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Aiming for Control

The need to include ammunition in the Arms Trade Treaty

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Abbreviations

AMISOM	African Union Mission in Somalia
ATGW	Anti-Tank Guided Weapons
ATK	Alliant Techsystems, Inc
DAER	Daily Ammunition Expenditure Rate
GD-OTS	General Dynamics Ordnance and Tactical Systems
GOCO	Government-Owned Contractor-Operated
HEAT	High Explosive Anti-tank
IDEX	International Defence Exhibition
LURD	Liberians United for Reconciliation and Democracy
MAAWS	Multi-Role Anti-Armor Anti-Personnel Weapon System
MANPADS	Man-Portable Air Defence Systems
OFB	Ordnance Factory Board
RPG	Rocket-Propelled Grenades
RSR	Required Supply Rate
SEESAC	South Eastern and Eastern Europe Clearinghouse for the Control of Small Arms and Light Weapons

1. Executive summary

This paper argues for the inclusion of ammunition in the Arms Trade Treaty. It points out that ammunition offers specific opportunities to meet the Treaty's principles, goals and objectives. Particularly concerning warfare, controls over transfers of ammunition offer a greater opportunity to prevent atrocities compared to controls over weapons. Ammunition can only be used once, and needs to be re-supplied. Interrupting these supplies would offer an immediate means by which armed forces engaged in warfare could be stopped.

We identify five opportunities for control provided by ammunition:

1. **Warfare requires constant re-supply of ammunition.** Weapons often last for decades, but ammunition can only be used once. An army fighting a war will need to keep up regular supplies of ammunition, otherwise its effectiveness as a fighting force will degrade and ultimately cease.

2. **Global exports are dominated by a small number of states.** Just fifteen states accounted for 90 per cent of all identified ammunition exports in 2011. Only a small number of states have the industrial base required to make reliable supplies of the quantities and specific types of ammunition needed by many states involved in armed conflict.

3. **State ownership of ammunition production**. Just under half of all the major ammunition exporting companies are state owned. Ownership gives states additional means by which they can control the international trade.

4. **A small number of significant exporting companies.** While there are a large number of companies capable of producing ammunition, we only identified 36 which regularly have significant export sales. It is just these companies that have the industrial capacity, ownership of technology, and marketing expertise required to be global level exporters.

5. **Types of ammunition with single, or a handful of, producers.** Particularly concerning medium and large calibers, there are many occasions in which users of a weapon can only obtain ammunition from a single company, or a small number of companies. In such a circumstance the suspension of supplies of new ammunition could be carried out by a small number of states, or even one acting alone. This is especially the case with large caliber ammunition.

2. Introduction

This paper makes the case for including ammunition within the scope of the Arms Trade Treaty. It focuses upon the perspective of the use of ammunition in warfare, and the ways in which ammunition actually provides five opportunities to effectively control transfers. Concerning the draft treaty text submitted by the President of the 2012 ATT Conference,[1] this paper is directly relevant to:

- The terms 'peace and security', 'conflict' and 'armed conflict' as used in the Preamble.
- The terms 'threat or use of force against the territorial integrity or political independence of any State' and 'ensure respect for international humanitarian law' used in the Principles.
- The text 'Contribute to international and regional peace, security and stability;' in Article 1 Goals and objectives.
- The prohibition against transfers of arms which would facilitate "war crimes constituting grave breaches of the Geneva Conventions of 1949, or serious violations of common article 3 of the Geneva Conventions of 1949"found in Article 3 Prohibited transfers.
- The reference to arms being "used to commit or facilitate a serious violation of international humanitarian law" found in Article 4 National assessment.

This is not to say that ammunition is not relevant to other concerns – such as human rights - outlined in the draft treaty text. The distinction is that warfare generally requires huge quantities of ammunition, and in a very wide variety of types for use in many different weapons. Violations of human rights, for example, generally do not require as extensive supplies of ammunition as warfare. Indeed, they can often be carried out through the threat of the use of weapons.

We refer several times to production of ammunition, and how the structure of the industry offers opportunities to control the trade. We do not argue for production to be included within the scope of the Arms Trade Treaty.

2.1. Definitions and terms

The definition of ammunition used in this report is drawn[2] from the United Nations' *International Ammunition Technical Guidelines*:

> Ammunition: a complete device, (e.g. missile, shell, mine, demolition store etc.) charged with explosives, propellants, pyrotechnics, initiating composition for use in connection with offence, or defence, or training, or non-operational purposes, including those parts of weapons systems containing explosives.[3]

We divide ammunition into three different types based upon calibre. The three types are:

---

[1] United Nations. 2012. *Draft of the Arms Trade Treaty* A/CONF.217/CRP.1.

[2] The words "nuclear, biological or chemical material" were removed from the definition as the Arms Trade Treaty will cover conventional arms.

[3] United Nations. 2011. *International Ammunition Technical Guidelines.* Document downloaded on 17 03 2013 from www.un.org/disarmament/convarms/Ammunition/IATG/docs/IATG01.40-Glossary_and_Definitions(V.1).pdf

- Small calibre: used by pistols, rifles, shotguns and machineguns. Types referred to in this report include: 5.56mm which is used in assault rifles; 7.62mm which is used in assault rifles and machine guns; and 12.7mm (or .50 cal) which is used in heavy machineguns.

- Medium calibre: used in light weapons such as grenade launchers, recoilless rifles, mortars (below 120mm) and man-portable rocket and missile launchers.

- Large calibre: used in vehicle mounted or towed artillery, rocket and missile launchers.

A much more detailed categorization of ammunition is presented by Hilde Wallacher and Alexander Harang and in *Small, but lethal – small arms ammunition and the Arms Trade Treaty*.

The paper refers to two similar units of weight. The 'tonne' is a metric unit which weighs 1 000 kilograms, in the United States it is known as a 'metric ton'. The 'short ton' is used in the United States and weight 2000 pounds. The 'short ton' weighs 907 kilogrammes, so the units are roughly equivalent.

3. Warfare requires constant re-supply of ammunition

Combatants use vast quantities of ammunition. The development of automatic weapons (such as machineguns and assault rifles) and breach loading artillery dramatically increased the amount of ammunition that could be fired by a single weapon on the battlefield or during training. For example, the Browning M2 .50 cal heavy machine gun, introduced in 1923, can fire 450-600 rounds per minute.[4] By the first and second world wars military forces depended upon a huge industrial infrastructure designed to manufacture and transport sufficient quantities of ammunition to the battlefield.

This very high level of consumption of ammunition provides a unique opportunity for arms trade controls to prevent atrocities. Weapons often last for decades, but ammunition can only be used once. An army fighting a war will need to keep up regular supplies of ammunition, otherwise its effectiveness as a fighting force will degrade and ultimately cease.

A cessation of ammunition supplies therefore offers the possibility of being able to reverse a war or aggression, or prevent soldiers from being able to commit serious violations of International Humanitarian Law. The most powerful means is probably the threat. If a government faces a credible threat of having ammunition supplies cut because it violated international norms it may well modify its behavior.

3.1. Ammunition use by armed forces involved in warfare

Militaries often prefer to keep statistics on ammunition confidential. Information on daily usage, stocks and production could be used to work out an adversary's ability to fight a war. Nevertheless, some information has been published and a selection is presented here to illustrate the sheer quantity of ammunition used in combat.

3.1.1. Ammunition usage during war by the UK, France and Italy

The UK has one factory which produces ammunition for small arms (such as assault rifles and machineguns). By 2009 the UK's military engagement in Afghanistan had led to a more than doubling of the factory's ammunition production. In 2004 it produced 90 million rounds, and by 2009 the effects of the operations in Afghanistan had increased production to 236 million rounds.[5] To meet the demand, the factory was operating 24 hours per day and seven days per week, and in 2009 BAE Systems initiated a major upgrade.[6] It was reported in 2009 that the factory was producing 1 million small arms rounds per day, annual production is summarized in table 3.1:[7]

---

[4] Jones, Richard, D. And Ness, Leland, S., Eds. 2009. *Jane's Infantry Weapons 2009-2010*. Jane's Information Group, UK. p. 410.

[5] Information on ammunition production from Ripley, Tim. 2009. 'BAE Systems Ramps up ammo production'. *Jane's Defence Weekly,* 25 September.

[6] See Wilson, Amy. 2009. 'Bullets fly in Cheshire to support Afghan war'. *Telegraph* (London), 21 August; and Anderson, Guy. 2011. 'BAE Systems opens British munitions factory to serve Afghan theatre'. *Jane's Defence Weekly,* 29 September.

[7] Information on ammunition production from Ripley, Tim. 2009. op. cit. .

Table 3.1 2009 UK production of small caliber ammunition

Caliber	Quantity
5.56mm	101 million
5.56mm tracer	6 million
5.56mm blank	77 million
7.62mm	25 million
7.62mm tracer	13 million
7.62mm blank	12 million

In 2008 there were some 8,000 UK troops deployed in Afghanistan, and this number had increased to 9,500 by 2012. Between October 2008 and April 2012, 290 UK armed forces personnel were killed.[8] Over that period UK troops fired some 13,760,000 rounds of 5.56mm ammunition (the type used in the UK army's assault rifle).[9] The bulk of ammunition production was needed to train for combat up to 18,000 troops per year before they went to Afghanistan[10] (as UK troops were rotated in and out of the area).

Similar levels of ammunition use can be found in the French armed forces. In 2008 the circa 3,000 French troops deployed in Afghanistan used 400,000 rounds of small caliber ammunition, 6,000 rounds of 20mm ammunition, and a thousand 120mm mortar bombs. They were reported to have been involved in 40 skirmishes that killed 12 French soldiers.[11] The French Ministry of Defence reported that in 2007 the army used some 35 million rounds of 5.56mm ammunition.[12] The great bulk of this ammunition will have been expended that year in training (8 million of those rounds were blank cartridges)[13] and on France's many deployments of military forces abroad (including to forces in Afghanistan and Côte d'Ivoire).[14]

Statistics published in a Small Arms Survey provide a snapshot of ammunition usage by two Italian units - an infantry brigade and a special unit of some 30 soldiers.[15] The infantry brigade was not involved in combat (and used the ammunition for training). The brigade was comprised of some 5,000 soldiers and it's usage in 2008 is summarized in Table 3.2.

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[8] Casualty figures from Rogers, Simon and Guardian Research Department. 2012. 'British dead and wounded in Afghanistan, month by month.' *The Guardian*. 16 January. Article downloaded on 28 02 2013, from www.guardian.co.uk/news/datablog/2009/sep/17/afghanistan-casualties-dead-wounded-british-data

[9] UK ammunition usage figures reported in Crawford, Angus. 2012. 'Should armies use lead-free bullets?' *BBC News*. Article downloaded on 28 02 2013, from www.bbc.co.uk/news/magazine-19116438

[10] Ripley, Tim. 2009. 'BAE Systems Ramps up ammo production' *Jane's Defence Weekly,* 25 September.

[11] Ammunition use, skirmish and casualty figures from *RAIDS*. 2009. *Afghanistan la réalité crue, par les chiffres* p.5.

[12] See France. 2010. *Le parcours d'une munition*. 5 July. Downloaded 28.02.2013 from www.defense.gouv.fr/terre/actu-terre/le-parcours-d-une-munition

[13] Blank cartridges are also used in ceremonial duties.

[14] Details of French deployments on peacekeeping forces can be found at France. Undated. *Opérations de maintien de la paix*. Downloaded 28 02 2013 from www.franceonu.org/la-france-a-l-onu/dossiers-thematiques/paix-et-securite/operations-de-maintien-de-la-paix/article/operations-de-maintien-de-la-paix

[15] All statistics on Italy from Persi Paoli, Giacomo. 2010. 'Italian Procurement, Exports, and Consumption of Smalland Large-calibre Ammunition and Munitions'. In Benjamin King ed. *Surveying Europe's Production and Procurement of Small Arms and Light Weapons Ammunition The Cases of Italy, France, and the Russian Federation*. Small Arms Survey Working Paper 10. Geneva: Small Arms Survey.

Table 3.2 Small caliber ammunition used for training by an Italian brigade in 2008

Caliber	Quantity used (rounds)
5.56mm	500 640
7.62mm	48 450
9mm	174 450
12.7mm	45 400

This usage amounts to, on average, about 100 rounds of 5.56mm ammunition per person per year (weapons using the other calibers would not be issued to every soldier).

The brigade's ammunition usage can be compared to a specialist unit of just 30 who were deployed to high intensity theatres for six months, and spent six months training in Italy. The usage of this small unit is summarized in Table 3.3.

Table 3.3 Selected small caliber ammunition used by a small specialized unit in 2008

Caliber	Quantity used (rounds)
5.56mm	520 000
9mm	310 000

The difference is clear. A small unit of 30 deployed in, and training for, high intensity operations used more ammunition than a brigade of 5,000 solely engaged in training.

3.1.2. Ammunition usage during war by the USA

The British, French and Italian forces engaged in high intensity operations were relatively limited in size. By contrast, in recent history the United States has both deployed hundreds of thousands in combat, and released data on anticipated and actual ammunition usage.

In 2005 the Congressional Research Service published a report detailing the effects on ammunition usage by US armed forces in operations in Iraq, Afghanistan and other locations. The effect of the wars was to more than double small caliber ammunition requirements to 1.79 billion rounds per year. The increase in is shown in Table 3.4.

Table 3.4 Annual US ammunition requirements 2000 - 2005

	In millions of rounds					
Type	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY2005
5.56mm	626.2	575.6	689	929	1181	1353
7.62mm	47.2	50.7	92.2	136.3	313	282
12.7mm	20.4	15.7	22.6	41.8	67	74
9mm	39.6	133.7	104.2	146.4	75	81
Total	733.4	775.7	908	1253.5	1636	1790

Source: United States Government Accountability Office. 2005. *DOD Meeting Small and Medium Caliber Ammunition Needs, but Additional Actions Are Necessary,* p. 9.

Similar increases were noted for medium caliber (20mm to 40mm) ammunition requirements, which almost doubled from 11.7 to 21.5 million rounds per year. As with the UK (mentioned

above) the increased usage of ammunition was not just due to firing in combat, but also greatly increased training using live fire exercises.[16]

The US Army has only one plant which produces its small caliber ammunition (see Section 5.1). Despite increasing production to 1.375 billion rounds in FY 2008[17] the Lake City plant was unable to meet the needs of the US armed forces. It was therefore necessary for the US Department of Defense to sign additional commercial contracts to meet its ammunition needs. In 2004 it purchased an additional 313 million rounds of ammunition from outside suppliers.[18] One of these was the US based Olin Corporation. Crucially, it is variously reported to have also sourced significant supplies of ammunition from abroad. These imports included the purchase of some 120 million rounds from the UK's reserve stocks,[19] and further imports from commercial suppliers in Sweden, Israel Military Industries of Israel, the Poongsan Corporation of South Korea, and SNC Technologies Inc. of Canada.[20] In the event ammunition obtained from Israel and the UK was only used for training, with the South Korean supplies being the main source of imported ammunition used in combat.[21]

An indication of total US ammunition usage during a modern war can be found from its deployment to the Saudi Arabia during operation Desert Shield in 1990 and the subsequent fighting against Iraqi forces in Desert Storm during 1991. Some 406 000 short tons of ammunition was shipped to Persian Gulf, which is broken down in Table 3.5.[22]

Table 3.5 Total quantity of ammunition delivered to the Persian Gulf 1990-91

Type	Quantity in short tons
Artillery Shells	245 000
Small Arms	34 000
Mortar, tank and naval gun	36 000
Assorted	91 000

Note: In addition 274 000 short tons of aerial bombs were transported.

Source: Porter, Kimberley and Herbert LePore. 1991. *Legacy in the Sand: The United States Army Armament, Munitions and Chemical Command in Operatios Desert Shield and Desert Storm*. Rock Island Il: Historical Office United States Army Armament, Munitions and Chemical Command, pp. 133-4.

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[16] Pappalardo, Joe. 2005. 'Pentagon Taking Steps to Avert Ammunition Crisis'. *National Defense Magazine* July.

[17] Siekman, Mark. 2010. 'Small-Arms Ammunition Production and Acquisition: Too Many Eggs in One Basket?'. *Army Sustainment*. Vol. 4 Issue 5.

[18] United States Government Accountability Office. 2005. *DOD Meeting Small and Medium Caliber Ammunition Needs, but Additional Actions Are Necessary,* p. 12.

[19] United States Government Accountability Office. 2005. Op. cit.

[20] See Hedges, Stephen J. 2005. 'U.S. cranks up ammo output'. *Chicago Tribune*. 7 February; Schorr, Thomas. 2010. 'Ammunition Management: A Joint or Army Function?' *Army Sustainment*, Vol, 42 Issue 4.; Pappalardo, Joe. 2005. 'Pentagon Taking Steps to Avert Ammunition Crisis'. *National Defense Magazine,* July; and United States Government Accountability Office. 2005. *DOD Meeting Small and Medium Caliber Ammunition Needs, but Additional Actions Are Necessary,* p. 12.

[21] Schorr, Thomas. 2010, op. cit.

[22] In addition 274 000 short tonnes of bombs (not defined as ammunition in this paper) were shipped. Figures from Porter, Kimberley and Herbert LePore. 1991. *Legacy in the Sand: The United States Army Armament, Munitions and Chemical Command in Operations Desert Shield and Desert Storm.* Rock Island Il: Historical Office United States Army Armament, Munitions and Chemical Command, pp 133-4.

Those vast quantities were carried by 23 ships containing Army ammunition and 9 ships containing Marine Corps ammunition.[23] Despite amassing such huge stocks, the US armed forces anticipated shortages in many types of ammunition – in particular some tank and artillery shells, machinegun rounds, rockets and mortar bombs.[24] These fears caused the US to dip into Cold War stockpiles in Europe and its transfers included: 3000 TOW II anti-tank missiles; 4000 105mm artillery rounds and 900 000 rounds of 25mm ammunition.[25] In the event, not all the ammunition was used (the war was brought to a halt after 100 hours), and the United States needed to repatriate 270 909 short tons were returned (a further 11 486 short tons were destroyed and 2891 donated to Kuwait.[26] These returns do though not rule out shortages of specific types of ammunition. US consumption of ammunition during Desert Storm and Desert Shield can therefore be assumed to be 331 741 short tons of ammunition.[27]

Supply of ammunition involves complications not found with most other aspects of military logistics. During the 1990s US forces used over 500 different types of ammunition and associated components.[28] All of these had to be delivered to the right personnel at the right time – it doesn't help a soldier needing 5.56mm caliber ammunition to receive a supply of 7.62mm.

3.1.3. Ammunition procurement during war by Nepal

The above examples concern relatively well resourced militaries from developed countries. An indication of ammunition use during war by developing world governments can occasionally be found from official export data and press reports.

The civil war in Nepal lasted from 1996 until a comprehensive peace agreement in 2006. During that period Nepal imported large quantities of ammunition, which are summarized in Table 3.6.

Table 3.6 Identified ammunition imports by Nepal 1996-2006

Supplier	Ammunition Type	Year	Financial value current USD	Quantity	Notes
Austria	Small caliber	1996	756 853	36.6 tonnes	
	Medium and large caliber and other munitions	2000	13 452		
Austria	Small caliber	2001	670 110	82 tonnes	
Austria	All calibers	2003	152 183		Export license authorisation
Bosnia Herzegovina	Small caliber	2003	413 580		
Bulgaria	All calibers	2005			Value and quantity not

[23] Porter, Kimberley and Herbert LePore. 1991. op. cit., pp 135-6.

[24] Scott, Beth, James Rainey and Andrew Hunt.2000. *The Logistics of War*. Maxwell, Ab: The Air Force Logistics Management Agency, pp221-222.

[25] Scott, beth, James Rainey and Andrew Hunt. 2000 ,op. cit.

[26] Porter, Kimberley and Herbert LePore. 1991. Op. cit. p. 136.

[27] This figure includes aerial bombs (which were not disaggregated from the total returned) and transfers to allied forces.

[28] Scott, Beth, James Rainey and Andrew Hunt. 2000. op. cit, p. 319.

					specified
Burundi	Medium and large caliber and other munitions	2006	3 959 221	25.820 tonnes	
Canada	Small caliber	1996	330 088		Quantity not specified
China	7.62mm	2005	800 000	4 000 000 rounds	Deal included 18 000 hand grenades.
Germany	Medium and large caliber and other munitions	1998	109 000	1 tonne	
Germany	All calibers	1999-2001			Value and quantity not specified; export license authorisations
Israel	5.56mm	2005			Value and quantity not specified
Pakistan	7.62mm and 5.56mm	2005	1 000 000	6 750 000 rounds	
United Kingdom	Small arms and light weapons ammunition	1997			Value and quantity not specified; export license authorisations
United Kingdom	Small arms and light weapons ammunition	2000			Value and quantity not specified; export license authorisation.
United Kingdom	Medium and large caliber and other munitions	2001	308 978		
United Kingdom	Medium and large caliber and other munitions	2002	51 395		
United Kingdom	Small caliber	2002	28 118		
United Kingdom	Small caliber	2003	213 135		
United Kingdom	Bombs, rockets and other munitions	2004			Value and quantity not specified; export license authorisation.

United States	Small caliber	1999	270 800	820 000 rounds	
United States	Small caliber	2000	24 160		
United States	Small caliber	2001	117 894	11.39 tonnes	
United States	Small caliber	2006	16 000	0.935 tonnes	

Note: not included are imports of shotgun shells and associated parts, trades described as 'sporting ammunition', trades which were likely to double count where data was available from several sources, and trades valued under USD 10 000. License authorizations may not have been delivered.

Sources: NISAT database of arms transfers www.nisat.org; *Jane's Defence Weekly*. 2005. 'Nepal buys ammunition from China, Pakistan'. 28 September; *BBC Monitoring*. 2005. Nepalese army buys Ammunition from Israel. 27 August.

The total value of identified ammunition imports was USD 9 234 967. The imports of small caliber ammunition from Austria, Bosnia, Canada, United Kingdom and United States for which the number of rounds has not been reported have a financial value of USD 2 569 938. Using the ratio found in the import from the United States in 1999 of USD 0.33 per round for small caliber ammunition,[29] the quantity of imports in those transactions can be estimated to be approximately 7 700 000 rounds. Added to the transactions for which quantities of small caliber ammunition were reported, the total identified imports of ammunition by Nepal between 1996 and 2006 are in the region of 20 million rounds.[30] It is very likely that this figure significantly understates the real picture. In several instances we just have knowledge of a license authorization or a report that a transfer took place (for example concerning supplies from Bulgaria). Information on the supplies from China and Pakistan is from press reports – other unreported transfers could have taken place. In addition, there were USD 4.4 million worth of identified imports of medium and large caliber ammunition and other munitions not presented in Table 3.6.

In addition to purchasing finished ammunition, Nepal also imported components and production machinery for ammunition, which are summarized in Table 3.7.

Table 3.7 Identified export of ammunition production equipment to Nepal, 1996-2006.

Supplier	Equipment	Year	Financial value current USD	Notes
Germany	Components for small caliber ammunition	1999	495 250	Export license authorisation.
Germany	Production equipment for	1999	593 428	Export license authorisation.

[29] The USD 0.33 per round of small calibre ammunition accords with other international examples of bulk imports.

[30] Some of the imports may well have been supplied to police units (though police were also engaged in counter-insurgency duties). Civilian purchasers are also likely, but Nepal has restrictive firearms ownership laws so their purchases of small calibre ammunition (as opposed to shotgun shells) are not likely to be significant.

	small caliber ammunition			
Germany	Production equipment for small caliber ammunition	2000	342739	Export license authorisation.
Germany	Production equipment for small caliber ammunition	2001	336 142	Deal also included maintenance equipment for small arms; export license authorisation.
Germany	Production equipment for small caliber ammunition	2002	512 127	Deal also included ballistic measurement equipment; export license authorisation.
United Kingdom	Components & accessories for small arms and ammunition	1998-2001, 2003		Value not specified; export license authorisation.

Source: NISAT database of small arms transfers, www.nisat.org.

These imports of components and production machinery represent an upgrade of Nepal's domestic capacity to produce ammunition. Details on Nepal's industry are sketchy, but this equipment likely represents an upgraded capacity to produce additional millions of rounds.

Nepal's imports were, unsurprisingly, at a lower level than the NATO members' usage described above. Nepal couldn't afford to expend ammunition at the same rate. Nevertheless, it imported at least an estimated 20 million rounds over the course of its civil war, and in addition procured USD 4.4 million worth of medium and large caliber ammunition and other munitions. The lesson is the same, for a country like Nepal, fighting a civil war means that its armed forces have to continually obtain large quantities of ammunition. Attempts to develop its domestic production capacity did not obviate the need for it to import ammunition from abroad.

3.1.4. Daily ammunition rates

Another indication of ammunition usage comes from ratios used by military planners to anticipate ammunition usage during warfare. Shortages are avoided through establishing daily expected ammunition usage for particular units engaged in combat. These daily rates are known as the Daily Ammunition Expenditure Rate (DAER) or Required Supply Rate (RSR). Armed forces are usually reluctant to publish their DAER estimates as this will provide key information about military effectiveness to potential adversaries. Nevertheless, some information is available.

A US Army teaching document for logistics personnel published in 2000 provides some illustrative examples of daily ammunition usage which staff college students could use to

"estimate ammunition handling and transportation requirements for a supported force".[31] Table 3.8 shows the daily Required Supply Rate for selected military units:

Table 3.8 Daily quantity of ammunition required by selected military US Army units

Unit	Short tons per day
Attack helicopter battalion (24 AH-64 Apache)	6.6
Field Artillery Battalion, 18 155mm Self Propelled Guns	88.7
Field Artillery Battalion, 18 105mm Towed Guns	22.3
Field Artillery battalion, circa 18 MLRS	736.3
Light Infantry division, circa 15 000 soldiers	147

Source: U.S. Army Command and General Staff College. 2000. G1/G4 Battle Book. Fort Leavenworth, KS: U.S. Army, p. 5.

3.2. Explaining the level of ammunition usage

A document produced by the South Eastern and Eastern Europe Clearinghouse for the Control of Small Arms and Light Weapons (SEESAC) contains some illustrative Daily Ammunition Expenditure Rates (DAER) used to highlight how a government can determine whether it has surplus ammunition stocks. They provide an example of how much ammunition could be used on the battlefield (though of course actual usage would be decided by "force structure, strategic concept, deployment and equipment levels").[32] The document provides other hypothetical rates for weapons which are summarized in Table 3.9.

Table 3.9 Illustrative Daily Ammunition Expenditure Rates for intense warfare

Weapon type	DAER	Number of weapons	Number of days	Total requirement rounds
5.56mm assault rifle	120	600	30	2 160 000
RPG anti-tank rocket	20	100	30	60 000
60mm mortar	20	40	30	24 000
152mm Artillery	200	20	30	120 000

Source: SEESAC. 2006. *Ammunition and Explosives Stockpile Management*. RMDS/G 05.50. 4th Edition. Belgrade: SEESAC, p. 4.

These hypothetical examples provide useful data on how units can expend so much ammunition. To take the first example in Table 3.9, a daily use of 120 rounds of ammunition represents four magazines of a typical assault rifle (30 rounds being a common magazine size). A force of 600

[31] U.S. Army Command and General Staff College. 2000. G1/G4 Battle Book. Fort Leavenworth, KS: U.S. Army, p. 5.

[32] SEESAC. 2006. *Ammunition and Explosives Stockpile Management*. RMDS/G 05.50. 4th Edition. Belgrade: SEESAC, p. 4.

troops (not a particularly large number) would therefore use 72 000 rounds per day. If they fight for 30 days then we get to over two million round being expended in a month.

The great majority of rounds fired in combat have not been aimed at a specific enemy individual (or other target) which appears in the sights of the soldier. To start with, large quantities of ammunition are fired during training – and that training consumption often increases dramatically if a unit is about to go into combat. The UK procurement outlined in Section 3.1.1 included millions of rounds of blank cartridges whose only used would be for training.

Secondly, actual combat differs markedly from a static practice range. Troops' fire is much less accurate when they have to shoot while selecting cover and moving. Their accuracy is further reduced if the enemy is shooting at them, especially with automatic weapons or tanks.[33]

Finally, the most common use for ammunition in combat is for what is known as 'suppression', which is described by retired army officer Jim Storr as being:

> Suppression is the effect of small arms and other weapons systems which temporarily prevent the enemy firing its weapons or moving in the open. In simple terms, it makes them keep their heads down. It is critically important. In the offence it allows the attacker to move forward, to find gaps and weak points, and exploit them. In the defence it prevents the enemy moving forward and firing, and thereby sets him up for counterattacks.[34]

Very large quantities of ammunition are fired so as to pass close enough to an enemy combatant to force them to remain in cover and therefore ineffective. For a military tactician, the aim of suppressive fire should be to pin down an enemy unit while other means are used to attack it. But Storr points out that too often it becomes an end to in itself – ammunition is fired just in order to do something.[35] An example of this instinct is the 'spray and pray' tactics often seen in untrained combatants. There people simply fire an automatic weapon in the general direction of the enemy without making any attempt to aim at a specific target.

The very high levels of ammunition used in suppressive fire means that ammunition usage on the battlefield by non-state armed groups or poorly trained government troops can also be high. A 1999 UN group of experts report on ammunition notes that:

> A general lack of training leading to poor accuracy and lack of fire discipline is characteristic of inexperienced combatants involved in many of the conflicts being fought around the world. As a result, military operations in those areas of conflict not only require weapons but also need large quantities of ammunition to go with them.[36]

As poorly trained combatants usually have poor logistic support to supply them with ammunition, combat can take the form of relatively fast engagements in which people fire off all their ammunition quickly and then have to retreat.

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[33] From Storr, Jim. 2009. 'The Real Role of Small Arms in Combat'. *RUSI Defence Systems*. Volume 12, No. 1, p. 44.

[34] From Storr, Jim. 2009. op. cit p. 45; for more on suppression see also Storr, Jim. 2009. *The Human Face of War*. London: Continuum International Publishing, pp. 83-106.

[35] From Storr, Jim. 2009. Op. cit. p. 47.

[36] United Nations General Assembly. 1999. *Report of the Group of Experts on the Problem of Ammunition and Explosives*. A/54/155. 29 June.

3.3. The consequence of ammunition shortages

Failure to supply needed ammunition to troops in combat can have serious consequences. If a military force runs out of ammunition then it will simply be unable to fight and will have to retreat or be captured. Restricted supplies, or a threat that they could be restricted, therefore offer the potential to reduce violations of International Humanitarian Law and inhibit the military forces of a state engaged in a war of aggression.

Reduced supplies of ammunition can also inhibit an army's effectiveness. Some US military logistics specialists note that even if they don't result in a battlefield defeat, shortages of ammunition can cause "waste, hoarding, confusion, and sometimes panic at critical points in battle."[37] Stephanie Pézard finds that shortages of ammunition can lead to non-state armed groups enforcing more discipline amongst their members – for example prohibiting celebratory firing in the air or hunting with firearms – in order to conserve ammunition for military usage.[38]

The clearest example of the effects of ammunition shortage can be found during 2003 in Liberia. There had been a civil war, on and off, in the country from 1989, and the first UN arms embargo was declared in 1992. Charles Taylor became President in 1997, but by 2003 Liberia was still at war and under embargo. Up to 2003, there were numerous cases in which the Taylor government and armed opposition groups were able to flout the embargo and import large quantities of arms and ammunition.[39] By the summer of 2003, though, the restrictions on imports by the government of Liberia were beginning to bite. An expert panel had exposed the means by which Taylor was importing arms, and peacekeeping force deployed in Liberia was actively enforcing the embargo.

By late June 2003 the main anti-Taylor group, Liberians United for Reconciliation and Democracy (LURD) was engaged in an offensive against Monrovia, Liberia's capital. Human Rights Watch reported that on 27 June LURD forces ran out of ammunition and retreated, and then both opposing forces attempted to obtain fresh supplies from abroad.[40] Soon their fates diverged. The LURD forces were able to obtain fresh supplies via the neighboring government of Guinea, and these munitions "made possible their final rebel assault on Monrovia."[41]

In contrast the Taylor government's attempted re-supply ended in failure. The UN expert panel monitoring the embargo reported that during the night of 6-7 August an aircraft loaded with small arms and ammunition landed near Monrovia. The plane was intercepted by West African peacekeeping troops who refused to allow the cargo to leave the airport.[42] The cargo was reported as containing: "twenty-two tons of weapons, including two brand new mortars and numerous boxes of mortar rounds, as well eleven tons of 7.62 mm small arms ammunition and rocket-propelled grenades (RPGs)."[43] Human Rights Watch asserted that the interception of the cargo

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[37] Scott, Beth, James Rainey and Andrew Hunt. 2000. op. cit p.319

[38] Pézard, Stéphanie. 2006. 'Sustaining the Conflict: Ammunition for Attack'. In Stéphanie Pézard and Holger Anders eds. *Targeting Ammunition A Primer*. Geneva: Small Arms Survey.

[39] For an overview of embargo violations concerning Liberia see Wenzel, Maraike and Sami Faltas. 2009. 'Tightning the Screws in West African Arms Embargoes.' In Michael Brzoska and George Lopez eds. *Putting Teeth in the Tiger: Improving the Effectiveness of Arms Embargoes*. Bingley: Emerald, pp. 110-119.

[40] Human Rights Watch. 2003. *Weapons Sanctions, Military Supplies, and Human Suffering: Illegal Arms Flows to Liberia and the June-July 2003 Shelling of Monrovia*. Briefing Paper. 3 November, pp. 2, 6-7.

[41] Human Rights Watch. 2003. op. cit., p. 3.

[42] United Nations Security Council. 2003. *Report of the Panel of Experts appointed pursuant to paragraph 25 of Security Council resolution 1478 (2003) concerning Liberia*. S/2003/397, p. 25.

[43] Human Rights Watch. 2003. Op. cit, p. 4.

was decisive. The Taylor government had no ammunition left to fight with, and if the cargo had reached Taylor's troops "the re-supply of Taylor's forces might have plunged Monrovia back into full-scale war just as it was beginning to emerge from a long period of fighting."[44] As an assessment of the embargo by Paul Holtom put it:

> Restrictions on the war-fighting capabilities of Taylor's forces, coupled with the fact that the Liberians United for Reconciliation and Democracy (LURD) forces were able to continue receiving supplies from its supporters at decisive moments during the battle for Monrovia, played a role in Taylor's decision to leave office in August 2003 and the end of the second Liberian civil war (1999–2003). Therefore, there were times during the first and second Liberian civil wars when the implementation of UN arms embargoes played a role in limiting the warfighting capabilities of Taylor's forces and non-governmental armed forces. This is because these forces generally had limited ammunition stocks and thus relied on regular shipments to operate.[45]

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[44] Human Rights Watch. 2003. Op. cit p. 4.

[45] From Fruchart, Damien Paul Holtom and Siemon T. Wezeman, Daniel Strandow and Peter Wallensteen. 2007. *United Nations Arms Embargoes. Their Impact on Arms Flows and Target Behaviour*. Stockholm: SIPRI, p.29. In addition, another assessment of the effects of arms embargoes concludes that, in the end the embargo "seems to have contributed decisively in limiting the military capabilities of the government forces and this to a negotiated settlement that brought an end to the conflict." From Brzoska, Michael. 2009. 'A Quantative Analysis of Arms Embargoes.' In Michael Brzoska and George Lopez eds. Putting Teeth in the Tiger: Improving the Effectiveness of Arms Embargoes. Bingley: Emerald, p. 234

4. Global exports are dominated by a small number of states

In 2011 the total value of identified international transfers of ammunition was USD 5.6 billion. Just fifteen states accounted for 90 per cent of all these exports. The governments of this handful of states already control almost all the global trade in ammunition through existing laws and regulations concerning export, import and transit.[46] These 15 states are (in alphabetical order): Brazil, China, Canada, France, Germany, Israel, Italy, Norway, Russia, South Korea, Spain, Sweden, Switzerland, United Kingdom and United States. Embrace of an Arms Trade Treaty by just this small number of states would encompass the vast majority of the current trade in ammunition.

As described above, armed forces involved in warfare require great quantities of ammunition (see Section 3). There are a limited number of suppliers who can regularly deliver ammunition in the quantities needed to sustain a military campaign. In addition to the volumes exported, these fifteen states are also significant in terms of the variety of types of ammunition they produce. In many cases there are only a handful of suppliers, or even one, for particular types ammunition. As a group, the fifteen states described here, for example, are responsible for almost all global production of Man-portable Surface to Air Missiles (MANPADS) and Anti-Tank Guided Weapons (ATGW).[47]

For states likely to be involved in serious violations of International Humanitarian Law (those that are involved in warfare), supplies of ammunition from the major exporters mentioned in this section are often crucial. Only a small number of states have the industrial base required to make reliable supplies of the quantities and specific types needed by many states involved in armed conflict. The small number of major exporting companies is described in Section 6.

4.1. Global ammunition exports

The best available data source is the United Nations Commodity Trade Statistics Database (known as Comtrade) which uses a system which disaggregates ammunition into three categories:

- small calibre ammunition and parts which covers rounds equal or less than 14.5mm and parts used to make them;
- shotgun shells;
- medium and large calibre ammunition (above 14.5mm), other munitions such as bombs, grenades, rockets and missiles, and parts.

The latter category includes equipment such aerial bombs not included in the definition of ammunition used in this paper. Unfortunately, it is not possible to further disaggregate the data. Reporting to this Comtrade is not universal, and figures for some states that do not report data are likely to be under-estimates (the clearest example being China). Much more information on the

[46] Laws and regulations concerning production and stockpiles are also relevant to export and import.
[47] Other producers, usually of limited quantities for export, of MANPADS or ATGW are Bulgaria, Iran, North Korea, Pakistan and Serbia.

trade in ammunition and reporting can be found in the 2010 Small Arms Survey yearbook.[48] In addition there is a considerable undocumented (authorized but not reported) trade in ammunition[49] The value transferred of these three categories is shown in Table 4.1.

Table 4.1 Value of identified ammunition transfers in 2011

Type	Billions USD
Medium and large calibre ammunition, other munitions, and parts	3.7
Small calibre ammunition and parts	1.4
Shotgun shells	0.4

In general, shotgun shells are mostly used by civilian hunters and sport shooters (though there is some use by law enforcement and military forces).[50] Small calibre ammunition is used by both civilian and military customers. Medium and large calibre ammunition and other munitions are almost exclusively used by military forces.[51] The trade in ammunition is dominated by a small number of exporters, they are presented in tables 4.2 and 4.3.

4.1.1. Global exports of medium and large calibre ammunition, other munitions, and parts

The USD 3.7 billion identified trade in medium and large calibre ammunition, other munitions, and parts is dominated by the USA. Only three other states have five per cent or more of global exports. Only 14 states have identified exports of over 1 per cent of the global trade. Together they account for 93 per cent of global exports. To that list we should also add China and Russia which are likely to have exceeded the 1 per cent threshold, but are not included due to lack of reporting.

Table 4.2 countries with more than 1% of identified exports in 2011 of medium and large calibre ammunition, other munitions, and parts

Country	Value USD millions	Per cent of identified global exports
United States	1 882	53
France	238	7
Germany	216	6
Israel	164	5
United Kingdom	155	4
Sweden	150	4
Norway	147	4
Italy	105	3
Canada	67	2
Australia	56	2
Turkey	45	1

[48] See Herron, Patrick, Nicholas Marsh, Matt Schroeder and Jasna Lazarevic. 2010. 'Emerging From Obscurity The Global Ammunition Trade'. In Berman et al eds 2010. *Small Arms Survey 2010: Gangs, Groups, and Guns.* Cambridge: Cambridge University Press, pp. 10-13.

[49] See Herron, Patrick, Nicholas Marsh, Matt Schroeder and Jasna Lazarevic. 2010 op. cit. pp. 17-20.

[50] Shotguns have been used by police and military forces to commit human rights violations, and shotguns have a role in combat, particularly urban warfare.

[51] Some police units use medium caliber ammunition, for example CS gas cartridges.

Switzerland	39	1
Spain	38	1
Netherlands	38	1

Note: due to a lack of reporting China and Russia are not in this table. It is very likely that they have more than 1 per cent of the global trade.

Source: NISAT database of small arms transfers, www.nisat.org.

4.1.2. Global exports of small calibre ammunition

The USD 1.4 billion identified trade in small calibre ammunition is more diverse, but still dominated by a small number of exporters. The United States has 27 per cent of identified global exports and just six other states have five per cent or more of the global trade. In all, the 20 exporters with 1 per cent or more of identified global trade in small calibre ammunition also accounted for 93 per cent of all exports.

Table 4.3 countries with more than 1% of identified exports in 2011 of small calibre ammunition and parts

Country	Value USD millions	Per cent of global exports
United States	381	27
Germany	136	10
Switzerland	116	8
Russia	79	6
Norway	77	5
South Korea	75	5
Pakistan	74	5
Canada	42	3
Brazil	42	3
Spain	42	3
Czech Republic	34	2
Sweden	33	2
France	33	2
Finland	27	2
Serbia	25	2
Italy	24	2
Israel	21	1
United Kingdom	20	1
China	20	1
Taiwan	19	1
Singapore	10	1
Hungary	10	1
Bosnia Herzegovina	9	1
Ukraine	7	1
Mexico	7	1

Note: due to lack of reporting, the estimated trade for China is likely to be a large under estimate.

Source: NISAT database of small arms transfers, www.nisat.org.

4.1.3. Global exports of shotgun shells

The USD 400 million trade in shotgun shells is much smaller, and is the only one which is not dominated by the United States. Brazil is the largest exporter, followed by Italy and Spain. The 16 exporters with more than 1 per cent of the trade also account for 93 per cent of all exports. The smaller size of the trade is reflected by the level of the 1 per cent threshold. With comparatively modest exports of some USD 4 million per year, Israel is able to just cross the threshold.

4.2. Importance of the trade in ammunition

There are, of course, alternatives to obtaining ammunition exported from the major suppliers described in this section. There is a trade in surplus ammunition from states outside the major exporters. In addition, it is possible to create or improve production capacity (see below). However, especially for states involved in warfare which require very large quantities of ammunition in a short period of time (see Section 3), these two options are not without problems. Building up a production industry takes months or years. Moreover, ammunition for the more sophisticated weapons requires technology which may well be difficult if not impossible for a state involved in warfare to obtain or develop indigenously (see Section 7). There are problems with the quality of often decades old surplus ammunition. Moreover, concerning higher technology weapons, the specific types of ammunition available from surplus sales may not be those required. For many States involved in warfare, imports are a vital source of ammunition supply.

5. State ownership of ammunition production

Analysis of the most important exporting states (see Section 4) reveals 36 companies which make small caliber ammunition to military standard (see Section 6) or medium or large caliber ammunition (almost exclusively used by militaries). Of these, 22 companies (or 46 per cent) are wholly state owned or a state is a significant shareholder.

Regulations usually govern the production and export of ammunition by both public and private companies. State ownership though provides an additional opportunity to control the trade in ammunition. States could use their ownership to influence commercial contracts which govern the activities of companies beyond their borders. They could do this via:

- Subsidiary companies located abroad. If a state owned company has a subsidiary which is based in another country then the state owner has an opportunity to influence the subsidiary's exports and production.
- Licensing and technology transfer. Companies frequently sell or otherwise provide licenses which allow other firms to produce ammunition (see Section 7 for examples). In general, licensing and technology transfer agreements have strict clauses regarding the further export of items produced under the auspices of the agreement. As noted in Section 5, some license agreements only allow for production for the licensee's national armed forces and do not allow export.
- Joint ventures. These occur when two or more companies agree to co-produce ammunition (or other military equipment). If a state owned company is part of a joint venture it has the potential to influence export sales.

Ministries that control or own shares in ammunition producing companies may not wish to engage in the day to day minutiae of writing commercial contracts. But they could nevertheless exercise control by establishing a set of general guidelines governing commercial contracts with overseas companies. Clearly, respect for an Arms Trade Treaty would form the foundation of such guidelines.

5.1. Ownership of small calibre ammunition production

An analysis of the main States that export small calibre ammunition (see Section 4.1) shows that in 40 per cent of States production is state owned. Overall, of 30 companies which are significant producers of military standard small calibre ammunition, 43 per cent are State owned, or States own all or a majority of the shares (see Table 5.1).

Production in some western European countries that might be expected to be owned by private companies is in fact State owned. For example, Nammo AS of Norway is 50% owned by the Norwegian government, 36.6% by the Finish government and has minor stakes held by the French, German and Spanish governments. RUAG of Switzerland is 100% owned by the Swiss Confederation.

Conversely, whereas it might be expected that Russian military standard small calibre ammunition production would be State owned, the opposite is in fact the case. Of the six

companies that manufacture military specification small calibre ammunition, the majority of production is by private companies, such as Barnaul or Tula. The Federal State Enterprise Amursk Cartridge Plant (Vympel) is the only manufacturer that is State owned.

In addition to state ownership of producing companies, there are also important elements of State interest in ammunition production. For example Alliant Techsystems, Inc. (ATK) operates the Lake City Army Ammunition Plant for the US Government, on a Government-Owned Contractor-Operated (GOCO) basis. This means the US government owns the facility but it is operated by ATK, a private company. Lake City produces 99% of small calibre ammunition produced in the Unites States for the US military.[52] This facility cannot currently fulfil the US military requirement and therefore is not an exporter (see Section 3.1.2). Should a time come when the US military requirement shrinks, this factory would have excess capacity, and may then become an exporter – but one with State ownership of the production facilities.

Lake City is one of 6 Army Ammunition Plants operated on the GOCO basis in the US, with others producing, for example, Mortars, 40mm Cartridges and Tank/Artillery ammunition.[53] Thus a significant percentage of the production facilities of medium and large calibre ammunition in the United States are State owned.

Table 5.1 State / Private ownership or interest in ammunition production companies in countries with more than 1% of identified exports in 2011 of small calibre ammunition and parts

Country	Percentage of identified global exports	State Owned	Partial State Owned / Government interest	Private
United States	27			100%
Germany	10	Majority (via Ruag)		Minority
Switzerland	8	100%		
Russia	6	10%		90%
Norway	5	100%		
South Korea	5			100%
Pakistan	5	100%		
Canada	3			100%
Brazil	3			100%
Spain	3			100%
Czech Republic	2			100%
Sweden	2	100%		
France	2	100%		
Finland	2	100%		
Serbia	2	Minority		Majority
Italy	2			100%
Israel	1	100%		
United Kingdom	1			100%

[52] Siekman, Mark W., Major., Anderson, David A. Dr., and Boyce, Allan S., *Small-Arms Ammunition Production and Acquisition: Too Many Eggs in One Basket?* Army Sustainment, Vol 42, Issue 5, Sept-Oct 2010. http://www.almc.army.mil/alog/issues/SepOct10/spectrum_smallarms_ammo.html

[53] Zimmerman, M., *PM Acquisition Panel:PD Joint Services.* Presentation to the Munitions Executive Summit 4 Feb 2011. Downloaded on 17 03 2013 from www.dtic.mil/ndia/2011MES/Zimmerman.pdf

China	1	100%		
Taiwan	1	100%		

Source: Analysis carried out using company data held in Omega Research Foundation database.

5.2. Ownership of medium and large calibre ammunition production

An analysis of the top 10 countries that export medium and large calibre ammunition, other munitions, and parts (see Section 4.1) shows a higher proportion of private ownership. Seventy per cent of the exporting countries have State owned industries. In the United States, the companies are privately owned, but in some cases they operate government owned facilities (see above). For all other countries the majority of manufacture of large calibre ammunition is carried out by companies which are mainly wholly State owned. (See Table 5.1 below)

Table 5.2 State / Private ownership or interest in ammunition production Companies in countries with more than 1% of identified exports in 2011 of medium and large calibre ammunition and other munitions

Country	Per cent of global exports	State Owned	Partial State Owned / Government interest	Private
United States	53		Major (via ownership of production facilities)	100%
France	7	Majority	Minority	
Germany	6			100%
Israel	5	Majority		Minority
Russia	4	100%		
China	4	100%		
United Kingdom	4			100%
Sweden	3	100%		
Norway	2	100%		
Italy	2			Majority

Source: Analysis carried out using company data held in Omega Research Foundation database.

5.3. Changing ownership and conflicts of interest

It is important to note that the figures on ownership have been given for 2011 (the year which corresponds to the export data presented in Section 4). Ownership can be fluid, with mergers and takeovers a regular feature of the defence industry. For example, following reduced orders and economic uncertainty, the Palencia site of Santa Barbara Sistemas (part of General Dynamics European Land Systems group) was sold to Nammo in late 2012.[54] This means that this portion of Spanish small calibre production now has Norwegian and Finnish government ownership.

[54] Nammo. Undated. *Nammo and Santa Barabara Sistemas reach agreement for takeover of Palencia factory*. Downloaded on 15 3 2013 from www.nammo.com/News/NAMMO-AND-SANTA-BARBARA-SISTEMAS-REACH-AGREEMENT-FOR-TAKEOVER-OF-THE-PALENCIA-FACTORY/

While state ownership offers an opportunity for control it is important to note that it also represents a potential conflict of interest. If a government is responsible for both licensing exports and is the owner of the companies that produce them, there is a danger that undue political influence could be brought to bear on decision-making. We do not recommend State ownership as a means to control the arms trade. Instead, we point out that given the high levels of public ownership that currently exist in the industry, this offers an additional opportunity for control.

6. A small number of companies

Global exports of military standard ammunition are produced by a small number of companies. In all we identified only 36 companies as *significant* producers of ammunition *for export* to military customers. These were the major companies located in States identified as having 1 per cent or more of the global trade, and they are listed in Annex 1. While it is of course possible for supplies to be obtained from surplus or small producers, this small number of companies shows that the great majority of production for export is taking place in a small number of States.

It is striking how there are relatively few major exporters of military ammunition. Research for this report has identified over 100 companies which produce ammunition, in hundreds of factories around the world, although often only for supply to national armed forces. However, many fewer are actually capable of exporting large quantities of ammunition to military customers. This is especially true if we factor in those companies that manufacture ammunition that would satisfy the requirements of a State's armed forces, i.e. ammunition that is manufactured:

- to a recognized design standard (NATO or Russian);
- to a recognized international quality management system (such as ISO 9001:2008); and
- in sufficient quantities and with timely delivery and supply of newly manufactured rather than old stock items.

If all of these factors are taken into account then the number of manufacturers falls considerably. Moreover, even amongst firms that meet these standards, a large number have limited or non-existent export sales. Their customers are the national government - perhaps supplemented by limited export sales (often to neighbouring states). Of course, such supply of ammunition to a national police force engaged in committing atrocities, or exports to a neighbour involved in warfare, could still have profound humanitarian and human rights consequences. Control of the export trade in ammunition is not a panacea.

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This study only identified 36 companies located in 20 countries (in alphabetical order): Brazil, Canada, China, Czech Republic, Finland, France, Germany, Israel, Italy, Norway, Pakistan, Russia, Sweden, Switzerland, South Korea, Spain, Serbia, Taiwan, United Kingdom, United States. It is these companies which have the industrial capacity, ownership of technology, and marketing expertise required to be global level exporters. Even then, none of them produce the full range of ammunition used by militaries. In most cases a company just has a small number of products which have strong export sales. This finding is important in the debate about how to control the trade in ammunition, as many governments continue to state that ammunition is a commodity which is too difficult to control.

7. Types of ammunition with single, or a handful of, producers

Frequently, a weapon can only be used with a specific type of ammunition. Even if the weapon has been sold to tens of countries there is still a clear opportunity for control if there is only one, or a handful, of companies producing ammunition. In such a circumstance the suspension of supplies of new ammunition could be carried out by a small number of states, or even one acting alone. This is especially the case with large caliber ammunition.

7.1. Specialist suppliers of large calibre ammunition

As the calibre of ammunition increases, the number of manufacturers decreases. As the processes for manufacturing and assembling larger calibres become more specialist, the risks with high explosive fills and warheads increase and production machinery is more complex, more expensive and difficult to install, and available only from a limited number of specialist suppliers. Many larger calibres have only a small number of producers, or sometimes just one.

A small number of companies manufacture and offer for export a wide range of calibres from 40mm up to 155mm, including mortars, grenades and artillery ammunition, with production concentrated to make best use of machinery and skills. So for example a single company such as Pakistan Ordnance Factories manufactures and offers a wide range of products including: 30 and 37mm anti-aircraft ammunition; aircraft bombs; 60, 81 and 120mm mortar bombs; 105, 122, 130 and 155mm artillery ammunition; 40 and 122mm rockets; 105, 106 and 125mm tank and anti-tank ammunition.[55] Rocket and missile production is similarly concentrated, sometimes within the same manufacturers, but often in a different small subset of specialist manufacturers. This larger calibre ammunition is used exclusively by armed forces (excepting a very small usage of medium calibre low velocity grenades which are used by law enforcement agencies).

A detailed analysis of all ammunition manufacture is beyond the scope of this paper, but available data indicates that ammunition up to 20mm is manufactured by the largest range of manufacturers, with progressively fewer manufacturers the higher the calibre. There are notable exceptions for some calibres which have become widely used (for example 155mm artillery rounds) – however even when higher calibres are manufactured by a wider number of companies, this total number is still small (10-30) compared to that for small calibres (50-100 or more).[56]

7.2. Single source suppliers of man-portable missiles

If we examine higher technology weapons and their ammunition, for example anti-tank weapons or man portable air defence systems (MANPADS), we find that increasingly the ammunition is an integral part of the system and cannot be substituted. There is a further reduction in the number of manufacturers, with some weapons and ammunition being manufactured by a single source.

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[55] Pakistan Ordnance Factories. Undated. *POFs Product Range.* Promotional materials displayed at IDEX 2013, UAE, February 2013.

[56] Data from the Omega Research Foundation company and product database and Ness, Leland, S. and Williams, Anthony, G. Eds. 2010. *Jane's Ammunition Handbook 2009-2010*. Jane's Information Group, UK.

For example, the US Javelin anti tank system, a modern 'fire and forget' weapon, is manufactured solely by a joint venture between Raytheon and Lockheed Martin – a single source. It consists of a reusable command launch unit and its ammunition – a missile sealed in a disposable launch tube.[57] This single source supply would allow for effective control of further supplies of the ammunition to any states engaged in armed conflict.

Man portable air defence systems (MANPADS) offer a similar picture of ammunition linked to a particular version of a weapon, a specific manufacturer or date of manufacture – especially for modern weapon systems. Older MANPADS models such as the Russian SA-7 and variants manufactured for example in Bulgaria, or reverse engineered version such as the Chinese HN-5 would fire missiles made by different manufacturers. However, modern MANPADS such as the Russian SA-24 or the US Stinger will only fire missiles manufactured specifically for that launcher and usually only by the same manufacturer. The interface between sensors, gripstock and firing mechanism requires more processing and integration before firing can occur. Different versions of the Stinger system will not fire all Stinger missiles, for example you cannot fire a European Stinger from a Block 2 Stinger (US) launcher because the design licensed to the licensed producer is purposefully different than that of the original equipment manufacturer. This would also mean that any reverse engineered versions of such missiles would be unlikely to function in those launchers. This specificity of launcher and ammunition (missile) gives an added opportunity for controlling the resupply of armed forces engaged in combat.[58]

7.3. Small and medium calibres

Many types of ammunition for small arms and light weapons are produced by numerous companies. The ammunition for assault rifles, in a small range of calibres, is ubiquitous. It is produced in massive quantities, generally to a recognised standard (Russian or NATO). This standardisation means that the user can substitute the same calibre ammunition from a wide range of different sources for firing from a weapon, without generally encountering problems.[59] As noted in Section 3.1.3, countries (such as Nepal) can develop their domestic ammunition production, though this takes time. Of the ammunition types discussed in this report, it is easiest to develop a small calibre ammunition industry. In general, the number of companies producing small calibre ammunition does not offer as clear an opportunity for control as for large calibre. Though as mentioned in Section 6, while there are many manufacturers, only a few are actually geared up to be significant global exporters.

Some small and medium calibre ammunition is however manufactured by a limited number of companies. Sometimes this is ammunition for weapons whose manufacture has been discontinued but whose use is still widespread or sometimes for obsolete calibres. For example Kompanija Sloboda (Cacak, Serbia) are reported to be one of the few manufacturers of quality 20 x

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[57] Raytheon Inc. Undated. *Javelin Weapon System.* Downloaded on 15 3 2013 from http://www.raytheon.com/capabilities/products/javelin/

[58] Correspondence with Dr Michael Ashkenazi, Senior Researcher, Bonn International Centre for Conversion, Germany. February 2013. Ashkenazi, M, Dr., Amuzu, P., Grebe, J., Kögler, C. and Kösling, M. 2013. *Manpads A terrorist threat to civilian aviation*?.. BICC Brief 47. Bonn: Bonn International Centre for Conversion. Available from www.bicc.de/uploads/tx_bicctools/BICC_brief_01.pdf

[59] Whilst some ammunition is marked with a specific symbol of standardization, eg the NATO circle with cross symbol which makes substitution very easy, other ammunition is not, even thought the calibre marking may be identical. Trying to use the incorrect type or caliber of ammunition in a weapon can cause jamming or weapon failure.

100mm rebated rim Oerlikon ammunition for the 20mm Oerlikon gun, still widely used in Asia, Africa and Latin America.[60]

Some weapons developed only recently can have a limited number of suppliers of ammunition. Often a weapon in a new calibre takes some years to gain acceptance with military (or law enforcement) users. For example, PPU Prvi Partizan (Uzice, Serbia), claims to be the 'sole manufacturer in the world of .416 Barrett cartridge case for the American market."[61] If the Barrett .416 becomes more widely used, this sole source supply would be a potential opportunity to restrict ammunition supply.

A further example is the Heckler & Koch MP7 is a personal defence weapon / sub machine gun introduced in 2000 and reported to be in use by over 20 countries, including by special operations units.[62] It uses a 4.6 x 30mm ammunition which was developed by Royal Ordnance, Radway Green (now BAE Systems). The ammunition is manufactured by only 6 companies: BAE Systems (UK), RUAG Ammotec (Switzerland/Germany), Fiocchi Munizione (Italy), Metallwerk Elisenhuette GmbH (Germany), Sellier & Bellot (Czech Republic) and Hornady Manufacturing (USA).[63]

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[60] Kompanija Sloboda. 2013. Downloaded on 5 3 2013 from www.sloboda.co.rs. Omega Research Foundation company and product database. Also see: *Small Arms Defense Journal.* 2011. 'Sloboda: Munitions in the Mountains'. 15 August. Downloaded on 15 3 2013 from sadefensejournal.com/wp/?p=274

[61] Yugoimport. 2013. *PPU Prvi Partizan Production of small arms ammunition*. Yugoimport SDPR J.P. (Serbia) 2013 Report, pp 78-79. Downloaded on 17 03 2013 from www.yugoimport.com/slike/yreport.pdf

[62] Jones, Richard, D. And Ness, Leland, S., Eds. 2009. *Jane's Infantry Weapons 2009-2010*. Jane's Information Group, UK. and Ness, Leland, S. and Williams, Anthony, G. Eds. 2010. *Jane's Ammunition Handbook 2009-2010*. Jane's Information Group, UK. Omega Research Foundation company and product database. Company product brochures held on file with authors.

[63] Sellier & Bellot company information. 2013. Downloaded on 15 3 2013 from www.sellier-bellot.cz Heckler & Koch. 2013. *MP7A1 Products/ accessories*. Downloaded on 15 3 2013 from http://www.heckler-koch.com/en/military/products/submachine-guns/mp7a1/mp7a1/overview.html Omega Research Foundation company and product database.

7.4. Case studies of limited manufacturers

The following case studies illustrate two weapon types that have a limited number of manufacturers enabling the possibility of effective control of their ammunition supply, but requiring a concerted international effort – one that the ATT could fulfil.

7.4.1. Case Study 1:Carl Gustaf 84mm M3 weapon system

The Carl Gustaf 84mm M3 launcher and ammunition, on display on the Saab stand at Defence Systems International Exhibition 2009, London. © Robin Ballantyne, Omega Research Foundation.

The Carl Gustaf is an old design, and has been in use for many years, it remains a potent weapon in the modern battlefield. It is use by around 40 countries, including the US, and continues to be promoted on the international arms market. However the ammunition for it can only be manufactured by 5 companies, one of which has stated that its products are licensed solely for its own country. It is likely that some of the other licensees are similarly restricted in their sales, as this is a common feature of licensed production – retaining the majority of sales for the original equipment manufacturer – and this would mean that the other manufacturers would have to seek permission from Saab before any exports could take place. The restricted availability of ammunition for such a weapons system could enable effective export controls to be placed on any proposed transfers in a time of conflict.

The 84mm Carl Gustaf is a lightweight, man-portable recoilless gun. It was originally developed as an anti-tank weapon, but developments over the last 50 years in both the weapon and ammunition have resulted in a multipurpose system for use against tanks, armoured and soft skinned vehicles, fortifications and personnel. This almost continuous development has kept the weapon relevant to contemporary conflicts and it is still widely fielded.

The Carl Gustaf was developed in Sweden and first fielded in the 1950s. The most up to date version of the weapon is the M3, manufactured by Saab Bofors Dynamics (Saab Group) in Sweden. Saab are a privately owned company, the biggest shareholder being Investor AB of Sweden.[64] The older and slightly heavier M2 version and the M3 are manufactured under license by the state-owned Indian Ordnance Factory Board (OFB)[65], both for use with the Indian armed forces and also promoted and offered for export. Available information indicates that these are the only two manufacturers of the weapon.

The weapon is reported to be in use in over 40 countries including the USA, India, Canada, Germany, Ghana, Greece, Lithuania, Latvia, Estonia, Japan, Malaysia, Nigeria, Singapore and Venezuela.[66] It was reported in 2012 that the Burmese army was using Carl Gustaf weapons and ammunition which had originated from India.[67] The Indian government subsequently denied that this was a direct export, and investigations were initiated both in India and by the Swedish Government.

A wide range of ammunition for the weapon has been developed, which now numbers over 10 different types[68], with an additional three training rounds. Ammunition includes HEAT – high explosive anti-tank, HE-high explosive, HEDP – high explosive dual purpose, ASM – anti-structure munition, ADM –area deterrent munition (anti-personnel), white screening smoke and an illuminating round.

The 84mm ammunition for the Carl Gustaf M2/M3 weapon system is only manufactured by 5 companies, and of these only Saab offers the full range:

> Saab manufacture the full range of ammunition with a variety of fuzes available and warheads certified for insensitive munition regulations.[69]

General Dynamics Ordnance and Tactical Systems (GD-OTS) of Canada manufacture the standard High Explosive Anti-tank (HEAT) 551 and 751 and the Target Practice (TP) 552.[70] These

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[64] Ownership as at December 28th 2012. Saab Group. 2013. Downloaded on 6 3 2013 from http://www.saabgroup.com/en/About-Saab/Investor-relations/The-share/Ownership/

[65] Indian Ordnance Factory Board. Undated. *Products*. Downloaded on 6/3/2013 from ofbindia.gov.in/index.php?wh=Weapons

[66] Ness, Leland, S. and Williams, Anthony, G. Eds. 2010. *Jane's Ammunition Handbook 2009-2010*. Jane's Information Group, UK., Saab Group. 2013. Downloaded on 6 3 2013 from http://www.saabgroup.com/en/Land/Weapon-Systems/support-weapons/Carl_Gustaf_M3_weapon_system/In-use/ and Omega Research Foundation company and product database.

[67] See for example: , *The Irrawaddy*.2012 'Govt uses Swedish weapons against KIA'. 12 December. Downloaded on 17 03 2013 from www.irrawadddy.org/archives/21063

[68] Saab Bofors Dynamics. Undated. Product brochures held on file by Omega Research Foundation. Saab Group. 2013. Carl Gustaf product brochure. Downloaded on 6 3 2013 from http://www.saabgroup.com/Global/Documents%20and%20Images/Land/Weapon%20Systems/Carl-Gustav/Saab_Carl-Gustav.pdf

[69] Saab Group. 2013. Carl Gustaf product brochure. Downloaded on 6 3 2013 from http://www.saabgroup.com/Global/Documents%20and%20Images/Land/Weapon%20Systems/Carl-Gustav/Saab_Carl-Gustav.pdf and Pacella, G., *Shoulder Fired Munitions.* presented at the NDIA International Armaments Technology Symposium & Exhibition, June 14-16 2004. Donloaded on 15/3/2013 from http://www.dtic.mil/ndia/2004armaments/2004armaments.html

[70] General Dynamics. 2013. *Cartridges 84mm Target Practice (TP) 552*. Downloaded on 6 3 2013 from http://www.gd-otscanada.com/html/en/products/detail.php?id=63&thisSection=77 and General Dynamics.

were licensed exclusively for the Canadian Department of National Defense by SNC TEC, which has since become part of GD-OTS,[71] meaning they cannot be sold to any other customer without further permission from SAAB.

Ordnance Factory Khamaria (part of the state-owned Indian Ordnance Factory Board) manufacture the High Explosive Anti-tank (HEAT) 651, High Explosive 441B, Illuminating 545 and a practice round.[72] The OFB promotes and offers this ammunition for export sale.

The state-owned Hellenic Defense Systems, Greece, manufacture the High Explosive Anti-tank (HEAT) 551 and the Target Practice (TP) 552.[73] HDS promotes and offers this ammunition for export sale.

Mecar (a wholly owned subsidiary of Chemring Group PLC, a privately held UK company) manufacture a range of 84mm ammunition including High Explosive, High Explosive Anti-Tank, Smoke, Illuminating and training rounds and have recently reported the development of a canister round (anti-personnel multiple small projectiles).[74] Chemring and Mecar promote and offer this ammunition for export sale.

The USA considers Saab as a sole source supplier for the M3 weapon system and ammunition, which is designated the *Multi-Role Anti-Armor Anti-Personnel Weapon System* (MAAWS). In a 2010 Contract Notice it cites a number of reasons including "only one responsible source" and the lack of a US manufacturer due to the high cost of purchasing the data package – which SAAB stated was more than $12 million.[75]

2013. *High Explosive Anti Tank (HEAT) 551*. Downloaded on 6 3 2013 from http://www.gd-otscanada.com/html/en/products/detail.php?id=62&thisSection=77

[71] SNC TEC (Canada). 2013. *Product Range brochure 0115/5M COM SNC 002.* Downloaded on 6 3 2013 from http://www.gd-otscanada.com/upload/File/products.pdf

[72] Indian Ordnance Factory Board. Undated. *Products*. Downloaded on 6/3/2013 from ofbindia.gov.in/index.php?wh=Weapons

[73] EAS (Greece). Undated. *84mm HEAT 551*. Downloaded on 6 3 2013 from http://www.eas.gr/uploads/4468619a576eb088.pdf

[74] Chemring (UK). 2012. *Munitions Brochure, Issue 2, 2012*. Downloaded on 6 3 2013 from. http://www.chemring.co.uk/~/media/Files/C/Chemring-V2/PDFs/sector-brochure-munitions-web-300512.pdf and Mecar (Belgium). 2013. *84mm - Recoilless rifle ammunition.* Downloaded on 6 3 2013 from http://www.mecar.be/content.php?langue=english&cle_menus=1156856589

[75] Loren Data (USA). Undated. Federal Business Opportunities. Multi-Role Anti-Armor Anti-Personnel Weapon System (MAAWS)/Adapters, 84mm Ammunition and Sub-caliber Training Ammunition. Solicitation Number: W15QKN-06-R-0258 Agency: Department of the Army. Downloaded on 6 3 2013 from https://www.fbo.gov/index?s=opportunity&mode=form&id=e97e86f01925a924e2e4a6f1d8ac12b7&tab=core&tabmode=list&=

7.4.2. Case Study 2: Chinese grenade launchers and 35mm ammunition

The QLZ87 35mm automatic grenade launcher, on display on the Norinco stand at the International Defence Exhibition (IDEX) 2007, UAE. © Robin Ballantyne, Omega Research Foundation.

China manufactures a range of 35mm grenade launchers in automatic, semi-automatic and single shot versions. Development of these weapons began in the 1980's and the first automatic grenade launcher, the QLZ87 (QLZ-87), was fielded by the People's Liberation Army PLA at the beginning of the 1990's.[76]

The range currently includes the QLZ87 35mm AGL in light and heavy versions, the W87 35mm AGL, the LG1 35mm grenade launcher, the QLZ04 35mm AGL (lighter and with improved firepower) and most recently the QLZ87B (also known as the QLB-06).[77] The Hunan Small Arms Institute, part of Hunan Ordnance Industries Group Co., Ltd[78], reports that it developed and produces the QLZ87.[79]

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[76] Juanjuan Yang, Xinlong Li, Bin Yang, Yi Ren, Junli Wang. Undated. *Grenade launchers in China*. Presentation to the NDIA Small arms Symposium May 15 2010. Downloaded on 17 3 2013 from http://www.dtic.mil/ndia/2010armament/WednesdayLandmarkBJuanjuanYang.pdf

[77] Omega Research Foundation company and product database. Company brochures held on file with author. Jones, Richard, D. And Ness, Leland, S., Eds. 2009. *Jane's Infantry Weapons 2009-2010*. Jane's Information Group, UK.

[78] Hunan Small Arms Institute (China). Undated. *About Us*. Translated from original Chinese Downloaded on 25 6 2012 from http://www.hnqwq.com/Aboutus.asp?Title=%C6%F3%D2%B5%BC%F2%BD%E9 [webpage no longer available].

[79] Hunan Small Arms Institute. Undated. *Product Information.* Downloaded on 15/3/2013.from http://www.hnqwq.com 7/5/2010

The QLZ87 first appeared on the international market at the International Defence Exhibition – IDEX in the UAE in 2003 – offered by Norinco for international sale and export.[80] Norinco and Poly Technologies now market all the models of 35mm grenade launcher.[81]

The ammunition used in these grenade launchers is the 35 x 32mm SR grenade. There are at least five types of ammunition available, with other models under development. They include the DFS87 anti-personnel grenade, DFJ87 armor-piercing grenade, DFR87 incendiary grenade, DFN87 anti-personnel incendiary grenade, DFD87 smoke marking grenade.[82] The 35mm grenade is unique to China and no other companies manufacture this type of ammunition.

There is no publicly available data on exports of the different versions of the 35mm grenade launchers or the ammunition. However, the data below has been gathered from field study of weapons found in conflict zones and image analysis and identification of weapons in use by other armed forces.

The QLZ87 was first identified in use outside China in 2006. A QLZ87, serial number 90555, was identified in the hands of fighters for the United Front for Democratic Change. Members of the group were carrying QLZ87 35mm automatic grenade launchers outside the town of El Geneina in Western Darfur, Sudan, near the Chad border, on 28 February 2006.[83]

The QLZ87 and its ammunition has been found in circulation in Sudan, Darfur and South Kordofan on a number of occasions. New supplies of QLZ87 were documented by the UN Panel of Experts to Sudan in the hands of Chadian armed opposition groups in 2008/2009, supplied by the Sudan Armed Forces.[84]

Amnesty International gathered evidence of the use of QLZ87 35mm grenade launchers and grenades, supplied to Sudan by a Chinese company under a contract dated 2008 according to packaging markings, which were captured from SAF forces in Southern Kordofan in June 2011.[85]

The QLZ87 has also been photographed being used by Somali government soldiers. It was in use during clashes between Islamist insurgents and Somali government soldiers in southern Mogadishu's Bakara market neighbourhood on Sunday May 22, 2011.[86]

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[80] Jones, Richard, D. And Ness, Leland, S., Eds. 2006. *Jane's Infantry Weapons 200-2007.* Jane's Information Group, UK. p415

[81] Omega Research Foundation database and company product brochures held on file with authors.

[82] Juanjuan Yang, Xinlong Li, Bin Yang, Yi Ren, Junli Wang. Undated. *Grenade launchers in China*. Presentation to the NDIA Small arms Symposium 15/05/2010. Downloaded on 17 3 2013 from http://www.dtic.mil/ndia/2010armament/WednesdayLandmarkBJuanjuanYang.pdf Omega Research Foundation company and product database. Company brochures held on file with author.

[83] Amnesty International/Omega Research Foundation. 2006. *China: Sustaining conflict and human rights abuses: The flow of arms continue.* 10 June. Available from www.amnesty.org/en/library/info/ASA17/030/2006/en

[84] Small Arms Survey. 2012. *Sudan Human Security Baseline Assessment. Tracing Desk Report July 2012.* Downloaded on 17 3 2013 from http://www.smallarmssurveysudan.org/fileadmin/docs/facts-figures/arms-ammunition-tracing-desk/HSBA-Tracing-Desk-SAF-weapons-SK-July-2012.pdf and Small Arms Survey. 2012. *Sudan Human Security Baseline Assessment. Sudan Issue Brief.* No 20, September 2012. Downloaded on 17 3 2013 from http://www.smallarmssurveysudan.org/fileadmin/docs/issue-briefs/HSBA-IB-20-Arms-flows-to-Darfur-2009-12.pdf

[85] Amnesty International. 2010. *Sudan no end to violence in Darfur.* Downloaded on 17 3 2013 from http://www.amnestyusa.org/sites/default/files/afr540072012en.pdf

Ugandan soldiers serving with the African Union Mission in Somalia (AMISOM) were photographed with QLZ87 grenade launchers patrolling Baidoa airstrip in March 2012.[87] The weapons appeared worn, rather than new, and could have been supplied in early 2011 as part of the package of vehicles, arms and ammunition that Uganda imported from China.[88]

The QLZ87 is also reported to be in use by the Bolivian armed forces.[89]

China, via its international arms trading companies Norinco and Poly Technologies, is the sole source of the 35mm ammunition, needed to resupply users of any of the models of 35mm grenade launcher. The documented use of the QLZ87 in active conflict zones in North Africa highlights the need to control exports of ammunition under an Arms Trade Treaty.

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[86] AP Photos. 2011. *'Somali government soldier take positions during clashes between Islamist insurgents and Somali government soldiers in southern Bakara market neighborhood on Sunday May 22, 2011'* Farah Abdi Warsameh, AP Images. No: #110522011813 via http://www.apimages.com/

[87] United Nations UNPOS - UN Political Office for Somalia. 2012. *Ugandan soldiers standing near defensive line in Baidoa.* Downloaded on 17 3 2013 from www.flickr.com/photos/unpos/7215002034/

[88] Butagira, T. 2011. *Police arm heavily ahead of elections.* Daily Monitor [Uganda]. Downloaded on 17 3 2013 from www.monitor.co.ug/News/National/-/688334/1090988/-/cisuqtz/-/index.html

[89] Johnson, S. 2011. *Chinese QLZ-87 35mm grenade launcher.* The Firearm Blog. Downloaded on 17 3 2013 from www.thefirearmblog.com/blog/2011/03/18/chinese-qlz-87-35mm-grenade-launcher/

Appendix I: Companies with significant exports

Table 8.1 Companies which are significant producers of military specification ammunition in countries with more than 1% of identified exports in 2011 of small calibre ammunition and parts

Country	Company	State / Private
United States	Alliant Techsystems Inc. (ATK) Winchester (Olin Corp) Remington Arms Company, Inc.	Private Private Private
Germany	RUAG Ammotec Metallwerk Elisenhutte GmbH (CBC, Brazil)	State Private, possible small state holding via IMBEL
Switzerland	RUAG	State – a "private-sector company whose shares are fully owned by the Swiss Confederation"
Russia	Barnaul Tula Ulyanovsk LVE Novosibirsk Klimovsk Vympel	All private – Joint Stock Companies JSC's - except Vympel - State
Norway	Nammo AS	State Norwegian Government 50% Patria Oy (Finland) 50% (Patria is 73.2% owned by State of Finland)
South Korea	Poongsan Corporation	Private
Pakistan	Pakistan Ordnance Factories	State
Canada	General Dynamics Ordnance and Tactical Systems-Canada Inc. (includes SNC Tec)	Private
Brazil	CBC	Private
Spain	General Dynamics Santa Barbara Sistemas	Private
Czech Republic	Sellier & Bellot (CBC, Brazil)	Private
Sweden	Norma Precision (RUAG)	State

	Nammo Vanasverken	State
France	Nexter (formerly GIAT)	State
Finland	Lapua (Nammo)	State
Serbia	Prvi Partizan	Private
Italy	Fiocchi Munizioni	Private (family)
Israel	Israel Military Industries	State "fully owned by the Israeli government"
United Kingdom	BAE Systems	Private
China	Norinco Poly Techologies	State
Taiwan	Plant 205 / 205th Arsenal	State

Source: Omega Foundation database

Table 8.2. Companies which are significant producers of military specification ammunition in countries with more than 1% of identified exports in 2011 of large calibre ammunition and other munitions

Country	Company	State / Private
United States	Raytheon General Dynamics ATK	Private Private Private
France	Nexter (formerly GIAT) TDA (Thales)	State Part State (37.1%)
Germany	Rheinmetall Diehl	Private Private (family)
Israel	Israel Military Industries Soltam (Elbit)	State Private
Russia	GNPP Bazalt FNPTs Pribor KBP Instrument Design Bureau	State State State
China	Norinco Poly Technologies	State State
United Kingdom	BAE Systems	Private
Sweden	SAAB	Private
Norway	Nammo	State
Italy	Simmel Difesa (Chemring)	Private

Source: Omega Foundation database

Aiming for Control

The need to include ammunition in the Arms Trade Treaty

This paper argues for the inclusion of ammunition in the Arms Trade Treaty. It points out that ammunition offers specific opportunities to meet the Treaty's principles, goals and objectives. Particularly concerning warfare, controls over transfers of ammunition offer a greater opportunity to prevent atrocities compared to controls over weapons. Ammunition can only be used once, and needs to be re-supplied. Interrupting these supplies would offer an immediate means by which armed forces engaged in warfare could be stopped.

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