B119 The Soap Box Bullet Recovery System — Or the Soap Solution

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The goal of this presentationt is to call to attention a novel bullet recovery system enabling microscopical comparisons to be performed.

To test the proposition that a questioned or evidence bullet was fired from a particular gun barrel, test bullets fired from that barrel are necessary. Such test or exemplar bullets need to be decelerated gradually in order to be most useful for forensic microscopical comparison with evidence bullets. Achieving the required degree of uniform deceleration is not a trivial matter. Historically, a range of types of bullet recovery devices has been used. One of the earliest of these to be used widely in forensic science laboratories was the cotton waste box. The basic design consisted of an elongated rectangular box with a hole or port at one end through which the test shot was fired. The box was filled with cotton mill waste as the decelerating medium. Alternatively, cotton batting could be used. The mill waste, consisting of tangled lengths of threads or yarns, had the advantage that the spinning bullet would often cause the short lengths of yarn to become wound around it forming a cocoon-like structure and rapidly increasing its size and crosssectional area. This caused the bullet to slow down and come to rest in a shorter distance than it would have otherwise. An additional advantage was that the "cocoon" forming early and encasing the bullet protected the bearing surface containing the micro-striae from further abrasion damage. Despite this potential for protection, important microscopic details could be polished off the bearing surface. This was especially true in the case of non-jacketed lead bullets.

Beginning about four decades ago, the cotton waste boxes began to be replaced by purpose-built vertical water tanks. These could occupy the better portion of two office-size rooms, one above the other, on two floors in a building. It was easier to incorporate these vertical water tanks into a newly designed structure while it was being built rather than to retrofit an existing building. These tanks normally had a basket-like device at the bottom for collecting the test bullet. After each shot it was necessary to raise the basket to allow the bullet to be recovered. The devices for accomplishing this were often quite elaborate. The next generation of bullet recovery devices consisted of various horizontal water tank designs, which are widely used today. They can be accommodated on a single floor of a building, if the floor loading is adequate for supporting the weight of the few thousand kilograms of water contained in the tank. In use the bullet is fired into the tank at a slightly downward angle. The bullet is more easily recovered than was the case with the vertical water tank. Because the horizontal tank is relatively shallow, a device as simple as a wand or rod with a piece of tacky modeling clay or plasticine on the end can be used to effect recovery of the bullet. The wand-like device is manually inserted into the water until the plasticine contacts and adheres to the bullet, at which point it can be withdrawn. To keep the water clear and free of microbial growth the designs incorporate a circulation and filtration system, and a disinfectant such as hypochlorite may be added to the water. Due to their size and complexity these tanks can represent a significant investment. Such an expense can be difficult to justify for a small laboratory. An additional drawback of water tanks is that high-speed interaction of hollow-point bullets with the water causes them to open as they are designed to do when striking a body. Much of the bearing surface can be obscured by jacket and core material that has folded back. This can make the use of such bullets as exemplars difficult.

Recently, two additional approaches have been used. One consists of a metal cabinet where heavy gauge polyurethane curtain-like sheets are hung vertically normal to the line of fire. Depending on its energy a bullet will perforate a succession of sheets losing its energy incrementally until it lacks sufficient energy to even penetrate the next sheet. Typically, it will deform this sheet elastically, rebound, and fall into a collection tray. The tough elastic polyurethane sheets are several millimeters thick and resistant to deformation. After the passage of the bullet, the hole can be observed to have closed much like what is seen with a bullet hole in a vehicle tire tread. Clearly, each passage through a sheet wipes the bullet quite vigorously. For lead bullets significant material is removed from the surface, as visible bullet wipe surrounds the hole on the entry side, again similar to what is seen with tire treads. Despite this removal of material by this trapping technique, success in matching bullets has been achieved with those stopped in this fashion. However this is not an ideal technique for producing exemplar bullets.

The second newer technique utilizes a chamber filled with specially designed small elastomer balls. Each of these elastomer balls displaced along the bullet trajectory by contact with the bullet absorbs some of its energy. The mass of each ball is chosen to be similar to the mass of typical bullets for efficient momentum transfer. This results in lower impacts for each interaction and less damage to the balls. The bullet is stopped efficiently

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after multiple low impact interactions. Some of the elastomer balls do suffer damage after a number of shots and do need to be replaced. The cost is about $250.00 for the elastomer ball replacement kit. The typical chamber has a capacity of ~2 gallons.

Although developed independently, conceptually the method described in the present paper is very similar to the elastomer ball method. Here small hotel-size soap bars are used in place of the elastomer balls. The soap bars have several advantages. Soap in bulk form has been used for many years as a medium in ballistics research. Some researchers have used it in lieu of ballistic gelatin. Hotel supply houses sell large quantities of small bars at economical prices. For example, the authors purchased 2,00 one-half ounce bars for 85 dollars, including shipping. The friction between the soap and bullets is very low. As smaller fragments of soap form with extended use of the recovery trap, they can be collected, put into water, and reformed into small bars. Thus soap, in addition to being a low cost medium to begin with, can be recycled. The authors have designed and built a Lexan® bullet recovery box to be used with the soap bar medium. The soap is supported by a coarse grid, which allows the bullet to fall through, when the soap bar assemblage is agitated following a shot. Small fragments of damaged soap can fall through the grid as well. By opening a shallow drawer these and the test bullet can be recovered.

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