Bearing a bandolier filled with hundreds of bullets, an Iraqi Kurdish soldier stands at a checkpoint along a road to Kirkuk, northern Iraq, in March 2003. (© Abdullah Zaheeruddin/Getty Images)

Rounding out the Gun:
AMMUNITION

1

INTRODUCTION

In 1996–97, mutinous soldiers from the Central African Republic (CAR) supplemented their arsenal by seizing weapons from members of the armed forces, gendarmerie, and police of Zaire as they crossed the border. Many of the armaments seized, such as Galil and M-16 automatic rifles, proved to be of little value, though, because the corresponding ammunition, 5.56 mm cartridges, was almost impossible to obtain in CAR. Having no use for these otherwise perfectly functioning weapons, the soldiers threw them into the Ubangi River (Berman, 2005).

This example underscores the crucial point that, without ammunition, small arms and light weapons are useless. Weapons and ammunition are complementary goods: an increase in the demand for weapons results in an increase in demand for ammunition, and their prices shift accordingly. In many instances, the procurement of ammunition can be more problematic than that of weapons: while weapons are durable goods, which can be used for many years in several areas of conflict, ammunition is quickly depleted and stocks must be replenished.

Despite its critical role in conflict, ammunition has so far been neglected in the arms control debate. In 1999, the UN Group of Experts on the problem of ammunition and explosives acknowledged this fact and stated that ‘attempts to address small arms and light weapons would be incomplete if they did not include due regard for ammunition and explosives. Ammunition and explosives controls cannot be the sole remedy, but left unaddressed, they could represent a serious flaw and a missed opportunity’ (UNGA, 1999, sec. 11, pp. 4–5).

The sheer scale of ammunition stocks underscores this observation. In the Russian Federation, 140 million rounds of ammunition have reportedly been designated for destruction between 2002 and 2005, and this is only the tip of the iceberg (Faltas and Chrobok, 2004, p. 109). Ukraine estimates it stocks around 2.5 million tonnes of ammunition, Belarus some 97,000 tonnes, and Kazakhstan and Uzbekistan a further 90,000 tonnes. The case is similar in south-eastern Europe. Albania, Bosnia and Herzegovina, and Bulgaria alone are believed to stock some 400,000 tonnes of ammunition (Greene, Holt, and Wilkinson, 2005, p. 14).[1] This is to say nothing of the rest of the world.

‘Ammunition’ encapsulates numerous items, ranging from small-calibre cartridges to mortar rounds or rocket-propelled grenades. For the purpose of this short chapter, we will focus on small arms ammunition. The UN definition of small arms includes revolvers and self-loading pistols, rifles and carbines, assault rifles, and sub-machine and light machine guns (UNGA, 1997, p. 11). Small arms ammunition encompasses cartridges for handguns and rifles, shotgun shells,[2] and their components.

Because they are complementary, small arms and ammunition present a number of similar problems. Ammunition regulation is a complex matter because, as with small arms, there are legal and illicit users; ammunition produced for legitimate purposes may end up being transferred to conflict zones or misused by some individuals.

Ammunition also raises a host of specific questions, including:

- How widespread is ammunition production, and what technological developments are associated with it?
- What impact does ammunition availability have on conflict?

- How have issues regarding the production, supply, and control of ammunition been addressed at the national, regional, and international levels?
- Can the regulation of ammunition have an effect on the misuse of small arms?

The main findings of this chapter are as follows:

- Although less copious than their small arms counterparts, ammunition producers are present in all regions of the world; many countries want to be self-reliant and develop their own production facilities.
- The military ammunition cottage industry is less widespread than that of firearms. In some cases, guns are craft-produced to fit the type of ammunition that can be found on the market.
- The type and quantity of ammunition available to an armed group influences its choice of weaponry to a great extent.
- Ammunition issues are not adequately addressed in regional aor global agreements, nor through legal instruments.
- Improved ammunition controls can help identify illicit cases of shipping and stockpiling, smuggling routes, and individuals or groups engaging in acts of weapons misuse.

CHARACTERISTICS OF CARTRIDGES AND SHOTGUN SHELLS

As noted above, small arms ammunition comprises cartridges for handguns and rifles, and shells for shotguns. Cartridges and shells consist of four main components: the primer (explosive); the propellant (powder); the projectile; and the case (see Figure 1.1).

- **Primer.** Primers are initiating explosives and belong in the high-explosive category (like dynamite and TNT); they are very sensitive to shock or heat and can detonate if subjected to either.
- **Propellant (powder).** At the end of the 19th century, black powder (a mixture of nitrate, charcoal, and sulphur) was replaced by smokeless powder, still in use today. Smokeless powder can be single-base (when nitrocellulose is the only explosive) or double-base (if it also contains nitroglycerin in addition to nitrocellulose) (Saferstein, 1995, p. 334; FAS, 2004).
- **Projectile.** Depending on the intended use, different types of bullets can be manufactured: ball (the most common); armour-piercing (with a harder core); tracer (containing a chemical in the base that leaves a trace of light along the bullet's trajectory); incendiary (containing a chemical that ignites on striking); and ranging or spotter (containing a chemical that produces a flash on striking). Bullets can be ogival or cylindrical in shape, and the nose of the bullet can be round, half-flattened ('semi-wadcutter'), or flattened ('wadcutter'). A bullet can be either fully jacketed (that is, entirely covered in a harder metal) or not.
- **Case.** The cartridge casing contains the primer, the propellant, and the projectile; it is the only component that can be reused. Cases have a heat-absorbing property that protects the bore of the gun during shooting.

Shotgun shells have a plastic body ('tube') that holds the primer, powder, and shot. Shot pellets held in a wad serve as projectiles for shotguns, although other types of projectiles can also be used, such as flechette rounds.

Figure 1.1 Schematic representations of a cartridge and a shotgun shell

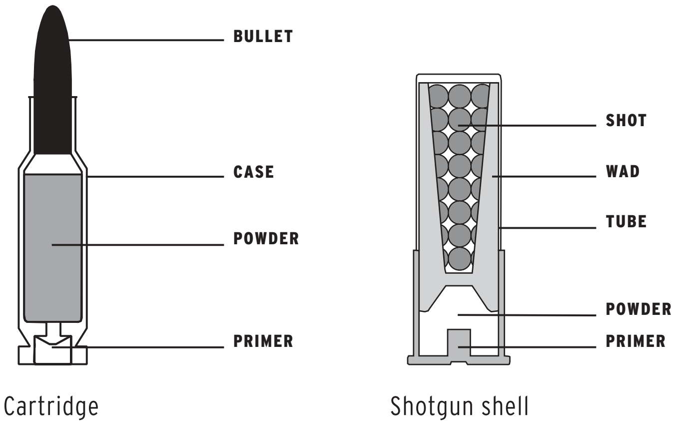

Illustration: James Bevan

Box 1.1 Counting cartridges

With regard to stockpiles, an estimated All Up Weight (that is, the weight of ammunition and packaging) is the most relevant variable for planners assessing transportation needs and the best means of disposal. For regular stockpiles, the quantity of cartridges can be deduced from their overall weight: since sealed boxes are assumed to be full, the packaging statistics (dimensions, weight when full, and the number of rounds in a box) can be used to calculate the total number of rounds stored.

When ammunition is seized, the quantity is generally expressed in terms of the number of cartridges. Production figures are expressed in terms of the number of cartridges produced per day. An average eight-ton truckload can contain close to 750,000 5.45 x 39 mm ball cartridges, which weigh approximately 10.75 grams per round (Cutshaw and Ness, 2004, p. 4). The calibre and the type of metal or alloy of which ammunition is made help to determine its weight, which can vary considerably.

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An Antioquia Police officer stands guard before ammunition seized during a raid on the Revolutionary Armed Forces of Colombia (FARC) in January 2004 in Medellín, Colombia.

Ammunition is defined in terms of calibre. The calibre measures the diameter of the gun's barrel and is expressed in hundredths or thousandths of an inch (for instance, .22 or .357) or in millimetres (for example, 9 mm). Cartridges with the same calibre can differ according to the length of the case (such as 7.62 x 39 mm, 7.62 x 51 mm, or 7.62 x 63 mm). One explanation for the large number of cartridge types currently in existence is that many countries used to set their own standards for their military weapons (including 7.5 mm French, 7.5 mm Swiss, and .303 British round). In recent years, many of the new weapons that have been produced have been manufactured to

Table 1.1 An overview of some common types of cartridges

Calibre in millimetres and inches	Other names	Types of weapon	Examples of weapon
5.45 x 39 mm	5.45 mm Kalashnikov/ Russian; 5.45 x 39 mm Soviet	Sub-carbines, assault rifles, light machine guns	AK-74 (Russian Federation)
5.56 x 45 mm 0.223	5.56 mm NATO; 0.223 Armalite/Remington	Rifles, machine guns, carbines	FN FNC, FN Minimi (Belgium), Heckler & Koch G41 and G-36 (Germany), Galil (Israel), Beretta AS 70/90 (Italy), Vektor R4 (South Africa), Enfield L85A1 (UK), AR15/M16 (US)
7.62 x 39 mm	7.62 mm M43/Kalashnikov/ Obr 43 g; 7.62 x 39 mm Soviet	Carbines, rifles, light machine guns, machine guns	Chinese Type 56 carbine and, assault rifle and Chinese Type 68 rifle (China); Kalashnikov AK-47 and AKM and Simonov SKS (Russian Federation), Zastava M70B1 (former Yugoslavia)
7.62 x 51 mm 0.308 Winchester	7.62 mm NATO	Rifles, machine guns	FN FAL (Belgium), Heckler & Koch G3, PSG1, and MSG90 (Germany), M14 Rifle (US)
7.62 x 63 mm 0.30-06 Springfield	0.30 US Service/Browning	Bolt action rifles, semi-automatic rifles, machine guns	Browning M1919A4 (US)
9 x 17 mm 0.380 auto	9 mm Browning short/ Kurz/Corto; 0.380 ACP	Mainly pistols	Taurus PT 52 S (Brazil)
9 x 18 mm Makarov	9 x 18 mm Soviet; 9 mm PM Stechkin/Type 59	Pistols, sub-machine guns	Makarov and Stechkin pistols (Russian Federation)
9 x 19 mm Parabellum	9 mm Luger/Patrone '08	Pistols, revolvers, semi-automatic carbines (it is the world's predominant sub-machine gun cartridge)	Glock 17 (Austria), Browning High Power Model 1935 (Belgium), Uzi (Israel), Beretta Models 92 and 93R (Italy), some SIG pistols (Switzerland)
0.357 Magnum	0.357 Smith & Wesson Magnum	Revolvers	Manurhin MR73 (France), Desert Eagle (Israel), Colt Python, Colt King Cobra, and Ruger GP100 (US)
0.45 ACP	0.45 Auto Colt/ Automatic; 11.43 x 23 mm Norwegian Colt	Pistols, revolvers, carbines, sub-machine guns	Colt M1911/M1911A1 and Smith & Wesson 625 (US)
12.7 x 99 mm 0.50 Browning		Machine guns, anti-matériel rifles	Barrett 0.50 models and Browning M2HB .50 (US)
12.7 x 108 mm	12.7 x 107 mm; 12.7 Russian Federation machine gun; 12.7 mm DShK/Type 54	Machine guns, heavy machine guns, and anti-matériel rifles	Type 77 (China), 12.7 mm Gepard M2 and MA1 (Hungary)

Note: Bold text signifies the most commonly used names.
Sources: Hogg (2002); Cutshaw and Ness (2004); Jones and Cutshaw (2004)

North Atlantic Treaty Organisation (NATO) standards (5.56 x 45 mm and 7.62 x 51 mm). All weapons produced in the former Soviet bloc, as well as in countries such as China and North Korea, however, continue to apply their own standards (see Table 1.1).

The diameter of a shotgun barrel is expressed in terms of gauge. The higher the value of the gauge, the smaller the diameter of the barrel; for instance, a 12-gauge shotgun has a larger bore diameter than a 16-gauge shotgun (0.730 versus 0.670 inches) (Saferstein, 1995, p. 446).

PRODUCTION

Industrial production

Most ammunition manufacturers could be more accurately described as assembly plants, producing only a few components themselves and subcontracting the manufacture of the rest of the cartridge or shell to other companies (see Box 1.2). Ammunition manufacturers then assemble the complete round. On a worldwide scale, there are more bullet producers than case producers, more case producers than powder producers, and more powder producers than primer producers (Stohl, 1998, p. 9).

Box 1.2 Rationalizing ammunition production

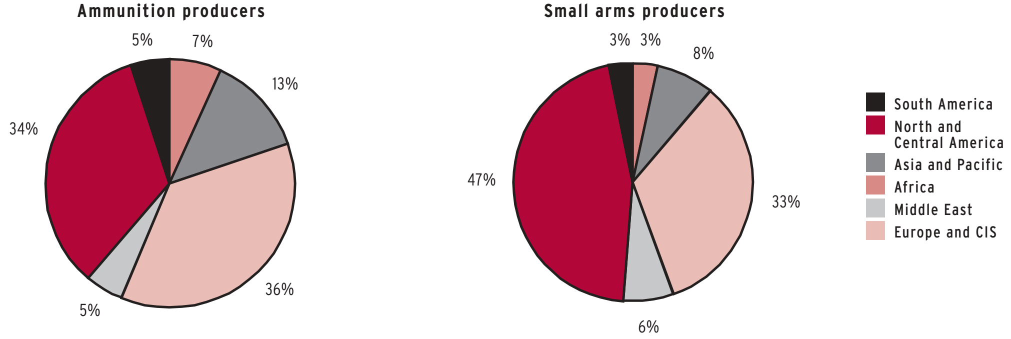
RUAG Ammotec (Germany and Switzerland) is equipped to manufacture all necessary components except propellant; yet, for certain types of ammunition, the company subcontracts work to other firms, especially when only small quantities are needed. RUAG Ammotec itself produces high-quality, leaded and unleaded (that is, environmentally friendly) primers. The company produces most of its bullets and casings in-house, except when small quantities are needed (fewer than 10,000 units per year) or specific types for which it is not worthwhile investing in relevant equipment.[3]

The companies that produce weapons are generally not the same ones that make ammunition (PRODUCTION). The two processes need different raw materials and machinery, and utilize different marketing techniques (UNGA, 1999, sec. 24, p. 6). Most ammunition producers specialize in certain types of products: a number of South African companies, for instance, focus on 'big game' hunting. Ammunition plants also have very different equipment requirements; some still use machinery that dates back to the Second World War, while others use new Computer Numeric Control (CNC) methods to mass produce high-quality ammunition. The latter allow the manufacturer to switch quickly from one type and calibre of ammunition to another (UNGA, 1999, sec. 19, p. 6).

Many countries have sought to develop their own production capacity in order to be self-reliant. Some, such as Iran, Pakistan, and South Africa, started producing ammunition in response to the imposition of embargoes, before looking for export markets (DeClerq, 1998). Small-calibre (no larger than 12.7 mm) ammunition production is widespread (encompassing 76 countries), but uneven (Omega Foundation, 2003). Major differences exist between regions, and the geographical distribution of ammunition producers is quite similar to that of small arms producers (see Figure 1.2).

The UN Group of Experts on the problem of ammunition and explosives noted that a number of countries are reluctant to provide information on the amount of ammunition that they produce annually or the number of plants that they have on their territory (UNGA, 1999, sec. 22, p. 6). Developing countries willing to undertake local production often work under licence from major companies; in a number of instances, these technology transfers have raised concerns about who the final end-users are, especially when the recipients are located near conflict zones (see Box 1.3). This is the case with the Eldoret ammunition factory in Kenya, the construction of which was completed in 1996 by FN-Herstal (Belgium) and which produces 20,000–60,000 cartridges per day (Kamenju, 2001; Kwayera, 2003) for the armed forces, police, and wildlife services of Kenya. Concerns about the possible dissemination of Kenya-made cartridges to surrounding conflict areas are mitigated by the fact that Eldoret does not produce the 7.62 x 39 mm cartridges that would fit an AK-47, the most common conflict gun in the region (Kamenju, 2001).

Figure 1.2 Distribution of total ammunition and small arms producers by region



Note: Small arms comprise pistols, revolvers, rifles, carbines, sub-machine guns, and light and heavy machine guns, while ammunition consists of all calibres equal to or less than 12.7 mm.

Source: Omega Foundation (2003)

Box 1.3 Licensed production: New Lachaussée in Tanzania

In 2003, New Lachaussée—which is part of the Forrest Group run by George Forrest, whose activities in the mining sector of the Democratic Republic of Congo (DRC) elicited concern in 2002 from a UN Group of Experts (UNSC, 2002)—was scheduled to build an ammunition production facility in Mwanza, Tanzania, close to Lake Victoria. The company, based in Liège, Belgium, would deliver and supervise an ammunition production line, as well as provide local training and technical assistance (Chambre des Représentants de Belgique, 2004). Belgium's national export credit agency, Ducroire, supported the project by awarding New Lachaussée with insurance cover worth USD 10.6 million for a total investment value of EUR 11 million (approximately USD 13.3 million) (Africa Confidential, 2004).

A number of NGOs launched a campaign to protest the sale of military material to Tanzania by New Lachaussée. The purpose was to block the transaction and licence. The Belgian project was attacked on three main grounds. First, it allegedly contravened the fourth and seventh criteria of the 1998 *European Union (EU) Code of Conduct on Arms Exports* (now part of Belgian law), according to which arms should not be exported to countries where they could threaten regional stability, and where there is a risk of diversion (GRIP, 2004). On several occasions, Tanzania has reportedly served as a country of transit for weapons bound for conflicts in the region (HRW, 1999; GRIP, 2004).

Second, it breached international guidelines for export credit agencies, according to which countries should avoid 'unproductive expenditures' towards Heavily Indebted Poor Countries (HIPCs), which include Tanzania. Such expenditures are defined as 'transactions that are not consistent with these countries' poverty reduction and debt sustainability strategies and do not contribute to their social and/or economic development' (OECD, 2001).

Third, it blatantly contradicted Belgium's proclaimed commitment to restoring peace in the Great Lakes Region, especially in Burundi and the Democratic Republic of Congo (GRIP, 2004). The Belgian Law of 26 March 2003 states that exports must be consistent with Belgium's foreign policy interests and objectives (Chambre des Représentants de Belgique, 2004; GRIP, 2004).

The case sparked an important debate in Belgium, particularly in the lower house of parliament in early 2004 (Chambre des Représentants de Belgique, 2004), and before the Minister-President of the Walloon Government, Jean-Claude Van Cauwenberghe. On 11 February 2004, the licence was denied on the grounds that an export licence for ammunition production risked exacerbating the problem of small arms proliferation and disrupting the peace process in the region (Bayet, 2004).

A reversal occurred on 17 Feburary 2005, when the foreign relations minister for the Walloon government, Marie-Dominique Simonet, decided to grant the export licence to New Lachaussée because of what she deemed a gradually improving situation in Tanzania. She nevertheless attached a number of conditions to the authorization. Notably, the old Tanzanian chain of production is to be dismantled, and the new one is to produce ammunition with a distinctive marking that should enable its tracing—and hopefully prevent diversion to conflict zones. Despite these reassurances, the granting of this licence to New Lachaussée is still feeding a heated debate, both at the Walloon and the federal governing levels (*Le Soir*, 2005; RTBF, 2005).

Handloading and craft production

Ammunition can also be produced on a small scale. Some people make their own ammunition by assembling the different components themselves (see Box 1.4). Known as handloading or reloading (because the same case can be used several times), this activity is considered a hobby with its aficionados, dedicated Web sites and training manuals, and monthly columns in gun magazines. In the United States, most of the different ammunition components (including powder and primer) can be easily bought at local stores,[4] and companies that produce reloading equipment, parts, and accessories have formed a National Reloading Manufacturers Association. While this mode of production is usually cheaper, it is also likely to be less reliable, due to the lack of quality control and varying skill levels among craftsmen. The volume of ammunition produced through handloading is extremely low compared to industrial production (UNGA, 1999, sec. 18, p. 5). Only simple lead-based projectiles can be manufactured at home with the proper materials and skills: jacketed and other complex projectiles have to be purchased new (Gebhardt, 2004). Consequently, most handloaders in the United States and in other developed countries do not routinely handload common military rounds (Gebhardt, 2004).

In addition to the different components of a cartridge (case, primer, propellant, and projectile), the basic elements needed for handloading are proper tools and data. Tools include a 'press' and a selection of dies that are specific to the calibre of the cartridge being reloaded. Data handbooks, sometimes published by the manufacturers themselves, specify how much of a particular type of propellant should be used in order to ensure optimum and safe performance of the finished product. All of these elements can be purchased in most gun stores. The cases can be simply picked up off the ground and cleaned for reuse, rather than purchased new (Gebhardt, 2004).

Box 1.4 A handloader comments on his hobby

I begin reloading by first cleaning the used case in a tumbler, using a mixture of crushed walnut shells and a chemical substance. Then I process each case through a die that resizes it for shape and diameter, while at the same time punching out the used primer. A new primer is installed in each case, using a hand-held tool. One must be careful to install the proper size and type of primer for the cartridge being reloaded. There are small- and large-calibre pistol primers and small- and large-calibre rifle primers.

Using a calibrated device called a powder measure, I pour and weigh several measures of powder to ensure that I have calibrated the device for the correct amount (weight) of propellant. I then charge each empty, reprimed case with this amount of propellant. It is important to ensure that one never 'double charges' an empty case.

The final step is to seat a new projectile to a measured depth and crimp the mouth of the case around the projectile so that it will neither fall out nor be seated deeper when cycled through the action of the firearm. When I have completed this step, I use a micrometer to measure the finished cartridge. I know from my data the minimum and maximum length allowed for the finished cartridge.

Now all that is left is to place the loaded cartridges into an appropriate plastic or paper storage container, labelled as to type and amount of propellant used, projectile calibre and weight, and date of loading.

Author: James Gebhardt

The extent of ammunition craft production outside of developed countries is difficult to assess. According to the International Committee of the Red Cross (ICRC), 'non-state entities may be reluctant to accept the risk to life and weapons systems which "home-made" production of munitions and ammunition would entail' (ICRC, 1999); but this assertion is contradicted by numerous accounts of ammunition craft production worldwide. In 2004, the Nigerian police made several arrests of illegal arms manufacturers and seized 5.56 mm, 7.65 mm, and 9 mm home-made cartridges (AllAfrica, 2004a; 2004b).

Although production of one's own ammunition does not require complex skills, and the ammunition made in this manner is reliable enough to be used confidently by the handloaders themselves, what may prove challenging in certain areas is finding the different components. The quality of the powder and primer must be of sufficient quality for the ammunition to be usable—but it is still possible to produce one's own powder, provided the ingredients are available. Brass casings, too, are difficult to craft produce (DeClerq, 1998), but this may not be a problem, since old cases can be reused a number of times (while all other components can be used only once). Projectiles, meanwhile, are relatively easy to manufacture: one only needs a cutting machine, which can mould anything in metal (DeClerq, 1998).

Technological developments

Small arms ammunition technology is relatively stable: 'Ammunition technology in all its permutations is best described as a mature technology; that is to say, there can be few revolutionary breakthroughs expected in the immediate future' (Cutshaw and Ness, 2003, p. 15). One noticeable change, however, is the development of non-lethal weapons (see Box 1.5), providing law enforcement and military forces with the opportunity to graduate their response.

Box 1.5 Ammunition in non-lethal weapons

'Non-lethal' weapons, such as rubber bullets, are more accurately termed 'less-than lethal' or 'sub-lethal' weapons. Rubber bullets are mostly employed in crowd control operations; they are made of either plain rubber or rubber-coated steel. They are shot from a canister mounted on the muzzle of an ordinary rifle (an M-16 for instance). Although not designed to kill, rubber bullets can cause permanent damage or even death. Because of their very low ballistic coefficient, they are erratic in flight and can generate unintended casualties if they hit soft tissue (eyes, for instance). Rubber bullets have been used in a number of contexts, most notably in Northern Ireland and the Palestinian Territories, where, at times, they have been responsible for loss of life and permanent injuries. A medical report on the use of rubber bullets by the Israeli Defense Forces concluded, in October 2002, that 'this type of ammunition should therefore not be considered a safe method of crowd control' (Mahajna et al., 2002, p. 1795). The Israeli Defense Forces have consequently issued new regulations to counter improper use of rubber bullets and to limit accidental casualties. Since the 1970s, the British Army has been using plastic baton rounds (PBRs) instead of rubber bullets, although these have caused fatalities as well; so, too, have beanbags, which are small nylon pockets containing birdshot.

Source: Blue Line (1997); Di Maio (1999, pp. 304–05); Krausz and Mahajna (2002); Mahajna et al. (2002); Small Arms Survey (2004, pp. 221–24)

Each year a number of new products stand out as developments in ammunition production. For instance, pre-fragmented bullets driven at hyper-velocity have recently been developed (under the trade name of 'Quik-Shok') for the 0.22 calibre long rifle. On impact, these pre-fragmented bullets dissociate into three components that create larger wounds (Cutshaw and Ness, 2003, p. 5). Also, caseless cartridges that weigh 50 per cent less than classic ammunition have been developed; they are made of a block of propellant in which a bullet is embedded (DeClerq, 1999b). Use of these new cartridges is limited, though, mostly to the German Heckler & Koch G11 automatic rifle.

The shift towards lighter ammunition is a logical consequence of the process by which personal automatic rifles have progressively replaced, in military forces, high-powered rifles; the former have an increased ammunition capacity and rate of fire (Hogg and Weeks, 2000, p. 221).

Another innovation in ammunition, which is rendered even more necessary by increased magazine capacity, is the development of 'green' ammunition. Lead, which is currently present in most types of bullets and primers, is toxic if inhaled or ingested, and can cause neurological damage. This issue is of particular concern for shooting ranges where discharged bullets, shotgun pellets, and primers after firing, leave high concentrations of lead in the immediate environment. In the case of outdoor ranges, certain physical conditions, such as acidic soil, are particularly conducive to ground pollution: bullets and shots slowly dissolve into the soil and groundwater, endangering wildlife and drinking water supplies (Kennedy, 2004; AP, 2004d). The cost of lead cleaning is considerable: the US Army Environmental Center (USAEC) estimates it at USD 130–400 per cubic metre (USAEC, 1999).

Such concerns have led to the development of cartridges with lead-free bullets and primers. These new, non-polluting cartridges are designed mainly for range use. In 1995, the US Army launched a 'green bullet' programme (USAEC, 1999), and after technical tests proved that these bullets were as accurate as lead-core ones, they went into production, in March 1999, at the Lake City Army Ammunition Plant in Missouri. The latter is currently developing 5.56 mm bullets with a tungsten–tin or tungsten–nylon core, and aims to manufacture 7.62 mm, 9 mm, and .50 calibres in the medium term (USAEC, 1999). The Federal Law Enforcement Training Center (FLETC), which trains the employees of 76 federal agencies, uses these non-polluting bullets in 75 per cent of its activities that involve ammunition consumption. This switch from lead to unleaded ammunition is estimated to have eliminated more than 30 tons of lead waste from the FLETC's three campuses (CNN, 2004). Unleaded ammunition is being produced worldwide, and national armies, such as the Danish Armed Forces (Nordic Business Report, 2004), are increasingly choosing to utilize it.

THE IMPACT OF AMMUNITION AVAILABILITY ON WEAPONS USE

Storage and shelf life

Ammunition longevity is expressed in terms of shelf life and service life. Shelf life could be viewed as the ammunition's 'expiry date' and is defined by the Pentagon as: 'the total period of time […] that an item may remain in the combined wholesale (including manufacturer's) and retail storage systems and still remain suitable for issue to and/or consumption by the end user' (US Department of Defense, 1997). Service life, meanwhile, is the length of time that an item is expected to be in working order.

In practice, ammunition can be, and often is, used well beyond its shelf life. Also called 'stability', the service life of ammunition is determined by how long it takes for the propellant to decompose. If the propellant is well made and stored, it will remain serviceable for many decades. Ammunition, however, can be quickly degraded by moisture and heat, and must be stored in a dry and cool place, preferably in the producer's original packaging; excessive and frequent variations of temperature are particularly damaging to powder: 'under good storage conditions (i.e. stable temperature and low humidity combined with properly sealed packaging), small arms ammunition can last 50 years or more without significant deterioration' (UNGA, 1999, p. 20). Handloaded ammunition is seldom as robust as factory-produced ammunition made to military specifications.

As the propellant decomposes (that is, the stabilizer within it becomes depleted), its burning properties change and it will generate more pressure on firing. Since military small arms are designed to withstand significantly high pressure, the shooter faces little danger in using old ammunition. Decomposed primer or propellant, however, may also cause it to misfire, that is, the primer will either not ignite, or it will ignite but fail to ignite the powder; in both cases the faulty cartridge can simply be ejected. A third possibility is that the primer will ignite enough powder to dislodge the bullet from the case, but not enough to allow it to travel all the way through the barrel; if a bullet that is blocked in the barrel goes unnoticed, and another cartridge is loaded and fired, this may, in some instances, severely damage or rupture the barrel or breech, with a risk of injury to the shooter.[5]

Military small arms ammunition is generally made to withstand greater temperatures and amounts of moisture than civilian ammunition. In the Pacific region, for instance, some armed groups have been using old .303 and .50 Browning Machine Gun (BMG) cartridges that date back to the Second World War. Such cartridges were still usable thanks to their thick brass casings; also, the Allies had stored them in their original containers, which were designed to repel tropical moisture. Despite these precautions, however, a number suffered water damage over the years, leading to the primer and/or the powder failing to fire.[6] Ammunition is also likely to become unusable with age as a result of it being deformed by external corrosion and thus no longer fitting the weapon for which it was designed.

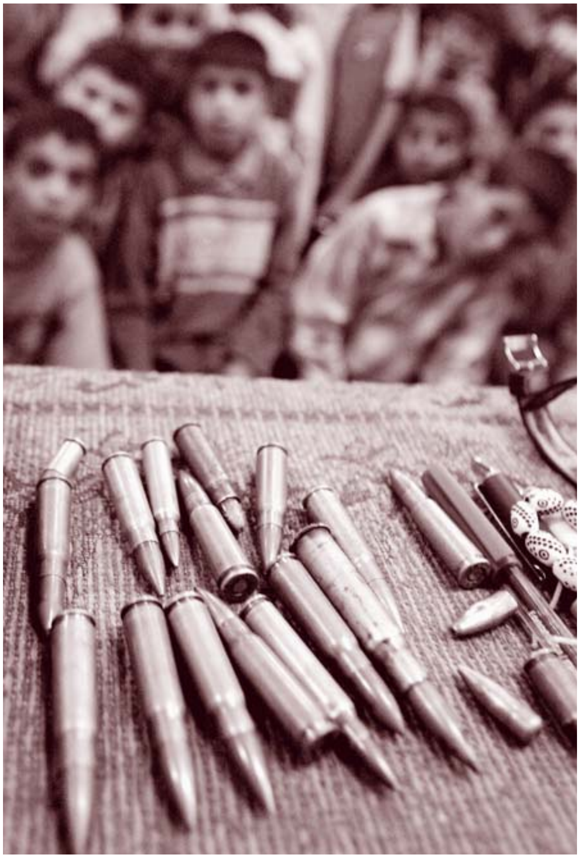
Ammunition availability and conflict

A common notion is that it is the weapon that determines the choice of ammunition, not the other way round. In practice, though, the availability of ammunition often proves decisive in the selection of weapons, and influences the value that combatants place on a given model. In Ghana, weapons are craft produced depending on the type of ammunition that can be procured on the market (Aning, 2005); and in the conflicts in Bougainville and the Solomon Islands, some guns were handmade specifically to suit ammunition stocks inherited from the Second World War (Alpers, 2005).

The availability of ammunition often proves decisive in the selection of weapons by combatants.

Although weapons and ammunition are complementary, they have different production structures, and it can happen that one is widely available while the other is scarce. Non-state armed groups, in particular, often have irregular supply lines that result in occasional (sometimes endemic) shortages of ammunition (Small Arms Survey and CECORE, 2004).[7] In the 1990s, the Tajik opposition, for instance, initiated attacks and engaged in kidnapping to solve their ammunition problem (Torjesen, Wille, and MacFarlane, 2005, p. 12). A similar example comes from Cambodia, where the Khmer Rouge experienced a severe lack of ammunition in the last years of the war (after the withdrawal of Chinese support)—although it was still possible to find weapons in sufficient quantities.[8]

Weapons for which the corresponding ammunition cannot be found are, at least temporarily, useless. As noted above, in CAR, in the late 1990s, 5.56 mm cartridges were in extremely short supply,



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Palestinian children look at bullets donated to Hamas activists during a campaign in the Gaza Strip in April 2004.

meaning that many Western-produced rifles, machine guns, and carbines could not be used (Berman, 2005). A similar example can be drawn from the rebellion that took place in the early 1990s in northern Mali, where any weapon for which it was too difficult to find ammunition was considered almost useless.[9] When rebels bought weapons abroad, their choice was constrained by the fact that they needed those whose ammunition could later be obtained from the arsenals of the Malian Armed Forces—their main source of supply. According to one Malian ex-combatant, the FN-CAL (Belgian) assault rifles that could be imported from Mauritania were of limited utility because they use 5.56 mm ammunition, and Malian troops possess, for the most part, Chinese and Russian-type cartridges (7.62 x 39 mm).[10] In Papua New Guinea (PNG), weapons like AK-47 assault rifles are of little value, since only NATO-calibre ammunition is available; although Soviet-type weapons are easy to obtain in nearby Asia, they are, therefore, unlikely to end up in PNG (Alpers, 2005).

During conflict, ammunition is needed in great quantities and stocks can be rapidly depleted.

During a conflict, ammunition is needed in great quantities. Assault rifles, which are widely used, consume a large number of cartridges, and the lack of training and discipline in certain armed groups leads to excessive expenditure of cartridges (UNGA, 1999, sec. 48, p. 9). The amount of ammunition needed also depends on the intensity (planned or actual) of the conflict. For this reason, there may be a high demand for ammunition, even though the quantity of firearms used may be low. Because ammunition stocks are rapidly depleted, there is often a risk of shortage, and hence ammunition is considered an extremely valuable commodity. In Malian rebel groups, an ordnance officer would distribute ammunition to combatants before each mission. The type and quantity of ammunition supplied would depend on: the amount of ammunition remaining in the arsenal (if ammunition was scarce, only the best shooters would be dispatched, tasked with acquiring more for the group); the kind of weapon needed by the combatant; and the strength of the combatant (due to the weight of ammunition).[11] In Cambodia, Khmer Rouge combatants involved in attacks would only carry 60 cartridges each; ammunition was strictly rationed.[12]

The high value accorded to ammunition is illustrated by the fact that many armed groups consider ammunition wastage to be a grave offence. Among Malian armed groups, sanctions for shooting in the air included having one's head shaved as a symbol of shame or being confined to barracks for a week.[13] Using ammunition to shoot birds or other animals was also prohibited in the former rebel Uganda National Rescue Front II (UNRF II) (Small Arms Survey and CECORE, 2004). An impending shortage of ammunition can compel a group or a country, whenever possible, to diversify its means of supply (see Box 1.6).

As with any commodity, the price of ammunition is dependent on supply and demand. When ammunition is scarce and demand is high, its price will increase. A sudden peak in demand for ammunition occurs when there is a conflict, or when trade routes are cut (due to an arms embargo, for instance).

The availability of ammunition in a given conflict depends on many variables. One critical factor is whether the combatants enjoy the support of foreign states or groups. Rebel groups in Burundi and the Democratic Republic of Congo (DRC), for example, receive important quantities of ammunition from Rwanda and Uganda.[14] For those groups that do not have external backing, other key sources of supply are domestic procurement: raids on military and police arsenals, and in some cases direct purchase from government forces themselves.[15] Another source of supply is, to a much lesser extent, craft production (Capie, 2004; Small Arms Survey and CECORE, 2004).

The availability of ammunition has direct consequences for how firearms are used in a conflict. During the Rwandan genocide of 1994, it even had an impact on the categories of people killed, and on the kinds of weapons used to kill them. Those who were shot (rather than butchered with machetes) were mostly young adults (Verwimp,

Box 1.6 Ammunition shortage in the United States: diversifying supply

In May—June 2004, the US military experienced a major shortage in small-calibre ammunition, related to the wars in Afghanistan and Iraq, as well as to increased training—since the terrorist attacks of 11 September 2001, soldiers have been required to undergo live-fire training twice a year instead of once (Manufacturing and Technology News, 2004; Merle, 2004). In June 2004, the chief executive of the Lake City Army Ammunition Plant in Missouri, which manufactures small-calibre ammunition for the US military, reported that his facility had experienced its fastest production increase since the Vietnam War (AP, 2004a). Yet, in spite of the 1.2 billion cartridges already produced annually by Lake City, the armed services are still short of 300–500 million cartridges (Wingfield, 2004), and there is some indication that soldiers in Iraq have not been able to obtain all the ordnance that they have needed (AP, 2004c). It is estimated that the US Army will require 1.5 billion cartridges annually from 2004, three times the quantity used in 2001 (Merle, 2004).

To avoid tapping into its strategic reserves, the Pentagon imported 130 million cartridges from the United Kingdom in June 2004, and awarded contracts to Israeli Military Industries and Winchester Ammunition, commissioning each to produce 70 million more 5.56 mm and 7.62 mm cartridges (Leser, 2004; Merle, 2004). In January 2005, a news report suggested that the United States intended to purchase 300 million 5.56 mm cartridges, for around USD 62.5 million, from Taiwan (AFP, 2005). Private contractors have been approached about supplementing supply from Lake City on a regular basis (Wingfield, 2004); more than a dozen ammunition manufacturers responded, in September 2004, to the US Army's draft request for proposals, involving 500 million cartridges per year (5.56 mm rifle cartridges as well as 7.62 mm and .50 calibre machine-gun cartridges) (Scully, 2004). The shortage has raised concerns that the US military may become dependent on foreign suppliers (Merle, 2004).

2005). The reason is that ammunition stocks were limited, forcing the perpetrators to save supplies and to select their targets carefully. Firearms, then, were used against those who were considered most threatening, that is, 'young to middle-aged men with a respected status in the commune' (Verwimp, 2005).

The availability of ammunition has direct consequences for how firearms are used in a conflict.

The amount of ammunition available affects potential weapons misuse; if ammunition is scarce, armed groups will enforce, if their authority structure permits it, a 'shooting discipline' so as to avoid wasting a single round. In such circumstances, military targets of strategic value are likely to be preferred to civilian ones. Also, when ammunition is scarce, only the best shooters are tasked with conducting attacks, reducing the risk of collateral damage. When ammunition is easily available, by contrast, there is likely to be less restraint in the employment of firearms. A shortage of ammunition can also induce a change in military objectives: interviews with former rebels in Mali and Uganda revealed that the usual response to a lack of ammunition is to launch an assault on state arsenals in order to regain a sufficient number of cartridges, before pursuing other goals.[16]

It should be noted, however, that the consequences of a shortage of ammunition depend to a large extent on the type of war being fought. If the civilian population is the main target, as in Rwanda, it is likely that such a shortage will lead to weapon substitution, that is, to the use of bladed weapons and probably the targeting of the most vulnerable sections of the population.

Limiting the availability of ammunition

Because ammunition availability shapes, to a certain extent, the use of weapons, many countries have laws limiting the type and/or quantity of ammunition that can be legally purchased, used, or stored by civilians.

Individual access to ammunition

In most countries, the sale of ammunition is, like that of firearms, prohibited with respect to certain categories of the population, such as minors, mentally disabled persons, or repeat offenders. Retail services must comply with these national regulations (see Box 1.7). In most Pacific states, for instance, people can purchase ammunition only if they have a licence for the corresponding type of firearm (Alpers and Twyford, 2003, p. 62). In the United Kingdom, a shotgun certificate is required for anyone wanting to buy corresponding cartridges (United Kingdom Home Office, 2004, p. 17).

A limit is sometimes placed on the quantity of cartridges or shells that one is allowed to purchase. In most Pacific states, there is a ceiling on the amount of ammunition that can be bought for a given licence (Alpers and Twyford, 2003, p. 62). In South Africa, special authorization is needed for anyone wishing to possess more than 2,400 primers, or 200 cartridges per licensed firearm (Government of South Africa, 2004, ch. 8, art. 74).

Another way to limit the quantity of ammunition available is to impose restrictions on the size of magazines for semi-automatic weapons. The assault weapons ban that was in force in the United States from 1994–2004 prohibited high-capacity magazines for a number of weapons (Butterfield, 2004; AP, 2004b; see also PRODUCERS).

Civilian storage of ammunition is regulated in many countries; a UN survey that collated the responses of 69 states on national firearms regulations found out that 'the majority of responding States place restrictions on the storage of firearms and ammunition, and firearms must usually be stored in such a way as to preclude immediate use (that is, unloaded or otherwise disabled; or secured in a safe or locked cabinet)' (UN, 1998, p. 57).

Restrictions on the type of ammunition

States also regulate the sale or use of certain types of ammunition that are considered to be particularly dangerous. Armour-piercing bullets, for instance, have been at the centre of a long debate in the United States. Dubbed 'cop-killer bullets' because of their capacity to penetrate standard bullet-proof vests, they were, ironically, invented in the 1960s for law enforcement purposes, and were designed to pierce obstacles made out of metal (particularly vehicles) or glass. Although most high-powered rifle bullets can also go through body armour, the United States has specifically restricted the manufacture and importation of armour-piercing ammunition since 1986. It can be used only by

Box 1.7 Gun control advocates versus Kmart

One outstanding scene in Michael Moore's 2002 film *Bowling for Columbine* is when two students who were severely wounded in the Columbine High School massacre of 20 April 1999 ask the management of Kmart to provide a refund for the 17-cent bullets bought in one of their stores and now lodged in their bodies. To emphasize their point, one of the students (aged 18) went to the local Kmart and purchased easily 1,000 cartridges of 9 mm and .38 special ammunition. Twenty-four hours after their first visit to Kmart's headquarters in Troy, Michigan, a company spokesperson told Moore and the students that Kmart would phase out the sale of its handgun ammunition within the next 90 days in its 2,100 stores nationwide (Klein, 2001). Everyone's astonishment, including Moore's, was visible: no one expected such a quick victory.

Since then, however, the company has denied that it capitulated before the film-maker. According to a company spokesperson, this decision was based solely on 'marketing concerns', since handgun ammunition was quite insignificant for Kmart in terms of quantities sold (AP, 2001a).

This was not the first time that Kmart had found itself in the spotlight with regard to gun control. In 1997, the company was found liable for selling a rifle to an intoxicated man who used it to shoot his ex-girlfriend (Center to Prevent Handgun Violence, 1997). In November 1999, US television celebrity Rosie O'Donnell resigned from her position as a Kmart spokesperson because of her pro-gun control stance. One month later, Kmart decided, under pressure from demonstrators, not to sell rifles and shotguns at a New York store that it had just opened (AP, 2001b).

federal, state, or local authorities, exported, and employed in tests and experiments (United States Code, 2003, title 18, part I, ch. 44, sec. 922). This type of ammunition is also subjected to strict record-keeping and must be clearly marked as armour-piercing (Legal Community Against Violence, 2004).

Box 1.8 Origins of the prohibition on the use in war of expanding bullets

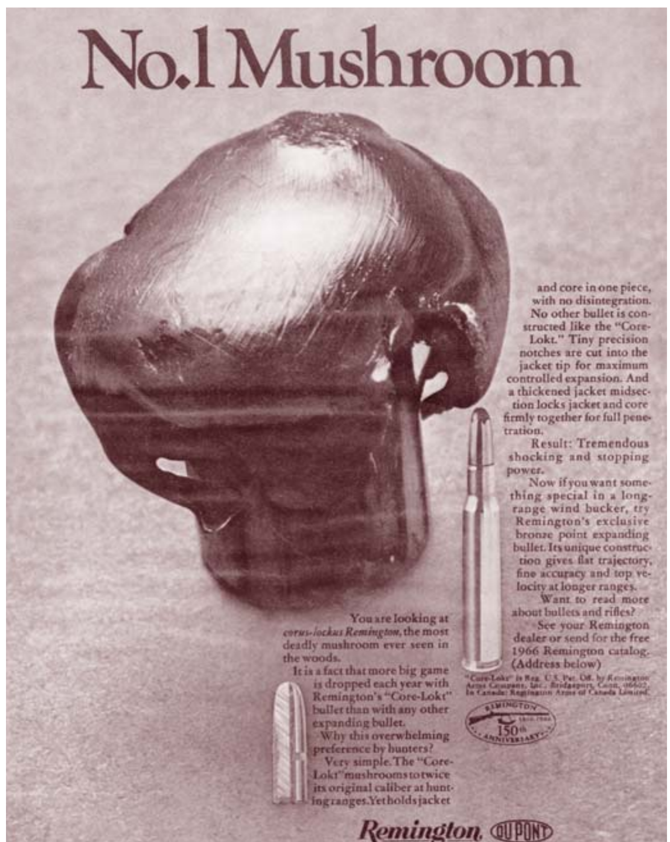
In the 1890s, a new type of bullet with lead exposed at the tip was developed for military use. These 'dum-dum' bullets, which are not fully jacketed, expand on impact. The name 'dum-dum' comes from the location of the British factory in India where they were manufactured, mainly for use in colonial wars.

Delegates present at the First Hague Peace Conference declared, on 29 July 1899, that: 'The Contracting Parties agree to abstain from the use of bullets which expand or flatten easily in the human body, such as bullets with a hard envelope which does not entirely cover the core or is pierced with incisions' (*Hague Declaration* (IV, 3) *concerning Expanding Bullets*). To this day, the ban on the use of expanding bullets (also known as soft-nosed, soft-point, hollow-point, open-tip, or semi-jacket bullets) in armed conflicts still holds: all bullets for military use must be covered by a full-metal jacket (FMJ).

In Brazil, the use of certain calibres[17] is restricted to the armed forces, the police, small arms collectors, and registered sport shooters. Such ammunition, which is not sold in gun shops, can only be purchased direct from the factory and must be authorized by the Brazilian Army's Directorate of Controlled Products (DFPC) (Dreyfus, 2004).

The ban on expanding ('dum-dum') bullets is another example of a restriction that applies to the type of ammunition used (see Box 1.8). Adopted at the Hague Conference of 1899 (*Hague Declaration 3 concerning Expanding Bullets,* a treaty which entered into force in September 1900), this prohibition now has the status of customary law (Coupland and Loye, 2003, p. 135; ICRC, 2005, Rule 77, p. 268), and the use of such bullets has been recognized as a war crime in the 1998 Rome Statute of the International Criminal Court (art. 8(2)(b)(xix)). A recent study by the International Committee of the Red Cross (ICRC) found that it is also prohibited under customary international law in cases of non-international armed conflicts (ICRC, 2005, Rule 77, p. 268).

The use of expanding bullets against civilians has nevertheless been signalled in several instances, including in Papua New Guinea (Bougainville) (Amnesty



© Remington, 1966

Remington advertises its 'Core-Lokt' expanding bullet in a 1966 magazine. The bullet's selling point: it 'mushrooms to twice its original caliber ... yet holds jacket and core in one piece'.

Box 1.9 Terminal ballistics

Terminal or 'wound' ballistics describes the trajectory of a projectile and its effects once it has hit its target.

One common misperception is that a bullet makes a straight hole in the body; in reality, the hole created is much larger than the bullet itself. This so-called temporary cavity puts a great deal of pressure on surrounding organs and tissue, damaging them, even though they never came into contact with the bullet. This cavity is also made bigger as a result of the movement of the bullet, which becomes unstable and starts wobbling or even tumbling end-over-end as it moves along its path. The size and location of the temporary cavity determines the overall damage done. Small, low-velocity missiles like pistol bullets will produce only a small temporary cavity, while high-velocity rifle bullets will create a large one. Beyond a certain threshold, the temporary cavity may be too large to be contained in the organ or tissue hit (if it does not have sufficient elasticity), and may cause it to 'burst'.

The extent of the wound also depends on the design of the bullet: bullets that expand on impact create a larger temporary cavity than non-expanding ones.

- Hollow-point bullets have a hole at the top, and sometimes incisions to ensure additional expansion on hitting the target; their expansion creates sharp edges (and, in case of high velocity, fragmentation). They are mostly used for hunting, because they increase the likelihood that the animal will be killed and not just wounded.
- Soft-point bullets expand as well, but typically they do not fragment (they assume a 'mushroom' shape on impact).
- Entirely-jacketed bullets do not expand, but they still cause significant tissue damage at high velocity.

Source: Coupland (1999); Di Maio (1999); DeClerq (1999b); Gebhardt (2004)

International, 1997, p. 13) and the Palestinian Territories (UN ECOSOC, 2000). In the context of law enforcement, the use of such ammunition is authorized because it ricochets less, and the fact that it flattens on impact means that there is less chance that it will pass through the intended target and wound innocent bystanders—it is thus considered 'safer' for use in urban surroundings. Lastly, these bullets have very strong stopping power when shot at close range, making them particularly attractive to self-defence users. This is why law enforcement officers, as well as units that specialize in anti-terrorist or hostage release operations, use expanding bullets.

New types of expanding bullets have little in common, though, with the original 'dum-dum'. Their energy when fired from a handgun is about one-sixth of that produced by bullets fired from 19th century military rifles (Coupland and Loye, 2003, pp. 140–41) (see Box 1.9).

MEASURES

International and regional measures to control small arms ammunition

Ammunition is mentioned in a number of international and regional instruments that focus on small arms control. In order to assess to what extent current regulations on small arms also apply to ammunition, one must examine two questions:

- Does the instrument, in principle, cover ammunition, as reflected in its definitions section?
- If ammunition does appear in the instrument's definitions section, is this accompanied by concrete and specific provisions relating to it?

Although most international instruments cover ammunition in their definitions, their operational provisions often ignore ammunition, concentrating solely on small arms (McDonald, 2005); this is often true for regional instruments as well (see Table 1.2).

At the international level, the 2001 *UN Protocol against the Illicit Manufacturing of and Trafficking in Firearms, Their Parts and Components and Ammunition ('Firearms Protocol')* includes a definition of ammunition in Article 3, which does not apply to ammunition components (such as the case and primer) if these are not already regulated by the relevant state (UNGA, 2001a, p. 3). A closer look reveals, however, that many of this instrument's provisions do

Table 1.2 Regional small arms instruments

Instrument	Date of adoption	Is small arms ammunition covered in the definitions?	Specific provisions on small arms ammunition
ECOWAS Moratorium and *Code of Conduct* (ECOWAS, 1998; 1999)	31 October 1998 and 10 December 1999	Yes (Art. 3 of the Code of Conduct)	The whole text covers small arms ammunition and components
European Union Code of Conduct on Arms Exports (EU, 1998)	8 June 1998	Yes. See Common Military List: ML3 referring to ML1 (EU, 2003b)	The whole text covers small arms ammunition
Council Common Position on the control of arms brokering (EU, 2003a)	25 June 2003	Yes	The whole text covers small arms ammunition
Nairobi Protocol (Nairobi Protocol, 2004)	21 April 2004	Yes	None. Ammunition is only mentioned in the definitions
Inter-American Convention against the Illicit Manufacturing of and Trafficking in Firearms, Ammunition, Explosives, and Other Related Materials (OAS, 1997)	14 November 1997	Yes	The whole text covers small arms ammunition, except for Art. VI on marking and Art. XI on record-keeping, which deal with firearms only
OAS *Model Regulations* (OAS, 1998)	2 June 1998	Yes	Contains detailed procedures for the import, export, and in-transit shipment of ammunition
Bamako Declaration on an African Common Position on the Illicit Proliferation, Circulation and Trafficking of Small Arms and Light Weapons (OAU, 2000)	1 December 2000	Unclear	Says that states should establish as criminal offences the illicit manufacturing of, trafficking in, and illegal possession and use of, ammunition (V. 3. A. iii). States should encourage the codification and harmonization of legislation governing the manufacture, trading, brokering, possession, and use of ammunition (V. 3. B. ii)
OSCE Document on Small Arms and Light Weapons (OSCE, 2000)	24 November 2000	No	Mentions ammunition only in relation to post-conflict disarmament, demobilization, and reintegration (DDR) programmes, for instance the 'disposal and destruction of surrendered or seized small arms and ammunition' (V. D. 5)
SADC Protocol (SADC, 2001)	14 August 2001	Yes (Art. 1, para. 2)	The whole text covers small arms ammunition

not pertain to ammunition. Article 8 on marking and Article 9 on deactivation, for instance, apply only to firearms, not to ammunition (UNGA, 2001a, pp. 5–6).

The *UN Programme of Action* of 2001 is the only global instrument that covers most issues pertaining to small arms, from manufacture to stockpile management. Although ammunition was included in the definition of small arms and light weapons the UN Panel of Experts put forward in 1997 (UNSG, 1997, III.26(c)), the *Programme* has no definition of small arms and light weapons. Nor do its provisions use the word 'ammunition' (McDonald, 2005). Nevertheless, several states have supplied information on ammunition when reporting on their implementation of the *Programme*. They have referred to ammunition mainly in relation to changes in national legislation and regulations, and in connection with assistance provided or received for stockpile destruction. Many countries have also provided precise figures on ammunition collected or destroyed (Kytömäki, 2004).

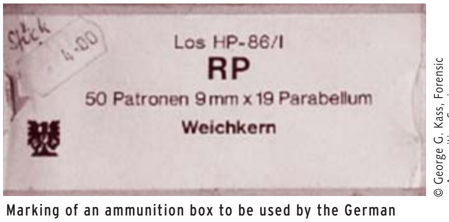
There seems to be widespread understanding that ammunition is part of the arms proliferation problem, and should, therefore, be regulated at the regional and international levels. This understanding is often reflected in the titles, introductions, and definitions of the international and regional texts that address the issue of small arms and light weapons. Recognizing the importance of ammunition, the UN General Assembly recommended in 1997 that a study be conducted to assess all aspects of the problem of ammunition and explosives (UNGA, 1999, p. 1). Few, if any, subsequent steps have been taken, however, to address the ammunition issue at the international level.

Marking and tracing

The simplest way to trace ammunition is by lot number. If cartridges have been taken out of their original packaging, their origin can still be determined to a certain extent using their headstamp. Marking, however, could be improved by adding the lot number to the headstamp, or by engraving the bullet itself.

Lot numbers

If the ammunition is still in its original packaging, identification is facilitated by the fact that the name, calibre, type, and producer, as well as the year and lot of manufacture, are printed on the box (UNGA, 1999, para. 77, p. 12). The lot of manufacture, in particular, is used to trace ammunition during transportation (UNIDIR and Small Arms Survey, 2003, p. 59) (see Box 1.10).



© George G. Kass, Forensic Ammunition Service

Marking of an ammunition box to be used by the German police. Indicated are: the producer (HP for the Austrian manufacturer Hirtenberg Pat); the year of production (86 for 1986); the lot number (1); the recipient (RP for police forces of Rhineland-Palatine); and the number, calibre, and type of cartridges (50 soft-core cartridges, calibre 9 x 19mm Parabellum).

Although the lot number lacks precision (there are usually between 250,000 and one million cartridges in a single batch), it nevertheless allows the source of manufacture to be identified, as well as a particular production run, which is useful in the event of malfunctioning (UNGA, 1999, sec. 21, p. 6). For similar reasons of quality control, all ammunition components are given their own lot number prior to assembly. The lot number also helps trace the provenance of stolen boxes of ammunition when or if they are recovered (see Box 1.11).

Box 1.10 Regulating the transport of ammunition

As it consists, in part, of explosives, ammunition for small arms (and light weapons) is classified as a 'dangerous good' by the UN and is thus subject to a series of rules governing various aspects of its transport.

In 1953, the UN Economic and Social Council (ECOSOC) set up a Committee of Experts on the Transport of Dangerous Goods and tasked it with developing and harmonizing regulations in this area for all modes of transport. The committee published an initial set of recommendations in 1956, which has been updated regularly and has been referred to as 'Model Regulations' since 1996. The fourteenth revised edition is scheduled for publication in late 2005.

An expansion of the original committee's mandate resulted in the creation of a Sub-Committee of Experts on the Transport of Dangerous Goods (TDG Sub-Committee), which continues to carry out technical work on this issue. The TDG Sub-Committee consists of 27 'expert countries', together with non-voting observers, representing various states, international organizations, NGOs, and industry bodies.

The Model Regulations are not legally binding. Nevertheless, they form part of national legislation in many, perhaps most, states around the world, often as a result of their incorporation into legally binding multilateral instruments (Kervella, 2003, sec. 4). European agreements governing the transport of dangerous goods by road, rail, and inland waterway have made the Model Regulations the basis of their own legally binding rules. At the international level, they have been applied—again in legally binding form—to rules developed for maritime and air transport.

The Model Regulations provide a detailed, item-by-item classification for such goods, based on the type of risk involved. Small arms ammunition falls under Class 1, dealing with explosives. Among other things, the Model Regulations set out standards for transport packaging, including its testing and certification. General packing provisions for small arms cartridges (UN classification no. 0012) mandate the use of 'good quality packagings ... which shall be strong enough to withstand the shocks and loadings normally encountered during transport'. More detailed instructions prescribe the kinds of materials to be used in the construction of outer packaging (UN, 2003, part 4, pp. 5, 27).

The Model Regulations also establish rules for labelling, marking, and documentation designed to ensure that dangerous goods can be identified as such by all those involved in their transport (UN, 2003). But they do not address the question of responsibility or penalties for non-compliance. In general, it is for each state to decide how to monitor and enforce implementation of the Model Regulations, in accordance with national legislation.

Author: Glenn McDonald
Source: Kervella (2003); UN (2003); Berkol (2004)[18]

Box 1.11 Ammunition smuggled from Paraguay to Brazil

On 2 August 2002, Brazilian Federal Police agents seized 50,000 rounds of ammunition in different parts of Rio de Janeiro. According to police sources, the ammunition was bound for several criminal groups based in the city's slums (*favelas*). The items seized were 5.56 mm, 7.62 mm, 9 mm, .306, and .40 cartridges manufactured by Companhia Brasileira de Cartuchos (CBC) in Brazil and by the Czech Republic. Since the CBC bullets were still in their original boxes, the police could tell that these cartridges belonged to lot number LT 547.4-Trim/POL K N-135 L 479/81, which the company had exported to Paraguay. Identification of the lot number was, therefore, vital to tracing the trafficking route back to Paraguay, whose law allowing foreign tourists to buy small arms and ammunition was being intensively taken advantage of by Brazilian criminals. After Brazilian government and civil society representatives applied heavy pressure, this law was eventually overturned by Paraguay.

Author: Pablo Dreyfus

Cartridge marking and headstamps

In some instances, the lot or batch number is not just printed on the box, but also engraved on the base of the cartridge. This is one of the measures recently adopted in Brazil to counter ammunition proliferation (see Box 1.12). Once ammunition is taken from its packaging, only the headstamp can be used for identification.

A headstamp is a distinctive mark printed on the bottom of the case. It identifies the manufacturer and the country of origin, and is still readable after the cartridge has been fired. Headstamps sometimes also include the date of manufacture (mostly for military ammunition), the calibre, and the army unit that placed the order (in the case of military ammunition) (International Ammunition Association, 2003; UNGA, 1999, sec. 75, p. 12).

Although generally reliable, headstamps do not provide a full guarantee of the origin of the ammunition: on several occasions, deceitful headstamps have been used to conceal the actual source (International Ammunition Association, 2003). Some ammunition used in covert military operations bears no marking at all, or employs markings with a secret meaning. Some dealers also put their own trade mark on the ammunition, which is designed especially for them (UNGA, 1999, sec. 75, p. 12). Another problem is the complexity of the current headstamping classification system, which is due to the very large (and constantly changing) number of ammunition producers and the necessity to use cryptic symbols and codes because of a lack of space on the bottom of the casing.

Box 1.12 Improving police accountability through ammunition marking: the new Brazilian Statute of Disarmament

On 22 December 2003, Federal Law No. 10,826—the Statute of Disarmament—was finally passed. It was the product of a decade of campaigning for a federal law that would establish tight controls over the circulation and use of small arms. Besides forbidding the carrying of small arms by civilians and calling for a referendum on a ban on small arms and ammunition sales to civilians (scheduled for October 2005), it incorporates provisions targeted at the small arms and ammunition industries. Measures include a mandatory electronic link between the databases of the army (which controls production, imports, and exports) and the Brazilian Federal Police (which, under the new law, is tasked with centralizing registration data and information on seized weapons and ammunition). In the past, lack of communication and failure to exchange information between the two institutions has prevented an efficient struggle against diversion and trafficking. The law also establishes a centralized ballistic information system, managed by the Brazilian Federal Police, which will contain samples of bullets fired by every small arms item manufactured in Brazil. This should allow for small arms used in crimes to be identified.

As for ammunition, the new law stipulates that the headstamps on 5.56 mm, .30, 7.62 mm, 9 mm, .357, .380, .38, .40, .45, and .50 calibre cartridges and 12-gauge shotgun shells produced in Brazil for the police and armed forces must include the lot number. This should enhance the security of military and police stockpiles, as police will be able to identify patterns of leakage (of ammunition) from either institution to organized criminal entities.

The sanctions set out in the law should be deterrent enough: trafficking in ammunition and diverting, stealing, and illegally stockpiling ammunition fall under Articles 17 ('Illegal trade in firearms') and 18 ('International arms trafficking'), which specify prison terms of between 8 and 16 years.

The law could also help in identifying those responsible for unjust killings through analysis of the lot numbers engraved on empty casings found at shoot-out scenes. Hopefully, this could lead to the emergence of a virtuous circle whereby police units feel compelled to increase their level of training and to use firearms only when absolutely necessary.

Author: Pablo Dreyfus

Marking cartridges with the lot number is already common practice in a number of countries. Since 1985, Industria Militar (INDUMIL), which has a monopoly on small arms ammunition production in Colombia, has marked cartridges with a lot number that identifies the army purchaser. Similar procedures exist in Austria and Germany (Dreyfus, 2004).

The advantage of headstamps is that they cannot be tampered with; someone trying to erase this marking would cause the primer to fire, rendering the cartridge unusable. The downside is that if one disposes of the spent case, there is no way of identifying the projectile anymore. The same problem arises when a case is employed several times, as with reloading, or in the rare instances when caseless cartridges are used.

Headstamp of a cartridge manufactured by Dynamit Nobel AG Troisdorf (DAG) of Germany for the country's military, as indicated by the NATO symbol at the top. The lot number is 75-28.

Bullet marking

A potential solution to the problem highlighted above is to engrave the base of the bullet, rather than the case, with a serial number or code (UNIDIR and Small Arms Survey, 2003, pp. 59–60). This method of marking is currently under review in California, United States, where all handgun bullets may soon have to be laser-marked (Reuters, 2004). The Ammunition Coding System (ACS) that is being tested would engrave a code on both the bullet and the case. This code would be unique for each box of bullets sold, and would be entered into a database, along with personal information about the purchaser of the ammunition, creating a general record of all ammunition sales in the state (Ammunition Coding System, 2004). It would represent a major improvement on classical forensic tests, whereby one needs to recover the firearm (often a difficult task) to see if it matches a given bullet. This initiative is, however, likely to spark debate on the additional cost to manufacturers, especially the smallest ones, since the price of a laser-engraving machine is quite high (Ammunition Coding System, 2004). Such technology may be beyond the reach of most developing country producers. Another concern relates to ensuring the confidentiality of the information collected (which only authorized law enforcement personnel should be able to access). It also remains to be seen whether this method will work with military ammunition, the base of which can be damaged during firing, which may result in the engraved number becoming unreadable.

In cases where the primer is manufactured by the same company as the finished cartridge, such as CBC in Brazil, it is possible to mark the cup containing the priming mixture. Original CBC cartridge primers are marked with a 'V' on the external side, allowing forensic experts to distinguish between newly produced cartridges and those that have been reloaded; the latter would have the CBC headstamp but no 'V' on the primer cup.

International and regional marking and tracing initiatives

At the international level, the Group of Governmental Experts on Tracing Illicit Small Arms and Light Weapons stated in its 2003 report that '[a]mmunition and explosives … are generally regarded as a part of the problem of small arms and light weapons', and acknowledged the work done in 1999 by the Group of Experts on the problem of ammunition and explosives (UNGA, 2003, para. 33). Nevertheless, little progress has been made to date in translating such awareness into concrete international action.

In December 2003, the UN General Assembly, pursuant to the recommendation of the same group of governmental experts, established an Open-Ended Working Group to negotiate an international instrument for identifying and tracing illicit small arms and light weapons. It soon emerged, though, that there was no consensus within the group on whether its mandate covered ammunition. As of 15 February 2005, it appeared unlikely that the international tracing instrument, when finalized in June 2005, would contain firm commitments in relation to ammunition, although it seems possible that there will be some acknowledgement in the instrument of the need for follow-up work.

Other international instruments address ammunition only partially, if at all. The record-keeping provisions of the legally binding *UN Firearms Protocol* apply to ammunition only 'where appropriate and feasible' (Art. 7). Article 8 of the protocol, on marking, deals only with firearms (UNGA, 2001a). The *Programme of Action* underlines the importance of marking and tracing for small arms and light weapons, but does not mention ammunition (UNGA, 2001b).

Almost all of the regional instruments that cover marking, record-keeping, and tracing, such as the *Inter-American Convention* (OAS, 1997), the *SADC Protocol* (SADC, 2001), the *OSCE Document on Small Arms and Light Weapons* (OSCE, 2004), or the recent *Nairobi Protocol* (2004), limit themselves to firearms, ignoring ammunition. The *Bamako*

Declaration (OAU, 2000) is the only exception. It encourages the development of common standards for marking and record-keeping for both small arms and ammunition (OAU, 2000, sec. V. 3. B. ii).

Management and destruction of ammunition stockpiles

Maintaining and securing existing military stockpiles are matters of the utmost importance. Ammunition that has expired or become obsolete, unserviceable, or redundant is routinely removed from military stockpiles. When ammunition is still in usable condition, excess stocks are sometimes given to other countries (DeClerq, 1999a). At other times, however, such ammunition is simply kept, leading to excessive accumulation and storage problems. A 1996 report by the United States General Accounting Office (GAO) pointed out, for instance, that the Marine Corps was storing approximately three million .50 calibre cartridges for a machine gun (the M85) that was not in use anymore; but this ammunition could not be used with any other weapon (US GAO, 1996, p. 4). In the past decade, ammunition stockpiles have increased as a result of the reduction of the size of the armed forces in many countries (UNGA, 1999, sec. 60, p. 10).

Stockpile mismanagement can represent a serious threat to life and the environment, in addition to the risks of diversion. In November 2003, the OSCE adopted a *Document on Stockpiles of Conventional Ammunition* that seeks to help participating states to identify their surplus stocks, and to request assistance with their management if needed (OSCE, 2003).

Stockpile mismanagement can represent a serious threat to life and the environment, in addition to the risks of diversion.

Destruction of small arms ammunition is not particularly difficult or expensive, at least for small quantities (DeClerq, 1999a). Unlike grenades and mortar bombs, small arms ammunition contains very little explosive material that can be used for its own destruction (UNDDA, 2001, p. 25). Consequently, it is usually burnt, or simply fired, using different methods (see Table 1.3). Large quantities of ammunition, meanwhile, are more difficult to dispose of, since burning may result in the emission of toxic particulates into the air.

Table 1.3 Ammunition destruction methods

	Most suitable depending on the:			
	quantity of ammunition	**condition of the ammunition**	**Advantages**	**Disadvantages**
Firing	Small	Good	Leaves only empty cases	Creates projectile debris, need for a safety area
Burning using an improvised incinerator	Small to medium	Poor	Mobile, requires little equipment	Needs a long cooling-down period, creates smoke
Large-scale burning using improvised means	Large	Poor	Ceremonial destruction	Needs a significant amount of preparation time and a long cooling-down period, creates smoke
Burning using a mobile incinerator	Small	Poor	Reusable, mobile, easy	Only small quantities can be handled at a time
Burning using a fixed incinerator	Any	Any	Little or no air and noise pollution	Not mobile, requires constant fuel supply
Rotary kiln incineration	Large	Any	Efficient, little or no air pollution	Very high cost (purchase and maintenance), lack of mobility, requires fuel supply

Source: Adapted from UNDDA (2001, pp. 26–39)

A number of private companies, mainly located in North America and Western Europe, specialize in ammunition and explosives destruction, be it excess state stockpiles or remnants from theatres of conflict. A few ammunition manufacturers provide similar demilitarization services, such as Nammo AS of Norway or SNC Technologies of Canada (Nammo, 2005; SNC Technologies, 2005).

Ammunition is sometimes included in post-conflict weapons collection programmes. The Small Arms Reduction Project of the United Nations Development Programme (UNDP) assists the Government of Bosnia and Herzegovina in destroying its surplus and obsolete ammunition (UNDP, 2005). In Albania, weapons in exchange for development (WED) programmes implemented in three districts allowed 13 million rounds of ammunition to be collected (UNDP, 2004, p. 6)—although it should be remembered that, when Albanians raided military depots in March 1997, they seized between 900 million and 1.6 billion cartridges (Van der Graaf and Faltas, 2001, p. 165; UNDP, 2004, p. 6). The disarmament, demobilization, and reintegration (DDR) programme in Liberia (1996–99) was also particularly successful in reducing ammunition stockpiles: more than five million rounds of small arms ammunition were collected (BASIC, 2004; AllAfrica, 2004c; AllAfrica, 2004d). Following some tense discussions with the Liberian government over the fate of the weapons and ammunition, all of the items were destroyed in October 1999 (BICC, 2005).

Some programmes specifically target ammunition. In 2002, for example, Canada took the lead in a NATO Maintenance and Supply Agency (NAMSA) ammunition destruction project in Albania, established to reduce the country's surplus stocks of ammunition (OSCE, 2002, pp. 16–17). This programme aims to destroy a total of 11,665 tons of ammunition (Republic of Albania, 2004).

One recurrent problem with ammunition collection is that, as with weapons, the items handed in are often old and unusable, while the population retains ammunition that is still in good condition. This seems to have been the case, for instance, with the ammunition recently collected in the Solomon Islands (Alpers and Twyford, 2003, pp. 94–95). Attempts to find ammunition caches may prove more fruitful than efforts to unearth firearms, since ammunition contains explosives and powder that trained dogs, for example, may detect more easily (SEESAC, 2003, p. 19).

It is also worth noting that, despite the obvious complementary roles played by weapons and ammunition in perpetrating conflict, ammunition is often forgotten in weapons collection and destruction programmes. In Mali, for example, a public bonfire of weapons ('Flame of Peace') was organized in March 1996 as part of the reconciliation process. An estimated 2,600–3,000 rifles, machine guns, grenade launchers, and pistols were destroyed (Poulton and Ag Youssouf, 1998, p. 120; DeClerq, 1999a, p. 8), but very little ammunition was collected. The weapons that were handed over to the Malian authorities apparently contained one cartridge each, yet most were destroyed without ammunition—and no ammunition was placed in the Flame of Peace for fear that it may represent a hazard to the people watching (Poulton and Ag Youssouf, 1998, p. 120). Hence, major stockpiles of cartridges and shotgun shells remained unaccounted for, and soon people started acquiring new weapons in order to be able to use this leftover ammunition, or they sold it to those who still had weapons.[19]

Ammunition is often forgotten in weapons collection and destruction programmes

Ammunition and the small arms control agenda

Ammunition production sources are easier to map than those of weapons, because there are fewer ammunition producers than small arms producers in the world, and the former are more easily identified (ICRC, 1999). A relatively small number of companies produce primers, whose manufacture involves complex techniques and whose manipulation is risky (they are ultra-sensitive to heat, shock, and friction, which can result in a violent detonation) (Saferstein, 1995, p. 335; SAAMI, 2005). Producers of ammunition components could therefore be a good target for ammunition control.

One argument for targeting ammunition centres on the fact that weapons are a durable good while ammunition is not: three of its four components (projectile, powder, and primer) can be used only once. Although ammunition's longevity can extend well beyond its official shelf life, 'small arms and light weapons used in conflict require frequent re-supply of ammunition and therefore enhanced controls on ammunition and its explosive components and on the manufacturing technology to produce them could be of particular value in dealing with the existing dissemination of small arms and light weapons and reducing the incidence of their use in conflict or post-conflict situations' (UNGA, 1999, sec. 104, p. 16). The fact that the shelf life can be very long only matters if the ammunition does not need to be used for a long time. In conflict settings, by contrast, ammunition stocks are depleted very rapidly, fuelling a need for constant resupply. Because high expenditure of ammunition often signifies severe conflict or intense waste (through 'spraying' rather than aiming at targets), it serves as a good indicator of potential weapons misuse. Limiting ammunition proliferation and keeping supplies under control could help in preventing some of this misuse.

High expenditure of ammunition often serves as a good indicator of potential misuse.

Marking military and police ammunition, as in Brazil, or all bullets, as in the project currently under review in California, could represent a major improvement by making purchasers more accountable and limiting the risk of abusive use of firearms. In regions where there is a danger of ammunition being diverted to armed or criminal groups, marking ammunition could even be more useful than marking the weapons themselves, since it is quickly depleted. If one started marking all sold ammunition today, it would probably take just ten years to mark most of the ammunition transferred worldwide—while guns already in circulation are likely to remain so for decades.

Another instrument that has proved effective in the past is export control, or, more specifically, the restriction of ammunition exports to countries that may resell the imported products, or where they are likely to be misused. Australia, the major exporter of ammunition to PNG, decided in 2002 to limit drastically its sales to the country, for fear that they might accentuate existing proliferation and fuel violence; New Zealand has taken a similar stand (Alpers, 2005).

CONCLUSION

Ammunition, it seems, has long been considered nothing more than a subsidiary of weapons. In 1999, the Group of Experts on the problem of ammunition and explosives highlighted the 'insufficiency and unavailability of existing information on matters related to ammunition for small arms and light weapons and explosives in all their aspects' (UNGA, 1999, sec. 9, p. 4). This chapter has introduced a number of issues pertaining to small arms ammunition, but much more remains to be done on a subject that has been neglected to date. A closer look at light weapons ammunition, for instance, would raise significantly different questions regarding international transfers, stockpile management, and detection of caches, as it contains much more explosive material than its small arms counterpart, and is used almost exclusively in military settings.

Looking at the problem of firearms misuse through the ammunition lens leads to consideration of new control strategies. Up to now, however, international instruments have covered ammunition very imperfectly, leaving it mostly to individual governments to decide on whether they should report on ammunition-related matters. The ammunition issue is often left aside because it is considered either too complex, or of secondary importance. In practice, though, measures that target ammunition can be easier to implement than those that focus on firearms. Headstamping, for example, is a marking that can not be tampered with—unlike the marking of firearms.

Widening the scope of small arms research to include all aspects of ammunition will facilitate understanding of larger patterns of weapons proliferation and misuse, particularly in conflict regions. Knowing more about how ammunition is produced, stored, sold, used, and ultimately destroyed will provide a clearer idea of ammunition availability, and what steps can be taken to control its spread. Effective post-conflict ammunition collection programmes and improved security of existing stockpiles are measures in need of further development and more effective implementation. This, in turn, will affect small arms use and misuse.

Additionally, it should be noted that, as with small arms, most proposed or existing initiatives concentrate on controlling supply; yet the demand side should not be neglected. Efforts to control production and transfers will prove useless if demand is high enough to encourage a diffusion of technology and craft production; improved and efficient stockpile destruction methods will be of little use if the populations involved mistrust the process and thus keep their ammunition. Further research is thus needed on the determinants of the demand for weapons and ammunition, and how the two are interrelated.

LIST OF ABBREVIATIONS

ACS	Ammunition Coding System
BMG	Browning Machine Gun
CAR	Central African Republic
CBC	Companhia Brasileira de Cartuchos (Brazil)
CIS	Commonwealth of Independent States
CNC	Computer numeric control
DDR	Disarmament, demobilization, and reintegration
DFPC	Directorate of Controlled Products (Brazil)
DRC	Democratic Republic of Congo
ECOSOC	Economic and Social Council (UN)
ECOWAS	Economic Community of West African States
EU	European Union
FLETC	Federal Law Enforcement Training Center (United States)
FMJ	Full-metal jacket
GAO	General Accounting Office (United States)
HIPCs	Heavily Indebted Poor Countries
ICRC	International Committee of the Red Cross
INDUMIL	Industria Militar (Colombia)
NAMSA	NATO Maintenance and Supply Agency
NATO	North Atlantic Treaty Organisation
NGO	Non-governmental organization

OAS	Organization of American States
OAU	Organization of African Unity
OSCE	Organization for Security and Co-operation in Europe
PBRs	Plastic baton rounds
PNG	Papua New Guinea
SADC	Southern African Development Community
UN	United Nations
UNDP	United Nations Development Programme
UNRF II	Uganda National Rescue Front II
USAEC	US Army Environmental Center
WED	Weapons in exchange for development

ENDNOTES

1 These figures, however, include small arms as well as non-small arms ammunition. This chapter also addresses ammunition designed for heavy machine guns and anti-matériel rifles because, in basic terms, it differs from small arms ammunition only in size.
2 Shotguns are not specifically mentioned in the UN definition of small arms (UNGA, 1997, sec. 26, pp. 11–12).
3 Interview with a representative of RUAG Ammotec, September 2004.
4 Correspondence with James Gebhardt, American firearms hobbyist, 27 September 2004.
5 Correspondence with James Gebhardt, American firearms hobbyist, 10 December 2004.
6 Correspondence with Philip Alpers, gunpolicy.org, 24 January 2005.
7 Interview with Malian ex-combatants, Bamako, Mali, 2–3 September 2004.
8 Interview between Christina Wille, senior researcher at the Small Arms Survey, and a former Khmer Rouge commander, Pailin, Cambodia, 1 February 2005.
9 Interview with Malian ex-combatants, Bamako, Mali, 2–3 September 2004.
10 Interview with Malian ex-combatants, Bamako, Mali, 2–3 September 2004.
11 Interview with Malian ex-combatants, Bamako, Mali, 2–3 September 2004.
12 Interview between Christina Wille, senior researcher at the Small Arms Survey, and a former Khmer Rouge commander, Pailin, Cambodia, 1 February 2005.
13 Interview with Malian ex-combatants, Bamako, Mali, 2–3 September 2004.
14 Interview with Henry Boschoff, military analyst at the ISS (Institute for Security Studies, Pretoria), Geneva, 8 October 2004.
15 Interview between Christina Wille, senior researcher at the Small Arms Survey, and a former Khmer Rouge commander, Pailin, Cambodia, 1 February 2005.
16 Interview with Malian ex-combatants, Bamako, Mali, 2–3 September 2004; Small Arms Survey and CECORE (2004).
17 5.56 x 45mm, .22-250, .243 Winchester, .270 Winchester, .308 Winchester, .375 Winchester, 7mm Mauser, 7.62 x 39mm, 7.62 x 51mm, .30-06, 9mm, .357 Magnum, .38 Super Auto, .40 Smith & Wesson, .44 Magnum, .44 Special, .45 Colt, .45 Auto, .50, 12-gauge.
18 Additional source: interview with Sergio Benassai, Head of Italian Delegation to the Sub-Committee of Experts on the Transport of Dangerous Goods, Geneva, 9 December 2004.
19 Interview with Malian ex-combatants, Bamako, Mali, 2–3 September 2004.

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