

3

Conventional Ammunition Marking

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Overview

This chapter focuses on marking practices applicable to conventional ammunition. It is intended to present, in brief, the utility of systematic ammunition marking for improving the safety and security of conventional ammunition stocks, particularly in relation to the risk of accidents (including explosive and incendiary risks) and the potential for illicit diversion. The chapter also provides an overview of common marking methods and the rationale behind them.

Marking, safety, and security

Conventional ammunition marking can be defined as the application of marks—including colours, descriptive text, and symbols—to munitions, parts, and components thereof, and associated packaging, for the purposes of identifying, among other things, their role, operational features, and age; and the potential hazards posed by those munitions (UKMoD, 2006a, p. 4; US Navy, 2001, p. 1). Marking is a critical precursor to effective stockpile management and, ultimately, has considerable bearing on the safety and security of ammunition stocks.

Marking and safety

From the perspective of safety, ammunition marks facilitate effective stockpile management because they classify munitions that are subject to differing safety procedures (UKMoD, 2006a, p. 4). Marks identify the class of explosive or propellant contained in the round (the *nature* of the ammunition) and any explosive or contamination hazards that each might pose to personnel and

infrastructure (US Navy, 2001, p. 1). In so doing, they provide information that enables stockpile personnel to carry out safe storage and handling procedures that are specific to different ammunition types.

Ammunition marks also detail the expected shelf life of munitions. While this information cannot be used to determine the physical condition of munitions—which can only be ascertained through physical and chemical examination (CHAPTER 6)—such marks can indicate which stocks may require testing and possible reclassification or disposal.

Marking practices, furthermore, exist to ensure that the correct munitions are deployed to security forces. Marks designate which types of ammunition are suitable for particular weapons systems (indicating the ‘role’ of a particular round) and, notably, are used to discriminate among inert, practice, and explosive ammunition. These distinctions have critical safety implications, because a failure to use the correct ammunition or the potential for accidentally substituting inert training rounds with high-explosive warheads could be fatal.

Marking and security

Marking also diminishes the security risks associated with lost, misplaced, or stolen munitions entering the illicit market (CHAPTER 15). Not only can it be used as the basis of an accounting system to monitor for potential losses and thefts, but it can also establish the origins of ammunition recovered from illegal users.

Effective management dictates that personnel keep records of all ammunition movements (including relocations and transfers into and out of stockpiles). Systematic recording by munition type and lot number enables personnel to detect misplaced or missing stocks and launch immediate investigations into why they are absent.

Marks can also be used to ‘trace’ ammunition that has been recovered from the illicit market to a factory or branch of the security forces. This can be facilitated if unique lot numbers are assigned to ammunition batches that have been issued to particular units or locales (CHAPTER 16). Failing that, any marks that indicate the calibre, year, and origin of ammunition—notably in the case of small arms ammunition—can be used to indicate potential paths of illicit diversion (Bevan and Dreyfus, 2007, pp. 288–315) (CHAPTER 4).

Marking classification systems

In the case of both small arms ammunition and major conventional munitions, marks are used to identify some or all of the following characteristics:

- the type of ammunition and its uses;
- the production or filling lot;
- the manufacturer;
- the propellant;
- the type of explosive used in the warhead;
- the model designation of the ammunition;
- any modifications made to the ammunition; and
- the condition of the ammunition (serviceable or unserviceable).

The meaning of some of these features is self-evident. It is, however, worth explaining the importance of lot or batch numbering marks, which have particular saliency for safe storage and handling, and can minimize the risks of illicit diversion.

Lot and batch numbering

The lot number comprises a code that is systematically assigned to each ammunition batch or 'lot' at the time of manufacture, assembly, or modification. It identifies a fixed quantity of ammunition that has been assembled from uniform components under similar conditions and that, as a result, is expected to function in a similar manner (US Navy, 2001, p. 4; USDoD, 1998, p. 3).

When employed in conjunction with effective accounting procedures (CHAPTER 5), lot numbering can be used to track the location and movement of certain groups of munitions. From a safety perspective, it can be used to identify—and subsequently recall—batches of defective or unstable and potentially dangerous stocks. Lot numbers are also a useful means to trace illicitly diverted ammunition to its original purchaser or to the security force unit to which it was issued (Anders, 2006, pp. 207–27; Dreyfus, 2006, pp. 173–206).

In the case of small arms ammunition, lot numbers usually feature on packaging rather than on the round itself, due in part to the limited space available on small calibre cartridges. Direct lot marking on small arms ammunition is not a standardized practice in most countries, although some

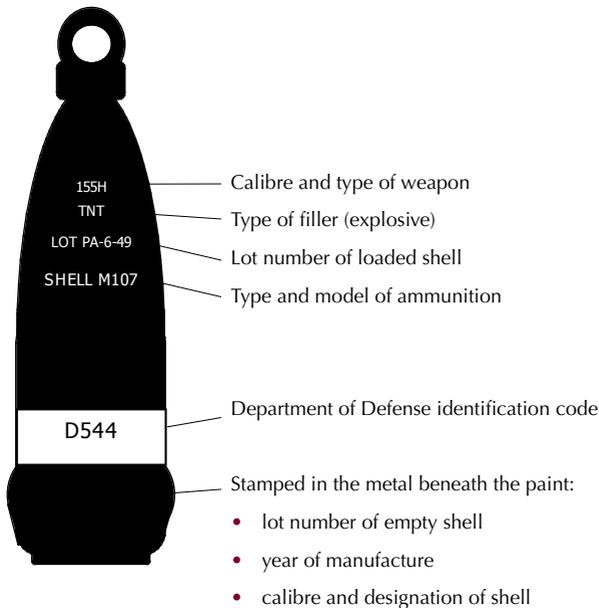
countries have begun to lot mark security force ammunition (CHAPTER 16).

By contrast, lot marks are usually directly applied to the warheads of light and major conventional weapons. These indicate the batch of propellant or explosive contained within the warhead, and their application is facilitated by the larger size of the ammunition in question. For example, the shell illustrated in Figure 3.1 displays a lot number that designates that it is one of a batch of shells loaded with the same consignment of TNT. It also displays a lot number that identifies the body of the shell as one among a batch of empty shells that were manufactured at the same time and under similar conditions.

Modes of marking

Effective classification of ammunition necessitates a system that is clear, consistent, and easily comprehensible. The UK's Ministry of Defence (UKMoD, 2006a, p. 5) notes the following principles of conventional ammunition marking:

Figure 3.1 **Example of marks on an artillery shell**



Source: Adapted from USMC (2006, chap. 10, sec. 3)

- *Clarity*: Identifying marks should be clearly visible. For reasons of speed and efficiency, primary identifying marks should also be more prominent in size and position than those required for detailed identification. Complicated symbols and superimposed colours should also be avoided wherever possible.
- *Uniformity*: The style and position of marks should be consistent for stocks that have similar characteristics, thereby minimizing the potential for personnel to overlook stocks that are of the same type, nature, or lot.

Marks can be applied to munitions in a number of ways (see Table 3.1), ranging from paint coding to the application of other types of code, symbols, and letters.

Table 3.1

Types of media used to mark munitions

| Medium | Application | Notes |
|-----------|--|---|
| Painting | Paint colour is designed to signify the type of use (operational, training, etc.) that the round is intended for, in addition to the explosive hazard presented by the munition. Colour-coded paint comprises the final body coating for ammunition, ammunition components, and their packaging. | In some instances, the choice of paint colour has no code significance. |
| Coding | Coding involves the application of coloured spots, bands, or symbols to ammunition, ammunition components, or their packaging. Codes, by their colour or shape, identify ammunition fillers (i.e. explosives or propellants), the presence of specific ammunition components, or directions for handling and lading. | Coding is almost always accompanied by text, which provides a more detailed description of the ammunition components in question. |
| Lettering | Letters, words, abbreviations, or numerals are applied to ammunition, ammunition components, or their packaging by die stamping, stencilling, decals, etching, or rubber-stamping. Lettering identifies the type, version, potential modifications, ammunition lot number, and lading information of the munition. | Lettering applied in black or white may not have colour-code significance. |

Source: US Navy (2001, p. 3)

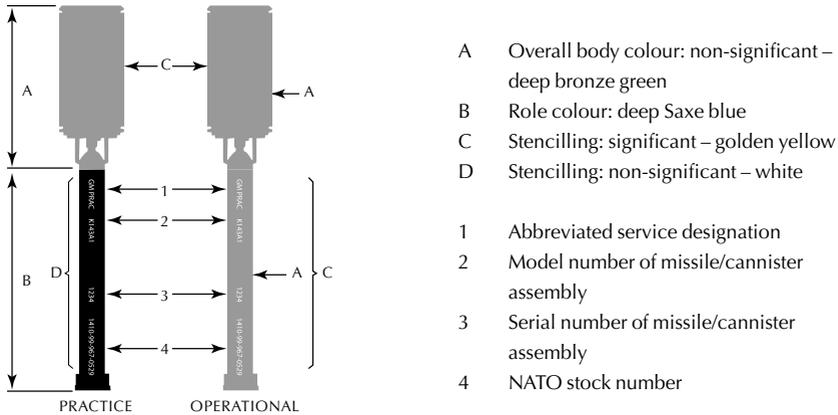
Systematic marking practices are particularly essential when the armed forces of different countries require interoperability of munitions. The 26 North Atlantic Treaty Organization (NATO) member states provide a good example in this respect. The following sections present a number of NATO standard muni-

tions in which combinations of paints, codes, and letters comprise a standardized and easily comprehensible designation system.

Paint codes

Distinguishing the ‘role’ of munitions (e.g. practice or operational) is made easier through allocating specific colours consistently to those roles. As Figure 3.2 illustrates, however, for the case of a ground-to-air guided missile, colour codes are often only significant when applied to specific parts of the ammunition in question. In this case, while the overall body colour of the ammunition is insignificant, blue denotes its role as a practice munition. The colour alone, however, is not deemed a sufficient indicator of a weapon’s role and associated safety risks. Colour-coded lettering in this respect has greater significance than body paint, with yellow lettering designating the munition as operational (see Figure 3.2).

Figure 3.2
**Typical markings for ground-to-air guided missile container/
 missile canister**



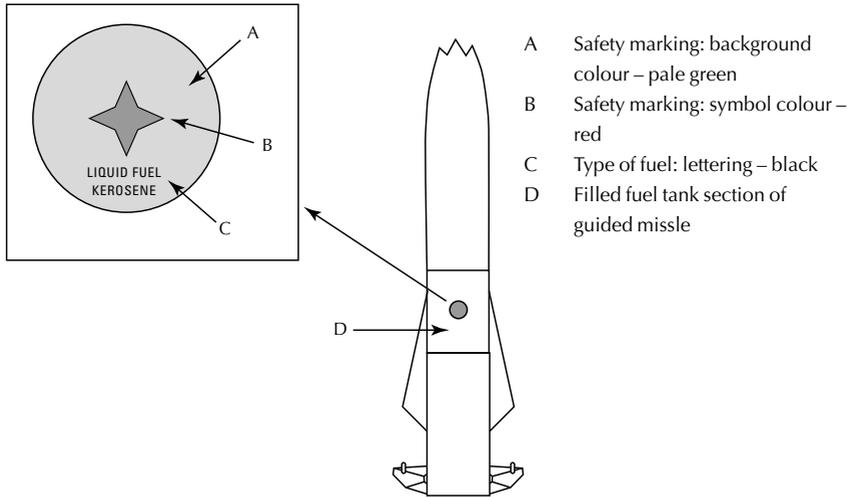
Source: UKMoD (2006d, p. 10)

Coding

Codes, and notably symbols, provide rapid indication that a munition contains components that are potentially hazardous (CHAPTER 8). As Figure 3.3

illustrates, in the case of a guided missile, a red star on a pale green background provides clear indication that the ammunition contains liquid fuel. The text, which accompanies the symbol but is less visible, details the type of liquid fuel. In this case, brightly coloured symbols impart the most important information first—the hazard—and smaller text outlines the particular nature of that hazard.

Figure 3.3
Hazard marking on a guided missile



Source: UKMoD (2006d, p. 12)

Letters

Letters provide detailed information about the nature and role of the munition in question, as well as providing historical information, such as date and origin of manufacture. Like colours and codes, they provide 'significant' information for successfully identifying hazards and appropriate storage and handling practices.

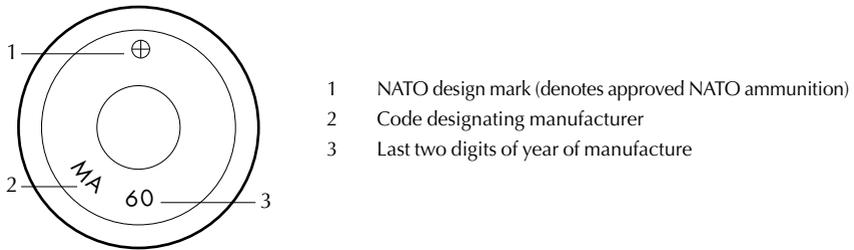
Combinations of marking media

The munitions illustrated in Figures 3.2 and 3.3 demonstrate that the use of paints, codes, and letters is designed to provide multiple and mutually supporting indicators of the potential hazards posed by specific types of ammu-

munition and their components. In practice, most effectively marked pieces of ammunition display such multiple marking systems.

This is even the case for munitions that are generally deemed to pose a relatively small explosive or contamination hazard. NATO classification marks for small arms ammunition are illustrative. Basic information regarding the cartridge is stamped onto the cartridge base, which is called the head-stamp (see Figure 3.4). In addition, paint is used to mark the tips of bullets with colours that signify the role of each round (see Table 3.2).

Figure 3.4
Minimum basic markings on NATO small arms ammunition



Source: Canadian Army (n.d., p. 4)

Table 3.2
NATO bullet tip colours and their roles

| Bullet tip colour | Role |
|-------------------|----------------------------|
| No colour | Ball |
| Red | Tracer |
| Black | Armour-piercing |
| Silver | Armour-piercing incendiary |
| Yellow | Observing |
| Blue | Incendiary |

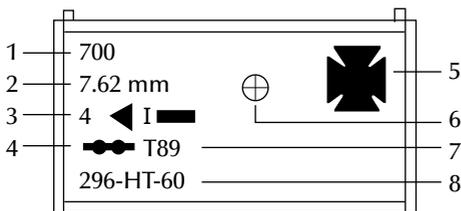
In most cases, small arms ammunition lot numbers appear only on packaging (see Figure 3.5) (CHAPTER 16).

Packaging and container marks

The markings on packaging are as important for safe and secure handling, transportation, and storage as the markings on the ammunition within it. Adequate labelling of packages and containers entails reproducing the same symbols and lettering that are marked on the ammunition, including hazard warnings. In some cases, packaging will feature a number of standard symbols that apply to the hazards presented by the various components of the ammunition within it. These symbols may also comprise a hierarchy, indicating primary and subsidiary risks in the event of accident.

For logistical and safety reasons, munitions packages often detail the modes of loading applicable to the ammunition inside them, as Figure 3.5 illustrates for the case of small arms ammunition.

Figure 3.5 Basic NATO small arms ammunition package markings



- 1 Quantity of ammunition
- 2 Calibre and nomenclature
- 3 Symbols for nature of bullets as loaded
- 4 Symbol for type of pack
- 5 NATO symbol for interchangeability
- 6 NATO design mark
- 7 Model of link
- 8 Lot number, code designating manufacturer, and the last two digits of the year of manufacture or packing

Source: Canadian Army (n.d., p. 3)

Progress to date

The vast majority of conventional ammunition is marked, despite the fact that many states fail to use these marks as the basis for effective accounting

(CHAPTER 5) and comprehensive stockpile management (CHAPTER 8). One area of critical concern, however, is marking small arms ammunition. Numerous states fail to mark small calibre ammunition, which means that ammunition circulates on the illicit market that cannot be attributed to a source (CHAPTER 15). While lot marking (CHAPTER 16) has gained favour with some states, these are few in number. Small calibre ammunition marking is potentially one of the most powerful ways to control diversion, but it is rarely employed.

Conclusion

This chapter is a short introduction to the rationale behind marking practices for conventional ammunition. Ammunition marking is crucial for effective stockpile management, because it enables personnel to identify, classify, and count munitions. It also provides hazard information that is essential for efforts to minimize the risks posed by ammunition, whether stockpiled, in transit, or awaiting destruction. Moreover, an adequate marking system can deter diversion and help trace ammunition that has already been diverted to the illicit market. Combined with effective stockpile management and security procedures, marking is a fundamental tool for ensuring the safe and secure administration and disposal of ammunition surpluses. ■

Further reading

- UKMoD (United Kingdom Ministry of Defence). 2006. *Defence Standard 00-810: Marking of Ammunition and Associated Packages*. <<http://www.dstan.mod.uk/data/>>
- USDoD (United States Department of Defense). 1998. *MIL-STD-1168B: Department of Defense Standard Practice: Ammunition Lot Numbering and Ammunition Data Card*. Washington, DC: USDoD.

Bibliography

- Anders, Holger. 2006. 'Following the Lethal Trail: Identifying Sources of Illicit Ammunition.' In Stéphanie Pézard and Holger Anders, eds. *Targeting Ammunition: A Primer*. Geneva: Small Arms Survey, pp. 207–27.
- Bevan, James and Pablo Dreyfus. 2007. 'Enemy Within: Ammunition Diversion in Uganda and

- Brazil.' In *Small Arms Survey. Small Arms Survey 2007: Guns and the City*. Cambridge: Cambridge University Press, pp. 288–315.
- Bevan, James and Stéphanie Pézard. 2006. 'Basic Characteristics of Ammunition: From Handguns to MANPADS.' In Stéphanie Pézard and Holger Anders, eds. *Targeting Ammunition: A Primer*. Geneva: Small Arms Survey, pp. 17–68.
- Canadian Army. n.d. *Primary Leadership Qualifications (LAND): Ammunition Marking Handout*. <http://armyapp.dnd.ca/38CBG_ARSD/CD/plq/mlp/mod3/210-01HandoutAmmunitionMarkings.doc>
- Dreyfus, Pablo. 2006. 'Crime and Ammunition Procurement: The Case of Brazil.' In Stéphanie Pézard and Holger Anders, eds. *Targeting Ammunition: A Primer*. Geneva: Small Arms Survey, pp. 173–206.
- OSCE (Organization for Security and Co-operation in Europe). 2003. *OSCE Document on Stockpiles of Conventional Ammunition*. Vienna: OSCE.
- UKMoD (United Kingdom Ministry of Defence). 2006a. *Defence Standard 00-810: Marking of Ammunition and Associated Packages, Part 1: General*. <<http://www.dstan.mod.uk/data/00/810/01000100.pdf>>
- . 2006b. *Defence Standard 00-810: Marking of Ammunition and Associated Packages, Part 3: Bombs, Mortar*. <<http://www.dstan.mod.uk/data/00/810/03000100.pdf>>
- . 2006c. *Defence Standard 00-810: Marking of Ammunition and Associated Packages, Part 6: Grenades*. <<http://www.dstan.mod.uk/data/00/810/09000100.pdf>>
- . 2006d. *Defence Standard 00-810: Marking of Ammunition and Associated Packages, Part 7: Guided Missiles, Components and Parts*. <<http://www.dstan.mod.uk/data/00/810/07000100.pdf>>
- . 2006e. *Defence Standard 00-810: Marking of Ammunition and Associated Packages, Part 13: Small Arms Ammunition (below 20 mm)*. <<http://www.dstan.mod.uk/data/00/810/13000100.pdf>>
- . 2006f. *Defence Standard 00-810: Marking of Ammunition and Associated Packages, Part 20: Packaging*. <<http://www.dstan.mod.uk/data/00/810/20000100.pdf>>
- US Army (United States Army). 2001. *FM 4-30.13: Ammunition Handbook: Tactics, Techniques, and Procedures for Munitions Handlers*. 'Appendices E and F.' <<http://www.globalsecurity.org/military/library/policy/army/fm/4-30-13/index.html>>
- USDoD (United States Department of Defense). 1998. *MIL-STD-1168B: Department of Defense Standard Practice: Ammunition Lot Numbering and Ammunition Data Card*. Washington, DC: USDoD.
- USMC (United States Marine Corps). 2006. *FM 6-50: Tactics, Techniques, and Procedures for the Field Artillery Cannon Battery*. Marine Corps Warfighting Publication No. 3-1.6.23. Washington, DC: Headquarters, Department of the Army. 23 December. <<http://www.globalsecurity.org/military/library/policy/army/fm/6-50/index.html>>
- US Navy (United States Navy). 2001. *NAVEDTRA 14313: Aviation Ordnanceman*. 'Chapter 12.' Non-resident Training Course. <http://www.globalsecurity.org/military/library/policy/navy/nrtc/14313_ch12.pdf> and <http://www.globalsecurity.org/military/library/policy/navy/nrtc/14110_ch2.pdf>

4

Conventional Ammunition Tracing

James Bevan

Overview

Tracing is a set of diverse methods used to identify ammunition, its origins, and patterns of transfer. It is a prerequisite for successful ammunition management and a crucial means of identifying diversion and the illicit trade in all munitions.

Tracing is contingent on being able to identify specific production runs, batches, lots, and other collections of ammunition, and to ascertain where they have come from. It therefore shares many similarities with ammunition accounting procedures (CHAPTER 5), but its application is usually retrospective and applied to illicitly circulating arms and ammunition—notably diverted munitions (CHAPTER 15).

This chapter sketches a number of modes of ammunition tracing, ranging from identifying stocks via systematic and accurate markings to methodologies that can be applied where ammunition is poorly marked or bears no markings at all. It concludes that ammunition tracing is in its infancy, but offers considerable hope for identifying and alleviating illicit arms proliferation.

Modes of tracing

There are two modes of ammunition tracing: direct identification using marks on the ammunition in question and indirect identification by a process of elimination. As Table 4.1 illustrates, the degree to which each method is employed is contingent on the degree of specificity in the way ammunition is marked.