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## Forensic Science Problems Associated with the Accelerator® Cartridge

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**ABSTRACT:** The Accelerator® cartridge is unique in that the bullet has no barrel markings after it is fired. The plastic sabot does have barrel markings and can produce distinctive wound patterns. The .30-'06 Accelerator cartridge was fired into poster board, gelatin blocks, and pigs. The results of these studies are presented.

**KEYWORDS:** pathology and biology, wound ballistics, ballistics, sabot, firearms examination

Remington Arms Co., Inc., introduced the .30-'06 Accelerator® cartridge in November 1976. Since that time the company has also begun to manufacture the .30-30 and the .308 Winchester Accelerator cartridges. Remington advertises the Accelerator as a cartridge that offers the hunter who owns only a .30-caliber rifle a versatile cartridge that can be used to shoot small game and varmints. Advertisements point out that the hunter can use standard ammunition in the .30-caliber rifle to hunt game such as bear or deer and then can switch to the Accelerator for use on small varmints like woodchucks and groundhogs.

The Accelerator cartridge is designed to be fired in a .30-caliber rifle, but the bullet is approximately .22 caliber. A plastic sabot surrounds the base of the bullet (Fig. 1) to increase the latter's diameter to approximately 0.30 in. for sealing when it is fired from barrels having the 0.308-in. groove diameter common to .30-caliber rifles.

The plastic sabot has six slots equally spaced around the forward diameter of the bullet to aid in the uniform separation of the sabot from the projectile after they exit the muzzle of the

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The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Navy or the Department of Defense. In conducting the experiments described in this report, the investigators adhered to the "Guide for Laboratory Animal Facilities and Care," as promulgated by the Committee on the Guide for Laboratory Animal Facilities and Care of the Institute of Laboratory Animal Resources, National Academy of Sciences-National Research Council.

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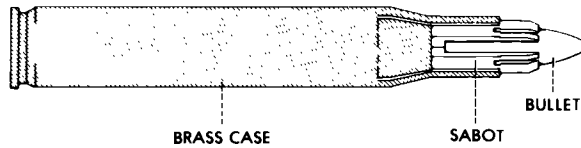


FIG. 1—Diagram of parts of Accelerator cartridge (AFIP Negative 79-12383).

firearm. The forward portion of the sabot flares outward along the slots, giving a petal-like formation (Fig. 2). The increased frontal area of the sabot retards the flight so that the sabot falls away from the projectile. The bullet, thus never having engaged the bore of the rifle, continues its flight unmarked by rifling of the firearm. The bullet is a 54.6-grain copper-jacketed, pointed soft-point projectile. The sabot weighs 5.7 grains, giving a total of 60.3 grains for bullet and sabot.

### Experimental Procedure

In this study the .30-'06 Accelerator cartridge was selected for study. The weapon used was a Remington, Model 700, bolt-action .30-caliber rifle with a 22-in. barrel.

The ammunition was fired into a thin poster board, 20% gelatin blocks, and anesthetized pigs.

The ammunition was fired into the poster board at the following distances in centimetres (feet): 30, 91, 183, 244, 245, 274, 305, 366, 549, 762, 1065, and 1524 (1, 3, 6, 8, 8½, 9, 10, 12, 18, 25, 35, and 50).<sup>4</sup> The firing into the poster board was preliminary to the firing into the animals so that some idea of the distance that the sabot separated from the bullet could be gotten.

The gelatin blocks were prepared as described by Lewis et al [1], and the ranges of fire were 183, 305, and 549 cm (6, 10, and 18 ft). The firing into the gelatin blocks was recorded on movie film with a Hycam high-speed motion picture camera at a speed of 8000 frames per second. Each of the gelatin blocks was photographed and X-rayed. The missile tracks in the blocks were opened, and the recovered fragments were photographed.

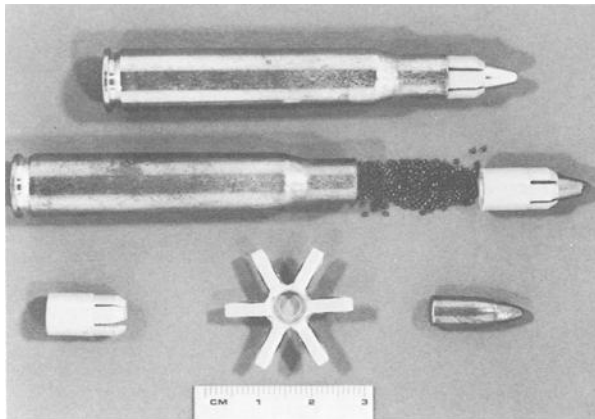


FIG. 2—Photograph of Accelerator cartridge (AFIP Negative 82-12348).

<sup>4</sup>Original measurements were in inch-pound units.

The animals used were male Yorkshire white swine, each weighing approximately 60 kg (135 lb). Anesthesia was achieved with intramuscular injections.

The anesthetized animals were washed, and their hair was lightly clipped. The Accelerator cartridges were shot into the animals at ranges of 91, 183, 274, 366, and 549 cm (3, 6, 9, 12, and 18 ft). Except for one firing into the flank area, all of the missiles were fired either into the chest or the abdominal areas. During one firing, at 366 cm (12 ft), the animal had a layer of a surgical scrub suit over the area fired into. The wounds were photographed and the pigs X-rayed. Selected pigs were autopsied, and the recovered fragments were photographed.

The barrel markings left on the sabots were studied by a firearms examiner (ACJ) from the Bureau of Alcohol, Tobacco and Firearms.

## Results

### *Firing Into Poster Board*

When the muzzle-to-target distance into the poster board was less than approximately 240 cm (8 ft), the bullet and the sabot entered the poster board together, thus making one hole. The petals of the sabot made a characteristic star-shaped pattern (Fig. 3). When the muzzle-to-target distance was approximately 240 cm (8 ft) and greater, the bullet and the sabot became separated, and made separate holes in the poster board (Fig. 4). Initially the sabot rose above the level of the flight path of the bullet; then, as it lost momentum, it would fall below the flight path of the bullet. Of course, the point at which it would fall below the flight path of the bullet would depend on atmospheric conditions and the angle at which the gun was held. At a range of 762 cm (25 ft), the sabot made a hole in the poster board, but at 1067 cm (35 ft) it did not hit the target area, hitting instead the wall in the firing range. At 1524 cm (50 ft) the sabot did not hit the wall but was found near the target area on the floor.

### *Firing into Gelatin Blocks*

When the muzzle-to-target distance was 305 and 549 cm (10 and 18 ft), the sabot hit the surface of the block and bounced off. When the muzzle-to-target distance was 183 cm (6 ft), the sabot and the bullet went into the block together, making one hole. X-rays of the blocks showed the typical "snow-storm" pattern of a high-velocity missile. Examination of the fragments from the block that was shot at 183 cm (6 ft) revealed fragments of lead, copper jacket, and plastic sabot.

High-speed photography of the firing into the gelatin blocks showed a large temporary cav-

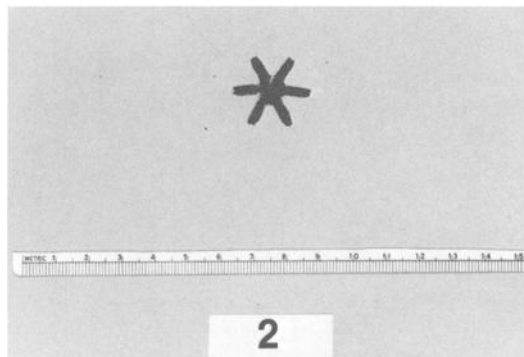


FIG. 3—Results of firing of Accelerator cartridge into poster board at range of 91 cm (3 ft) (AFIP Negative 82-12349).

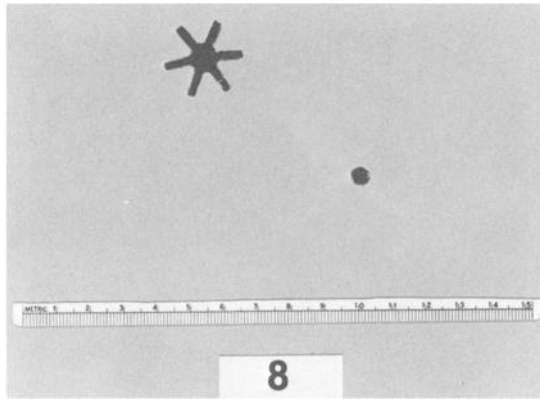


FIG. 4—Results of firing of Accelerator cartridge into poster board at range of 244 cm (8 ft) (AFIP Negative 82-12350).

ity and the blocks being knocked completely off the stand (by the kinetic energy of the missile). One of the frames of the movie showed the sabot bouncing off the surface of the gelatin block.

#### *Shooting into Anesthetized Pigs*

At ranges of 91 and 183 cm (3 and 6 ft) the sabot and the bullet entered the pig together, forming a star-shaped wound pattern (Fig. 5). When the cartridge was fired into the chest and abdominal regions of the pig there were no exit wounds. To try to evaluate an exit wound made by the Accelerator cartridge, we fired into the thigh area at a range of 183 cm (6 ft); the entrance wound was a large split, and the exit wound was a complete “blow-out” pattern.

At a range of 274 cm (9 ft), the sabot and bullet separated before hitting the pig, and the sabot embedded itself in the skin and subcutaneous tissue (Fig. 6).

When a pig was shot at a range of 366 cm (12 ft) the sabot made a distinctive star-shaped abrasion (Fig. 7) on the surface of the skin. Also at 366 cm (12 ft) with a one-layer scrub suit having been placed over the pig’s skin before the firing, the sabot made a star-shaped pattern

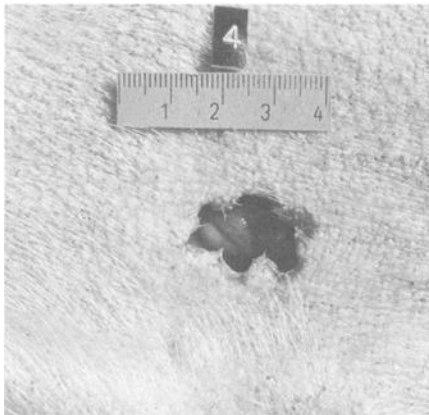


FIG. 5—Results of firing of Accelerator cartridge into pig at range of 91 cm (3 ft) (AFIP Negative 82-12351).

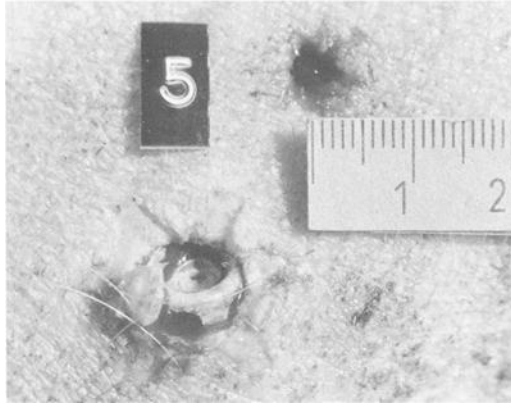


FIG. 6—Results of firing of Accelerator cartridge into pig at range of 274 cm (9 ft) (AFIP Negative 82-12352).

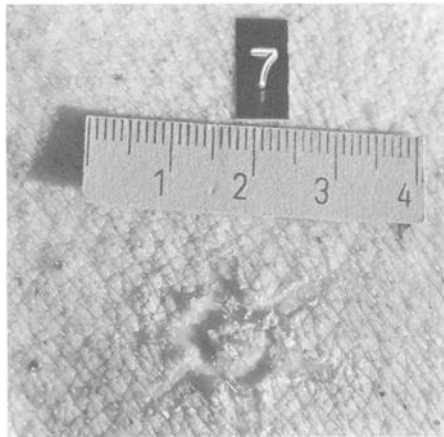


FIG. 7—Skin abrasion made by sabot at range of 366 cm (12 ft) (AFIP Negative 82-12353).

both on the surface of the scrub suit (Fig. 8) and beneath the scrub suit on the skin (Fig. 9) of the pig.

At a range of 549 cm (18 ft), the sabot was observed to hit the skin of the pig, but no abrasion was identified.

X-rays of the pigs showed the typical "snow-storm" pattern (Fig. 10) of a high-velocity missile. Selected pigs were autopsied, and portions of lead, copper jacket, and sabot were removed from the wound tracks. It was not possible to identify the plastic sabot on X-ray.

#### *Examination of Sabots Ballistically*

Examination of the markings (Fig. 11) on the sabot revealed class characteristics (the number of lands and grooves, direction of twist, and so forth) but insufficient individual characteristics for identification with a particular firearm.

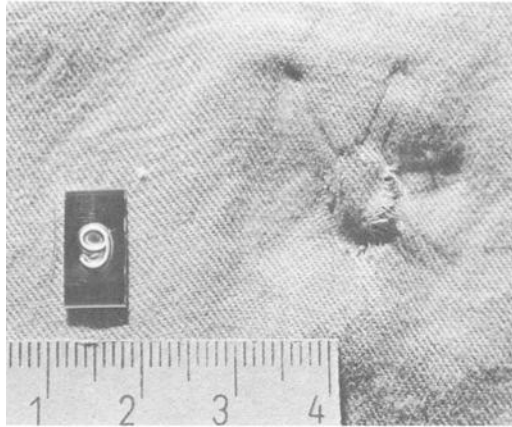


FIG. 8—Impression made in pig's scrub suit by sabot at range of 366 cm (12 ft) (AFIP Negative 82-12354).

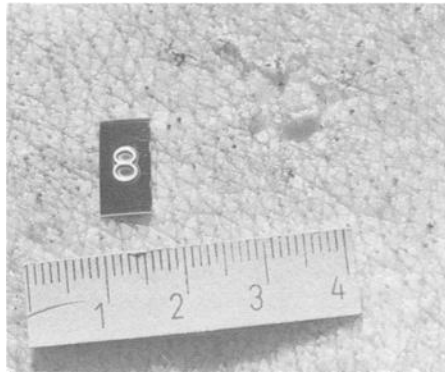


FIG. 9—Skin abrasion under pig's scrub suit. Range was 366 cm (12 ft) (AFIP Negative 82-12355).

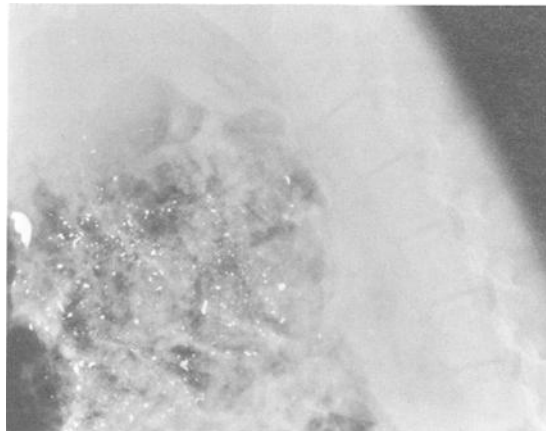


FIG. 10—X-ray of pig after he was hit by Accelerator cartridge (AFIP Negative 82-12356).

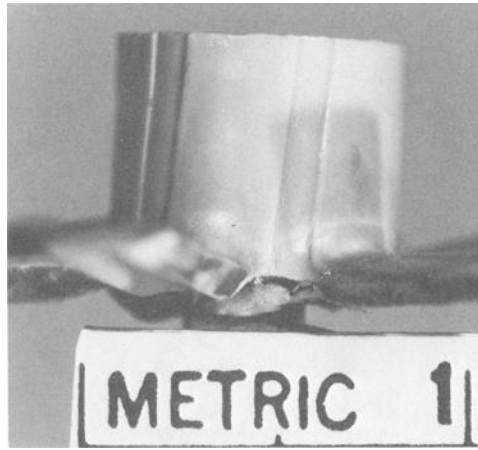


FIG. 11—Barrel markings on sabot (AFIP Negative 82-12357).

### Discussion

In evaluating the forensic science problems associated with the Accelerator cartridge, there are several things that need mentioning. At approximately 240 cm (8 ft) from the muzzle of the rifle, the bullet and sabot separate, leaving the sabot with a much shorter flight path than the bullet. The sabot can travel approximately 1520 cm (50 ft); the exact distance depends upon the direction and velocity of the wind and somewhat upon the angle at which the weapon is fired. According to the muzzle-to-target distance, the wound produced by the Accelerator cartridge will have a distinctive pattern: it may be a petal-shaped entrance wound (if the sabot goes into the body) or a petal-shaped abrasion (if the sabot hits only the surface of the skin). If the range is approximately 365 cm (12 ft) or less, an abrasion can be produced through clothing.

Examination of the barrel markings on the sabot disclosed only the class characteristics of the firearm used. In other words, the type of firearm could be determined but not the specific firearm that fired the cartridge, because of the lack of identifiable characteristics within the markings. This situation may be unique to the particular firearm used in this study. Sabots recovered from another firearm may retain sufficient identifiable characteristics.

Because barrel markings are located only on the sabot, it is important to recover the sabot, whether it is located in the wound track or at the scene of the incident. The head stamp on a cartridge case identifies the cartridge by caliber only; the Accelerator designation does not appear. Thus, if a .30-'06 cartridge case is found at a scene, it is not possible to tell whether the cartridge case was from an Accelerator cartridge or other type of .30-'06 ammunition.

### Reference

- [1] Lewis, R. H., Clark, M. A., and O'Connell, K. J., "Preparation of Gelatin Blocks Containing Tissue Samples for Use in Ballistics Research," *American Journal of Forensic Medicine and Pathology*, Vol. 3, No. 2, June 1982, pp. 181-184.

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