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Trends in Small Arms and Light Weapons Development: Non-Proliferation and Arms Control Dimensions

Major (Ret'd) David DeClerq

International Security Research and Outreach Program
Non-Proliferation, Arms Control and Disarmament Division

October 1999



Department of Foreign Affairs
and International Trade

Ministère des Affaires étrangères
et du Commerce international

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PREFACE

The Department of Foreign Affairs and International Trade commissioned a study to examine future trends with respect to small arms and light weapons, together with their possible consequences for arms control and non-proliferation efforts. This report stemmed from that study.

The views expressed in this report are those of the author and do not necessarily reflect the views or positions of the Department of Foreign Affairs and International Trade or of the Government of Canada.

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EXECUTIVE SUMMARY

The small arms and light weapons (SALW) issue currently being addressed by various governments, international organizations, NGO groups and individuals is not a new phenomenon. It took years to recognize this problem and it may take more years to even partially redress it. Much of what is being done at present amounts to little more than damage control. However, preventing a disease is always preferable to curing it. In this vein, this paper addresses developing trends in SALW, including non-lethal weapons and the potential of directed energy weapons (DEW) in an anti-personnel role. Its goal is to determine their possible impact and to suggest practical methods for ameliorating potential issues of concern (primarily within an arms control context). It also provides a general overview of new developments in this area and offers policy makers some suggestions in formulating strategies to address this issue.

New developments in small arms are generally evolutionary in nature. Those small arms currently entering inventories are not dramatically more effective than their predecessors. However, they are for the most part lighter, easier to use and maintain. They are also capable of more discriminate fire, a development due in large part to their enhanced sights and target acquisition capabilities. New ammunition developments have further enhanced their lethality and/or effectiveness. Similar improvements have been made with regard to the capabilities of various light weapons. The most significant improvements can be found in the digitization of weapons systems, something which improves hit probability under all conditions. Small arms currently under research and development (R&D) are more complex and expensive largely because they are replacing two systems – the rifle and the grenade launcher, and because they are heavily reliant on a built-in digitized target acquisition and fire control system. These small arms systems are unlikely to be used in large numbers by non-state actors due to the potentially restricted availability, complexity and cost of these weapons.

Newer non-lethal weapons are presently being considered by numerous militaries and law enforcement agencies. Such weapons have not been an SALW issue to date; still, they could be, given the substances used and the policies under which they would be applied. DEW figure most prominently here, given the potential for the use of lasers in a blinding role. Continued examination of this development (including the application of appropriate constraints) is required.

The implementation of reasonable international and national constraints on most of these new systems is something well within the capability of most governments – if they chose to rigorously enforce existing treaties, agreements, codes and regulations. However, many of these arrangements must be updated so as to address the potential impact of DEW and other non-lethal weapons. As new SALW enter military and police inventories, the primary or secondary weapons being replaced should be destroyed. In other words, for every new SALW acquired somewhere a similar weapon should be destroyed. The only exception to this might be a provision for mobilization or expansion which could not be accommodated through the use of war reserves. Significant acquisitions of new small arms systems currently under R&D should

be made more formally transparent. It is worthwhile re-visiting the “rules of war” as they apply to ammunition, non-lethal substances and DEW. As well, the international and domestic application of rules should, where possible, be rationalized and harmonized. All major arms-producing states on all continents (and indeed, all countries) should be involved in the resolution of these issues. The issues discussed in this paper will require a holistic approach – one which addresses not just the means of conflict but also the causes – if they are to be resolved.

RÉSUMÉ

La question des armes légères et de petit calibre (ALPC), sur laquelle se penchent actuellement divers gouvernements, organismes internationaux, groupes d'ONG et particuliers, n'est pas un phénomène nouveau. Il a fallu des années pour que ce problème soit reconnu et il pourrait en falloir davantage pour le régler, ne serait-ce que partiellement. La plupart de ce qui est en cours de réalisation actuellement constitue à peine plus que la limitation des dégâts. Cependant, mieux vaut prévenir que guérir, et c'est dans cette optique que ce document traite des tendances qui se dégagent dans le domaine des ALPC, notamment des armes non meurtrières, et du pouvoir des armes à énergie dirigée (AED) dans un rôle antipersonnel. Il a pour objectif de déterminer leurs incidences éventuelles et de suggérer des méthodes pratiques pour améliorer les questions préoccupantes (tout d'abord dans le cadre d'un contrôle des armes). Il donne aussi un aperçu général des progrès récents dans ce domaine et offre aux décideurs quelques suggestions quant à l'élaboration de stratégies visant à aborder ce problème.

Dans le domaine des armes de petit calibre, les progrès récents sont généralement de nature évolutive. Les armes légères qui font actuellement partie des inventaires n'ont pas une efficacité bien plus grande que les précédentes. Elles sont surtout, pour la plupart, plus légères, et plus faciles à utiliser et à entretenir. Elles sont également plus précises, principalement grâce à l'amélioration des systèmes de visée et d'acquisition d'objectif. Les nouveaux perfectionnements en matière de munitions ont encore augmenté leur pouvoir meurtrier et/ou leur efficacité. Des améliorations semblables ont été apportées en ce qui concerne les capacités de diverses armes légères. Les plus importantes ont trait à la numérisation des systèmes d'armes, qui améliore les probabilités d'atteinte de l'objectif, quelles que soient les conditions. Les armes de petit calibre qui font actuellement l'objet de recherche-développement (R-D) sont plus complexes et onéreuses, surtout parce qu'elles remplacent deux systèmes - le fusil et le lance-grenades, et qu'elles dépendent fortement d'une acquisition d'objectif numérisée incorporée et d'un système de conduite de tir. Ces systèmes d'armes de petit calibre ne seront vraisemblablement pas utilisés en grand nombre par des acteurs non étatiques, en raison de leur disponibilité qui peut être restreinte, de leur complexité et de leur coût.

De nombreux organismes militaires et organismes d'application de la loi envisagent actuellement de recourir à des armes non meurtrières plus récentes. Jusqu'à présent, ces armes n'ont pas été incluses dans les ALPC; cela pourrait cependant se produire, étant donné les substances utilisées et les politiques visant leur utilisation. On parle beaucoup des AED à cet égard, en raison de la possibilité de recourir aux lasers pour aveugler. Il est indispensable d'examiner en permanence les développements dans ce domaine (notamment l'application des contraintes appropriées).

La mise en oeuvre de contraintes internationales et nationales raisonnables à l'égard de la plupart de ces nouveaux systèmes entre tout à fait dans le cadre des capacités de la plupart des gouvernements - s'ils choisissent d'appliquer rigoureusement les traités, accords, codes et règlements existants. Cependant, beaucoup de ces ententes doivent être mises à jour afin de tenir

compte des incidences éventuelles des AED et autres armes non meurtrières. À mesure que les nouvelles ALPC entreront dans les inventaires militaires et policiers, les armes primaires et secondaires remplacées devront être détruites. Autrement dit, pour chaque nouvelle ALPC achetée, une arme similaire devra être détruite quelque part. La seule exception à cette règle pourrait être une disposition visant une mobilisation ou expansion à laquelle les réserves de guerre ne pourraient suffire. Les acquisitions importantes de nouveaux systèmes d'armes de petit calibre faisant actuellement l'objet de R-D devraient être faites avec une plus grande transparence officielle. Il faudrait revoir les « règles de guerre » en ce qui concerne les munitions, les substances non meurtrières et les AED. De même, l'application internationale et nationale des règles devrait, dans la mesure du possible, être rationalisée et harmonisée. Tous les principaux États producteurs d'armes sur tous les continents (et, en fait, tous les pays) devraient s'engager à résoudre ces problèmes. Les questions étudiées dans le présent résumé exigeront une approche holistique - de celles qui n'abordent pas seulement les moyens de conflit, mais aussi les causes - pour parvenir à une solution.

ABBREVIATIONS AND ACRONYMS

ACR	Advanced Combat Rifle
AK-47	Avtomat Kalasnikova (designator for Russian designed automatic rifle first made in 1947)
cal	caliber
CCW	Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons
CN	tear gas, alpha-chloroacetophenone
CNN	Cable News Network
cm	centimeter
CS	strong irritant gas, O-chlorobenzalmalononitrile
DEW	Directed Energy Weapon
DFAIT	Department of Foreign Affairs and International Trade
DND	Department of National Defence
EU	European Union
FIBUA	Fighting in Built Up Areas
FN	Fabrique National (small arms manufacturer)
FAL	Fusil Automatique Léger (SLR rifle built by FN)
fps	feet per second
H&K	Heckler and Koch (small arms manufacturer)
in.	inch
ICRC	International Committee of the Red Cross
IANSA	International Action Network on Small Arms
Laser	Light Amplification by Stimulated Emission of Radiation
mm	millimeter
MOUT	Military Operations Urban Terrain
NATO	North Atlantic Treaty Organization
NGO	Non Governmental Organization
OAS	Organization of American States
OAU	Organization of African Unity
OSCE	Organization of Security and Cooperation Europe
RCMP	Royal Canadian Mounted Police
OICW	Objective Individual Combat Weapon
OCSW	Objective Crew Served Combat Weapon
RPG	Rocket Propelled Grenade
RPM	Rounds per Minute
RPV	Remotely Piloted Vehicle
SALW	Small Arms and Light Weapons
SLR	Self Loading Rifle
SMG	Sub-Machine Gun
THEL	Tactical High Energy Laser
UN	United Nations
UNGA	United Nations General Assembly

TRENDS IN SMALL ARMS AND LIGHT WEAPONS (SALW) DEVELOPMENT: NON-PROLIFERATION AND ARMS CONTROL DIMENSIONS

INTRODUCTION

Small arms and light weapons (SALW) as a non-proliferation and arms control issue and a domestic security and safety issue have been the topic of much discussion over the past several years. It has been addressed in numerous fora ranging across a wide spectrum of agendas and concerns.¹ The challenge of controlling “the excessive and destabilizing accumulation and transfer”² of SALW is being examined by governments and non-governmental organizations (NGOs) both domestically and within international organizations such as the United Nations (UN), the Organization for Security and Cooperation in Europe (OSCE), the Organization of American States (OAS) and the European Union (EU). It is of particular concern for international NGOs who deal with the outcome of SALW misuse either directly or indirectly within a humanitarian perspective, mostly but not exclusively in less developed states. It is an issue that may take years to successfully redress. As well, the consideration of firearms³ as a criminal and public health (primarily suicide and accident) concern is an issue that many governments are grappling with, particularly in developed countries. This matter has frequently

¹ There are many sources that provide information on the arms control and humanitarian issues concerning SALW. For details see “Canada, Department of Foreign Affairs and International Trade (DFAIT). *Small Arms and Light Weapons: An Annotated Bibliography, Update 1996-1998*. Ottawa, September 1998; Canada, DFAIT. *Light Weapons and Micro-Disarmament*. Ottawa, January 1997. Both these publications refer to some 200 reports and studies. Following are some of the Internet Web Sites containing ongoing updates on the issue: www.prepcom.org; www.basicint.org; and www.bicc.uni-bonn. These sites also provide links to other sites dealing with the issue. The term “SALW issues and/or concerns” will be used in this paper in its broadest sense. The problem with defining the “issue” is that it is many issues. These issues have differing priorities and are not always perceived in the same way by the various stakeholders both government and NGOs.

² This phrase is best associated with UNGA Resolution 50/70B which mandated the formation of a “Panel of Governmental Experts on Small Arms” to investigate and make recommendations concerning SALW within the context of conflict, particularly that being dealt with by the UN. The UN Panel tabled 24 recommendations for addressing various SALW issues. See United Nations. *Report of UN Panel of Experts on Small Arms A/52/298* (27 August 1997).

³ The term **firearms** means any barreled weapon which expels a bullet or projectile by the action of an explosive - this would include light weapons, small arms, personal protection arms and sporting arms. The term **small arms** will be arbitrarily used in this paper to mean personal firearms primarily designed for military and security force operations, usually automatic and/or semi-automatic (self loading) with a large capacity magazine (usually 10 or more rounds). The term light weapons includes small arms plus most other military weapons between a 12.7 mm and a 100 mm barrel as well as grenades and other explosive warheads of various design including their launchers. This explanation leaves handguns, particularly some semi-automatic pistols somewhat in limbo for definition purposes. The focus of this paper is on small arms and light weapons (SALW). Small arms as defined herein are not legally available for civilian use in Canada and many other states.

pitted domestic gun control lobbies, and sports shooting and self defence lobbies against each other as they represent their respective interests and constituents.

Initially, the two spheres of arms control and criminal justice (which included public health) followed separate paths in their efforts to address the issues of firearms and SALW.⁴ However, over time, particularly within the NGO context, the two groupings have merged to form a coalition dealing with SALW and firearms writ large.⁵ This merging is an attempt to emulate, in part, the success of the anti-personnel land mines campaign, which successfully used NGOs from diverse roles and agendas as advocacy groups to publicize the problem and pressure governments to take action.

There is apparent momentum (both prescriptive and declaratory) within the international context towards addressing the myriad concerns pertaining to SALW and firearms.⁶ However, there are also numerous political and practical obstacles which must first be satisfactorily addressed before substantive progress can be made.⁷ Whether an incremental and selective approach to addressing the issues at hand would be more successful than a broad all-encompassing approach is subject to debate. Over time, one need not exclude the other. The benefit of addressing a distinctive SALW issue is that sometimes specific incremental solutions can be more easily adopted than broad based ones. As well, there are SALW concerns that have not been sufficiently analyzed to determine their scope, the reality of their impact, and the practicality of proposed solutions to mitigate that impact. Unproven solutions or non-solutions exist on all sides of the debate. There has been insufficient impartial operational or applied

⁴ From a UN perspective these separate paths can best be demonstrated by the issues dealt with in the First Committee in New York on arms control and through the UN Commission on Crime Prevention and Criminal Justice in Vienna. The first is more concerned with conflict and disarmament from an international security perspective while the second deals primarily with criminal issues.

⁵ An International NGO Consultation on Small Arms Action was held in August 1998 in Canada and formalized a loose coalition of NGOs (arms control, humanitarian and domestic gun control). A 14 October conference in Brussels formalized an NGO grouping called "Action Network On Small Arms" [IANSAs] consisting of a facilitating committee a secretarial and a continuation committee. For further details see the web site for the Preparatory Committee for a Global Campaign on Small Arms and Light Weapons www.prepcom.org. Prepcom, through its membership list, is an excellent source for accessing other sites concerned with SALW and firearms control issues.

⁶ The UN is the one organization where SALW issues have been addressed most frequently. In Oct 1998 several draft resolutions were tabled in the UNGA/First Committee addressing elements of the SALW issue; one was on consolidation of peace through practical disarmament measures, a second was on small arms and a third on illicit trafficking. For details on this and other disarmament issues see the NGO Committee on Disarmament at: <http://www.peacenet.org/disarm/dt.html>

⁷ One concrete example of a concluded agreement is The Organization of American States (OAS) Convention Against Illicit Manufacturing of and Trafficking in Firearms, Ammunition and Explosives and Other Related Material. Signed in November 1997, the OAS Convention is a regional effort to control the illicit manufacturing and trafficking in firearms, ammunition and explosives.

research to determine the utility and practicality of these many ideas in their implementation and effect.

This paper will address the specific area of developing trends in SALW to determine their possible impact and to suggest practical methods of ameliorating potential issues of concern, albeit primarily within an arms control context. Trends in SALW military developments (including ammunition) will be examined to ascertain whether they should be of concern due to uncontrolled and unnecessary diffusion and/or the impact of increased effectiveness in creating casualties and potential inhumane effects.⁸ Accordingly, observations and, where appropriate, recommendations applicable to both state and non-state actors in all types of conflict will be made regarding whether new procedures should be considered to control their distribution or limit their effect. The possible impact of new developments in "non-lethal" weapons (to be primarily used in low intensity military operations and law enforcement operations) and the more esoteric but nonetheless very real concern of potential developments in the area of directed energy weapons (DEWs) (such as "light amplification by stimulated emission of radiation", or lasers) in an anti-personnel role will also be examined. This paper is not intended to be a detailed technical analysis of these new systems, but rather a general overview designed to provide policy makers with basic technical information on new developments and assist them in formulating strategies in this area. The principal focus of the analysis will be on weapons and ancillary equipment that could enhance or replace the common current military and security force inventories of personal weapons such as the American (US) AR-15/M16, the Russian and former Soviet (FSU) Kalashnikov AK-47/AK-74, the Belgian Fabrique National (FN) Fusil Automatique Léger (FAL) and the German Heckler & Koch (H&K) G (Gewehr) -3 and all their variants.

A SHORT HISTORY OF SALW DEVELOPMENT

There are many excellent references⁹ which give a detailed technical as well as layman's analysis of firearms developments over the years. This simplified overview does not pretend to offer a comprehensive survey of this subject area, but rather provides a very cursory layman's introduction. By and large, improvements in firearms have been incremental and evolutionary in scope, highlighted on occasion by significant developments that might be considered revolutionary. How and when the gun was invented is lost in antiquity. Historically its use was

⁸ The term inhumane is based on the Convention on prohibitions or restrictions on the use of Certain Conventional Weapons which may be deemed to be excessively injurious or to have indiscriminate effects. (1980).

⁹ Those used in this synopsis include: Ivan V. Hogg, *Guns and How They Work* (Marshall Cavendish Books Limited, 1979); Ivan V. Hogg, *The Story of the Gun* (St Martin's Press, 1996); Derel Allsop and L. Popelinsky (et al), *Brassey's Essential Guide to Military Small Arms: Design Principles and Operating Methods* (Brassey's Inc. 1997); and James Marchington (ed), *Handguns, Sub-machine Guns, Semi-Automatic Pistols & Revolvers (Brassey's Modern Army Factfile Series)* (Brassey's Inc. 1997).

first noted in early 14th century in Europe. The fundamental characteristic of the gun has not changed from that day to this. Even the terminology remains the same:

“A gun consists basically of a tube closed at one end, inside which an explosion takes place in order to eject a missile. The tube is called the *barrel*; the hole down the middle of the barrel is the *bore*, the closed end the *breech* end and the open end the *muzzle*. The missile discharged by the gun is broadly called a *projectile*, though in small arms... is usually called the *bullet*. The bullet is ejected from the gun by the explosion of a *propelling charge*, which may be of *gunpowder* [black powder] or *smokeless powder*, and the complete combination of all the requisites to fire one shot from the gun – bullet, propelling charge and means of ignition – are collectively referred to as a *cartridge* or *round*...”¹⁰

For many centuries the gun changed very little. Except for some experimental pieces, small arms were single shot muzzle loaders using black powder as the propellant, a lead ball as the bullet, and over the centuries a match, flint or percussion cap as the igniter. By the early 19th century, reloading took anywhere from 12 to 30 seconds or longer, depending on the firearm and the skill of the shooter. Over time, qualitative improvements were made with regard to the propellant, igniter mechanisms, gun metallurgy, and accuracy of the weapon itself [primarily through the use of rifling grooves, sights and development of the Minié ball]. Many other minor innovations improved overall reliability and efficiency. However, there were no revolutionary improvements in the effectiveness¹¹ of the firearm from one century to the next. It would be fair to say that, all else being equal, 100 skilled long bowmen from 14th century England could probably defeat 100 skilled British infantrymen using the Brown Bess Musket circa 1815 on open terrain. The longbow men could fire farther, faster and with as much or more accuracy, using an arrow which was every bit as lethal as the musket ball (depending on the range).¹² Why then did the musket prevail over the long bow? It was simply much easier to train soldiers to use muskets effectively and these new weapons could be produced in a reliable quantity more cheaply and more efficiently than the long bow and its ammunition, the arrow.

It was the era from the 1860s to the 1890s that saw a truly revolutionary change in the nature of SALW. (This included the development of the first crew served non-artillery fire arm or light weapon – the machine gun.) Some of these developments could be indirectly attributed

¹⁰ Hogg, *Guns and How They Work*, p .10.

¹¹ The words “effectiveness” and “effective” as opposed to “lethality” and “lethal” are perhaps better descriptive terms. A .753 inch calibre lead ball fired from an 18th century muzzle loader at 100 meters is just as lethal, if not more so than a 5.56 mm round fired from the most modern rifle. The term “Lethality” is a synonym for “deadly” and is not generally suited to comparative analysis. Effectiveness takes in a multitude of considerations, including lethality, accuracy, range, ability to acquire and/or engage multiple targets and different types of targets, ease of use, reliability, ease of maintenance, and combat sustainability [ammunition loads etc].

¹² James F. Dunnigan, *Digital Soldiers* (St Martin’s Press, 1996), pp. 13 and 281.

to improved metallurgy and machine tooling. Others were a reflection of the impetus to firearms improvement encouraged by the shortcomings and requirements of the Crimean War, the American Civil War and various Prussian wars in Europe. In fact, this was an era where the term “arms race” could be applied. Events during this period would serve as a precursor for future rapid development programs designed to achieve qualitative SALW superiority over a potential adversary. While qualitative improvements were expensive for modern armies to undertake, failure to do so could mean defeat on the battlefield. Obsolescence in turn meant surpluses and the requirement for disposal and cost recovery programs in order to help finance improvements. This marked the beginning of significant resales of older military arms to armies with less financial resources, together with sales to commercial companies for civilian resale.

The development of the self-contained cartridge in conjunction with the breech-loading rifle significantly increased the effectiveness of small arms. First, small arms could be loaded much more quickly, increasing the firepower of armies by an order of magnitude. The development of repeating systems using lever or bolt actions fed by a box or a tubular magazine further improved the firepower potential of firearms. This in turn increased the vulnerability of a target by exposing it to more frequent fire within a given range. The use of the brass cartridge also provided a tighter seal, something which in turn gases from escaping and thus increased both the accuracy and the range of the firearm. The invention of smokeless powder and the steel/copper jacketed bullet significantly reduced fouling, thus permitting a reduction in caliber size. By the beginning of the 20th century, individuals could fire a round approximately every four to five seconds from a 10 round magazine¹³ out to an effective range of 1,000 metres and even beyond. This represented a significant increase over a round every 15 seconds (highly skilled soldiers only) and the 200 metre effective range of personal fire arms less than 80 years earlier.¹⁴

The mechanical machine gun was introduced during this same time period. Most such weapons were multi-barreled, cylinder fed, multiple-fire guns which required cartridges to be fed through by mechanical means. The most renowned mechanical machine guns were the Gatling Gun, the French Mitrailieuse, the Swedish Nordenfelt and the American Hotchkiss. With these weapons, a second person was normally required to ensure a continuous supply of ammunition, feed it into the weapon, and help move the gun when required – hence the name “crew served weapon”. The first widely used true machine gun was the Maxim. (A true machine gun is one that is automatic – that is, one that uses the kinetic energy created by the burning of the propellant and/or the expelled gases to manipulate internal mechanisms in a manner which permits the empty casing to be ejected and a new cartridge inserted in the chamber and fired, with the firer only required to keep the trigger depressed.) It was introduced in 1885;

¹³ A skilled rifleman could probably get a round off every 2 seconds with effect out to 300 metres, not counting time to change magazines or reload magazines.

¹⁴ Hogg, *Guns and How They Work*, p. 51.

its later variant was the Vickers.¹⁵ Both weapons could fire a .303 in. or 7.92 mm cartridge at a rate of 450 to 550 round per minute (RPM). In WW I these guns fundamentally changed the nature of battle. Some of these weapons may still be in use today.

It was only a matter of time before the attributes of the crew served medium or heavy machine gun were incorporated into such personal, rapid fire small arms such as the pistol, the sub-machine gun, the self loading rifle, the assault rifle and the light machine gun of today. While some initial research and development (R&D) took place in the late 19th century, it was the experience of WW I that provided the major impetus for this development. There are many references which cover the development of these weapons (including the characteristics of countless variants).¹⁶ Initially these small arms were seen as specialist weapons and were issued only to soldiers in units deemed to require them. All semi-automatic and automatic firearms¹⁷ use the energy created by the firing of a round to operate through one of three different methods – recoil (short or long), gas pressure, or blowback. Each has its own advantages and disadvantages, depending on the role of the weapon. Throughout WW I and WW II, the standard infantry personal weapon was the bolt action or box magazine-fed rifle. The US Army was the first to issue a semi-automatic rifle (the self loading rifle, or SLR) as a standard issue weapon. The M1 Garand was a .30 in. caliber gas-operated rifle that could fire effectively at a rate of 20 RPM. It first saw service in WW II. As with most military weapons, a number of subsequent improvements were made to this rifle, many as a result of the hard lessons of combat. The final rifle of the series, the M14, saw service in Vietnam. It was eventually replaced by the M16 and such current variants as the M16A2.

It should be noted that firearms development over the years has not been exclusively a case of military development influencing or leading civilian development. In the early years of small arms development, civilian innovations and requirements often paved the way for changes to weapons. This was certainly the case up until the end of the 19th century as firearms developments did not necessarily distinguish between civilian and military requirements, and there were often no regulations in democracies to restrict civilian ownership of military weapons. Even now, pressures for improvements in firearms remain something of a two way street, with both military and civilian manufacturers contributing to one another's requirements

¹⁵ *Ibid*, p. 83.

¹⁶ See footnote 9.

¹⁷ A semi-automatic self loading rifle (SLR) requires the trigger to be pulled each time a cartridge is to be fired. An automatic firearm will fire bullets continuously, at various rates of fire [usually 600 – 1000 RPM] depending on the firearm, limited of course by magazine capacity, as long as the trigger is held. Moving an internal sear pin determines whether the weapon fires fully automatic or semi-automatic. Most automatic firearms enable the user to select an automatic or semi-automatic function through the use of an external lever catch which changes the position of the sear. In some cases semi-automatic firearms not manufactured to fire automatic, particularly those designed for military use, can be modified by a gunsmith/armourer to fire automatic.

(especially in the area of handguns). The fact that many manufacturers of civilian firearms are also manufacturers of military firearms only reinforces this situation.

Today, the primary personal infantry small arm of most armies is a light SLR capable of firing on both semi-automatic or automatic settings (select fire). The principal weapons caliber are 9 x 18 or 19 mm (usually reserved for handguns and sub-machine guns), 5.56 x 39 mm and 45 mm (usually reserved for rifles/assault rifles¹⁸), and 7.62 x 39 mm and 51 mm (also for rifles/assault rifles and light machine guns). The most common personal combat weapons now in use are (or are variants of) the American AR-15/M16, the Russian/FSU AK-47/AK-74, the Belgian FN FAL and the German H&K G-3. These are by and large the weapons that have been used in the last three decades to inflict the majority of casualties in insurgencies and civil wars, and in their aftermath have remained to fuel both criminal and violent political conflict.¹⁹ They are circulating in an uncontrolled manner by the millions in such war zones and former war zones as the Balkans, central Africa, southern Africa, central America and south-east Asia. Retrieving most of them will be difficult, if not impossible. The issue here is not just one of political will but also the weak economic, social and political capacity in these regions needed to deal with this problem. While the weapons themselves did not create the situation for their use, one might wonder whether casualties would have been more limited if the small arms in question had been bolt action .303 Lee-Enfields, 30-06 inch Springfields, 7.9 mm Mausers or even .30 caliber semi-automatic 8 round magazine Garand M1 rifles. These weapons, while generally more lethal at longer ranges, do require considerably more skill to operate effectively and cannot lay down the same amount of fire in a given time. They are also certainly more difficult for the majority of women and children to use than assault rifles.²⁰ It should be noted that in most countries

¹⁸ The assault rifle definition is somewhat ambiguous. The name was derived from the WW II German Sturmgewehr (Assault Rifle) – a semi-automatic/automatic (selective-fire) short barreled rifle with a 30 round magazine and a rate of fire of 500 RPM. Hogg, p. 151. However, according to a U.S. Army definition, an assault rifle is a selective-fire rifle chambered for a cartridge of intermediate power. See www.infinet.com/~bmueller/Docs/Glossary. An assault rifle has a shorter barrel and a shorter effective range than a standard rifle. It falls somewhere between a sub-machine gun and a rifle.

¹⁹ The evidence supporting the assumption that small arms are the greatest casualty producers within the context described is largely hearsay and anecdotal. Statements contained in some of the advocacy literature on SALW control suggesting that 80 percent of all casualties in conflict are women and children (this does not appear to include male non-combatants) or that 90 percent of all casualties are caused by small arms are not supported by reliable statistical evidence. Most of the execution-style murders facilitated by small arms in the Balkans were directed against males, while indiscriminate casualties to women and children were the product of explosive ordnance. Casualties of such genocides as the one which occurred in Rwanda undoubtedly had a different gender and age ratio than conflicts in Central America.

²⁰ Some armies and police forces, particularly in developed countries, provide equal opportunity for women in front line police work, combat and near combat roles. A personal firearm requiring less strength to use ensures that these personnel requirements can be met. Light, low recoil small arms have benefits for men as well as women. However, making weapons easier to handle for men and women in combat also makes the use of those firearms easier for youths. Child soldiers has been an issue of considerable concern for a number of governments and NGOs.

possession by civilians of automatic firearms is normally restricted or illegal. This is not the case in countries where security cannot be reasonably assured by the state, where citizens are allowed or even encouraged to arm themselves, where the state is either unable or unwilling to enforce its own regulations or, obviously, where there are no regulations.

Ammunition

The firearm is the launcher for the object that creates casualties – be it a projectile or a bullet. This perfunctory overview will merely highlight a few issues and observations.²¹ Developments in ammunition and the weapons that fire them are generally synergistic, with improvements in one enabling improvements in the other. As already stated, the development of “smokeless powder” along with the self-contained cartridge (incorporating the casing, propellant, primer and bullet) occurred circa the late 19th century and represented the last revolutionary change in ammunition development. Subsequent improvements have been incremental and progressive, focusing on improved ballistics, lighter ammunition, and enhanced role characteristics. This statement is not meant to suggest that evolutionary developments have been insignificant by comparison. Over time a number of incremental improvements have offered considerable enhancements in ammunition effectiveness. In some instances an improvement in one area necessarily has necessarily led to degradation in another (for example, lighter ammunition and smaller calibers generally mean less effective ranges and potentially less energy transferred to the target). Personal military small arms have tended towards smaller-sized calibers. A number of factors have mitigated for this trend. Analyses of combat situations during and after WW II suggest that few soldiers effectively engaged the enemy with small arms at ranges exceeding 300 metres.²² As well, the advent of medium and heavy machine guns and light and medium mortars, together with their subsequent increase in availability and performance has made these the more effective weapons for engaging the enemy at longer ranges. Fighting in built-up areas (FIBUA) favoured short range sub-machine guns (SMGs), something which has increased the types of weapons carried. Considering the constant effort to lower the combat loads of soldiers (or at least increase the amount of ammunition they can carry)

²¹ For a technical overview of military ammunition development and current use see for example: Ivan Hogg, *Small Arms Grenades and Projected Munitions* (1998); Gander and Hogg (ed), *Jane's Ammunition Handbook* (Jane's Information Group Ltd, 1998-99). For an overview of ammunition within the context of SALW controls see: Canada, Department of Foreign Affairs and International Trade with the assistance of David DeClerq, *The Role of Ammunition Controls in Addressing Excessive and Destabilizing Accumulations of Small Arms* (April 1998); and Rachel Stohl, *Deadly Rounds: Ammunition and Armed Conflict* (BASIC, May 1998).

²² According to an unattributed study provided by Robert Anglin (a former Canadian Army officer responsible for small arms requirements, a small arms collector and a graduate of the UK Army Technical Staff College specializing in small arms), various studies by the US Army regarding small arms engagements in WW II, Korea and Vietnam, and UK Army studies based on Korean engagements all indicated that 73 per cent of all small arms engagements took place at less than 100 metres.

and the introduction of women into combat roles²³ (a smaller round means less recoil, making weapons easier to handle for both men and women), it became clear that a reduction in caliber size was both logical and necessary. The switch to automatic personal small arms also abetted the development of smaller/lighter cartridges, as the use of such weapons tended to foster a concomitant increase in ammunition expenditures.

Casualty creation is a function of the mass, shape, composition and speed of the bullet, the location of the impact, the track of the bullet in the body, and the yaw characteristics of the round in flight and in the body; together, these variables influence the amount of energy transferred to the target on impact. By and large, high velocity heavy bullets that expand or tumble when they hit a target produce more significant wounds. In this regard, bullet design is an important variable in assessing the wounding potential of ammunition. As a result of *The Hague Declaration* of 29 July 1899, which outlawed (in international conflict) the use of bullets which expand or flatten easily in the human body, military bullets have full metal jackets around the lead/metal core. Modern military rifles fire projectiles at a high velocity (around 3000 fps); bullets that have a full metal jacket are more accurate as soft point lead bullets may fracture either in the barrel or in flight due to heat generation and composition breakdown, thus upsetting their ballistic balance. Furthermore, a bullet lacking a full metal jacket may possess insufficient penetration capability, particularly at longer ranges or when engaging targets behind cover. The advent of military body armour makes the use of soft nosed bullets even more problematic, something which is in turn leading ammunition R&D to design new rounds capable of countering body armour.²⁴

Developments in explosive ammunition intended to create shrapnel (such as fragmentation hand grenades and mortar bombs) have tended to focus on better fragmentation and dispersion patterns, as well as enhanced delivery systems designed to reflect the demands being made of small arms – that is, an ability to reach farther faster, and to be lighter, more accurate and more effective. One way of enhancing the likelihood of casualties is to ensure

²³ According to the equipment procurement requirements of the Canadian Armed Forces, all equipment (including weapons) must be evaluated on the basis of a percentile range of human factors, including strength, weight and height; this is done in part with an eye to furthering the potential for increasing the numbers of women in the military. *Conversation* (16 March 1999).

²⁴ For a basic primer on wound ballistics and treatment, as well as a very basic primer on civilian personal firearms see <http://medstat.med.utah.edu/WebPath/TUTORIAL/GUNS>. Some of the information herein has been taken from that Web Site. Comparative wound ballistics science can be somewhat controversial, inconclusive, and subject to varying interpretation, particularly as it applies to the rules of war. See The Proceedings of the International Workshop on Wound Ballistics, held in Interlaken and Thun, Switzerland 8 - 9 October, 1997; M. L. Fackler, (M.D.), "What's Wrong With The Wound Ballistics Literature, and Why," *Institute Report No. 239 July 1987* (Letterman Army Institute of Research Division of Military Trauma Research Presidio of San Francisco, California 94219). For additional information see Peter Knudsen and Peter Theilade, "Terminal Ballistics of the 7.62 mm NATO bullets experiments in ordnance gelatin," *International Journal of Medicine* 108 (Spring 1995), pp. 62 -67; and "Memorandum of Law – Sniper Use of Open-Tip Ammunition," *The Army Lawyer* (Department of the Army Pamphlet 27-50-218 February 1991), pp. 86 - 89.

detonation where and when desired. In this regard, designs for contact fuses, delayed fuses, proximity fuses, and timed fuses have all improved over the years. New advances in digital and micro-chip technology will possibly further enhance the effects of explosive ammunition. Anti-armour or material ammunition designs have also witnessed improvements in the areas of propellant, warhead explosives and penetration capabilities. With regard to improved penetration, both chemical energy (shaped charges) or kinetic energy (for example, depleted uranium) systems are used.

While not a primary focus for this study, it is worthwhile noting that anti-armour weapons (such as rocket propelled grenades or RPGs) have been in existence since WW II and have gone through several generations of subsequent improvement. Although only in operational existence since the mid 1960s, similar generational improvements for short range shoulder fired anti-aircraft missiles have also taken place. Both weapons types have been a source of concern within the SALW arms control fora. As new types replace older models, the older ones become surplus and may be sold or given away, sometimes in an uncontrolled manner. Such transactions are of concern where these weapons end up in the hands of unrestrained and irresponsible non-state and/or state actors.

Other SALW Concerns

Non-lethal weapons,²⁵ while not a new development, have generally been the purview of internal security and police forces. However, they have recently attracted more interest in military circles. It is this interest that warrants their inclusion in any study on future weapons development. Non-lethal weapons have been around for centuries. Clubs and batons are considered non-lethal weapons in many circles. Many common non-lethal weapons are used by police forces and internal security forces for riot and hostile crowd control and for subduing criminal suspects when deadly force is not considered appropriate. For various reasons they have seldom been used in the context of the battlefield, except for the purpose of area denial or restriction (for example, barbed wire).

There are numerous non-lethal weapons currently in wide use. Some are advertised for self protection but like any protective weapon they can be used in an offensive manner as well. The most common is the police riot squad baton and shield. The shield serves as a protective device while the baton is used to deter and subdue. A number of sprays or riot agents are available for breaking up threatening crowds or forcing individuals out of confined spaces. CN (or tear gas) and CS (another irritant gas) are commonly used in this manner. Normally, the agents are contained in a cannister grenade which can be thrown or fired from a launcher. The water canon (essentially a high pressure fire hose) is frequently used in Europe as a non-lethal

²⁵ The term "less lethal" is a more appropriate nomenclature. The impact of a 7.62 mm round in the limbs or even the torso may be non-lethal while a concentrated amount of tear gas in an enclosed space or a hit by a rubber bullet in a vital area may be lethal. Nevertheless, as "non-lethal" seems to be the operative description for these weapons, that designation will be used in this study.

weapon: CN or CS gas is mixed with the water to further assist in breaking up unruly demonstrations. Pepper spray or oleoresin capsicum (OC) is another type of dispersant frequently advertised as a self-protective device for use against animals or criminals. It is also used by police in some jurisdictions to subdue or force into the open uncooperative suspects.²⁶ Other crowd dispersal and riot control weapons include electric prods, various type of entanglement wire such as razor wire, and rubber bullets. Additional non-lethal weapons include tranquilizer darts, netting and bean bag guns, to name a few. The use of these weapons is sometimes controversial, and new developments – particularly military ones – will heighten this controversy.

Directed energy weapons (DEWs) should be another area of unique concern to those seized of the SALW issue. Of particular importance is the use of “light amplification by stimulated emission of radiation” (laser) technology. The primary use of the laser with regard to SALW is in target acquisition and range finding. Laser ancillary equipment for SALW targeting is currently in common use and generally available not only in the military but also the civilian market. However, it could also be used in an offensive capacity, given its potential for use as a blinding weapon.

A SHORT HISTORY OF SALW INTERNATIONAL AND DOMESTIC CONSTRAINTS

Rules of War and Arms Control

Rules of war and arms control agreements have existed from very early times:

“The laws of war have two basic sources: customs and treaties or conventions. Customary law comes down to us from ancient practices and from case-by-case development, much like English and American common law. Treaties and conventional laws are the result of international agreements, conferences, and conventions. Before the mid-1800s, bilateral treaties represented the only source of law aside from customary law. Conventional law, which did not develop until the second half of the 19th century, is the outgrowth of international conferences such as those at The Hague (Netherlands) and in Geneva (Switzerland). Many of the early conferences took up the task of codifying customary law. As a result, much of the early customary law is also part of the conventional codes. The principal aim of the laws of war is to specify the rights and obligations of belligerents and the rights of neutrals and noncombatants.”²⁷

²⁶ According to S/Sgt Michael Johnson of the Ottawa-Carleton Police Tactical Unit, OC is his preferred agent as it is easier to handle and, unlike tear gas, is not prone to starting fires near combustible material when fired as a cannister grenade.

²⁷ Gary Anderson and Adam Gifford Jr., *Order Out of Anarchy: The International Law of War* 15 (1), Cato Institute WEB Site <http://www>.

Regarding conventions governing the conduct of war, the first modern convention to place restrictions on SALW was the December 1868 St Petersburg Declaration “*Renouncing the Use, in Time of War, of Explosive Projectiles under 400 Grams Weight.*” The Hague Conventions,²⁸ specifically the Hague II Convention of 1899 and the Hague IV Convention of 1907 (both respecting the Laws and Customs of War on Land), were the first international efforts to indirectly address potential restrictions on SALW. Chapter One, Section Two of the Hague II Convention (On Hostilities) states in Article 22 that “the right of belligerents to adopt means of injuring the enemy is not unlimited.” Article 23 of Chapter One states that “Besides the prohibitions provided by special Conventions, it is especially prohibited:.... (e) To employ arms, projectiles, or material of a nature to cause superfluous injury....”. The Hague IV Convention reiterated Article 22 and 23 of the Hague II Convention. As cited before, the year 1899 also saw the signing of The Hague Declaration III banning the use of dum-dum bullets – i.e. “bullets that would expand or flatten easily in the human body.” While the Hague Declaration and St Petersburg Declaration are quite specific on what is banned, the Hague Convention prohibiting weapons capable of causing “superfluous injuries” is open to interpretation.

The issue of limiting or proscribing certain SALW or their technologies did not re-surface as a significant issue until the 1970s.²⁹ On the basis of United Nations General Assembly Resolutions 32/152 of 19 December 1977, 33/70 of 28 September 1978 and 34/82 of 11 December 1979, a conference entitled “The United Nations Conference on Prohibitions or Restrictions of Use of Certain Conventional Weapons (CCW) Which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects” convened in Geneva in the fall of 1979 and 1980. Eighty-five states participated in the work of the conference. On 10 October 1980, the conference adopted the following instruments:³⁰

1. Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects (Appendix A);
2. Protocol on Non-Detectable Fragments (Protocol I) (Appendix B);
3. Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices (Protocol II) (Appendix C);
4. Protocol on Prohibitions or Restrictions on the Use of Incendiary Weapons (Protocol III) (Appendix D).

²⁸ There are numerous Internet Sites containing the text of various treaties. See: www.lib.byu.edu/~rdh/ww1/hague; <http://elsinore.cis.yale.edu/lawweb/avalon> and <http://www1.umn.edu/humanrts/instree>

²⁹ This involves voluntary agreements and declaratory statements, not imposed agreements such as the Versailles Treaty.

³⁰ This information, including that contained at Annex A, was obtained from the University of Minnesota Human Rights Library at <http://www1.umn.edu/humanrts/instree>

In addition, the Conference at its 1979 session adopted the following resolution: Resolution on Small-Caliber Weapon Systems (Appendix E). The texts of the above-mentioned instruments and resolution are appended to this Final Act. For an extract of the contents of those Protocols that have a direct implication for SALW see Annex A.

More recent declaratory statements have sought to address the challenge of applying these rules of war to domestic or internal conflicts. Two declarations (*The Declaration on the Rules of International Humanitarian Law Governing the Conduct of Hostilities in Non-International Armed Conflicts, San Remo, 7 April 1990* and *The Turku Declaration of Minimum Humanitarian Standards Applicable in All Circumstances, Turku, 2 December 1990*) specifically attempt to accomplish this.³¹ In the former declaration, under Section B (Prohibitions and Restrictions on the Use of Certain Weapons in Non-international Armed Conflicts), Paragraph Two prohibits “bullets which expand in the human body (such as dum-dum bullets). The customary rule prohibiting the use of bullets which expand or flatten easily in the human body, such as dum-dum bullets, is applicable in non-international armed conflicts.” In the latter declaration, Article Five, Paragraph Three states that “weapons or other material or methods prohibited in international conflicts must not be employed in any circumstances.”³²

With regard to potential new weapon technologies, the International Committee of the Red Cross (ICRC) and other organizations have lobbied for a ban on blinding laser weapons. Twenty-five countries have agreed to support a CCW protocol banning such weapons. A new CCW Protocol IV (on Blinding Laser Weapons) was adopted by a conference of States Parties on 13 October 1995. See Annex A for relevant extracts.

³¹ These two declarations are non-binding.

³² This declaration has not affected the domestic use of various types of soft nosed or controlled expansion bullets on the part of law enforcement agencies. Soft nosed ammunition is less susceptible to ricochet and the concomitant creation of unintended collateral casualties. Most metal-jacketed ammunition, particularly handgun ammunition, does not have sufficient “stopping” power to ensure that an individual hit by a bullet will be incapacitated to the point where he is no longer a threat. Handguns possess a relatively low velocity (on average 1200 to 1500 fps). Hunters also use bullets with a soft or hollow point designed specifically to deform on impact. Such deformation ensures that maximum kinetic energy is imparted to the target. This produces a larger wound cavity, thereby enhancing the kill probability and lessening the chance of a wounded animal escaping. However, the question remains: if such ammunition is inhumane on the battlefield, what makes it humane within domestic jurisdictions? Conversely, if there is a requirement to ensure that a “criminal” is hit to the extent that he will cease being a threat to a police constable, why is a soldier deserving of less consideration? The rationale that it is better to create enemy wounded rather than dead in battle because it ties up more resources – evacuation, medical, financial, etc. – may be true, but it is a spurious argument. Strategic, operational and tactical doctrine does not reflect this thinking. Soldiers are trained to try to kill their opponent (by aiming for center of mass), and not to try to wound them (ie. aiming for a limb). Furthermore, in developed states, medical attention is relatively efficient and effective – both on the battlefield and in the inner city. Thus, serious wounds do not carry the same consequences as they would on an early 20th century battlefield or in a less developed state.

In terms of SALW, it should be noted that the “rules of war” focus on the ammunition and not the delivery system (i.e. the gun). For legal, technical and other reasons it is better to focus on the ammunition than the launcher – after all, a rifle can discharge a legal or an illegal bullet. However, this approach is not useful in dealing with DEW.

Arms control agreements restricting numbers of weapons have generally not been applied to SALW. The most recent agreement of significance dealing with conventional weapons is the *Treaty on Conventional Armed Forces in Europe* (1990): it limits the number of tanks, artillery (100 mm plus), armoured combat vehicles, combat aircraft and combat helicopters that the States Parties can collectively hold in the Treaty Area. This restriction has de facto limited the number of such items held by the signatories. Similar agreements were later made under various articles of the *Dayton Accords* applicable to some states of the former Yugoslavia. Transparency agreements such as United Nations Register of Conventional Arms do not include SALW.

Multilateral and Unilateral Export/Import Constraints

There are numerous multilateral and unilateral means of preventing, constraining or regulating the flow of SALW from one state to another. Arms embargoes have had mixed success in preventing SALW flows. Failures are easier to measure than successes, and the failures are significant – witness the experiences of South Africa, Rwanda and the Balkans. Arms embargoes, whether initiated under the auspices of the UN, other international organizations or by individual states, often have the unintended result of diffusing SALW production to states that previously had no such production facilities. States such as South Africa, Israel, Pakistan, Taiwan, Argentina, and Chile have all been under various forms of embargo. The reaction of such states has been to develop a significant SALW production capability. They have also sought to cultivate an export market in order to support this expense, thus feeding the distribution of SALW into the world market.

A regulatory attempt to constrain illegal flows is manifested in The Organization of American States’ (OAS) *Convention Against Illicit Manufacturing of and Trafficking in Firearms, Ammunition and Explosives and Other Related Material*. Signed in November 1997, the OAS *Convention* is a regional effort designed to control the illicit manufacturing and trafficking in firearms, ammunition and explosives.³³ Although it is too early to ascertain whether this agreement will be an operational success, there is little doubt that it has made a significant political impression.

There have been a number of declaratory resolutions and agreements of a non-binding nature that demonstrate intent and encourage adherence to a standard regarding weapons

³³ This agreement requires signatories, among other things, to develop an effective paper control system for licit exports and imports, appropriately mark all firearms, and establish as criminal offences any acts of contravention.

transfers. Several UN Resolutions and multilateral and unilateral Codes of Conduct address various aspects of the SALW issue.³⁴ Still, because of their voluntary nature, the utility of these codes are questioned by many advocates. According to an analysis of the EU Code of Conduct by OXFAM,³⁵

“there is no explicit obligation to prohibit transfers to forces which would most likely use them to seriously violate international humanitarian law (which sets out the rules of war). Moreover, there are virtually no provisions to address the current deficiencies in most EU Members States’ arms control regimes, such as the failure to strictly regulate international arms brokering and licensed production agreements, or to adopt rigorous systems of certifying and monitoring end-use. Finally the Code, as agreed, contains no provision for parliamentary or public scrutiny over arms exports from the EU and thus does little to foster greater transparency and accountability over the arms trade across Europe as a whole.”

Nonetheless, brokering is difficult to control.³⁶ Most export regimes cover goods exported from one country to another, and it can be difficult to apply laws on an extra-territorial basis where transactions occur outside of a state’s effective national jurisdiction. While licensing measures address the issue of technology transfer, it is difficult to impose extra-territorial control once a license is granted – particularly given the legal and sovereignty implications to such efforts. After all, any precedence setting measure established for SALW might, in the minds of some states, lead to controls on other goods. A less complex safeguard might be to verify the nature of the customer and the integrity of that country’s export controls rather than to attempt extra-territorial controls. However, few states other than the United States have the clout to apply such constraints. In some cases, security concerns and the presence of economically sensitive information make it difficult to engage in open legislative and public scrutiny of SALW transactions.

³⁴ Several examples of relevant UN resolutions (non-binding) are: UN Security Council Resolution 1209 (1998) document S/1998/1091 on Illicit Arms Flows (dealing with African states and encouraging them to enact legislation to regulate firearms and imports/exports of same); UNGA Resolution 52/38 J of 9 Dec 1997 (which endorsed the recommendations pertaining to SALW in the UN Report of the Panel of Governmental Experts on Small Arms, A/52/298, 27 Aug 1997). A European Union Code of Conduct for Arms Exports was adopted on 9 June 1998. It contains 8 criteria to be considered before permitting arms sales. The EU Code of Conduct is binding on its 15 members. In addition, thirteen European non-EU countries aligned themselves with the Code in August of 1998. While the new Parties included such major exporters as Bulgaria, Poland and Slovakia, it did not include Russia or the Ukraine. See Alan Osborn, “Euro Arms Export Code Extended,” *Defence Industry Report: A Supplement to Jane’s Defense Weekly* (October, 1998).

³⁵ See: <http://www.peacenet.org/disarm/dt.html>. Also see Marc Rogers. “EU arms code hailed success as export reports flood in.” *Jane’s Defence Weekly* (7 October 1998), p. 33.

³⁶ See: Canada, DFAIT, *State Authorization and Inter-State Information Sharing Concerning Small Arms Manufacturers, Dealers and Brokers* (Ottawa, February 1999).

The Wassenaar Arrangement is a multilateral organization with some ability to constrain inappropriate SALW transfers. This forum of 33 industrialized countries represents a high percentage of the major SALW producers in the world. Its purpose is to ensure that goods and technologies designed for military use or possessing both civilian and military applications are not shipped to regions of the globe where regional military stability would be undermined. The intent of this organization is to contribute to regional and international security by promoting transparency and responsibility in the selling of such goods. Still, the potential of the Wassenaar Arrangement to seriously control SALW is marginal given its terms of reference and the subjective and liberal nature of defining the term "destabilizing" as it relates to SALW. Notwithstanding this difficulty, most of the leading developers in new SALW technologies are members of the Wassenaar Agreement (including, importantly, some non-European/North American states). In this regard, the organization is well suited to constrain the outflow of destabilizing SALW products and manufacturing capabilities if all of its members can muster the political will to do so. However, as this is a consensus organization and decisions are non-binding, it is unlikely to be effective in constraining SALW exports.

Most states have unilateral constraints on the exports of SALW and their technologies. In Canada,³⁷ the control of SALW transfers into and out of the country is the responsibility of several regulatory bodies, including the Export Control Division of the Department of Foreign Affairs and International Trade (DFAIT) in consultation with other DFAIT divisions, the Department of National Defence (DND), Industry Canada, and, if necessary, Revenue Canada (Customs and Excise), the Canadian Security and Intelligence Service (CSIS) and the Canadian Firearms Center.³⁸ These regulatory agencies are bound by numerous legislative and administrative acts and directives.³⁹ Canada closely controls the export of military goods and technologies to countries that pose a threat to Canada or its allies, or are involved or under imminent threat of hostilities, are under UN Security Council sanctions, or have a persistent record of serious violations of the human rights of their citizens unless it can be demonstrated that there is no reasonable risk that the goods might be used against the civilian population. It

³⁷ For details on export restriction see: "Annex C to - Canada, DFAIT, *Light Weapons and Micro-Disarmament* (Ottawa, January 1997), and Canada, DFAIT, *A Guide to Canada's Export Controls* (September, 1996). See also <http://www.dfait-maeci.gc.ca/eicb/cdaep-e.htm>. For details on the responsibilities of the Explosive Regulatory Division see <http://www.nrcan.gc.ca/mns/explosif>

³⁸ The Canadian Firearms Center will eventually take more responsibility for firearms import permits and export authorizations but will not displace the role of DFAIT's Export Division, particularly with regard to SALW over .50 in. cal. It should be noted that there are special restrictions on the export of automatic firearms of all types that limit such exports to a special list of countries that have special defence, research, development and production arrangements with Canada.

³⁹ Some acts relevant to SALW control are: the Criminal Code, various Criminal Law Amendment Acts, Customs Act, Explosives Act, Export and Import Permits Act and the National Defence Act.

would however be difficult for SALW sales to pass the test of “unlikely to be used against the civilian population” in an environment characterized by serious human rights violations.⁴⁰

Domestic Firearms Regulations

Until the 20th century the regulation of firearms from a criminal and particularly a public health perspective was not a significant issue.⁴¹ There were a variety of reasons for this. In the domestic context military small arms differed very little, if at all, from their civilian counterparts. In fact, civilian firearms were frequently better than their military equivalents. There was also no perceived requirement for such controls as governments of the day were less regulatory- and interventionist-minded. Furthermore, in some states, particularly those states settled by Europeans, firearms were owned by much of the population for sustenance and protection.

Within the North American and European context domestic firearms regulations evolved over a number of years, primarily in reaction to the real and potential criminal use of firearms as reflected in the political climate of the time. It is not the intention of this short overview to track the historical evolution of firearms regulation in various countries and jurisdictions, together with the controversy such regulations have at times generated. There are many sources which examine this subject.⁴² It is sufficient to observe that domestic firearms regulations in most countries have generally become more restrictive with the passage of time. The last decade has witnessed perhaps the most significant increases in levels of regulation. In Australia, Canada and the UK, citizens have been outraged by a number of multiple murders carried out by one or more individuals, acts made possible in part by access to modern firearms. Politicians have reacted swiftly to those events by imposing new and ever-more-stringent firearms regulations. New developments in firearms and the perception that this has led to, or might lead to, more lethal criminal activity has also been a factor in the growth of firearms regulations over the years. Examples of such development are advances in machine guns (in all of their manifestations) as well as the development of more easily concealed firearms and an increased magazine capacity for many SALW. Other reasons for increased firearm regulation relate to a demographic swing in many developed countries from a rural agrarian/hunter society to an urban industrial/service sector-oriented one: in this new socio-economic environment, guns are often no longer seen to possess a legitimate utilitarian value and are instead primarily associated with criminal activity

⁴⁰ Export permits are often perused by a number of government departments before approval is given for export: these many include Industry Canada, the Department of National Defence, the RCMP, the Canadian Security and Intelligence Service, the Communications Security Establishment, Customs and Excise and various Divisions within DFAIT.

⁴¹ This is not to suggest that domestic restrictions did not exist. But where they did, it was generally applied to discouraging uprisings and/or to maintaining the position of the authorities of the day. It was never a public health issue.

⁴² Anyone interested in this subject need only go to the Internet and type in “Gun Control” on any search engine.

and public safety concerns. In general, it would be safe to say that the newer developments in firearms intended for military and security forces will be denied to civilians in a growing number of states. Such measures, however, do not obviate the risk that these weapons could fall (with or without state complicity) into the hands of various non-state actors, including criminals – particularly in those states with poor firearms regulations and enforcement capabilities, inadequate public security measures and/or an ongoing civil insurrection.

RECENT SALW INNOVATIONS AND THEIR IMPACT

Small arms developments, like any other technology, take some time to move from the conceptual level, through R&D, and then into production and operational use. This section will review recent SALW innovations, some of which have existed in various development stages over many years. In an effort to avoid lengthy descriptions, Annex B contains pictures of various generations of military small arms and Annex C contains a table with a brief description of their characteristics and the general time frame of service within most armies.

As stated earlier, small arms development is largely evolutionary. The new weapons entering service today do not generally offer decisive advantages over the previous generation of small arms which they may be replacing or supplementing – in other words, “the basic infantry rifle has yet to be redefined”.⁴³ That having been said, newer systems do offer some unique advantages in terms of compactness, reliability, magazine capacity, rates of fire, new ammunition capabilities (in some cases), and – most significantly – improved ancillary equipment (particularly sights).

In 1989, NATO formulated a requirement for a “Personal Defence Weapon” for the post 2000 period. The stated requirement was for a weapon that

“should be... lighter, more durable, should make use of the latest state-of-the-art materials; easy to handle, require minimum maintenance; feature reduced audible and visible signature; a multi-purpose weapon with modular design – all with the objective of reducing the variety of different weapons and fire control systems in a unit.”⁴⁴

Before looking at the prospects for such a multi-purpose personal weapon system, a review of small arms that are replacing or have recently replaced such notable firearms as the AK-47 and AK-74, the H&K G 3, and the FN FAL is warranted.

⁴³ Terry J. Gander (ed). *Jane's Infantry Weapons (24th edition) 1998-99* (Jane's Information Group Ltd., UK, 1998). All of the small arms discussed in this paper are referred to in this edition. I have used *Jane's* sources, together with *Soldier of Fortune Magazine* articles (good for field assessments) and several Internet Sites such as http://members.xoom.com/russian_arms; and <http://www.remtek.com/arms>

⁴⁴ See NATO Document AC 225 (16 April 1989).

New Generation Small Arms – A Generic Overview

Design. Many of the newer generation of military small arms are of the “bullpup” design. (See Annex B for pictures of the FN P 90 and the AUG Steyr). Although the concept is almost 100 years old, the bullpup certainly looks “futuristic”.⁴⁵ The barrel is moved well back into the stock and the action and magazine are placed behind the trigger assembly. What this does (something which other more conventional small arms do not do) is to optimize the space taken up by the stock. The result is a more compact and often lighter weapon with less recoil, making it easier to control for those with less strength and thereby rendering the weapon more accurate. Such designs often combine the attributes of a sub-machine gun and an assault rifle. Most are 30 centimetres shorter than comparable assault rifles. While there are technical supporters and detractors of the weapon concept, it does appear to be the design of choice for replacing the current standard inventories in many armies. The majority of newer small arms, including those of the bullpup design, maximize the use of polymers and other synthetic material in order to help lighten the weapon and keep production costs down. Most of these new small arms are easier to handle and maintain and are much less susceptible to fouling or other problems than those of previous generations. With a few exceptions, these small arms continue to fire the same 5.56 x 45 mm round as their predecessors (or for the Russians, a 5.45 x 39 mm round).

Ammunition Capacity and Type. Most of the newer small arms do have larger magazine capacities than their predecessors. Magazine capacity ranges from 25 to 100 rounds, depending on the weapon and its configuration, with most small arms using a 30 round magazine. Some of these have side-by-side magazines (double or triple) giving the weapon an enhanced rapid change capability over older generations of assault rifles. New plastic pre-loaded throw away magazines are also being developed. Ammunition type continues to be the standard 5.56 x 45 mm or 9 x 19 mm, albeit with a few notable exceptions. These are the 5.7 x 28 mm used in the new FN P90 and the 4.73 x 33 mm caseless ammunition designed for the HK-G11 and HK-ACR. Both these rounds could have significant implications regarding SALW control issues should they become widely available to non-state actors (particularly criminal elements). In addition, the Chinese are also producing a new round – the 5.8 x 42 mm – which is being issued to troops in Hong Kong.

Rates of Fire. The rate of fire is not necessarily a positive indicator in determining a small arm’s effectiveness. The small arm is basically a discriminatory weapon and in most cases it is desirable to have controlled and accurate fire with a minimum expenditure of ammunition

⁴⁵ See: Peter Kokalis. “Steyr AUG; This Bullpup’s No Dog,” *Soldier of Fortune Magazine* (February 1985). It is interesting to note that some older firearms can be modified to a bullpup design, and, at least in the USA, conversion kits are available for civilian purchase. The design itself does not necessarily mean that it will make a firearm more effective or lethal after such a conversion, particularly if it still meets all other regulatory requirements. It will however decrease the overall length of the firearm. The bullpup design firearm is illegal for civilian use in Canada. See <http://www.bushmaster.com/catalog/bullpup.html>. and <http://www.sksman.com/aku/aku94>

used per hit. While the new designs generally have a higher cyclical rate of fire than their predecessors, what distinguishes a few of them from their predecessors is their ability to fire very rapid controlled bursts while optimizing the preferred target spread. The Russian AN-94 has a cyclical rate of fire of 1800 RPM with a two round burst on each trigger squeeze, something which significantly raises the hit probability at longer ranges.⁴⁶ For full automatic it drops to 600 RPM.

Sights. The most significant enhancement to new small arms is an improved ability to acquire and hit a target.⁴⁷ Until recently, most military small arms were aimed using iron sights of various types, including the leaf and adjustable aperture peep sights. While optical magnification cross hair scopes have been available for well over a century to both military/police sniper rifles and hunting rifles, they were not usually fitted to line infantry weapons because of their cost and lack of robustness. Today, almost all new military small arms have vision-enhanced sighting equipment which not only magnify vision but can also accurately determine ranges using built in laser range finders (RF). They can also function in low light environments. Various types of image intensifiers can magnify ambient light, thus providing improved target acquisition in low light conditions. Thermal imaging sights use source target heat radiation to acquire a sight picture. Laser aiming lights use a dot shaped beam to mark a target and in some cases determine the range. Battery powered optical electronic sights cause a small bright red dot to appear in the field of view coincident with the point of aim. Photonic optics ensure that the target and reticle pattern are always focused: with the addition of a tritium light source, this system can also function in low light conditions. It is this enhanced target acquisition and sighting capabilities, more than any of the other attribute of these newer versions of small arms, which has made these new weapons more effective. Newly developed sights can also be retrofitted to any small arm, including older models. As well, many of these sights are available for civilian shooting.⁴⁸ Still, while this new technology has significantly enhanced a soldier's ability to acquire and hit a target, proper training and maintenance is still necessary if the technology is to be used effectively.⁴⁹ Casual or untrained users would have difficulty in

⁴⁶ According to Robert Anglin the Canadian army assessed a 3 round burst capability on its C-7 (similar to M16) and found no increase in hit probability. There was a corresponding increase in ammunition expenditure. The burst capability was not adopted.

⁴⁷ For an overview of the numerous types of sights used for SALW see: *Jane's Infantry Weapons*, pp. 687-741. It should be noted that some types of this equipment are manufactured by other than European and North American countries.

⁴⁸ The Elcan Optical Sight with a 3.4 x nominal magnification was developed for the Canadian Army C-7A1 rifle (M16 variant) and is commercially available for US \$695. Enhanced sights are not banned for civilian use in Canada. See <http://www.bushmaster.com/catalog/scopesmounts.html> for this and other examples, including laser sights.

⁴⁹ See Dr Jean Dyer (et al), "Zeroing Techniques with Night Vision Devices" *Infantry* (September-October 1996), p. 6. As well, several adjustments and additional training were required to correct problems with the

optimizing the use of such sights. That said, almost all new small arms continue to mount conventional iron sights as well as newer optical sights.

Two Notable New Military Small Arms

As mentioned previously, two newly developed small arms (together with their ammunition) appear to offer unique enhanced effectiveness and/or lethality. These are the H&K G11 (firing 4.73 x 33 mm caseless ammunition) and the FN P 90 (firing the small caliber 5.7 x 28 mm ammunition). These bullpup-design small arms have characteristics that warrant a more detailed examination of their capabilities.

H&K G 11.⁵⁰ This firearm and its caseless ammunition have together been under development for many years. Various prototypes have been tested and the product has been improved over time. In recent years it has undergone testing by the German and American armies (each examining slightly different variants, with the American one known as the G11/Advanced Combat Rifle or ACR). The design has now reached the point where it is deemed by H&K to be a viable operational weapon. Testing for both the gun and its ammunition was extremely rigorous. The G11 K2 version was tested by new German draftees and results indicated a 50 per cent improvement in hits over the older G3. In the US Army it was tested by both men and women and praised for its accuracy and ease of use (very little recoil and easy maintenance). Basic characteristics are outlined at Annex C. Most of this testing was carried out in 1989-1990. It did not come into service in Germany, in part due to the political collapse of the USSR and the Warsaw Pact and the elimination of the military threat they posed. As a result, the weapon and the ammunition has not entered into commercial or military production.

The most unique attribute of the G-11 is the caseless ammunition it is designed to fire – a 4.73 x 33 mm cartridge encased in a square sleeve of solid propellant and then wrapped in a special thin plastic coating. It is 50 per cent lighter than similar ammunition calibers.⁵¹ According to one source, “the terminal ballistics effects on soft targets are in line with international conventions. Even at extremely short ranges there is no fragmentation of the bullet

Canadian Army C-7 Rifle Optical Scopes.

⁵⁰ Most of the information on the Heckler and Koch small arms was provided courtesy Heckler and Koch Inc. 21480 Pacific Boulevard Sterling, Virginia. They were forthright in answering all questions. Other detail in this paragraph was drawn from various Jane's sources and Internet Sites, including <http://www.remtek.com/arms/hk/mil/g11.htm>

⁵¹ According to H&K for the same weight a soldier can carry 510 x (4.73 mm caseless) cartridges with no magazines required as the caseless ammo forms its own magazine, or 240 x (5.56 mm brass cartridges) with 7 spare magazines, or 100 x (7.62 mm brass cartridges) with 4 spare magazines.

within the target medium".⁵² Caseless ammunition was developed to improve burst shot capability by eliminating the extraction process, thereby lessening the propensity of the weapon to climb during automatic fire. It is also intended to lighten combat loads, thus permitting more first line ammunition to be carried by soldiers. Finally, it also eliminates brass waste.

From an SALW control perspective, this weapon offers both positive and negative features. If the wound ballistics are well within international norms, the weapon's use over other designs could be considered a plus from a humanitarian perspective, although this may be offset by the increased likelihood of multiple hits. However, the G 11 would be unable to fire anything other than caseless ammunition and the corollary would be that small arms designed to fire standard brass cartridges could not fire caseless ammunition. Furthermore, no brass cartridges means no re-use possibilities for a home loader. The lack of a brass cartridge would also eliminate one opportunity for forensic analysis of evidence left at a crime scene. Over time, this ammunition could become the norm for many military weapons and as the science and economies of scale improve it could very well become much cheaper to produce than brass cartridges. Caseless ammunition as an SALW issue requires close examination. In principle, there would seem to be no reason for this ammunition to be made available for civilian use.⁵³ As the weapon and its ammunition are not yet in production, now is the time to review whether constraints on production and distribution are warranted and, if so, under what circumstances.⁵⁴ Even if Heckler and Koch, the producer of the weapon, and Dynamit Nobel, the producer of the ammunition, do not take this weapon into production, it may only be a matter of time before others develop a similar system. Considering that this is new technology, it is not remarkably expensive. According to H&K, the market price would probably be about US 30 cents per round of ammunition, and US \$800 to \$1200 for the weapon, including optical sights. Compared to a \$1300 price for the much older G 3, this is indeed inexpensive.⁵⁵

⁵² See: <http://www.remtek.com/arms/hk/mil/g11/caseless.html>. According to H&K sources the ammunition wound ballistics are comparable to the 5.56 x 45 mm NATO round out to 600 meters.

⁵³ According to RCMP Central Forensic Laboratory, Chief Scientist - Firearms, Murray Smith this is a critical consideration with regards to civilian use. However, thinking criminals could use revolvers which do not automatically eject casings or they could collect the brass to avoid forensic analysis possibilities. However, revolvers tend to be used less in crimes today than in the past.

⁵⁴ A unique type of caseless ammunition has had limited commercial use – the Daisy VL .22 caseless bolt action. It should be noted that caseless ammunition is on the Wassenaar munitions control list. See <http://jya.com/wa/waml.htm>.

⁵⁵ Correspondence with Jim Schatz, Keckler & Koch Inc (7 Dec 1998).

FN P 90.⁵⁶ The characteristics of the FN 5.7 x 28 mm P 90 personal defence weapon system make it more properly akin to a sub-machine gun than an assault rifle. The weapon is ultra-modern, easy to maintain, very light, and reliable. It can be equipped with a laser target designator as well as a wide variety of day and night sights. It has a standard integrated optical sight with no magnification. Like the G 11, its most significant characteristic is its ammunition. The development of this cartridge reflects NATO concerns that the 9 x 19 mm ball ammunition used in most handguns and sub-machine guns possesses insufficient power for the battlefield of the 21st century, where various types of body armour will be commonplace. Designed to provide (according to FN literature) substantially more lethality than the 9 mm round it is designed to replace, it also weighs less than 50 per cent of the latter round. Thus, like the G-11 caseless, a soldier can carry many more cartridges than before. It should be noted that the maximum effective range of this weapon is listed as 200 metres, less than the 300 to 600 metres of most assault rifles and the 1,000 metres of other rifles, but better than any pistol and most sub-machine guns. Of further significance is the fact that a pistol (the five-seven, with a twenty round magazine) has also been developed for the same round.

The SS190 5.7 mm round (it is actually the same bore size as the NATO 5.56 mm round but has a much shorter cartridge case – 28 mm versus 45 mm) is made in full metal jacket (ball), tracer, subsonic and blank forms. It is advertised as capable of creating a larger wound cavity in Fackler gelatin (5 cm by 30 cm) than either the 9 mm jacketed round (3 cm with over penetration) or the 9 mm hollow point (4 cm by 40 cm variable penetration).⁵⁷ Because it transfers most of its energy to the target, it is less likely to exit a target and strike something else. In comparison with the 9 mm FMJ round, it is also advertised as being less susceptible to ricochet and, with a shorter range lethality, less susceptible to creating casualties beyond the range of the intended target. These characteristics make it particularly attractive to military special operations units and police tactical units. In addition, the 5.7 x 28 mm round fired from a P 90 can penetrate 48 plies of kelvar body armour at 200 metres. The characteristics of the round when fired from the five-seven pistol are equivalent but with relative shorter ranges.

⁵⁶ Paul Tweedale, the Canadian FN Herstal representative provided much of the information contained herein and was forthright in answering all questions. The author was permitted to handle and fire both the P 90 and the Five-seven pistol. Additional views and collateral information on the P 90 were obtained from: *Jane's Infantry Weapons*, p. 88, and from <http://www.remtek.com/arms/fn/p90/p90.htm>.

⁵⁷ Note that the 9 mm hollow point would be banned under the "rules of war" but the 5.7 mm jacketed ammunition would not – even though the wound ballistics would appear to be potentially more traumatic. Thus, if all police forces adopted this round they would be in compliance with the international rules of war. At least one senior police force official believes that the wounding capacity of the round is insufficient.

The P 90 and its ammunition is in production only in Belgium⁵⁸ and is believed to be in the inventory of Saudi Arabia's Special Forces, together with some Far Eastern states. Several police forces in Europe are also armed with the P 90. It is priced at approximately US \$950, with the price of ammunition at about 30 cents a round. It should be noted that this small arm is being actively marketed for police forces and internal security force organizations. While it generally appears to meet new NATO specifications for a replacement round for the 9 mm, its adaptation is far from assured. This is due in large part to the fact that many states still use the 9 mm and the replacement of these weapons solely for the purpose of standardization would be an expensive proposition (again, a similar problem as regards the G 11, 4.73 mm caseless ammunition).

From a SALW control perspective the ammunition is a matter for some concern (particularly from the law enforcement perspective) due to its ability to penetrate police protective gear. From a civilian stand point, if the wound ballistics are indeed more devastating than other rounds, then there may be a likelihood of more fatalities. Whether or not in a case such as Rwanda or even the Balkans there would have been more fatalities if such ammunition was in wide use is difficult to determine. While it would not be too difficult to legally ban the ammunition and the firearms capable of chambering such a round to civilians,⁵⁹ this does not mitigate its effect and potential misuse by government authorities – be they law enforcement officials or military units. The requirements of police forces and the need to penetrate body armour (whether military or that worn by criminals) presents a conundrum for those who believe the round could cause unnecessary wound effects and concomitant suffering.

NEXT GENERATION SMALL ARMS

Two countries are known to be pursuing a definitive next generation small arm in line with NATO stated requirements and in accordance with NATO Document AC 225. The United States is developing what it calls the Objective Individual Combat Weapon (OICW) and the French are developing the PAPOP (Polyarme, Polyprojectiles). A few other states may be pursuing similar advanced concepts, particularly with regards to target acquisition and engagement capabilities. Both of these personal weapons incorporate the concept of an over and under weapon, with a grenade launcher on top and a rifle underneath supported by a plethora of electronic and digitized accessories designed to provide lethality and effectiveness at a range far beyond that possessed by any present personal weapon systems. Each of these systems have reached a prototype stage, although development is ongoing and both are expected to be in initial operational service around 2005.

⁵⁸ The simplicity of the P 90 and the fact that its ammunition is essentially a 5.56 mm bullet in a different casing suggests that both could easily be manufactured in any country currently capable of producing SALW and ammunition. FN Herstal have noted that "the SS190 can be manufactured on existing production lines".

⁵⁹ The ammunition is banned for civilian use under the Criminal Code of Canada as of December 1998.

The Objective Individual Combat Weapon (OICW): United States

The OICW has been under development for some time⁶⁰ and is part of the “Land Warrior Fighting System” being developed by the US Army. According to preliminary analyses, “if the Land Warrior Fighting System does everything it’s anticipated it will do, the American infantry soldier in the early 21st century will be the most deadly soldier in the world.”⁶¹ Land Warrior and OICW is more than just a new weapons system. It represents the digitization of the infantryman in a manner designed to increase the effectiveness of firepower delivery. What this system represents is not a new way to kill or neutralize a target, but rather a more efficient and effective means by which to do so. The OICW, simply put, is a grenade launcher mounted atop a rifle using a 5.56 x 45 mm round. Grenade launchers have been around for many decades, rifles for much longer. Grenade launchers have usually been a separate piece of equipment, except for those rifles which could take an attachment which used the impact energy of a fired cartridge to expel a conventional fragmentation grenade to a greater distance than it could be thrown. What makes this launcher different is its smaller size (20 mm), relatively flat trajectory, control-timed explosive and unique fragmentation pattern. The 20 mm grenade weight is a little less than 100 grams. When combined with state-of-the-art target acquisition and sighting capabilities, an ability to fire from cover, and an advanced digitized personal communication and locator capability, this weapon system will possess a very high target acquisition and kill probability within a 500 metre range. Notwithstanding the technical abilities of the system, it cannot simply be picked up and learned in a short period of time. As one American Sergeant stated, “when I initially started working with the Land Warrior system, I did have a little bit of difficulty engaging targets...it takes practice to start picking them up”.⁶²

The US Army is also developing a crew served light weapon system, called the Objective Crew Served Weapon or OCSW. According to the US Army Defense Technology Area Plan,⁶³

“The OCSW system will provide decisively violent and suppressive target effects, including a high probability of incapacitation against protected personnel (body armor and in defilade) out to 2,000 m and a high potential to damage light and lightly armored

⁶⁰ There is a fair amount of open information available on the OICW from both the developers of the system and the US Army. This is not the case for the French PAPOP being developed by Giat Industries. The following sources were used for OICW information: *Jane’s Infantry Weapons*; Market Brochures from AliantTechSystems courtesy of Heckler&Koch and various information brochures from the US Army Armament Research, Development and Engineering Center, Joint Service Small Arms Project. Also see US Defense Technology Area Plan at http://fas.org/spp/military/docops.defense/97_dtap/weapons/ch100303.for the operational equipment requirements for the new weapons systems being developed.

⁶¹ As quoted by Jim Caldwell, *Army News Service* (2 November 1998).

⁶² *Ibid.*

⁶³ See: http://www.fas.org/spp/military/docops/defense/97_datp/weapons/ch100303.htm

vehicles beyond 1,000 m. ...[It] will exploit lightweight, high-strength materials [, a] modular opto-electronic full solution fire control (leveraged from the OICW... program) [,] electronic time-set fusing [and] high-explosive air-bursting munitions. The OCSW will be a lightweight, two-man portable, single replacement weapon system for the current 40 mm MK19 Grenade Machine Gun and the Caliber .50 M2 Heavy Machine Gun. ...Technical challenges for the OCSW include efficient fragmentation, electronics miniaturization (fire control and fuze), systems integration, and overall system weight”.

The cost of the OICW is estimated at about US \$10,000 and the cost of the 20 mm grenade is approximately US \$30.⁶⁴ It is unlikely that this weapon system will be licensed for production elsewhere in the foreseeable future. Its unique 20 mm grenade ammunition, together with its built in digitized sighting and arming devices, cost and security concerns would seem to militate against this. Sales to close allies are possible and purchases by other potential customers could involve a slightly degraded capability export model, something not uncommon with military equipment exports. The cost of the OCSW could be two to four times as much as the OICW. It too is unlikely to be sold to states other than close allies. It should also be kept in mind that regardless of current developments there is no guarantee that the weapons in question will enter into operation as designed or in the numbers projected.⁶⁵ For example, the OICW could, for a number of reasons, become a single squad or fire section weapon not issued to all soldiers.

PAPOP (Polyarme Polyprojectiles) France

The PAPOP is essentially a French version of the OICW.⁶⁶ Like the OICW, this rifle is of a 5.56 x 45 mm caliber. The main difference between the two systems is that the grenade launcher on top of PAPOP is a 35 mm projectile. However, it is supported by a digitized state of the art individual support system similar to that of the American “Land Warrior”. A project with the acronym FELIN is developing a system of add-on modules (separate but compatible with PAPOP) that provide the soldier

⁶⁴ US Army Armament Research, Development and Engineering Center, Joint Service Small Arms *Project Information Paper: OICW* (8 May 1998).

⁶⁵ In the 1950s the US conducted \$30 million worth of R & D on a flechette and grenade-firing Special Purpose Individual Weapon (SPIW). Testing took place over 20 years, and involved various prototypes and contractors. The 10 grain serial flechette ammunition may have been the most lethal ever produced. For numerous reasons, many political, the SPIW was never produced. Source: <http://www.wva.com/~dvellex/future.html>

⁶⁶ There is very little information on the PAPOP. Primary sources were: Terry Gander, “PAPOP: the French OICW emerges,” *Jane’s International Defense Review*, p. 16; “France’s next century ‘soldier system’,” *Jane’s Defense Weekly* (10 June 1998), p. 11.

“with the ability to detect targets by day and night to a range of 300 m; identify friendly troops (IFF); use remote sighting to aim and fire from behind cover; designate targets; and transmit video data that is received on a helmeted mounted display”.⁶⁷

The PAPOP grenade system can be programmed at the instant of firing to optimize a lateral or frontal fragmentation pattern on the target area. The grenade weight is 200 grams. The weapon incorporates day and night sights, a laser range finder, and several digitized programmable features. The French believe that a 35 mm grenade is the minimum size required to meet their lethality requirements. It should be noted that while most high velocity, launch-fired spin stabilized grenades are 40 mm, the Russians have developed a 30 mm grenade with a round weight of 348 grams and grenade weight of 275 grams.⁶⁸

OTHER SALW DEVELOPMENTS

As in small arms, light weapons continue to evolve in terms of both effectiveness and lethality. A review of incremental improvements to existing systems together with new equipment (either in the R&D stage or in initial operational service) suggests changes similar to those experienced in the field of small arms. A few of these changes incorporate such variables as digitization, improved target acquisition and sights (all weather all light conditions), improved ammunition and/or warhead lethality, increased range, and ease of use. The following section examines some of the more significant systems relevant to the SALW arms control debate.

Anti-Materiel Rifles

While not a new system, the advent of new innovative ammunition types has renewed interest in this weapon. The term “anti-materiel” is a fairly new nomenclature for the rifle, which is, depending on its ammunition, a throwback to the .50 caliber long-range sniper rifle and various WW II anti-tank rifles. The name may appear somewhat disingenuous but new ammunition developments do make this a legitimate “anti-materiel” weapon. These rifles are generally long barreled bolt action or SLR of the 12.7 to 20 mm type mounted with appropriate sights and fired from the prone position using a bi-pod. They also come in a bullpup design. According to one source “these weapons are being adopted in greater numbers”.⁶⁹ According to Raufoss Technology of Switzerland, the development of the multi-purpose round

⁶⁷ “France’s next century ‘soldier system’,” *Jane’s Defense Weekly* (10 June 1998), p. 11.

⁶⁸ *Jane’s Infantry Weapons*, p. 566.

⁶⁹ Andrew Tillman, “Sniper Rifles: Maximum Havoc for Minimum Expenditure,” *International Defence Review* (12) 1993, p. 947. Also see Charles Cutshaw and Terry Gander, “Small Arms Heavyweights: The Growth of Anti-Materiel Rifles,” *Jane’s International Defence Review* (3) 1998, pp. 45-49.

“combines the properties of low sensitive incendiary and explosive charges. This creates a highly effective projectile with a state-of-the-art pyrotechnically initiated fuze and a reliable ignition train after target impact. This highly effective armour penetrating round features delay functioning, fragmentation, fire starting capabilities...”⁷⁰.

While clearly intended as an anti-materiel round, such ammunition could also be used against personnel: such action would however appear to be in violation of several rules of war.⁷¹ These weapons are essentially the “rifle” version of heavy machine guns or light cannons. Unlike machine guns, they are designed as a point and not an area weapon. Countries that manufacture anti-materiel rifles include, among others, Austria, Croatia, the Czech Republic, Finland, France, Hungary, Russia, Switzerland, South Africa and the United States.

Anti-Armour Weapons

These weapons range from hand-held individual weapons to crew-served ones mounted on ground vehicles and helicopters. Those weapons of SALW concern are the light anti-armour weapons, including such rocket propelled grenades (RPGs) as the Russian RPG 7 and 9 and the American M-72. As these systems have or are being replaced in many armies, it can be expected that states will attempt to dispose of older stocks. In the absence of a thoughtful export policy they could eventually end up in undesirable hands. Countries that manufacture light anti-armour weapons include, among others, Argentina, Austria, Brazil, Bulgaria, China, the Czech Republic, Egypt, Finland, France, Germany, India, Iraq, Iran, Israel, Italy, Japan, Pakistan, Poland, Russia, Slovakia, Singapore, South Africa, Spain, Sweden, Taiwan, the United Kingdom and the United States. A number of countries have also developed new systems.

Israel has developed a family of anti-armour missiles including the 2,500 metre range shoulder fired NT-Gill. The anti-armour systems are being developed through a consortium of various European countries in conjunction with Israel’s state owned Rafael Armament Development Authority. A number of European states, including Germany, may be potential customers.⁷²

Russia has continued to improve on its long line of RPGs with the production of the RPG-27 and RPG-29. Primary improvements have centered around the rocket and warhead and

⁷⁰ Advertisement claim by Raufoss Technology AS.

⁷¹ The problem is that any weapon designed as an anti-material weapon could be used against personnel, inadvertently (creating “collateral damage”) or otherwise. Anti-material weapons with potential use against personnel could be anti-armour weapons, anti-aircraft weapons and large caliber direct fire cannon, although their use in this regard would certainly not be “cost efficient”.

⁷² For details see: Christopher Foss, “Israel pitches AT missiles at Europe,” *Jane’s Defense Weekly* (2 September 1998), p. 12.

have involved tandem-shaped charges. Both the 27 and 29 are in production and are being offered for export.⁷³

The United States has also continued to improve on its venerable 66 mm M 72 light anti-armour weapon (LAW). This disposable tube launcher system has been enhanced over the years through a number of model improvements, and like the Russian equivalent, most of the improvements center around the rocket and the warhead in order to enhance range and armour piercing capability.⁷⁴

The United Kingdom is in the process of defining its next generation LAW requirements. It is looking at potential systems produced by several consortiums and contractors. Over 100,000 of its current LAW 80s were produced by Royal Ordnance for home and export markets.⁷⁵

Portable Surface-To-Air-Missiles (SAMs)

These too are being replaced and as is the case with anti-armour weapons the primary SALW concern should be the proper disposal of older stocks. Unlike small arms firing ball ammunition, these systems are not attractive to retain as war reserves because of the training required to use them and the generally finite shelf life of the propellant and/or warhead. Instead, resale is generally considered the more attractive option. The likelihood of manufacturing states ensuring more stringent export controls on these types of weapons are greater as such uncontrolled sales can come back to haunt the selling country – typically in the form of a threat against its own aircraft (in the context of a limited war or as a terrorist action). In this regard, developed countries have more to lose materially in the uncontrolled sale of such systems. According to Jane's, replacement sales for this type of weapon are constrained by cost and military downsizing.⁷⁶ Many of the replacement versions can launch multiple warheads and are capable of all-weather and night engagements. R&D is also taking place with regard to the development of hypervelocity missiles. A number of countries have developed such systems.

China has developed the QW-2 SAM, a portable shoulder fired fire-and-forget missile, with a passive infrared homing capability and an effective slant range of 6,000 metres, for home

⁷³ *Jane's Infantry*, p. 357.

⁷⁴ *Ibid*, 374

⁷⁵ For further details see: Christopher Foss, "UK set to choose anti-tank weapon," *Jane's Defense Weekly*, 7 Oct 98, 16

⁷⁶ Forward To *Jane's Land Based Air Defence 1998-99* (CD Rom Version).

and export.⁷⁷

Pakistan has developed the Anza Mk II, a system based on both Chinese and American technology.

Other countries producing these portable systems, including those actively seeking export markets, are Bulgaria, Denmark, Egypt, France, Germany, Japan, Poland, Romania, Russia, Ukraine, the USA, France and Sweden and the former Republic of Yugoslavia.

Remotely Controlled Weapons and Platforms

A combination of advances in technology, military downsizing, a desire to limit one's own troop casualties and constraints on certain weapons systems such as anti-personnel mines have encouraged the development of remotely controlled weapons and weapons platforms. Remotely piloted vehicles (RPVs) or drones have been in the inventories of the armed forces of several militarily advanced states for some years, and have been used primarily for tactical reconnaissance roles (including real time imaging). There has recently been a move to arm RPVs.⁷⁸ From a SALW perspective, such platforms should not be of much concern as they are expensive and require significant technical expertise to operate and maintain.

In the realm of remotely controlled or unmanned ground weapon systems the US Army is testing a remotely controlled robotic platform that can aim and fire weapons as basic as a rifle up to a heavy machine gun.⁷⁹ It can be operated by physical controls from a distance of up to 1,000 metres – and beyond, via a radio frequency link. The system uses a video camera with variable optics for sighting. As it is mechanically fired, human error through physical or mental lapses is reduced, thus making the weapon system more accurate. It is intended to be used as a platoon or section weapon. Its current cost is about US \$50,000. An interesting facet of the system is its use of lasers in order to warn someone approaching the weapon's field of fire. Among its many potential roles, it would be suitable for surveying gaps normally covered by anti-personnel minefields. This system is an excellent example of how countries with large military budgets can compensate for the tactical military disadvantages created by the Anti-Personnel (AP) Mine Ban Convention.

⁷⁷ For details see Christopher Foss, "New Chinese surface-to-air QW-2 system to enter production soon," *Jane's Defense Weekly* (23 September 1998), 15.

⁷⁸ The information on this system was taken from Damian Kemp, "USN advances on next generation of UAVs," *Jane's Defense Weekly* (21 October, 1998), p. 11.

⁷⁹ See George Seffers, "US Army to Test TRAP Remote Control Gun Platform," *Defense News* (29 June-5 July 1998), p. 25.

NON-LETHAL WEAPONS

As previously noted, non-lethal weapons⁸⁰ have been around for many years. Armies, particularly Western ones, have historically been reluctant to establish a non-deadly force capability. The reasons for this are many: psychological and technical conflicts in training; a reluctance to become involved in domestic security (the purview of the police); and the desire to emphasize that once the armed forces are involved the gloves are off and the rules of engagement have changed. However, in the past few years the potential military applicability of non-lethal weapons have been increasingly discussed. In 1997 and again in 1998 Jane's Information Group⁸¹ hosted a conference on the subject of non-lethal weapons; individuals from numerous organizations including a number of military officials were in attendance. Such topics as the use of non-lethal weapons in peacekeeping, military doctrine and non-lethal weapons, and various moral and ethical issues relevant to the use of such weapons were discussed. A NATO Defence Research conference also held a seminar on non-lethal weapons, during which the operational and technical aspects of this concept were examined, albeit mostly within the context of peacekeeping and peace support operations.⁸²

This increased attention has come about for a variety of reasons. The primary rationale for this development is the increased tendency in recent years for multinational or even unilateral intervention in an internal conflict situation where the warring parties are still engaged in hostile activities. In such cases, hostilities frequently take place within an environment which makes it difficult to separate combatants from non-combatants. In some cases, combatants may deliberately use civilians to thwart the efforts of peace enforcement and peacekeeping forces, either directly through the encouragement of hostile demonstrations using unarmed civilians or indirectly by using civilians as a cover or diversion for armed aggression. Mandated restrictive rules of engagement with regard to deadly force (the only force normally available to armies) frequently make it difficult for intervening forces to impose or otherwise create an atmosphere conducive to peacebuilding efforts. Furthermore, humanitarian concerns coupled with close media attention tends to constrain more aggressive approaches to enforcement – a situation that can certainly be taken advantage of by non-cooperative parties.⁸³

⁸⁰ Sometimes such things as electronic warfare and propaganda are included in the definition of non-lethal weapons. This synopsis will only deal with non-lethal weapons designed to physically restrain or otherwise affect the physical well being of a human target.

⁸¹ See advertisements in *Jane's International Defence Review* (1998).

⁸² NATO Review No 6 (November 1996), p. 18. According to a *Jane's New Brief* of 3 February 1999 France has reversed its long standing policy on denying non-lethal weapons to its Armed Forces. The source claims that France will now use them on peacekeeping missions and for deterring trespassing on defence installations.

⁸³ For a military perspective see: Martin N. Stanton (LCol), "Riot Control for the 1990s," *Infantry* (January-February 1996), pp. 22-29, and R.A. Dallaire (Mgen) and H.A. Culliton (Lt[N]), "Broadening the Spectrum of Response: Less-Lethal Weapons in Canadian Operational Deployments?" *Vanguard* 3(3), pp. 16-17.

There is another potential opportunity for the use of non-lethal weapons; this goes beyond peacekeeping and peace enforcement and falls instead within the realm of conventional combat operations. The use of certain systems to temporarily incapacitate troops for the purpose of rendering them incapable of either defending ground or mounting operations is seen in some areas as a realistic task for certain non-lethal weapons. These considerations are not indicative of any new effort to create a more "humane" way of winning battles: rather, they are being considered as a more efficient means to the desired end of prevailing in a combat situation. Furthermore, they do not rule out the simultaneous or subsequent use of lethal force. In fact, there is some evidence to indicate that during WW I such chemical weapons as chlorine gas were originally seen as a "non-lethal" means of creating gaps in enemy lines by forcing troops to withdraw from their defensive positions.

An analysis of the merits or limitations of non-lethal force in various situations will not be discussed here. There are numerous debates concerning this issue, not only among military doctrine specialists but also in the civilian arena where detractors and supporters can be found across the entire political spectrum.⁸⁴ The focus of this short synopsis will be on the potential for the diffusion and assimilation of these weapons on a global basis to both state and non-state actors together with what that might mean with regard to SALW issues.

Outside of the ethical and tactical concerns regarding the use of non-lethal weapons by authorities in general, of those non-lethal weapons now in common use, only one product – pepper spray – has created some controversy with regard to its use against non-state actors. Created either for civilian self defence (frequently intended for use by women) or, in the case of criminals, as a potential weapon to subdue a victim or aid in a theft, the use of this weapon has become a growing concern, primarily in developed countries. In many jurisdictions (Canada included) law enforcement agencies actively discourage the availability of pepper spray to the public and consider the use of such items on humans as equivalent to the use of a restricted weapon.⁸⁵ If the spray is labeled as "repellant" for use against attacking animals (such as dogs) it can sometimes be carried and used with reason on animals without proscription. Notwithstanding this, the use of pepper spray has not been a significant international issue to date. Its availability and use in less developed countries is currently a moot point considering the very real impact of SALW.

Also see F.M. Lorenz, "Non-Lethal Force: The Slippery Slope to War?" *Parameters* (Autumn 1996), pp. 52-62.

⁸⁴ This issue has seen an apparent alliance between individuals and organizations of both the political left and the right against the use of such weapons. For an extensive bibliography on non-lethal weapons from this perspective see <http://jya.com/stoa-bib.htm#Inno-a>

⁸⁵ See: Jake Rupert. "Pepper Spray New Weapons for Criminals," *Ottawa Citizen* (10 January 1999), p. A12.

The new advances in non-lethal weapons comprise both incremental improvements on current products and revolutionary developments towards the creation of new weapons. These new systems would not for the most part be suitable for use by groups other than state actors or very well-financed and organized non-state actors. They are technologically advanced, generally crew served, expensive and applicable only in unique situations. Most of the new developments are still in the R&D phase and have not been operationally deployed. According to the US Military "Joint Warfare DTOs for Military Operations in Urban Terrain (MOUT)":

"The Non-Lethal Weapons (NLW) Program will investigate and develop enhanced capabilities to deliver non-lethal products developed under the ongoing non-lethal weapons program. The main technology thrust of the NLW is to evaluate the ability to employ non-lethal weapons from standoff ranges in mid-intensity conflict and MOUT environments via unmanned aerial vehicles. Two delivery capabilities will be developed: a remotely activated payload door and a flare dispenser. The payload door system will be used to dispense irritant grenades and entanglements/barriers. Pyrotechnic irritant cartridges and acoustic whistles will be developed that can be remotely dispensed from a standard Navy flare dispenser. The program goal is to demonstrate the ability to clear civilians out of an area 75 x 30 m from a standoff distance measured in kilometers. The measure of success will be a circular area probable of 25 m from a distance of 25 km."⁸⁶

A less benign description of potential developments can be found in several critiques of such systems. One typical description states:

"They range from the ludicrous to the truly diabolical: low frequency noise (or "infra sound") that can cause uncontrollable nausea and defecation; soporific drugs wafted towards enemy lines; highly caustic chemicals able to eat through metals; polymers that clog up jet intakes; electromagnetic energy that can disable enemy weapons; sticky foam that immobilizes all those it comes in contact with; nets fired from canisters to immobilize both people and vehicles; laser rifles and other beam weapons that can temporarily or permanently blind troops or interfere with optical sensors on enemy weapons."⁸⁷

Another source states that "very low frequency electromagnetic radiation has been used to put test animals into a stupor or cause their brain cells to release histamines that would cause flu-like symptoms in a human."⁸⁸ Among the more conventional types of non-lethal weapons being developed for restraining or deterring unwanted activities are slickums and stickums to impede vehicle or foot traffic, movement-inhibiting foams and nets, and highly obnoxious

⁸⁶ See: http://www.fas.org/spp/military/docops/defense/97_datp/weapons/

⁸⁷ See Kathy Edges, "Killing Them Softly: Bizarre New Weapons Systems from the Pentagon's Black Budget," *Peacetime* (June 1994).

⁸⁸ *U.S. News & World Report* (7 June 1997).

sounds and smells capable of inducing immediate flight or temporary digestive distress.⁸⁹

Fortunately, from a SALW perspective, few of the non-lethal systems under R&D would have any real utility for non-state actors. It is difficult to visualize many scenarios where a perpetrator(s) would prefer a non-lethal weapon as opposed to a lethal weapon in most of the situations where SALW are problems⁹⁰. Secondly, some of these systems are untried and for many, suspect in their stated benefits. According to a Marine Corps source, “a few years ago the Marine Corps used sticky foam in their training videos for Somalia. Now sticky foam keeps rearing its ugly head. We used it to reinforce barriers, but that was where the benefits stopped. It has no other application. It has too many problems.”⁹¹ Notwithstanding this difficulty, the same article suggested that the Pentagon will place about 30 per cent of its non-lethal R&D budget on kinetic technologies (those weapons that pack a punch) and 25 per cent of the budget on acoustic weapons (those that produce painful or unpleasant audio frequencies). These are apparently classified as “crowd control tools.” One such kinetic item is the non-lethal claymore mine. The mine – preferred because of its universal recognition value – is stripped and rebuilt with rubber balls. Its recognisability generates deterrence. Should that deterrence fail, the impact of the balls is designed to disperse a crowd quickly and without bloodshed. Stingballs, malodorants, entanglements, electric taser-shockers, and dye-markers are also being explored. All allegedly offer non-lethal solutions to potentially deadly situations. The same source indicated that these solutions were preferable in the world where CNN shares the battlefield with the combatants.⁹²

A report on non-lethal technologies sponsored by the Council on Foreign Relations⁹³ cautiously supported the prospect of using such weapons but raised several concerns, one of which was the risk of proliferation. The Council noted that

“U.S. development of non-lethal weapons has already aroused and will continue to excite the interest of others, particularly since much military research and development is based

⁸⁹ Report of an Independent Task Force sponsored by the Council on Foreign Relations. See: <http://www.foreignrelations.org/studies/transcripts/taskfrc.htm>; and <http://hackvan.com/pub/stig/news/BAD:non-lethal-weapons-tech.htm>

⁹⁰ One example might be a group bent on kidnaping or raping – eg. an operation where the victims are desired alive. Another example could involve an activity aimed at seizing material while minimizing casualties for political reasons or to escape less severe penalties if caught. In all cases these activities could also be conducted using conventional SALW and would most probably be conducted with a mixture of non-lethal and lethal weapons, assuming both were available.

⁹¹ Jeffrey J Hinkle, “Weapons for Today’s World May Not Require Perfection,” *National Defense* (April 1998), p. 46-48. Available at <http://www.ndia.org/magazine/98Apr/nonleth.htm>.

⁹² *Ibid*, p. 47. For further details on conference and copies of all presentations see <http://www.ditc.mil/ndia/nld3>

⁹³ For details see <http://hackvan.com/pub/stig/news/BAD:non-lethal-weapons-tech.htm>

on mimicry. Moreover there is the risk that as second generation non-lethal weapons are developed, first generation weapons will gravitate into increasingly less responsible hands. No U.S. restraint, however, will guarantee against the development of weapons by others. Reports indicate that Russia, the United Kingdom, France, Italy, and Israel have developed or are developing significant non-lethal capabilities”.

It would seem that from a SALW issue perspective the potential impact of non-lethal weapons is at present not one of significant concern when contrasted with that of small arms. Non-lethal weapon development and acquisition should however be monitored to ensure that some easily available and inexpensive alternatives to small arms are not developed with a mind to circumventing present and future constraints on conventional SALW (thus enabling various groups or individuals to achieve their objectives as if they had used SALW). Of perhaps greater concern is the potential misuse of these weapons by authorities, particularly if they can influence a situation where subsequent events generate more fatalities than one might find if only SALW had been used. Of course, one will always have to deal with a situation where the outcome may be undesirable regardless of the weapon used. In such instances the central question becomes one of means versus ends. Is oppression with fewer physical casualties preferable to oppression with many physical casualties? Is a crime committed using a non-lethal weapon preferable to one where a lethal weapon is used?⁹⁴ If attempts to control the proliferation of SALW are seen primarily as an attempt to minimize or limit physical casualties (public health), does it follow that the development of non-lethal weapons is preferable relative to lethal weapons? As always when addressing the tools of violence only (in other words, the *means*), attention is often taken away from the initial reason for the violence (the *end*), which is the aim of coercing or eliminating a human obstacle by force. Whether this is done with a gun, pepper spray, machete, or baseball bat may not matter to the potential or real victims if the outcome is the same. That said, it is apparent that 10 people using cans of pepper spray or baseball bats against 100 unarmed people would probably inflict far fewer fatal casualties than one or two individuals indiscriminately using an assault rifle. However, in a one-on-one situation the outcome may be somewhat less predictable.

DIRECTED ENERGY WEAPONS (DEW)

Most research on DEW has centered on space-based systems for ballistic missile defense, including the destruction of satellites.⁹⁵ DEW R&D has focused on lasers, high-power

⁹⁴ The problem with such explanations is that there is no way of knowing whether or not the criminal would have used a gun, baseball bat, or knife to commit the crime if pepper spray were not available, or even if he/she would have committed the crime to begin with. This is another area that may be ripe for study.

⁹⁵ See N.A. *Jane's Information Group Ltd* (9) 1 May 1997, p. 305.

microwaves and, to a lesser extent, on charged particle beam weapons.⁹⁶ In simple terms, DEW excite and direct subatomic particles or electromagnetic radiation so that they hit a target at or near the speed of light. Unlike kinetic energy weapons, there is no firing signature. With the exception of lasers, there has been no significant research into this form of weapon within the anti-personnel context.

Outside of strategic DEW, these systems are being examined within the context of conventional hostilities (conflicts not involving weapons of mass destruction). The program statement of requirements for the ABCA armies (the United States, the United Kingdom, Canada and Australia) contains a clear reference to the need to “achieve common critical procedures for the employment of directed energy weapons”.⁹⁷ There are several other references to American R&D work in the area of these systems.⁹⁸ Such R&D does not necessarily mean that DEW are being developed as anti-personnel weapons. Instead, it appears that they are being considered (for the most part) as anti-material weapons. Still, like anti-material rifles, they remain potential anti-personnel weapons, given the possibility for accidental or deliberate “collateral damage” during their use.

As previously mentioned, by far the most prevalent uses for lasers on the battlefield are those of target designation, range finding, fire control and surveillance. These activities can involve all types of SALW. This ancillary equipment is not designed for use as a weapon, but in certain circumstances it can cause temporary or even permanent blindness, either directly or through spectral reflection. The danger of these systems is amply outlined in US Military Handbook – 828 para 30.1: it states that “...fire control lasers require control measures to prevent permanent blindness to an unprotected individual viewing the laser system from within the laser beam...”. There are laser safety filters on many combat laser fire control systems but these are often designed only for the wavelength that the fire control system emits. The severity of the damage to the eye is a product of the laser wave length and its energy. The damage can be increased many-fold if one is looking through an optical sight at the instance of exposure. Furthermore, injury will be worse if the eye is hit at night rather than during the day.

In general, there are four levels of blindness created by lasers. In order of seriousness they are: glare, flash blindness, thermal lesions and hemorrhagic lesions. Normally, people suffering from glare or moderate flash blindness will recover their vision over several days.

⁹⁶ For a simplified overview see: Bill Hillaby, “Directed Energy Weapons Development and Potential,” http://www.sfu.ca/~dann/nn4-3_12.htm

⁹⁷ See: serial B4d http://www.abca-armies-program.org/PPAAs/fire_support.htm

⁹⁸ See: Sebastian Gorka and Richard Sullivan “The Laser Threat on the 21st Century Battlefield”, *Jane’s Intelligence Review* 10(2), February, 1998, p. 45. Also see US official plans – Defense Technology Area Plan Chapter X – Weapons which states requirements and time frames for developing laser and high-power microwave systems, at: http://www.fas.org/spp/military/docops/defense/97_datp/weapons/

Other forms of damage tend to be permanent. It is one thing for trained soldiers to suffer blindness where countermeasures, medical procedures and knowledge of what happened may mitigate the impact of the wounding. It is something else for civilians not trained to identify what may or has happened. Damage is compounded when no medical treatment is available and where eye problems already exist – a situation which may be considered the norm in many developing countries. It should be noted that blinding as an incidental or collateral effect of the legitimate employment of laser beams on the battlefield is not covered by the CCW Prohibition on Blinding Lasers. In some circumstances, it may be difficult to determine if these systems are being deliberately employed for the purpose of blinding. According to one source, the Iranian military suffered over 4,000 documented eye casualties from Iraqi laser systems during the Iran/Iraq war, something which suggested a strong probability that some laser systems were being specifically used to inflict eye casualties⁹⁹. In a controversial case involving a pilot in the Canadian Armed Forces, a Russian cargo vessel overflown by a Canadian helicopter allegedly used a laser gun of unknown characteristics to injure the eyes of both the pilot and an accompanying US Navy Lieutenant.¹⁰⁰ Laser blindness, deliberate or otherwise, will be a concern for all during future conflicts, particularly as new generation systems are developed and counter-countermeasures are introduced.

There are very few examples of specifically designed anti-personnel laser weapons. The Chinese are the only identifiable state that has openly marketed an offensive anti-personnel laser – the ZM-87 (capable of flash blinding out to 10 kilometres).¹⁰¹ The United States seems to be straddling the fence. According to some, the U.S. is re-designating or retooling certain systems as dazzlers. Two articles refer to the Sabre 203, a device mounted on an M-16 rifle and capable of interfering with vision out to a range of 300 metres. Another device is a Laser Countermeasure System capable of blinding out to one kilometre.¹⁰² Whether these are true anti-material weapons developed to neutralize optical sights or whether they are designed simply to incapacitate the users of those sights may be difficult to answer. The US Stingray is a combat protection system designed to enhance survivability against enemy optical devices. It uses a laser to prevent enemy personnel from employing battlefield optics by threatening potential eye injury to anyone using such a system at the time of the Stingray's deployment. It is a scout platoon level system for use by battalion commanders.¹⁰³

⁹⁹ See: http://fas.org/spp/military/docops.defense/97_dtap/weapons/ch100303

¹⁰⁰ For details see Gary Dimmock, "Military Refuses to Believe Laser Injured Pilot," *Ottawa Citizen* (Tuesday, 17 November 1998), p. A5., and Gorka, "Assuming the Offensive," p. 44.

¹⁰¹ Gorka, "Assuming the Offensive", p. 44; Hillaby, "Directed Energy Weapons," p. 2.

¹⁰² See: Gorka, "Assuming the Offensive", p. 45 and Vincent Kiernan. "Dazzling vs. Blinding Laser Weapons: The Debate is On," *Optoelectronics World* (October 1998), at <http://www.lfw/archive/1998/101/10wr.html>

¹⁰³ See: http://fas.org/spp/military/docops.defense/97_dtap/weapons/ch100303

In an October 1998 Report¹⁰⁴, Human Rights Watch (HRW) questioned the apparent American development of dazzling as opposed to blinding lasers. They have also criticized the potential dual-use aspects of some target location and aiming lasers¹⁰⁵, and have queried the marketing of some of these systems to law enforcement agencies.

In one of their studies on lasers as weapons¹⁰⁶ (carried out in the early 1990s), the ICRC concluded that if production of anti-personnel lasers in industrial countries proceeds on a large scale, these weapons can be expected to become widely available. The fact that they are small, light and require no ammunition will make low-energy laser weapons attractive to insurgency movements, terrorists and criminal organizations. They are silent, the beam is invisible and it leaves no ballistic evidence. While their worst fears have apparently not yet materialized, the ICRC report underestimated the degree to which the technology in question had already diffused throughout the world, to the degree that many countries (including some less developed countries) are now capable of producing such weapons.

High energy laser weapons are being developed for air defence. The Tactical High Energy Laser (THEL) is a joint USA Israeli development for use against short range missiles.

“The THEL low-cost per kill (about \$3,000) will also provide a cost-effective defense against low-cost air threats. It features up to 60 shots without reloading and a P(k) near 1 at ranges of some 5 km. A joint US – Israeli program has been initiated to develop a THEL demonstrator using deuterium fluoride chemical laser technologies... THEL conducted test firing in FY1998, and Initial Operational Capability (IOC) was planned in FY1999.”¹⁰⁷

While such high energy laser weapon systems are clearly designed as anti-material weapons, it is unclear as to what effect their use might have on humans that fall within their energy beams. As well, like weapons such as the German 88 mm anti-aircraft gun of WW II, there is no apparent reason why they might not have their role changed to a ground based anti-material or even an anti-personnel weapon (although whether the weapon would have to be modified to do so is unknown). While clearly not an SALW problem, these issues do raise concerns regarding potential misuse and/or unintended collateral personnel casualties. While there is yet no evidence of the development of lethal anti-personnel lasers (lasers powerful

¹⁰⁴ See: <http://www.lfc.com/ifw/archive/1998/10/10wr.html> for details

¹⁰⁵ According to a Department of National Defence official, the Canadian Forces are establishing requirements for “eye safe lasers” for future laser target acquisition and RF procurement. *Conversation* 16 March 1999.

¹⁰⁶ See: Kieman at <http://www.icrc.org/unicc/icrnews> for details.

¹⁰⁷ See: http://fas.org/spp/military/docops.defense/97_dtap/weapons/ch100303. See also: <http://www.trw.com/seg/sats/THEL.htm>

enough to burn a hole through flesh) such systems may not be out of the question given the potential for future technological breakthroughs. It behooves the international community to address this possibility sooner rather than later. Interest groups should continue to ensure that due publicity is given to any R&D on such weapons with all its attendant concerns.

ADDITIONAL ISSUES AND CONCERNS

Special Weapons and Tactical Police Teams

The movement on the part of many armies towards acquiring more effective small arms is being imitated by police forces and various other domestic security organizations. At one time most police forces were equipped only with handguns, together with a few shotguns and rifles stored in police arsenals for special situations. Today many police force arsenals rival those of the military in terms of quality, given the former's efforts to procure the best possible small arms and ammunition. Moreover, manufacturers now design and market their products with this new market in mind. As mentioned earlier, the P 90 sub-machine gun and its ammunition are both actively marketed to law enforcement agencies, and a number of police forces in Europe are already using them. Many police forces, including Canadian ones, currently use the M-16A1 and the H&K MP-5N 9 mm SMG – a small arm used by the US Marine Corps for FIBUA operations.¹⁰⁸ The merits of police forces, border guards and other law enforcement and security agencies being armed to the extent that they can deploy units approaching the armament levels of a modern infantry platoon are various.¹⁰⁹ There is however one aspect of the diffusion of SALW which must be considered: the greater the diffusion, the more possibilities exist that these weapons and/or their ammunition will fall into the wrong hands and/or be misused. If the police use of such weapons is deemed legitimate by the domestic population but the state's ability to provide personal security to its citizens is considered inadequate, there may develop a concomitant pressure within the domestic population for individuals to arm themselves with similar weapons. Furthermore, considering the similarity of ammunition wound effects within both the domestic and international contexts, it may be time to revisit the concept of "unnecessary suffering and superfluous wounds".

¹⁰⁸ See: <http://www.hqmc.usmc.mil/factfile>

¹⁰⁹ See: Kenneth Whyte, "Keystone Killers," *National Post* (Monday, January 11, 1999), p. A14. This article notes the alarming increase in the use of heavily armed Canadian police emergency and tactical response units in so-called day to day policing. It also notes an apparent commensurate increase in civilian fatalities, with a number of victims unarmed at the time of the incident (events involving, for example, individuals who were mentally incoherent at the time or who were wrongly identified). These problems are not necessarily a SALW issue, except perhaps from a psychological perspective.

Commercial Lasers

The use of military lasers (including ancillary laser sighting and targeting equipment for small arms and fire arms) is clearly an issue of concern: however, the misuse of laser equipment not originally designed to create casualties (for the purpose of creating casualties) must also be considered. In Trail, British Columbia, a motorist suffered eye injuries from a laser light that was shone into his rear view mirror from a vehicle traveling to the rear. The laser tool in question was a laser pointer designed for use in the classroom and for highlighting presentations from overhead projectors.¹¹⁰ Governments and manufacturers will have to deal with this issue. Several US municipalities have already banned the use of laser pointers.

Technology Diffusion

As can be seen in Annexes C and D, small arms and light weapons manufacturing activities are not limited to Europe and North America. Near-state-of-the-art-manufacturing is being carried out in a number of countries throughout the world. A similar situation applies to laser technology and other non-lethal weapons systems. Considering improvements in and the proliferation of micro-chip and dual use machinery technology, together with an ability on the part of an increasing number of groups to program manufacturing machinery using CD-ROM and other technologies, the potential for the diffusion of capabilities increases significantly. There are several aspects of SALW diffusion which, if not recognized, have the potential to undermine efforts at future solutions. First, if it is assumed that the South is where the demand and victims exist and that the North is the source of supply, then there is significant potential for a North/South split and a polarization on views concerning this issue. Second, the same split may encourage denials on both sides – in the North that they too are victims, and in the South that they are also responsible for the situation (including the production, acquisition and supply of SALW). It is imperative that solutions focus on all manufacturing states and all supplier states.¹¹¹ If solutions are sought on the basis of the North acting as the suppliers and the South as the users, then the best that will happen is a short-term disruption in supplies and a potential for an even greater diffusion of production. All parties must see themselves as both part of the problem and the solution. The issue of the ease of diffusion of SALW must also be kept in mind with regard to embargoes, as they have often inadvertently contributed to diffusion by encouraging states to become self-sufficient. This can also happen with new technologies.

¹¹⁰ "Laser Shot Hurts Driver," *National Post* (2 January 1999), p. A4.

¹¹¹ It is important to note that any state that owns SALW, whether manufactured there or not, is a potential supplier state.

OBSERVATIONS AND RECOMMENDATIONS

There are a number of possibilities for ameliorating some of the concerns raised above with regard to developing and/or potential trends involving SALW. In some cases, the mechanisms are already in place. All that is required is the political will which will allow officials to more rigorously implement existing regulations, codes and declarations. Almost all of the SALW discussed in this paper are sold only to governments or their agents. If they become part of the SALW problem, governments will thus be primarily responsible. With regard to new ammunition, now is the time to proscribe their commercial non-government sale where appropriate or perhaps even to ban their production and/or acquisition outright to select state or non-state actors. Most new weapons are not cheap when compared with the older used models now circulating in the millions. However today's new small arm is tomorrow's used one. The use of synthetics versus expensive machined steel in the construction of new weapons makes them comparatively cheaper to manufacture than older models constructed through similar assembly process. In some cases, it may not be possible to realistically achieve anything until we possess a clearer picture of what is unfolding and what impact, if any, these developments have on stated SALW concerns. In other instances, it may be time to look more closely at the "rules of war", together with constraints or proscriptions on certain ammunition, be they kinetic, chemical or directed energy. What follows is a summary of observations and recommendations concerning the facts and issues raised in this paper.

Destruction of Older Inventories

It is apparent that the next generation of small arms and light weapons are already starting to enter the inventories of many states. This has the potential to once again encourage the diffusion of the SALW being replaced to other states and non-state actors in a cascading effect through arms dealers and state-to-state sales and transfers. In order to control the potential for a undesirable pattern of excessive accumulation and/or dispersal of these weapons (something which in turn could contribute to national, regional and global instability), consideration should be given to encouraging declarations (preferably agreements) that any acquisitions of new SALW to replace existing items be offset by the destruction of older equivalent items under international supervision, observation or any other appropriate accounting procedure.

This suggestion is perhaps more easy to introduce now than ever before, considering the world-wide downsizing of most military forces throughout the world. It can be applied to all states, SALW producers and non-producers alike. Its implementation can be voluntary or form the basis of a formal agreement negotiated at a national, regional or global level. It can involve cooperation between both the supplier and recipient countries and could place equal responsibility on both parties in this regard. It could encompass a situation where concerned supplier states could offer incentives to buyer states to cooperate in the implementation of such an agreement (See Box 1). Finally, it could assist in addressing two problems identified in the UN Panel paper – theft from storage facilities, and the dispersal and diffusion of weapons

resulting from downsizing (or, as discussed above, the upgrading or replacement of current holdings of SALW).

This is an area where SALW manufacturers may be more than willing to cooperate, possibly through such forms of financial and resource assistance as discounts for destruction of older stocks and destruction assistance or recycling (possibly involving government tax incentives). The destruction of replaced weapons not only limits diffusion but ensures that manufacturers are not competing with cheaper used products. This is certainly not an altruistic approach to the issue. Still, as these weapons are taken out of the global market, there is more likelihood that in the future new and more advanced weapons would be both subject to tighter controls and beyond the financial means of some undesirable would-be users.¹¹²

¹¹² For details on destruction, see: David DeClerq, *Destroying Small Arms and Light Weapons: Survey of Methods and Practical Guide* Report 13 (Bonn, BICC, 1999).

Box 1

Illustrative Examples

Country A wishes to replace sidearms for its police force to standardize and upgrade its current holdings. It needs 10,000 side arms of a certain type. Country B agrees to sell the firearms at a discount if country A will destroy the 10,000 sidearms that are being replaced. Both countries agree, the firearms are sold and distributed, and the old firearms are collected in a central location. Under observation by the selling country and a neutral third party the firearms are counted by all parties. These parties then witness the destruction of these weapons.

Country C produces its own firearms and reequips its army with new automatic rifles and light machine guns. It does not want to destroy the weapons that are being replaced as they will be used to replace weapons in its para military, internal security forces and border forces. Instead it decides to destroy the weapons that are being replaced by the used military weapons. It manufactures and replaces the weapons in question, collects the old para-military weapons and invites a neutral organization or party to count them and witness their destruction.

Country D purchases new small arms for its army (regular and reserve). It wishes to replace its war reserve mobilization stocks with the small arms being replaced. It gives notice of its intention to do so at the (UN/OSCE/OAS/OAU) and invites member states to witness the destruction of the old war reserve mobilization stocks.

Country E, not a manufacturing state, wishes to sell unneeded war reserves of SALW to country F. Country F agrees to destroy 50% of the equivalent number of old stock as it is modernizing its forces and is therefore increasing its level of armaments. Both countries notify the (UN/OSCE/OAS/OAU) and provide appropriate documentation regarding the sale and destruction of equipment.

In all examples significant numbers of firearms are being destroyed; where they are not, an appropriate explanation follows. The destruction of these weapons ensures that they will not find their way into illegal or destabilizing hands. In one case an incentive of a discount is offered to induce voluntary acceptance: in the other situations these actions are entirely voluntary.

Updating Treaties, Agreements, Codes of Conduct Domestic Laws and Export/Import Regulations

With regard to limiting or otherwise constraining the undesirable flow of these weapons, there are at present numerous means in effect by which to achieve those ends. The EU Code of Conduct, various UN Declarations, the Inter-American Convention Against the Illicit Manufacturing and Trafficking In Firearms, Ammunition, Explosives and Other Related Materials, the OAS "Model Regulations for the Control of the International Movement of Firearms, Their Parts and Components and Ammunition" and the export/import control system of many states all provide the necessary tools to restrain or prevent the diffusion of these weapons into areas where their use may be suspect or where adequate controls are not in effect. However, political will is often the primary ingredient lacking in efforts to ensure that these mechanisms actually work. In some cases, there may be a requirement to update legislation, and create the declaratory and treaty language capable of taking into consideration such items as caseless ammunition, non-lethal chemicals and directed energy systems. Bringing various agreements, conventions, declarations and particularly import/export controls up to date with reference to non-lethal weapons and DEW will be a critical step in the control of SALW proliferation, particularly as legislative changes sometimes tends to be slow.

Transparency

There are numerous references in the academic literature to the need for increased transparency together with other related policy initiatives.¹¹³ This study adds little to these discussions. However, given the difficulties inherent in finding an agreement on registering or otherwise accounting for current SALW inventories on a broad basis (both by state and type/numbers), it might be more fruitful to begin by accounting only for new unique types of SALW as they enter inventories. Examples might be SALW using new types of ammunition, such as the H&K G 11, or unique weapons, such as the US OICW and the French PAPOP. These measures would clearly be more in line with the reasons for transparency in the first place, as they would warn states of new acquisitions which might have an impact on stability and/or could serve to flag potential sources of used SALW which might subsequently be sold or transferred to areas of instability.

The Rules of War and Arms Control Agreements

It seems apparent that some of the issues concerning SALW might also be addressed within the context of the rules of war. This approach could be particularly useful with regard to SALW ammunition (including non-lethal ammunition) and DEW. Present technological developments would appear to mitigate for such a review. One might note that at present it is

¹¹³ For a background and ideas on transparency see: Canada, DFAIT, *An International Register of Small Arms and Light Weapons: Issues and Model* (Ottawa, October 1998).

easier to determine what ammunition may indeed “be deemed to be excessively injurious or to have indiscriminate effects and/or to cause superfluous injury or unnecessary suffering,”: another view would suggest that new developments in ammunition – conventional lethal and non-lethal, as well as DEW – would seem to demand such a review. It appears that some of the constraints on the use of weapons established in the 19th and early 20th centuries may for various reasons be outdated, unenforceable, impractical and even hypocritical today. On the other hand, there are factors which limit the possibility of successfully developing new or updated “rules of war” or other “humanitarian rules” within the context of addressing the proliferation challenges posed by modern SALW. One such challenge is that of establishing a common definition.¹¹⁴ Just what kind of weapon is considered superfluous, excessively injurious or to have indiscriminate effects? Another challenge will be involving 185 countries in this process – or at the very least, the 60 to 100 SALW-producing states. Obtaining consensus within such a diverse, political, geographic and cultural environment will be much more difficult than obtaining consensus within the essentially euro-centric agreements of the late 19th and early 20th century. Another issue complicating matters further is that most wars fought in the last twenty years have been civil or internal conflicts where international law has carried little to no weight.¹¹⁵ This trend towards internal conflicts and informal wars needs to be addressed within the context of “rules of war.” Attempts to date have appeared to accomplish little outside of lofty phrases. States must address the question of why rules regarding the use of ammunition in international wars are different from those established for domestic conflict. It is not clear why ammunition deemed to cause unnecessary suffering in international conflict is considered acceptable for domestic policing. The rationale for using or not using such ammunition frequently cuts both ways. The international and domestic application of rules should be rationalized and harmonized where possible. It is time to move forward on these issues, particularly as new types of ammunition (lethal and non-lethal) and new types of weapons (ie. DEW) are now undergoing R&D or entering the inventories of law enforcement agencies and/or military organizations. There are several fora where this may be addressed. They include the review conference for The Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to Have Indiscriminate Effects, the International Institute of Humanitarian Law and the ICRC.

New SALW Trend Dichotomies

Unlike landmines, artillery shells, mortar shells and iron bombs, small arms are very discriminate weapons. In the hands of responsible and well-trained individuals they should only

¹¹⁴ The ICRC has attempted to address this in its SIRUS project. For details see <http://www.icrc.org/unicc/icrcnews>.

¹¹⁵ Protocol 2 to Geneva Convention IV relating to the protection of victims of non-international armed conflicts certainly addresses many of these issues. To date, notwithstanding attempts to apply these rules to Rwanda and the Balkans, there have been few attempts and limited success in prosecuting accused violators. The establishment of an international court to try war crimes is one small step to addressing this issue.

create casualties where and when intended. Their proper use should create very few collateral casualties. New developments are making small arms and their ammunition more efficient and thus more discriminate in their effect. This does not, however, mean there will be fewer casualties. SALW, like all weapons, are merely inanimate objects – it is the person operating the weapon who is ultimately responsible for the damage created. New and very discriminate SALW in the hands of indiscriminate users have the potential to effectively create more casualties than their predecessors. With few exceptions, these weapons are by and large easier for all to use – be they men, women or youths. There is little to suggest that the weapons entering military and law enforcement inventories or presently under R & D require any more control than those which they are replacing, assuming appropriate controls already exist. The problem remains by and large the huge inventories of older SALW that are already beyond the purview of responsible governments or are being circulated by irresponsible state and non-state actors.

Global Resolution

While regional and local initiatives to SALW issues are welcome and indeed probably easier to obtain agreement on and implement, a global approach is preferable for a number of reasons. Without the involvement of major manufacturing states on all continents, supply constrained from one area may simply shift to another region. There is no question that the majority of SALW circulating in areas of recent and current conflict originated in Europe and North America. State subsidies, economies of scale, productivity and the geo-politics of the day gave NATO countries and former Warsaw Pact states a decided advantage in the production of such weapons and the wherewithal to distribute them. Enhanced controls that attempt to deny (or have the potential to deny) SALW to states and groups outside of Europe and North America may encourage states from the Middle East, Asia, Latin America and Africa to fill the void through production increases in those countries already in possession of such a capability, shift production from current states to new states, or encourage states that do not produce SALW to begin manufacturing. Western developed states cannot solve this issue by themselves.

As a final note to SALW issues both current and future, attempts to address the symptoms without considering the causes may only serve to check or mutate the disease and not cure it. It appears that the brutal Lord's Resistance Army is anticipating a world free of SALW. According to Ayebare Adonia, a journalist with the *East African Newspaper*,

“LRA fighters are quietly collecting spears from the villages in anticipation of the ‘silent world’...when this new era arrives all guns in the world will fall silent. Only those who know how to fight with stones, machetes and spears will be victorious”¹¹⁶

¹¹⁶ Ayebare Adonia, “Bullets Puncture Faith of Ugandan Rebels,” *Ottawa Citizen* (18 October 1998), p. F8.

Without a holistic approach which also addresses conflict origins, SALW controls by themselves may disrupt or moderate the means to the outcome and have only a limited impact on the outcome itself.

ANNEX A

**EXTRACTS OF CCW AND PROTOCOLS
RELEVANT TO SALW WEAPONS OR MUNITIONS**

**Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons
Which May be Deemed to be Excessively Injurious or to Have Indiscriminate Effects,
Geneva, 10 October 1980.**

“...the principle of international law that the right of the parties to an armed conflict to choose methods or means of warfare is not unlimited, and on the principle that prohibits the employment in armed conflicts of weapons, projectiles and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering....”

“... Reaffirming ' the need to continue the codification and progressive development of the rules of international law applicable in armed conflict,
' Wishing ' to prohibit or restrict further the use of certain conventional weapons and believing that the positive results achieved in this area may facilitate the main talks on disarmament with a view to putting an end to the production, stockpiling and proliferation of such weapons,....
' Further bearing in mind ' that the Committee on Disarmament may decide to consider the question of adopting further measures to prohibit or restrict the use of certain conventional weapons,....”

“....Have agreed as follows:.... Expressions of consent to be bound by any of the Protocols annexed to this Convention shall be optional for each State, provided that at the time of the deposit of its instrument of ratification, acceptance or approval of this Convention or of accession thereto, that State shall notify the Depositary of its consent to be bound by any two or more of these Protocols.... At any time after the entry into force of this Convention any High Contracting Party may propose amendments to this Convention or any annexed Protocol by which it is bound....”

“.... Any High Contracting Party may denounce this Convention or any of its annexed Protocols by so notifying the Depositary....”

Protocol on Non-Detectable Fragments (Protocol I), Geneva, 10 October 1980.

It is prohibited to use any weapon the primary effect of which is to injure by fragments which in the human body escape detection by X-rays.

Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices (Protocol II), Geneva, 10 October 1980

This protocol has been largely superseded, by the AP Mine Ban Treaty of 1997, at least for those who signed it. It deals with issues separate from the context of SALW as discussed in this study.

Protocol on Prohibitions or Restrictions on the Use of Incendiary Weapons (Protocol III), Geneva, 10 October 1980.

1. "Incendiary weapon" means any weapon or munition which is primarily designed to set fire to objects or to cause burn injury to persons through the action of flame, heat, or combination thereof, produced by a chemical reaction of a substance delivered on the target. (a) Incendiary weapons can take the form of, for example, flame throwers, fougasses, shells, rockets, grenades, mines, bombs and other containers of incendiary substances.

(b) Incendiary weapons do not include:

(i) Munitions which may have incidental incendiary effects, such as illuminants, tracers, smoke or signalling systems;

(ii) Munitions designed to combine penetration, blast or fragmentation effects with an additional incendiary effect, such as armour-piercing projectiles, fragmentation shells, explosive bombs and similar combined-effects munitions in which the incendiary effect is not specifically designed to cause burn injury to persons, but to be used against military objectives, such as armoured vehicles, aircraft and installations or facilities.

Resolution on Small-Calibre Weapon Systems, Geneva, 28 September 1979.

"... Recalling United Nations General Assembly resolution 32/152 of 19 December 1977, Aware of the continuous development of small-calibre weapon systems (i.e., arms and projectiles),

'Anxious' to prevent an unnecessary increase of the injurious effects of such weapon systems, 'Recalling' the agreement embodied in The Hague Declaration of 29 July 1899, to abstain, in international armed conflict, from the use of bullets which expand or flatten easily in the human body,

'Convinced' that it is desirable to establish accurately the wounding effects of current and new generations of small calibre weapon systems including the various parameters that affect the energy transfer and the wounding mechanism of such systems,

1. 'Takes note' with appreciation of the intensive research carried out nationally and internationally in the area of wound ballistics, in particular relating to small-calibre weapon systems, as documented during the Conference;

2. 'Considers' that this research and the international discussion on the subject has led to an increased understanding of the wounding effects of small-calibre weapon systems and of the parameters involved;
3. 'Believes' that such research, including testing of small-calibre weapon systems, should be continued with a view to developing standardized assessment methodology relative to ballistic parameters and medical effects of such systems;
4. 'Invites' Governments to carry out further research, jointly or individually on the wounding effects of small-calibre weapon systems and to communicate, where possible, their findings and conclusions;
5. 'Welcomes' the announcement that an international scientific symposium on wound ballistics will be held in Gothenburg, Sweden, in late 1980 or in 1981, and hopes that the results of the symposium will be made available to the United Nations Disarmament Commission, the Committee on Disarmament and other interested fora;
6. 'Appeals' to all Governments to exercise the utmost care in the development of small-calibre weapon systems, so as to avoid an unnecessary escalation of the injurious effects of such systems.

Protocol On Blinding LASERS

Article 1

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

Article 2

It is prohibited to (produce and) employ laser weapons primarily designed to blind permanently

Article 3

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

ANNEX B

Photography of Various Small Arms

For details on characteristics see Annex C



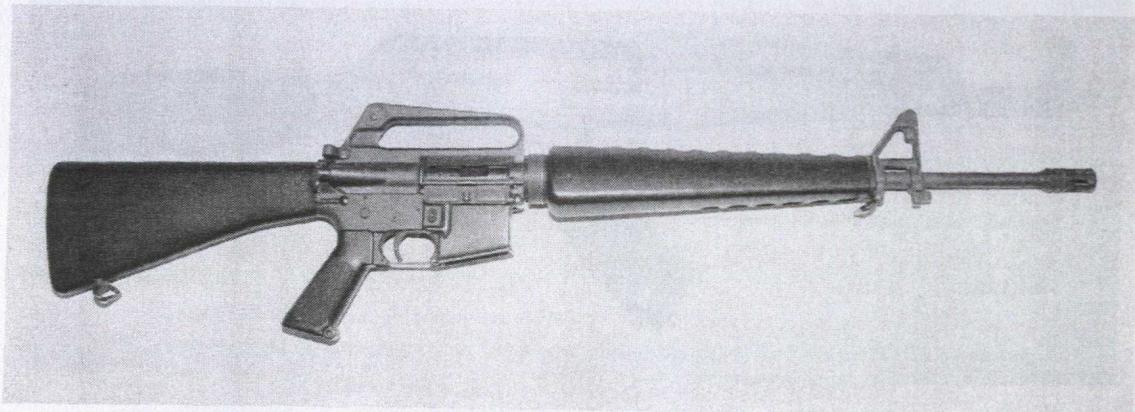
.303 in Lee Enfield Mark 1*
Made In Canada 1941
Picture Courtesy RCMP Forensics Ottawa



7.62 x 39 mm AK - 47 Made in the USSR 1953
Picture Courtesy RCMP Forensics Ottawa



7.62 mm FN L1A1
Made In Australia
Picture Courtesy RCMP Forensics Ottawa



5.56 mm Colt M16A1
Made In USA
Picture Courtesy RCMP Forensics Ottawa



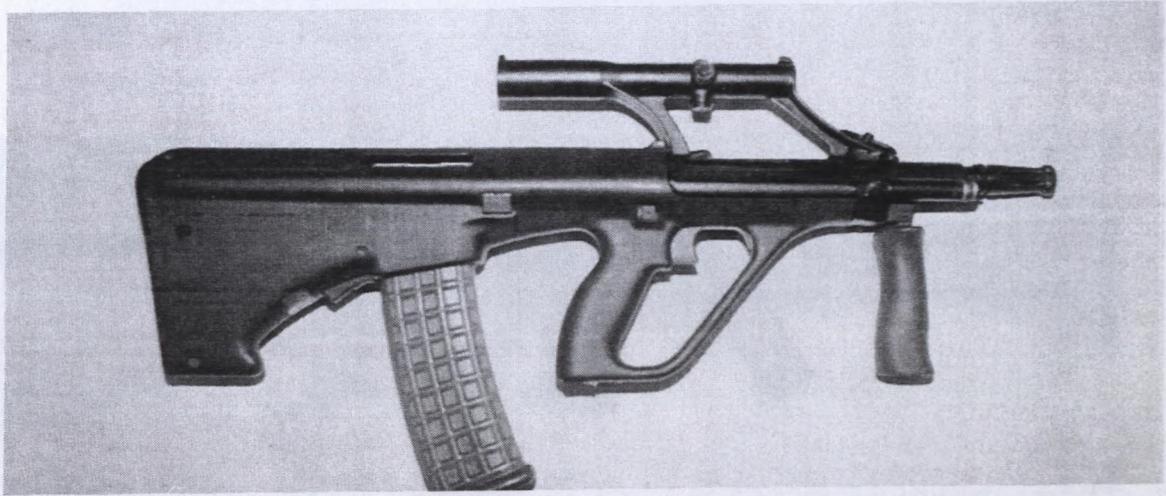
7.62 mm H&K G 3
Made In Germany

Picture Courtesy H&K Inc. Sterling Virginia



5.56 mm H&K G 36
Made In Germany

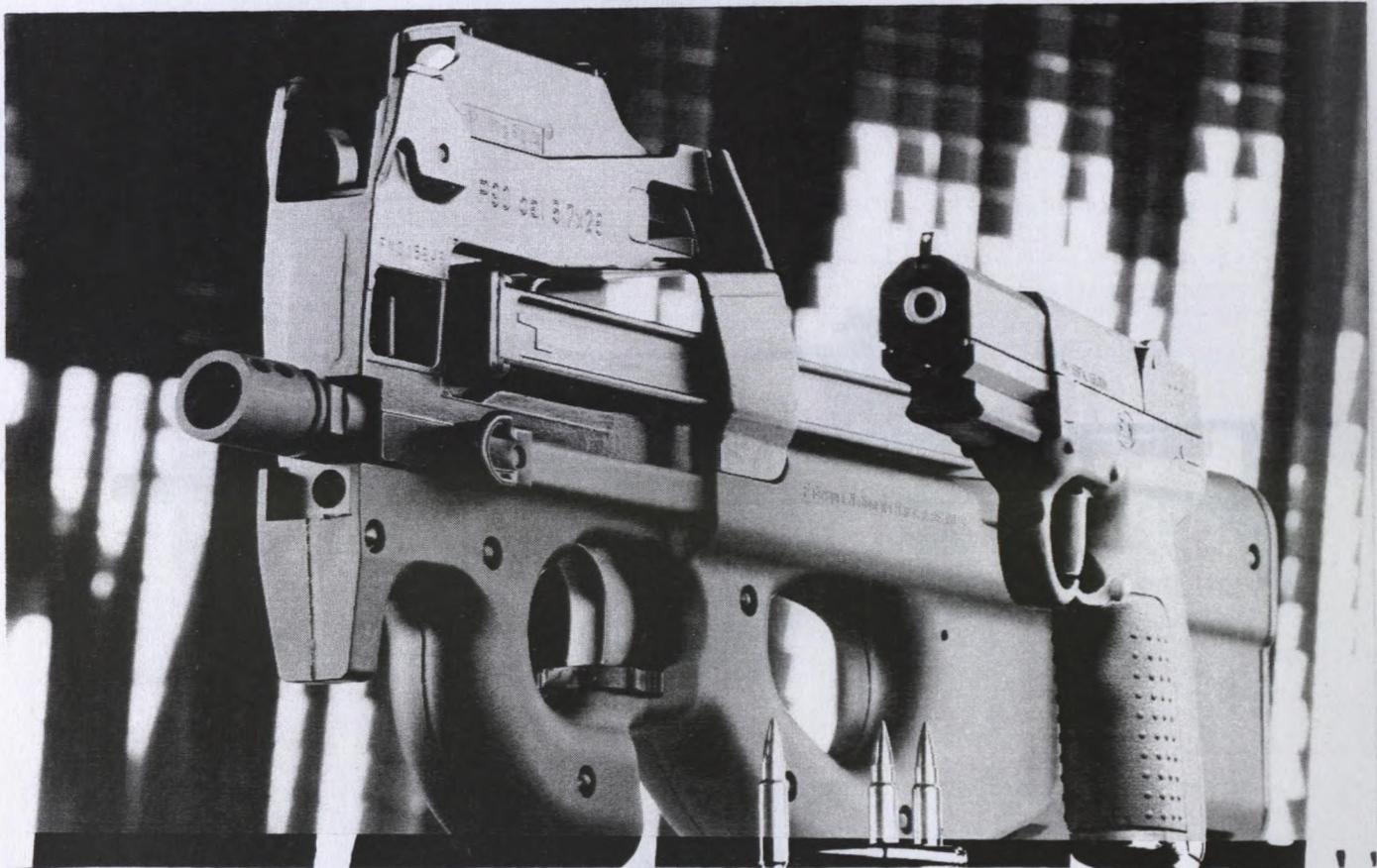
Picture Courtesy H&K Inc. Sterling, Virginia



5.56 mm AUG Steyr-Mannlicher GES.MBA

Made In Austria

Picture Courtesy RCMP Forensics Ottawa



5.7 x 28 mm FN Herstal P 90 SMG

Made In Belgium

Picture Courtesy FN Herstal

ANNEX C

Comparative Small Arms Characteristics - Old and New

Ⓢ indicates actual or approximate photo at Annex B.

Type/Model Caliber	Magazine Capacity	Cyclic RPM/Burst	Weight Length	Sights-Not all listed	In-Service and/or seeking export
Israel Military Industries Tavor Bullpup 5.56 mm	30		3.5 kg 72 cm	Red dot Laser RF	Likely seeking export market.
South Africa Vektor CR21 (bullpup) 5.56 mm	20 or 35	600 to 750	3.8 kg 76 cm	Reflex Optical	Likely seeking export market.
H&K SA 80 (UK) bullpup 5.56 mm	30	610 /770	4.98 kg L 75 cm	Optical	British Army 1985
H&K G 36 foldingⓈ stock 5.56 mm	30 100 LMG	750	3.3 kg	3.5 Optical Red dot	German special units
H&K G 11/ ACR variant 4.73 mm caseless	45 x 3	600/2200	4.3 kg L 75 cm	Various sights	Has not gone into production
China NORINCO bullpup Type 97 5.56mm	30	650	3.35 kg E 75 cm	Various	Seeking export market.
Steyr F88 bullpupⓈ 5.56 mm	30	680/850	3.6 kg E 79 cm	Optic 1.5	Austrian and Australian Army
FAMAS bullpup 5.56 mm	25	900-1000	3.6 kg E 76 cm	Variable	French Army 1980s. Exported to Africa & ME
Russian AN-94 5.45 mm	30	600/1800	3.85 kg E 94 cm	iron diopter	Likely seeking export market.
FN P 90 bullpup SMGⓈ 5.7 mm	50	900	3 kg F 50 cm	optical low-light	Possibly Saudi Arabia
Older Type Models	Many In	Less	Developed	Countries	
AK-47 Ⓢ 7.62 mm	30	600	4.8 kg 87 cm	iron U- notch	Ubiquitous 1950s onward
M 16Ⓢ 5.56 mm	20 & 30	700-950	3.1 kg E 99 cm	Flip Aperture	Ubiquitous 1960s onward
FN FAL many variantsⓈ 7.62 mm	20	600-700	4.45 kg E 109 cm	Sliding	Ubiquitous 90 countries 1950s onward
H&K G 3Ⓢ 7.62 mm	20	600	4.4 kg E 102 cm	rotary rear diopter	Ubiquitous 1960s onward
Lee Enfield various UKⓈ .303 in	10	15 RPM bolt action	3.91 kg 113 cm	iron U- notch	1890s to 1950s UK & Commonwealth

ANNEX D

SALW MANUFACTURING STATES

The countries noted below have been listed in various Jane's publications as having recently produced some types of SALW for their domestic market and/or for export. Those states that appear to be significant SALW producers and/or appear to be actively seeking export markets for SALW are indicated in **bold**.¹¹⁷ A state that is actively seeking exports may not necessarily be a large producer. There are numerous additional states not listed that manufacture, have manufactured, probably manufacture or are capable of manufacturing some or all types of SALW and ammunition.¹¹⁸

Argentina, Armenia, Austria, Australia, Belgium, Brazil, Bulgaria, Canada, China, Chile, Croatia, Czech Republic, Egypt, France, Finland, Germany, Greece, Hungary, India, Indonesia, Iran, Iraq, Israel, Italy, Japan, Kazakhstan, Netherlands, New Zealand, North Korea, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, Singapore, Slovakia, Spain, South Africa, South Korea, Sweden, Switzerland, Taiwan, Turkey, UK, USA, Yugoslavia (Serbia Montenegro).

The point of this admittedly incomplete list of some 50 countries is to indicate the geographic and political diversity of the manufacturing states. Any attempt to constrain the international spread of SALW exclusively within the context of an euro-centric agreement would probably enjoy only short term success. Without a significant number of major SALW manufacturing states from Asia, Africa and Latin America on board, international agreements alone will unlikely achieve anything more than a short- to mid-term disruption in supply for those actors seeking to acquire SALW. Furthermore, without a general global agreement, some SALW manufacturers and exporters in compliant states may believe that they are subject to unfair competition and a loss of markets, something which might then encourage a shift in production through various means to certain non-compliant states.

¹¹⁷ The listing and the indication of significant producer and/or active exporter is somewhat subjective. It is quite possible that a few states not in bold deserve to be highlighted over and above some that have been so indicated.

¹¹⁸ For a comprehensive listing of states that produce ammunition see: Canada, Department of Foreign Affairs and International Trade, with the assistance of David DeClerq, *The Role of Ammunition Controls in Addressing Excessive and Destabilizing Accumulations of Small Arms* (April 1998). DeClerq establishes that at least 70, probably 80 and possibly 100 countries are producing small arms ammunition.

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Whyte, Kenneth. "Keystone Killers." *National Post* (Monday, January 11, 1999), p. A14.

Internet Web Sites

Directed Energy Weapons

- http://www.sfu.ca/~dann/nn4-3_12.htm
- http://www.abca-armies-program.org/PPAAs/fire_support.htm
- <http://www.lfw/archive/1998/10/10wr.html>
- http://www.fas.org/spp/military/docops/defense/97_datp/weapons/
- <http://www.lfc.com/ifw/archive/1998/10/10wr.html>
- <http://www.icrc.org/unicc/icrnews>
- <http://www.trw.com/seg/sats/THEL.htm>

Non-Lethal Weapons

- <http://jya.com/stoa-bib.htm#Inno-a>
- <http://www.foreignrelations.org/studies/transcripts/taskfrc.htm>
- <http://hackvan.com/pub/stig/news/BAD:non-lethal-weapons-tech.htm>
- <http://www.ditc.mil/ndia/nld3>

SALW control issues

- Preparatory Committee for A Global Campaign on Small Arms and Light Weapons – <http://www.prepcom.org>
- Bonn International Conversion Centre – <http://bicc.uni-bonn>
- British American Security Information Council (BASIC) – <http://www.basicint.org>

- British American Security Information Council (BASIC) – <http://www.basicint.org>
- Bulletin of Atomic Scientists – <http://www.bullatomsci.org/issues/1996/so96>
- United Nations – <http://www.un.org/Depts/dpko>
– <http://www.peacenet.org/disarm/dt.html>

SALW Controls (export/import)

- <http://www.dfait-maeci.gc.ca/eicb/cdaep-e.htm>
- <http://www.nrcan.gc.ca/mns/explosif>

SALW Developments

- http://www.fas.org/spp/military/docops/defense/97_dtap/weapons/ch_100303.htm
- <http://www.bushmaster.com/catalog/bullpup.html>
- <http://www.sksman.com/aku/aku94>
- http://members.xoom.com/russian_arms
- <http://www.remtek.com/arms>
- <http://www.bushmaster.com/catalog/scopesmounts.html>
- <http://www.hqmc.usmc.mil/factfile>

SALW History and Definitions (ammunition)

- <http://www.wva.com/~dvelleux/future.html>

Treaties, Declarations and Agreements

- <http://www.lib.byu.edu/~rdh/ww1/hague>
- <http://elsinore.cis.yale.edu/lawweb/avalon>
- <http://jya.com/wa/waml.htm>
- <http://www1.umn.edu/humanrts/instree>

Wound ballistics

- <http://medstat.med.utah.edu/WebPath/TUTORIAL/GUNS/GUNBLST.html>

Correspondence and Interviews

Robert Anglin, a former Canadian Army officer who was responsible for army small arms requirements, a small arms collector, and a graduate of the UK Army Technical Staff College specializing in small arms. Technical consultation phone and written correspondence.

Staff Sergeant Michael Johnson, Ottawa Carleton Police Tactical Unit. Technical discussions on police tactical weapons and use of non-lethal agents (10 February 1999).

Jim Schatz, Heckler & Koch, Inc. Sterling Virginia. Printed and graphic material. Written response to questions (7 December 1998).

Murray Smith, RCMP Forensics Chief Scientist. Technical advice and permission to photograph RCMP small arms collection (25 January 1999).

Paul W. Tweedale, FN Herstal Representative Canada. Printed and graphic material. Written and verbal response to questions. Facilitated hands-on firing of FN P 90 SMG and the Five-seven pistol (26 January 1999).

Department of National Defence. Several experts (law, technical, scientific, operational requirements, policy and doctrine) were interviewed and/or provided comment on the contents of this paper. For various reasons anonymity is preferred.

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