton round. This achievement was reflected in the statement of the independent medical reviewers of the Defence Scientific Advisory Council placed in the Library of the House of Commons. Dstl is also the MOD's focus for development of injury models and research into the clinical management of trauma. The NIO has commissioned Dstl, supported by partners in academia and industry, to undertake research into concepts (that could ultimately be developed) for:

- (1) An Attenuating Energy Projectile (AEP) that will have a reduced injury potential compared to the L21A1, specifically to the head;
- (2) A Discriminating Irritant Projectile (DIP) that will deliver an incapacitating cloud of sensory irritant in a discriminatory manner to an individual.

5. The research requirement for the AEP is provided in Annex A; Annex B is the research requirement for DIP. Note that Annexes A and B are not the formal systems requirement for the weapon system, they are research requirements for concepts. The formal system requirement will evolve from this research requirement when the concepts prove to be sufficiently mature.

B. Technical Progress

Summary of Work to Date

6. Within Stage One of the research project, Dstl conducted a paper-based, initial assessment of a range of potential concepts for the two devices (AEP and DIP). The first step in this process took the form of a "brain-storming" session, in which engineers and scientists from MOD, industry and academia were asked to generate novel concepts which could be developed into workable solutions. All ideas generated were assessed and potential advantages/disadvantages ascribed based on effectiveness, accuracy and consistency, potential for serious injury, technical risk, manufacturing/ development cost and political/user acceptability.

7. From all of the generated concepts, the most promising were selected and further analyses on their cost, practicality and effectiveness carried out; recommendations for the most suitable designs were then produced.

8. These concepts for the AEP have included elements of the device that incorporate crushable/frangible sections to absorb the energy. This energy absorption could be achieved:

- Plastically – with a design similar to a car crush zone,
- Elastically - using a soft material or energy absorbent design,
- Destructively – using a fragmenting material.

9. Other options included a design similar to a “tower of pennies”, that would not ricochet intact and reduce the risk of injuries from a stray projectile.

10. The DIP included concepts to release an irritant material by incorporation of a:

- Fragmenting chamber – for bulk release of irritant,
- Crushing chamber – to produce an aerosol or jet,
- Pyrotechnic release initiated by the projectile.

11. Several other concepts were generated during this initial phase, but these were eliminated on the grounds of complexity and subsequent risk to successful deployment/operation, and cost.

12. A number of the most promising concepts have been discussed with the Steering Group and these have formed the basis for development work in Stage Two of the project described below.

Stage 2 – AEP Development

13. Initial outline concepts for the AEP have examined methods to absorb energy or extend the delivery of the energy, such that peak forces upon impact are reduced, compared to more rigid projectiles. This is a standard technique in automotive and aircraft safety systems, enabling the delivery energy to remain constant, but the method by which it is delivered reduces the peak loading. This has been shown, in many scenarios, to reduce the injurious effect (such as airbags, soft covered dashboards and crush zones in cars, and energy attenuating seats in aircraft). With particularly careful design, it is possible to ‘tune’ the energy absorbing ability so that this attenuation is particularly effective when a rigid object, such as the head, is struck, but effectiveness is not compromised when the impact occurs against a softer target (such as the lower torso).

14. Stage Two of the development work has started with an examination of the necessary trajectory to meet the requirements for the AEP round, without enhancing the injury causing potential of the round and to ensure that the risk of penetration is extremely low. This modelling exercise has addressed the optimum compromise between mass, velocity, calibre and projectile centre of gravity to produce a trajectory that will meet all of the AEP requirements. It has been desirable to maintain the energy and momentum at similar levels to the L21A1 for accuracy and

consistency. Good accuracy and low dispersion [consistency], are necessary to reduce the risk of an impact to a particularly vulnerable part of the body.

15. It is also necessary to keep the diameter of the projectile quite high (greater than 35mm) to ensure that the risk of penetration is extremely low. Maintenance of a large diameter is compatible with the desire expressed in the requirement (Annex A) that the AEP projectile should be fired from the L104 gun.

16. The use of the existing L104 baton round gun will have considerable cost and training benefits. The accuracy and consistency of the L21A1 baton round derives from design of an efficient cartridge and propellant, and from the aerodynamic properties of the projectile. The L21A1 design also incorporates features to optimise the internal ballistics, such as engagement of the rifling within the barrel. It is likely therefore that an AEP projectile designed for the L104 gun will have an external appearance similar to that of the L21A1 baton round. However, the AEP projectile will incorporate materials and features to reduce the peak forces to the head, and thereby reduce the risk of a life-threatening head injury. The key to reducing the injury potential therefore lies in the way that the energy is delivered, and ensuring that the risk of impacts to vulnerable parts of the body is minimised (through investigating the physiological, engineering and psychological aspects of the complete system).

17. This work on the external (flight) ballistics of the projectile has used simple concepts, such as a crushing projectile that will probably be of lower density than the current baton round because of an in-built void to allow crush. Simulation of the trajectory of this device has shown that it is possible to produce a projectile with the same kinetic energy at the gun muzzle as the existing baton round, with improved accuracy, coupled with lower momentum and kinetic energy at range. This will be developed to examine whether this projectile can be made in a reproducible manner and whether appropriate energy absorption techniques can be incorporated into the design. An assessment will also be made of the effectiveness of the projectile in its Operational Role.

18. In order to develop a projectile that will attenuate the impact forces upon the face and head the dynamic mechanical properties of the soft and bone tissues must be known or surmised. Additionally, mathematical or physical tools must be identified or developed that model the interaction. This is crucial to the development of an effective energy attenuating system.

19. A review of facial injury mechanisms has also been undertaken as part of this work and the refinement of mathematical models to predict skull fracture has been initiated. A review of novel materials, and their dynamic mechanical properties, applicable to providing energy attenuation has also commenced. It is also hoped a review of weapon sighting systems will be carried out to investigate any potential for further improvements in accuracy.

Stage 2 – DIP Development

20. Stage One of this research programme identified various concepts for the irritant delivery mechanism and from these the most promising were selected for further investigation to determine their overall practicability, likely effectiveness and cost. In addition, the research was broadened to examine commercially available irritant delivery systems that may address the DIP research requirement.

22. The type of irritant and the form in which it is to be dispersed is an important and fundamental decision that influences the design of the projectile. The most widely known irritants include o-chlorobenzylidene malononitrile (CS) and oleoresin capsicum (OC), however new, synthetic irritants have become available, including PAVA.

23. There is a large knowledge base with regard to human exposure to CS, when compared to other irritants and this fact makes it the prime candidate for inclusion in the DIP round, although at this stage other compounds have not been ruled out. There is a considerable body of information on the toxicology of CS²⁸. There is a very large margin between the effective dose and dosages likely to cause adverse health effects. In spite of its extensive use, there have been no verified deaths attributed directly to the application of CS.

24. The method of dispersal is also an important factor to consider and is limited to the following:

- Pyrotechnically generated aerosol
- Liquid solvent based aerosol
- Dry powder aerosol

25. To disseminate CS as a pyrotechnic aerosol, the CS pellets must be burned at high temperature. This has the potential to increase the build complexity of the projectile to ensure the safe and effective delivery of CS. Both liquid aerosol and dry powder aerosol dispersal methods are more suited for the DIP, as the irritant can be encapsulated in these forms within the projectile. Of the two, the liquid aerosol represents the less attractive option. The most commonly used CS solvent, MIBK (methyl isobutyl ketone), is very irritating to the skin, eyes and mucous membranes; even small drops of liquid placed on the skin are sufficient to produce irritation. At this stage, dry powder aerosol dispersal is the favoured option; the most appropriate irritant being micronised CS (CS(M)). This material consists of 95% CS, which is ground into a fine powder, together with Aerosil (a very fine silica powder). The result is a very fine, lightweight powder that will disperse rapidly and efficiently, with minimum impact force.

26. Studies conducted to date have been based around a small calibre round, which may be fired from a compressed air launcher, and a medium calibre projectile, that has the capability to deliver a greater irritant payload. For simplicity the medium

²⁸ Olajos EJ, Salem H (2001), "Riot Control Agents : Pharmacology, Toxicology, Biochemistry and Chemistry", J. Appl. Toxicol. Vol 21, 355-391.

calibre being considered during this research phase is 37mm, due to the availability of launcher systems. The issues of scaling the 37mm projectile concepts will be considered further when the initial down-selection of concepts has been completed.

27. One of the concepts for a 37 mm DIP projectile includes a light-weight, low cost frangible design, capable of dispersing CS(M). A similar projectile was developed in the late 1970's and made extensive use of polystyrene for the main component parts. Although this projectile was successful in that it delivered the micronised CS payload, its moulded polystyrene construction made it inaccurate at long range and was also a poor receptacle for the micronised CS because of its porous nature. With the development of new polymers and plastics combined with improved moulding techniques, there is the possibility of replacing the polystyrene of the original concept. A review of these materials is being undertaken and tests will be conducted to evaluate their suitability for moulding a frangible design.

28. Alternative ways of disseminating the CS(M) have been identified and include the use of very small compressed air cartridges, to eject the CS(M) on impact of the projectile. By using an internal source of energy, the impact force of the projectile on the target can be maintained at that required to operate the release mechanism. Work is planned to develop and test this concept during this stage of the research programme.

29. Two commercial irritant delivery systems have been identified, which, following modification, may fulfil this research requirement. One system comprises a compressed air launcher, which fires a range of 0.68 inch calibre projectiles, including impact, indelible paint and an OC based irritant. The manufacturer claims that the system is accurate up to 50 metres. The other system also uses compressed air to propel a similar range of projectiles (though the pepperball itself has previously been excluded from further consideration). In this system the effective range is claimed to be 30 metres.

30. These smaller calibre systems do have an advantage that the projectiles can be made significantly lighter and projected at a higher velocity than their 37mm equivalent. This should enable them to achieve greater accuracy at ranges where the lower velocity of a lightweight 37mm projectile would affect its ballistic stability.

31. The third concept projectile for delivering sensory irritant, is based upon a 37mm projectile designed to deliver pyrotechnically-generated CS. The concepts being considered would deliver a small number of discrete payloads of pyrotechnically disseminated CS over the desirable range out to 65m. The effects of the pyrotechnic smoke would be less discriminating than both the 37mm CS(M) projectile and the small calibre projectiles discussed above.

32. Thus the following activities have been initiated:

- Review of current, and near market, sighting systems.
- Ballistic modelling of projectile concepts.
- Review of materials for a frangible nose, with CS compatibility.

- Research into dispersion techniques for CS(M) from both small calibre and 37 mm projectiles.
- Refinement of CS concentration profile assessment for small calibre projectiles.
- Review of the toxicology of sensory irritants.

33. The performance of the sight on the projectile delivery system is critical for the AEP projectile, the small calibre DIP concept and the medium calibre CS(M) projectile. If the projectile can reliably hit the point of aim by using high quality ammunition and sighting systems (that can either predict range, and compensate aim point, or have a number of engagement range settings), then more options become available during the design phase of the projectile. Ballistic modelling of the concepts has been initiated to ascertain the effect of the location of the irritant payload in the projectile on ballistic stability.

34. Each of the above activities will feed directly into the initial design studies. Early in the programme, a small number of concepts will be constructed and used to assess the accuracy of the projectile, and test a number of irritant dissemination techniques.

Psychological Perspectives

35. Human factors, such as the psychological impact on the user and the target of deploying and using low lethality weapons, are an important component of developing effective less lethal technologies; this is an aspect which commercial developers fail to address.

36. The research team for this programme includes Human Scientists, for example psychologists, who will support engineering staff by assessing three key areas, to ensure effectiveness of the whole weapon system in operational use, whilst minimising the risk of adverse effects:

- The human: for example cognition (decision-making, risk, overload) and physiological factors.
- The equipment: for example design (weight, length) and guidance to users.
- External/environmental factors: for example the crowd, weather conditions, heat, noise, clothing.

37. All assessments will be factored into the design process for the development rounds.

Integration with other systems

38. One of the key requirements of this research programme is to ensure that the technologies produced are compatible with other policing equipment. This includes a physiological, psychological and safety assessment. The physiological aspects will include issues such as the effect of these systems on the human body (eg

respiratory system and physiological function). The safety assessment will ensure that no additional hazards are produced from this equipment (such as flammable solvent left on the body after action of the DIP). The psychological aspects will include user assessments of the equipment such as the selection of weapon and projectile systems under high workload conditions and the potential for human error. This is particularly important if there is an increase in the diversity of public order equipment (to address Patten's recommendations) and the risks of applying the wrong firing techniques to a system, or the issues involved in making decisions on the correct equipment to use for a certain task.

Future Directions

39. Within the next stage of the project, promising concepts identified by Dstl and the customer/user will be evaluated experimentally. Initial "proof of principle" prototypes will be designed and built. It is anticipated that these prototypes will be designed to be projected from an airgun over a short range, rather than integrated into a cartridge case for firing from the real weapon over the full operational envelope. In this way the cost of making and testing the prototypes will be significantly reduced.

40. The prototypes will be tested in a laboratory setting, to evaluate the following aspects:

- For the AEP projectile, comparison of (a) likely deterrent effect and (b) injury potential, given a strike on the head, chest or abdomen with existing projectiles (eg L21A1).
- For the DIP system, (a) likely effectiveness in delivering irritant to the target and the discriminatory nature of the effect, and (b) likely injury potential given a hit to the head, chest or abdomen.

41. Note that the evaluation will not address accuracy/consistency issues at this stage; it is not anticipated that the devices will have been engineered into cartridge cases that could be fired from a service weapon.

Annex A Attenuating Energy Projectile (AEP) Research Requirement

A.1 Introduction

This requirement is for research leading to the possible development of a new kinetic energy projectile for United Kingdom Police and British Forces to be used in situations of public disorder, self-defence and restraint and as a less lethal option in situations where officers with conventional firearms may be deployed. It is not the formal procurement requirement for the system. The Attenuating Energy Projectile (AEP) is a potential replacement for the L21A1 baton round.

This equipment must also be developed taking into account the 'ACPO Less Lethal Options – An Operational Requirement' (which was included in the phase 2 report). However if there is any conflict between the main text of this document and that, then the main text takes precedence.

A.2 Application

Operational Role. The AEP is to provide an option to deal with public disorder involving threats of serious violence, and as a less lethal option in situations where officers with conventional firearms may have to be deployed. The objective is to deliver an impact which is not intended to cause serious or life threatening injury, but is of sufficient force to prevent an individual from throwing a missile, breaching a sterile zone, or to dissuade/prevent a potentially violent person from their intended course of action and to facilitate arrest wherever possible. There are two operational roles for the AEP:

- Public Order. In situations of serious public disorder, there may be a requirement to maintain a sterile zone between the security forces and rioters for the safety of personnel. An AEP may provide a system to enforce the sterile zone or disperse rioters.
- Individual Aggressors. When faced with incidents involving individual aggressors (either on their own or in an element of a group), law enforcement officers or Army patrols need a system that may be used to dissuade/prevent aggressors from their course of action. The AEP should be accurate and discriminating, designed to be fired at selected targets. The equipment should be capable of carriage and deployment by an individual police officer or soldier.

A.3 Technical Specification

Accuracy: When fired from a fixed mount at a range of 40m [essential] (65m [desirable]) the system should achieve a 95% probability of impact on a target 400mm wide by 600mm high. When fired by trained officers wearing patrol/specialist protective clothing used for public order and firearms duties at a range of 40m [essential] (65m [desirable]) the system should achieve a 85% probability of impact on a target 400mm wide by 600mm high, from the standing and kneeling positions.

It is desirable that this accuracy could be achieved on a target 400mm high by 200mm wide. The probability statistics for this smaller target shall also be stated.

Kinetic Energy/Momentum: No specification on the kinetic energy or momentum is required, although the requirements on injury causing potential must be met.

Injury causing potential: The equipment developers will be required to produce a concept that meets the requirements of this document and causes reduced injury potential when compared to the L21A1, specifically, it should reduce the clinical consequences of an impact to the head. The AEP shall be designed not to introduce any new injury mechanisms compared to that of the L21A1.

The AEP must not produce fragments that may in themselves cause an increased risk of injury (eg risk of laceration/ocular injury from fragments, but a risk of injury by these mechanisms is reduced with an intact AEP).

The AEP system must not introduce or increase risk of occupational injury to the firer (eg through noise exposure, inhalation of harmful combustion products, repetitive impact/jolt injuries).

Operational Range: The operational range of the projectile is 1-40m [essential], 1-65m [desirable]. It is desirable that the potential for injury behind an intended target is minimised and it is highly desirable that the potential for injury behind a target at maximum range is minimised.

Dress. All requirements should be met when the system is fired by:

A police officer wearing full public-order dress, including a helmet fitted with a visor (BSI standard);

- A police officer wearing specialist firearms overalls and equipment;
- A soldier wearing Combat Body Armour (Internal Security), S10 respirator, gloves and a Mk 6 helmet with the visor up or down.

Weapon. The weapon for the projectile should desirably be the L104 baton round gun.

The psychological aspects of projectile selection should be included. This should include, as a minimum, the selection of different projectiles for the same weapon system; different weapon systems selection and associated aiming issues. Psychological perception by the crowd/target should be considered.

Nothing in the round should preclude the ability to fire a second round against the same target without delay, subject to continuous assessment.

If the L104 is selected, consideration should also be given on the application of this technology to 40mm calibre weapons.

Sighting System. The sighting system must have a clear aiming mark that the firer may place on the correct location on the target. The objective is, for operational

reasons, to have a single sight setting. If it becomes necessary due to trajectory degradation to have several sight (range) settings, the maximum that could be considered is three. It is essential that this sighting system is consistent and works in low light conditions (such as those provided by urban street lighting at night). It should be simple to use and require the minimum of additional training. The system must be capable of being fired without loss of accuracy from a gun port in a stationary vehicle or from a sangar window.

Use in a confined space. The system must be safe to fire from within a confined space, such as the back of a vehicle or within a building. It is desirable that smoke and contamination should be within occupational exposure limits when a notional 50 rounds are fired for health and safety assessment purposes within a stationary vehicle without ventilation or during training on a range. Firing in a confined space should present no additional risk to any personnel.

Flash, Smoke, and Noise. It is desirable that the AEP produces a visual flash and a noise on exiting the barrel to indicate that it has been fired to a crowd.

It is also desirable that the smoke and flash signature on firing does not affect visual performance (either through obscuration or loss of night vision), and that the risk of injury is not increased by the flash and smoke effect. Any noise or flash produced by the system (either during initiation or during flight) must be considered not to increase overall risk of injury.

AEP Material and Colour. All suitable material may be considered. The AEP should be incapable of being marked or tampered with by the user prior to firing. The AEP colour must not conflict with standard ammunition markings.

End Closure Cap. It is essential that nothing leaves the system with the projectile that may affect the trajectory of the AEP and that nothing leaves the system that may introduce its own injury risk.

Storage Life. In its storage containers, the AEP must have a storage life of 3-5 years when kept under specified conditions. The system should not deteriorate prematurely or perform differently after storage or carriage in logistic containers. It is essential that the storage life is achieved in climatic conditions A3 and C0 (UK). The storage life in climatic conditions A1, B2 and C2 (hot dry, hot and cold) must be at least one year and desirably three years.

Operational Life. The AEP must have an operational life of at least one year, desirably three, when carried on a daily basis in its internal packaging by soldiers or police in climatic conditions A3 and C0 (UK). The operational life in climatic conditions A1, B2 and C2 should be at least six months and desirably three years.

Environmental Conditions. The AEP must be suitable for use in temperatures of -21°C to +58°C and highly desirable that it may be used in temperatures between -46°C and +71°C. It is desirable that the AEP will operate successfully after five minutes immersion in one metre of water.

Packaging. The AEP should be available in 100 projectile and 25 projectile in-service logistic containers and must be palletised for delivery. The system and its packaging must be certified for transportation by road, rail, air and sea and must be certified for storage in approved premises. The system must also be suitable for transport by road and man in a ready to deploy condition.

Ease of Manufacture. It should be possible for the manufacture and integration of the AEP system to be achieved by a number of manufacturers in a cost-effective manner. It should also be possible during manufacture to ensure that adequate quality control may be applied to ensure that consistent performance may be achieved.

Blank, Training and Drill Ammunition. It is essential that blank, training and drill ammunition are available. The behaviour of these rounds should mimic the live ammunition in all pertinent features. The blank ammunition will have a maximum safety range of 10m essential, 1m desirable.

Annex B Discriminating Irritant Projectile (DIP) Research Requirement

B.1 Introduction

This requirement is for research leading to the possible development of a new sensory irritant release projectile for domestic use by the United Kingdom Police and British Forces to be used in situations of public disorder, self-defence and restraint, and as a less lethal option in situations where previously, officers armed with conventional firearms may have been deployed. It is not the formal procurement requirement for the system. Research into this equipment is to be considered in accordance with the Chemical Weapons Convention and Chemical Weapons Act.

This equipment must also be developed taking into account the 'ACPO Less Lethal Options – An Operational Requirement'; however if any conflict exists between the main text of this document and that, then the main text takes precedence.

B.2 Application

Operational Role. This Discriminating Irritant Projectile (DIP) is to provide an option to deal with public disorder within the United Kingdom involving threats of serious violence and as a less lethal option in situations where officers armed with conventional firearms may have to be deployed. The objective is to deliver an incapacitating cloud or burst of sensory irritant which is not intended to cause serious or life threatening injury, but has sufficient effect to temporarily impair, significantly affect someone's physical performance or isolate their activity in a crowd, facilitating scope for arrest. There are potentially two operational roles for the DIP:

- Individual Aggressors. When faced with incidents involving individual aggressors (either on their own or in an element of a group), law enforcement officers or Army patrols need a system that may be used to dissuade/prevent aggressors from their course of action. The DIP should be accurate and discriminating, designed to be fired at selected targets. The action of the DIP is discriminate to a single person, however it is acknowledged that persons within 1m of the target may also be affected by the irritant. The equipment should be capable of carriage and deployment by an individual police officer or soldier.
- Public Order. In situations of serious public disorder, there may be a requirement to maintain a sterile zone between the security forces and rioters for the safety of personnel. A DIP may provide a system to enforce the sterile zone or disperse rioters. The action of the DIP in this situation may become less discriminate with increasing range. When the DIP is used in this role, the sensory irritant dose should be delivered within 3m of the projectile impact point at the maximum range, or produce an irritant barrier effect.

The use of this equipment outside a domestic situation must be considered in accordance with the Chemical Weapons Convention, the Chemical Weapons Act and the Biological and Toxin Weapon Convention.

B.3 Technical Specification

Accuracy: When fired from a fixed mount at a range of 25m [essential] (65m [desirable]) the system should achieve a 95% probability of impact on a target 400mm wide by 600mm high. When fired by trained officers wearing patrol/specialist protective clothing used for public order and firearms duties at a range of 25m [essential] (40m [highly desirable], 65m [desirable]) that the system achieves a 85% probability of impact on a target 400mm wide by 600mm high, from the standing and kneeling positions. It is desirable that this accuracy be achieved on a target 400mm high by 200mm wide. The probability statistics for this smaller target and ranges of 40m and 65m shall also be stated.

Kinetic Energy/Momentum: No specification on the kinetic energy or momentum is required, although the requirements on injury causing potential must be met.

Injury causing potential: The equipment developers will be required to produce a concept that meets the requirements of this document and causes a probability of unacceptable injury not higher than the L21A1. Specifically, the DIP shall be designed not to introduce any new injury mechanisms to those of the L21A1.

The DIP system must not produce fragments that may in themselves cause an increased risk of injury (eg risk of laceration/ocular injury from fragments, but a risk of injury by these mechanisms is reduced with an intact DIP).

The toxicology of the sensory irritant (or carrier/solvent) must not introduce any serious risks to health for a representative target population (including fire risk). This condition should be met even when the target may also be subjected to other public disorder, self-defence and restraint options.

The DIP system must not introduce or increase the risk of occupational injury to the firer in comparison to the L104 with L21A1 (eg through noise exposure, inhalation of harmful combustion products, inhalation or repeated exposure of harmful chemicals, repetitive impact/jolt injuries).

Operational Range: The operational range of the projectile is 1-25m [essential], 1-40m [highly desirable] and 1-65m [desirable]. It is desirable that the potential for injury behind an intended target is minimised and it is highly desirable that the potential for injury behind a target at maximum range is minimised.

Ideally the projectile should dispense the sensory irritant when it comes to rest or hits an object.

Weapon System. Nothing in the round should preclude the ability to fire a second round against the same target without delay, subject to continuous assessment.

Consideration must be given to the type of weapon system used and the benefits/disadvantages of introducing a new system to the user's inventory. At a minimum this should include the availability of other ammunition for the weapon,

applicability of the design to similar calibre weapons (scaling), psychological aspects for user (weapon/projectile selection decisions).

If the DIP uses a 37mm calibre weapon, consideration should be given to scaling the system to be operational in a 40mm calibre system.

Dress. All requirements should be met when the system is fired by:

- A police officer wearing patrol/specialist protective clothing used for public order and firearms duties, and police respirator;
- A soldier wearing Combat Body Armour (Internal Security), S10 respirator, gloves and a Mk 6 helmet with the visor up or down.

Sighting System. The sighting system must have a clear aiming mark that the firer may place on the correct location on the target. The objective is, for operational reasons, to have a single sight setting. If it becomes necessary due to trajectory degradation to have several sight (range) settings, the maximum which could be considered is three. It is essential that this sighting system is consistent and works in low light conditions (such as those provided by urban street lighting at night). It should be simple to use and require the minimum of additional training. The system must be capable of being fired without loss of accuracy from a gun port in a stationary vehicle or from a sangar window.

Use in a confined space. The system must be safe to fire from within a confined space, such as the back of a vehicle or within a building. It is desirable that smoke and contamination should be within occupational exposure limits, when up to a notional 50 rounds are fired for health and safety assessment purposes within an armoured Land-Rover without ventilation and during training on a range.

Firing the DIP at personnel within buildings should not present the target with unacceptable risks compared with a firing in the open.

Flash, Smoke and Noise. It is desirable that the smoke and flash signature on firing does not affect visual performance (either through obscuration or loss of night vision), and that the risk of injury is not increased by the flash and smoke effect.

Any noise or flash produced by the system (either during initiation or during flight) must be considered not to increase the overall risk of injury.

DIP Material and Colour. All suitable materials may be considered. The DIP should be incapable of being marked or tampered with by the user prior to firing. The DIP colour must not conflict with standard ammunition markings. The DIP must not leak sensory irritant whilst in storage and must not subject the firer/loader to the effects of the sensory irritant during loading, firing, cartridge removal or weapon maintenance.

End Closure Cap. It is essential that nothing leaves the system with the projectile that may affect the trajectory of the DIP and that nothing leaves the system that may introduce its own injury risk.

Storage Life. In its storage containers, the DIP must have a storage life of at least 2 years when stored under specified conditions (desirably three years). The system should not deteriorate prematurely or perform differently after storage or carriage in their logistic containers. It is essential that the storage life is achieved in climatic conditions A3 and C0 (UK).

The DIP should be capable of being stored in standard Home Office licensed explosive storage facilities.

Following storage of the DIP, there should not be any special requirements to activate or redistribute the sensory irritant in the round (eg shaking after settling).

Operational Life. The DIP must have an operational life of at least one year, desirably three, when carried on a daily basis in its internal packaging by soldiers or police in climatic conditions A3 and C0 (UK).

The DIP must have a training use life of at least 3 years.

Following transport of the DIP, there should not be any special requirements to activate or redistribute the sensory irritant in the round (eg shaking after settling).

Environmental Conditions. The DIP must be suitable for use in temperatures of -21°C to +58°C. It is desirable that the DIP will operate successfully after five minutes immersion in one metre of water.

Packaging. The system and its packaging must be certified for transportation by road, rail, air and sea and must be certified for storage in approved premises. The system must also be suitable for transport by road and man in a ready-to-deploy condition, and should be able to be repackaged in a suitable facility in to ready-to-use packages if necessary.

Ease of Manufacture. It should be possible to manufacture and integrate the DIP system by a number of manufacturers in a cost-effective manner. It should also be possible during manufacture to ensure that adequate quality control be applied to ensure that consistent performance is achieved.

Blank, Drill and Training Ammunition. It is essential that blank, drill and training ammunition are available for training. The behaviour of these rounds should mimic the live ammunition in all pertinent features. Training rounds should have a simulant for the sensory irritant. Training and blank rounds should have a maximum safety range of 10m essential, 1m desirable.

Effectiveness. The effectiveness of the DIP should be reported. This should take the form of the measurement of the dose of irritant provided to the target at sample points from the impact location.

Countermeasures. The effectiveness of possible countermeasures to the DIP should also be examined. This should examine the effectiveness of simple respiratory protection to counteract the irritant effect.

CHAPTER 8: DISTRACTION DEVICES, MALODORANTS, TRANQUILLISERS, CS AND CN SMOKE

A. Distraction/Disorientation Devices

1. Laser/light devices and ‘non-injurious’ noise generating devices were placed in Category A of the priority list as meriting ‘immediate more in-depth research’. However, this category of technology has been classed as a lower priority than the other Category A technologies, ie tasers, kinetic energy rounds, long-range chemical delivery rounds and water cannon. As such, resources have been directed into the evaluation of these other technologies rather than distraction and disorientation devices in the light of ACPO priorities and resource considerations. Now that PSDB’s evaluations are completed for some of these technologies (namely tasers and water cannon), increased resources can now be directed to identifying and evaluating potentially suitable products of this type, in particular, laser/light devices and noise generating devices.

2. A piece of work has been initiated to investigate the packaging of laser sources and their possible utility in deflecting aggressors from hostile acts. This work will need to ensure that the lasers can be made eye safe and yet achieve an effective level of deterrence. Should this be successful the possibility of lasers or light sources will be considered in more detail by the Steering Group and further work recommended.

B. Malodorants and Tranquillisers

3. The phase 2 report proposed, *inter alia*, that malodorant and tranquilliser (anaesthetic) type “Riot Control Agents” (RCAs) warrant further research to assess their utility as part of a public order capability. However, we do not consider that sufficient progress has been made in the development of either malodorants or tranquillisers to merit further substantive investment at this stage. Either system would have the drawbacks noted in the phase 2 report. The Steering Group will continue to monitor any progress that may be made in other countries. It is assessed that it is acceptable for the UK Government to proceed with such research, providing that the following criteria are met.

4. The use of RCAs is specifically addressed by the Chemical Weapons Convention (CWC): it permits the use of RCAs for ‘law enforcement including domestic riot control purposes’, but explicitly prohibits their use as a method of warfare. This complete ban on the use of RCAs in warfare is necessary to reinforce the international norm that use of any toxic chemicals on the battlefield is unacceptable. It is also there to avoid situations where RCAs are used on the battlefield and are mistaken for lethal or incapacitating agents, which, when added to the fog of war, may result in more extensive use of CW agents. Equally importantly, this prohibition serves a critical role in placing legal obstacles in the way of any State Party minded to use development of RCAs as a cover for offensive CW programmes, or inappropriate agents and means of delivery for RCAs such as artillery projectiles or mortar rounds.

5. The Chemical Weapons Act 1997 enacts into UK law the provisions of the CWC, which apply to any place under the jurisdiction or control of the UK. Thus, it is policy that all UK Government-funded research, development or acquisition of chemical malodorants, tranquillisers and related delivery systems must be demonstrably for purposes fully compliant with the CW Act, the CWC and other international agreements.

6. The CWC also prohibits the provision of assistance to anyone in activities prohibited by the CWC. The Government must therefore be satisfied that if collaboration on RCAs is undertaken, any collaborative partners, whether national or international, will only use the information provided by the UK for purposes allowed under the CWC.

C. CS and CN smoke (known as “tear gas”)

7. Our research has demonstrated more clearly that a wide range of other countries, including several in Europe, and many law enforcement agencies in North America, use CS or CN smoke (“tear gas”) as an essential element of their systems for dealing with public disorder.

8. Historically, the technical approach adopted in the United Kingdom for generating CS for use in public order incidents has been to utilise ‘multi-source’ devices to enable the rapid dissemination of an irritant cloud; this approach also prevents individuals extinguishing the devices or picking them up and throwing them back. The multi-source approach has continued to be employed in the three CS delivery and generation systems described below.

9. The current store in service with MOD is a 66mm calibre rubber-bodied grenade, shoulder-fired by a man or from vehicles. It contains sub-munitions of a CS pyrotechnic composition, in pellet form. The CS cloud forms very rapidly. Subsequent dispersion characteristics of the CS will depend on meteorological conditions such as wind speed, direction and thermal gradients.

10. Preliminary design of a hand-thrown CS grenade had been undertaken but currently there is no perceived MOD requirement. The range would be dictated by the distance that the operator was able to throw the grenade. The grenade bursts, deploying the CS sub-munitions.

11. A 37mm system for firing from the L104A1 platform had also been partially developed. The design is based on the cartridge case and propulsion system developed for the L21A1 baton round. A sabot (or capsule) is projected that carries sub-munitions, containing the CS pyrotechnic composition. Further development and testing of the system would be required prior to entry into service. It would be possible to vary the performance characteristics to meet specific requirements.

12. It is not for the Steering Group to recommend that its use in appropriate circumstances, and according to strict guidelines, should be considered by the police

service in Northern Ireland. It is however an issue that others might wish to address, against the background set out in this report.

CHAPTER 9: DEVELOPMENTS IN TRANSPARENCY WITH THE EXISTING ROUND

A. Introduction

1. As previously made clear, the initiation of the development of the current baton round, the L21A1, predated the Patten Commission and its recommendations which refer to the L5A7 round. After a £1.65million programme, lasting several years, the L21A1 was introduced in June 2001. All police services in the UK have either already acquired the round or have placed orders. Many are now routinely carrying the baton gun and round in their Armed Response Vehicles. This enables a quick response to firearms incidents on a 24-hour basis. There had been four discharges of the round in England and Wales up to 28 November 2002 (see section F below).

2. Although the Steering Group has had no direct role in the introduction of the L21A1, it has proved a useful forum for noting developments. In particular, the Steering Group has had discussions on further events in the life-cycle of the round, and subsequent transparency. It therefore agreed that, although the development of the round was outside its remit, the publication of this report provided a convenient opportunity to bring together in one place several statements that have been made during the past twelve months.

B. The first review of the L21A1 round

3. On 30 October, Mr Adam Ingram, the Minister for the Armed Forces, replied to a Parliamentary Question as to the steps taken to respond to the Defence Scientific Advisory Council recommendations on a review of the L21A1 round. He stated:

“The review of L21A1 baton round performance after 1 year in service was completed and provided to the Sub-committee (SC) of the Defence Scientific Advisory Council (DSAC) as requested in June of this year.

The SC, DSAC have considered the review and have issued a statement, which is reproduced below and which is also being placed in the Library of the House of Commons. This concludes that there is no reason to amend the SC, DSAC statement that was placed in the Library of the House by the Secretary of State for Defence when the Secretary of State for the Home Department answered a written Parliamentary Question on the L21A1 on 2 April 2001.

The SC, DSAC statement also notes that some attempts have been made to suggest that the committee consider the L21A1 to be more dangerous than the previous system. The statement refutes these suggestions and states clearly that it is the view of the SC, DSAC that the L21A1/L104 weapon system is safer than its predecessor.”

4. The following is the DSAC statement that was placed in the Library of the House of Commons on 30 October 2002:

“DEFENCE SCIENTIFIC ADVISORY COUNCIL

Statement on the review by MOD of medical issues arising from use of the L21A1 Baton Round from June 2001 – April 2002.

1. *The statement of the Sub-committee (SC) of the Defence Scientific Advisory Council (DSAC) on the medical implications of the use of the new L21A1 Baton Round was placed in the Library of the House of Commons in April 2001. The statement compared the injury potential of the L21A1 system in public order role with that of the then current Baton Round, the L5A7.*
2. *The SC, DSAC requested that one year after introduction of the L21A1, the MOD should review perceived or quantitative changes in the frequency and nature of serious injuries from the system. The review was due in June 2002 and the SC DSAC received the report from MOD by the specified date.*
3. *The SC, DSAC considers that on the data available, there is no reason to amend the DSAC statement that provided the medical advice to Ministers. The SC, DSAC notes that from the available data there is no definitive or even indicative evidence that there is a higher frequency of thoracic impacts from the L21A1; thoracic impacts will occur occasionally in operational use.*
4. *The SC, DSAC requests that the performance and medical consequences of use of the L21A1 remains under review and that a further review is conducted by 31 July 2003, to consider the period 1 June 2001 to 31 May 2003 – the first two years of operational use of the L21A1.*
5. *The SC, DSAC has noted some claims that its medical statement on the L21A1 has shown the projectile to be more dangerous. These claims appear to have arisen from taking elements of the statement out of context. It remains the view of SC, DSAC that the L21A1/L104 weapon system is a safer system than its predecessors, when operated in accordance with agreed guidelines.”*

C. Guidelines on the use of baton rounds by the Armed Forces in Northern Ireland

5. The Secretary of State for Defence was also asked in a Parliamentary Question if he would publish the guidelines on the use of baton rounds by the Armed Forces in Northern Ireland.

6. Mr Ingram replied on 23 October: “Rules of Engagement are classified and are not therefore usually published for reasons of operational security. However, I have decided in this case, as an exceptional measure aimed at building confidence in Northern Ireland, that an extract from the relevant document should be published in the Library of the House. The extract is drawn from a more general guidance card

and includes all the relevant guidance on the Rules of Engagement for the use of Baton Rounds by the Armed Forces in Northern Ireland.”

7. The following are the guidelines that were placed in the Library of the House of Commons on 23 October 2002:

“The guidelines on the Rules of Engagement for the use of baton rounds by the Armed Forces in Northern Ireland

General

- *Only to be used on the command of the designated local commander, in situations of potential violent disorder. Its use must be no more than absolutely necessary in the circumstances, and there must be no alternative other than the use of lethal force. Personnel may only use items if they have been fully trained in its use and the application of these ROE.*
- *These ROE do not affect your general right to self defence. However in all situations you are to use no more force than absolutely necessary to achieve your aim.*

Warning

- *A warning is to be communicated before any items are used, unless to do so would increase the risk of death or grave injury to you or any other person. The commander at the scene or his representative is to give the following warning at the earliest opportunity:*

“ATTENTION, UNLESS YOU DISPERSE/STOP, BATON ROUNDS WILL BE USED AGAINST YOU.”

- *Where possible commanders are to order a change in profile for a visible demonstration of intent.*

Baton rounds

- *L21A1 baton rounds may be fired, if authorised by the commander at the scene when absolutely necessary to protect own forces or others under their protection from physical violence. This may include dispersing a violent crowd posing a risk to life by singling out the perceived ringleaders and troublemakers.*
- *Baton rounds are to be fired at selected individuals, not indiscriminately. They are to be aimed so that they should strike directly (ie without bouncing) the lower part of the body (ie below the ribcage). They are not to be fired at a range of less than 20 metres unless there is an immediate and serious risk of loss of life or serious injury, which cannot otherwise be countered.*

Medical assistance

- *Medical assistance is to be provided to casualties as early as possible.”*

D. The use of the L21A1 at a range of less than 20 metres

8. The Home Secretary was asked in a Parliamentary Question if he would make a statement on the use of the L21A1 baton round at a range of less than 20 metres.

9. Mr Denham replied on 6 November 2002:

“At the request of the Association of Chief Police Officers, who believe that the improved accuracy of the L21A1 baton round means it is suitable for use in serious public disorder and also in dealing with individuals posing an immediate threat to life in circumstances where use of a conventional firearm may otherwise be necessary, we have sought and received a medical statement from the Defence Scientific Advisory Council on the use of the L21A1 baton round at ranges from 1 - 19 metres. This supplements their earlier assessment of the injury potential over longer ranges published on 2 April 2001.

The statement confirms that the probability of unintentional impact to the most vulnerable parts of the body remains low when the round is discharged at ranges of less than 20 metres and that there is no significant change in the probability of rounds striking the potentially vulnerable chest area. This means that the likelihood of serious injury or death occurring as the result of the impact of an L21A1 baton round is no greater at ranges between 1 and 19 metres than at the longer ranges which were the subject of the earlier statement by the Defence Scientific Advisory Council.

I will be placing a copy of the statement in the Libraries of both Houses today. The Association of Chief Police Officers is considering, in consultation with the Government, what, if any revision to its existing guidelines on the use of baton rounds may be appropriate in the light of this statement.”

10. ACPO are currently finalising the revision to the existing guidelines on the use of baton rounds that may be appropriate in the light of this statement. The following is the text of the DSAC statement that was placed in the Libraries of both Houses on 6 November.

“DEFENCE SCIENTIFIC ADVISORY COUNCIL

Statement on the use of the L21A1 baton round at ranges less than 20 m.

1. *A sub-committee of the Defence Scientific Advisory Council (DSAC) has been requested to review their statement on the medical implications of the use of the L21A1 baton round. The statement (Annex A) addressed the comparative injury potential of the L21A1 and L5A7 baton rounds, and was placed in the Library of the House of Commons in Aug 00. The request originated in a letter from the Honorary Secretary of the Association of Chief Police Officers (ACPO) Firearms Committee to the Chairman of the Baton Rounds Steering Group.*

2. *ACPO (Firearms) are promoting the use of the L104A1 gun and L21A1 baton round for use as a less-lethal (LL) option at firearms incidents. The potentially close range nature of this role may result in engagements at lower ranges than are common in a public-order situation. The original DSAC statement considered use of the L21A1 baton round over the normal operating range for public-order use of 20-40 m.*
3. *Use of the L21A1 weapon system at ranges less than the normal operating range of 20-40 m raises three principal issues:*
 - (a) *Review of the specific Guidance to be promulgated to users for use as a LL option at ranges less than 20 m;*
 - (b) *The use of an optical sight (L18A1) with a fixed range setting of 20 m to target a fixed point on the body (the belt-buckle area) at ranges of 1-19 m, will generally lead to an elevation of the average impact point above the aim point. This arises from the curved trajectory of the baton round;*
 - (c) *The impact velocity of the projectile over the range 1-19 m will be higher than that over the range 20-40 m.*
4. **Guidance to users:** *The revised ACPO Guidance to users for use as a LL option specifies the minimum range as 1 m, and that the baton round should be aimed at the belt-buckle area so that it strikes directly the lower part of a subject's body, ie below the rib cage.*
5. **Elevation of the average impact point:** *At DSAC's request, the Defence Science and Technology Laboratory (Dstl) at Porton has calculated the maximum average elevation of the L21A1 over the range 1-19 m, and the dispersion of the rounds around the average. Dstl Porton also calculated the magnitude of the change in the probability of L21A1 batons striking the potentially vulnerable areas of the chest and head in an upright man of average height and of small height. These calculations made a number of simplifying assumptions and do not necessarily represent accurately the operational use of the weapon system.*
6. **Impact velocity at less than 20 m:** *Dstl Porton has also reviewed the impact modelling data used to underpin the aspects of the original DSAC statement addressing injuries to the head, chest and abdomen, given an impact by the L21A1 baton.*
7. *At the outset, the L21A1 was designed for use at 1-2 m and beyond. The original requirement stated that the maximum kinetic energy of the L21A1 at 2 m was not to be greater than that of the L5A7 at 20 m. However, the minimum range was amended to 20 m in Nov 99 by MOD and ACPO to reflect a change in the requirements of users; the reversion to the normal minimum range of 20 m did not result from concerns about the medical consequences of impact at the shorter range. Thus, prior to Nov 99, the*

comparison of the injury potential of the L21A1 and L5A7 given an impact had already addressed use of the L21A1 at 1-2 m.

8. **Conclusions – probability of impact to vulnerable areas:** *For L21A1 baton rounds fired according to the revised ACPO Guidance at upright adults at ranges of 1 m to 19 m, the probability of impact directly to the head is likely to be extremely low.*
9. *At the range predicted to result in maximum elevation of the L21A1 baton rounds (11-12 m), the probability of chest impact for upright adults of average and of small height remains low. The modelling predicts that there will be no significant change in the probability of L21A1 baton rounds striking the potentially vulnerable chest at 11-12 m, compared to the incidence at 20 m.*
10. **Conclusions – injuries upon impact:** *The medical assessment presented in para 18 of the DSAC statement (Annex A) placed in the Library of the House of Commons is applicable to use of the L21A1 at ranges between 1 m and 19 m, if fired according to the revised ACPO Guidance.”*

E. The report published by the Police Ombudsman for Northern Ireland in May 2002

11. On 28 May 2002, the Police Ombudsman for Northern Ireland published a research report on seven incidents in which baton rounds had been discharged by the Police Service of Northern Ireland, during 2001/2002.
12. It may be helpful to include the executive summary to that report which read as follows:

“Under section 55(4) of the Police (Northern Ireland) Act 1998, the Chief Constable of the Police Service of Northern Ireland can refer matters to the Police Ombudsman for Northern Ireland. The Police Ombudsman investigates and reports on these matters to the Secretary of State, the Chief Constable and the Northern Ireland Policing Board under Regulation 20 of the RUC (Complaints etc) Regulations 2000. This report is issued as a statement as to the Police Ombudsman’s actions, decisions and determinations, pursuant to section 62 of the Police (Northern Ireland) Act 1998.

In accordance with an agreed protocol, the Chief Constable routinely refers incidents relating to the discharge of baton rounds by police officers to the Police Ombudsman. The Police Ombudsman has now produced seven Reports relating to the discharge of baton rounds by police officers during 2001 and 2002. This paper summarises the findings of these Reports.

The seven incidents considered typically involved serious rioting, with attacks on the police by rioters using petrol, paint, acid and blast bombs. The police discharged 36 baton rounds during the incidents, which struck 26 persons (two persons were struck twice). At least 117 police officers were injured during the incidents, some of them seriously.

In all the incidents examined the Police Ombudsman's investigators concluded that the discharge of the baton rounds was fully justified and proportionate, as were the authorisation and directions given. The deployment and use of the baton rounds were fully in accordance with the relevant RUC/PSNI and Association of Chief Police Officers (ACPO) guidance. No occurrences of police misconduct were found.

Investigators from the Police Ombudsman's Office are currently investigating a further six referrals from the Chief Constable and five complaints from members of the public dealing with the discharge of baton rounds."

(No further report on the issue has yet been published by the Ombudsman.)

13. In a press statement also issued on 28 May, the Chairman of the Northern Ireland Policing Board welcomed the report. He said:

"We are pleased that in each incident the stringent procedures for discharging baton rounds were rigidly followed.

This is an important issue for the Policing Board and, at the April meeting, Members received a comprehensive presentation on baton rounds and the alternatives which are being researched. We have asked Government to complete this research as soon as possible.

Policing public disorder in a way that protects both the human rights of members of the public and of police officers is a difficult task as recent disturbances in Belfast demonstrated.

Obviously everyone in the community would much prefer to be in a position where the police do not have to resort to such measures but there is a duty of care to police officers as well as members of the public.

It is essential that the public has confidence in how the police deal with public disorder. Each time the police use a baton round, the Police Ombudsman investigates the circumstances surrounding the deployment and sends a copy of her report to the Policing Board.

Separately, the PSNI reports to the Board on instances of public disorder and the discharge of baton rounds. The Policing Board has responsibility to monitor police performance in public order situations and the police have responsibility to justify to the Board the use of baton rounds. All reports submitted are considered by the Complaints Monitoring Committee.

The police have stringent protocols that must be met before a baton round can be fired. This independent examination of the circumstances by the Ombudsman and the Board should ensure public confidence that the correct procedures and circumstances for deployment have been strictly adhered to."

F. Reports of four separate discharges of the baton gun in England and Wales in 2002

(i) North Wales Police – 27 February 2002

14. The first discharge of a baton round in England and Wales occurred in February 2002, in North Wales. Just before 9pm on 27 February, an Armed Response Vehicle of the North Wales Police Service attended the scene of a domestic incident. A report had been made to the police that a man was armed with a 8” carving knife and had attempted to stab his wife in the chest.

15. The subject had also threatened to kill the children who were still in the house, with him, upon the arrival of the police. He had been drinking cider all day and was described as very drunk.

16. The subject’s mood was described as volatile.....the kitchen, hall and stairways were covered in blood, as was he. It also appeared that he was self-harming and was still in possession of the knife. There was grave concern for the safety of the children. After a short time the subject opened the front door and stood in the doorway with the knife. He continued to threaten the officers present. The Tactical Adviser was now also present and the baton gun was discharged at a range of approximately 6 metres.

17. The baton round hit at point of aim in the mid-lower stomach region causing the subject to double up but he remained on his feet. He quickly moved the few feet back into the house, still clutching the knife. Officers charged the front door and found the subject lying face down on the floor at the top of the stairs outside the children’s bedroom. The children were in their rooms; they were unharmed.

18. The subject was taken to hospital on the night; in fact he walked to the ambulance, and was discharged after 48 hours. He suffered bruising to the lower abdomen region, bleeding to skin tissue.

(ii) Surrey Police – 7 April 2002

19. The second discharge took place in Surrey, in April. Surrey police introduced the use of the L104A1 Baton Gun as a less lethal option on 1 December 2001. One gun is carried on each Armed Response Vehicle (ARV), with additional baton guns available for firearms team activity. All ARV officers have been trained in its use. During baton gun authorisation/training officers recorded an overall accuracy of 99.2%. This was a particularly reassuring factor for officers involved in armed intervention and the resolution of armed incidents.

20. At 02.38 hours on 7 April 2002 Surrey police received a telephone call from a resident of the Milford area that a male....had consumed a bottle of vodka, was drunk and was described as dangerous when in this condition [and] that the subject was in his rear garden swinging a sword around chanting “One of you must die”.

21. Further calls were received from the subject, at 03.16 hours stating that he had a sword and that “he had had enough”. He said that he still had the sword and also that he had a Ruger 9mm pistol and ammunition.

22. Four armed officers in two vehicles were deployed to the scene from the rendezvous point. These officers were in possession of conventional firearms; in addition due to the intelligence and threat posed, two of them also had a L104A1 baton gun.

23. The officers witnessed the subject brandishing the Samurai sword and noticed he had a silver handgun tucked into the front waistband of his trousers. He then held the Samurai sword with both hands, faced the officers in an aggressive stance and started walking towards them.

24. When he was approximately 12/13 metres from the officers they issued a further challenge, at which point he stopped. Further warnings were given to put the weapon down which were ignored. He was then seen to reach for the pistol. At this point one of the armed officers perceived an immediate threat and discharged a single baton round which struck the subject in the abdomen.

25. As a result of being struck by the baton round the subject dropped the firearm and the sword, he put both arms across his stomach and fell forwards on to the ground – incapacitated. He was arrested for threats to kill. He was then conveyed by ambulance to the Royal Surrey County Hospital where his injuries were found to be severe bruising to the abdomen and a splitting of the skin in the area of his navel. He was detained in hospital under police guard for a short period after which he was released into police custody.

(iii) Dorset Police – 24 November 2002

26. At approximately 3am on Sunday 24 November, police were called to a property near Dorchester after receiving a phone call from a distressed woman who was being threatened by a man who was known to her. The woman’s two children, young boys, were also in the house. The man, who was brandishing a knife and machete, continued making threats to the woman and the police officers outside and prevented the woman from leaving the property.

27. Just after 3.30am, with police assistance, the woman was able to escape from the house but the man remained in the house with the children and continued to make threats. Armed police units then attended the scene and cordoned off the surrounding areas while negotiators attempted to make contact with the man. Around 7.40am, the incident was brought to a successful conclusion when the man was disarmed by an armed police officer firing a single baton round. As a result of the shooting, the man suffered bruising but although badly shaken the woman received only minor injuries and the children were unharmed.

(iv) Gwent Police – 28 November 2002

28. At approximately 12.20 on Thursday 28 November 2002, officers from Gwent police were at the car park of a reservoir near Pontypool when they were threatened

by a man armed with a sword. Firearms were authorised and one baton round was discharged. A 36-year-old man was subsequently arrested. He received a minor injury which did not require hospital treatment. No police officers were injured.

G. The review by the Independent Assessor of Military Complaints Procedures in Northern Ireland

29. In his annual report, published in June 2002, the Independent Assessor, Mr Jim McDonald, announced that he would be reviewing three aspects of the use of the L21A1 by the Armed Forces in Northern Ireland: the training, the circumstances in which the rounds were used, and the recording of these circumstances.

30. Mr McDonald's review of military use of baton rounds in Northern Ireland 2001-2002 was published on 10 December 2002. The Assessor's recommendations were as follows:

“Assessor's Recommendations

1. *Experienced evidence-gathering teams from the RMP, using video cameras, should be used when rioting is anticipated. (Such teams have not normally been deployed before.) This use of video would augment the statements justifying the use of baton rounds and may help with prosecution of offenders.*
2. *Soldiers who fire baton rounds should be interviewed before going on planned leave in order to capture their fullest recollection while the incident is still fresh in their minds.*
3. *I recommend that in paragraph 5 of the Guidelines the final sentence: “This may include dispersing a violent crowd posing a risk to life by singling out perceived ringleaders and troublemakers” be removed.*
4. *Also at paragraph 5 of the Guidelines I would recommend that the phrase “under their protection from physical violence” be retermed “under their protection from serious physical violence”.*
5. *Whilst recognising the different command and control systems between military and police, and indeed the differences in operational methods, I would urge that the guidelines for use of baton rounds issued by the MOD be developed in tandem with those of ACPO to achieve mutual best practice.*

Recommendations 1-4 should be implemented immediately.

Recommendation 5 should be dealt with as soon as possible.”

CHAPTER 10: CONCLUSIONS AND NEXT STEPS

1. The third phase of the research programme was envisaged as covering further research, the evaluation of performance and safety, and establishing deployment costs. The fourth phase was originally foreseen as defining operational objectives for public order equipment, and the preparation of a report on the tactical deployment of a range of public order equipment. The Steering Group has tried to keep faith with the terms of reference, while pressing ahead of schedule with developments that were judged to have potential. As foreshadowed in the phase 2 report, some matters have already been taken forward; specifically:

- PSNI have moved to purchase six vehicle-mounted water cannon, the first of which are due to be delivered next summer;
- PSNI have been assessing the case to equip officers with personal, hand-held CS incapacitant sprays (see paragraph 2 below);
- revised guidance is being drawn up by ACPO on the use of the existing baton round;
- guidance is also in preparation on the use of water cannon [and the taser in an operational trial];
- detailed research requirements have been prepared and set out in full in this report for both an attenuating energy projectile (AEP) and a discriminatory irritant projectile (DIP).

2. The Steering Group has been advised that the PSNI are at an advanced stage of seeking approval for the purchase of hand-held CS incapacitant sprays for their officers. The service would welcome the availability of CS sprays for the protection of individual officers as a proportionate response to the use of force.

3. This report has sought to bring out relevant issues. It has again demonstrated there is no single, available, item of equipment that could at this stage replace the current baton round. The current baton round is a discriminating instrument for use against targeted individuals, according to the published guidelines. The research programme has already identified a number of technologies that can form part of the equipment available to police services, in managing a range of conflict situations. This report again notes, as did the phase 2 report before it, the limitations of the existing equipment in situations of public disorder. Water cannon will fill some of the capability gap, but not all of it.

4. The testing and evaluation of commercial impact rounds and long-range discriminating chemical delivery rounds will continue, where products are identified as having potential to meet performance standards. Specifically one sock round is currently under detailed medical evaluation, albeit its range is limited to 25 metres. A statement on the medical effects of this round is expected to be available in spring 2003.

5. The Steering Group expects to address, in around six months time, the case for continuation of the in-house programme described in chapter 7. By that stage, promising concepts of both the attenuated energy projectile and the discriminating irritant projectile will have been evaluated experimentally. Initial “proof of principle” prototypes will have been designed, built and tested. However, considerable further work lasting up to a further 18 months, would still be required before a detailed specification would be finalised. If the go-ahead for one or both developments were to be given early next summer, it would be at least late 2004 before interested parties would be in a position to take a decision on putting that specification out to tender by commercial manufacturers.

5. It is important to look ahead. This report has set out some products that have potential and the arrangements for further assessment. Those involved with the Steering Group will continue to maintain close liaison with developments in other countries. It is to be hoped that improved sharing of information and further work towards the development of common standards that Steering Group members have directly helped to promote will bear fruit.

6. Within Northern Ireland, there is also the evolving nature of society and the relationship between its members and the police service. The PSNI has already taken significant strides towards becoming more representative, and there is cross-community participation in police accountability bodies. Any modern police service, including the one envisaged in the Patten Report, needs to be trained and equipped to deal appropriately with all levels of individual and community conflict.

7. In the context of further development towards a more normal security situation, it is right that the police service should be provided with the facilities to carry out the tasks it is called upon to perform on behalf of the community, without automatic recourse to military support. The approach to the resolution of conflict, and the problem-solving role set out in chapter 2, will play an increasingly central part in bringing to conclusion a debate that has for much of the last thirty years focused more on individual items of equipment than on the nature of the service provided by the police and the support that it receives from the community.

Glossary of Terms

A ACRONYMS and ABBREVIATIONS

ABE Attribute Based Evaluation

AC Alternating Current

ACPO Association of Chief Police Officers

ACPOS Association of Chief Police Officers Scotland

AEP Attenuating Energy Projectile

CN Chloroacetophenone

CR Dibenz (b.f.)-1:4-oxazepine

CS O-Chlorobenzylidene Malononitrile

DIP Discriminating Irritant Projectile

Dstl Defence Science and Technology Laboratory

Home Office Home Office

LASD Los Angeles Sheriff's Department

Laser Light Amplification by the Stimulated Emission of Radiation

LED Light Emitting Diode

MPE Maximum Permissible Exposure

NIJ National Institute of Justice

NIO Northern Ireland Office

OC Oleoresin Capsicum

PAVA Pelargonic Acid Vanillylamide

PBR Plastic Baton Round (now generally referred to as baton round)

PSDB Police Scientific Development Branch

PTSD Police Technical Services Division

rms Root mean square

SRDB Scientific Research and Development Branch

Taser Thomas A Swift's Electrical Rifle (from the Tom Swift fantasy stories)