B165 Performance and Ricochet Characteristics of Frangible Ammunition

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After attending this presentation, attendees will understand the difference between conventional ammunition and frangible ammunition. Attendees will also become familiar with several types of frangible ammunition, whether these types of frangible bullets acquire individual markings after being fired, and how some break apart into fragments that bear little resemblance to a bullet if found at a shooting scene.

This presentation will impact the forensic science community by exploring the components of the frangible ammunition obtained for the study, how they behave upon impact, and whether fired bullets are amenable to comparison microscopy.

Frangible ammunition is constructed in a similar fashion to conventional ammunition regarding the cartridge case, the primer, and the propellant, but that's where the similarity ends. Conventional bullets, often consisting of a dense lead core either fully or partially enclosed with a harder copper jacket, or even unjacketed, can remain intact after a ricochet or after perforating a barrier. Ammunition that is manufactured with a frangible bullet is designed to minimize the dangers from ricochet or unwanted barrier perforation by using a bullet that is constructed to break up or fragment upon impact with hard unyielding substrates. The energy of these smaller post-impact fragments or powder is so small that they cannot travel very far from the initial impact site. To perform this way, these bullets are made of various formulations of powdered metals held together by adhesives, resins, or polymer materials. In contrast to the formulations that are bonded together, at least one manufacturer has developed a line of frangible ammunition that instead incorporates a jacket to encase the frangible core. Because of this novel design, the manufacturer claims that their bullets will also behave on soft organic targets as they behave on hard unyielding materials (i.e., by breaking up into small pieces). The properties of several brands of frangible ammunition were tested in scenarios that could be encountered in a shooting scene.

Several types of frangible ammunition that included a variety of construction methods and constituents were analyzed. Cartridges from different manufacturers were disassembled and the bullets were cross-sectioned to gain an understanding of their construction. Stereomicroscopy was used to assess how the bullet was made and its constituents; then Scanning Electron Microscopy with Energy-Dispersive X-ray Spectroscopy (SEM/EDS) was used to identify the elements present. The impact dynamics of the various frangible bullets tested were compared to traditional Full Metal-Jacketed (FMJ) bullets with unyielding material (steel plate) and yielding materials (wet sponge and sheet metal). The frangible bullets were also assessed based on their ability to accept individual markings (i.e., stria) from passage down the barrel of the firearm. High-speed photography was used to gain an understanding of the bullet's performance characteristics on the aforementioned yielding and unyielding materials.

Recovered bullet or jacket fragments were examined microscopically to determine if stria were present from the barrel's rifling and, if so, whether they were useful for comparison purposes. Frangible bullets that were encased within a traditional jacket did retain stria from the barrel and were able to be compared successfully to other test-fired bullets from the same firearm. Those that were not jacketed and were made of composites of powdered metal and adhesive only had class characteristics imparted from the rifling of the firearm's barrel. While the conventional FMJ bullets remained intact after 15-degree incident-angle impact with steel plate, most frangible bullets broke up into fragments upon impact with the same steel plate. Some of these post-impact bullet fragments were still relatively large and retained enough energy to pose a danger at close range.

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