A199 Bullet Ricochet Off Water

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After attending this presentation, attendees will have learned about the minimum depth of water necessary to allow a bullet to ricochet, and at what angle the bullet has departed the water as a factor of incident angle.

This presentation will impact the forensic science community by revealing the dangers inherent in bullet ricochet off of water and offer the calculations used to make these determinations.

There are many different surfaces from which a bullet can ricochet. These surfaces could include but are not limited to hard, unyielding materials such as concrete or automobile glass, and soft, yielding materials such as soil or water. These surfaces have incident angles at which a bullet will ricochet, whereas angles larger than this critical angle will cause the bullet to either penetrate into and/or fragment upon contact with the surface.

The bullet morphology may also affect the ricochet. Round-nose bullets may produce a ricochet angle that is quite different than hollow point bullets. Impact velocity will also affect ricochet. For most unyielding surfaces, the ricochet angle increases as the incident angle increases, and the ricochet angle tends to be slightly lower than the incident angle, whereas for yielding surfaces the ricochet angle is greater than the incident angle. This is due to the formation of a small hill or "ramp" which the bullet must now overcome instead of the smooth flat surface that it originally encountered.

This research was undertaken to explore the ricochet phenomenon on a commonly encountered yielding substrate– water. It is already known that bullets can and do ricochet off water, but at what incident angle will the bullet no longer ricochet, and how deep must the water be to allow the bullet to ricochet? This project involved the construction of a large shallow water tank at which bullets were fired at various angles and at various depths of water. The height of the ricochets were documented by witness panels at the end of the water tank, and using high speed photography to determine the impact point on the water surface, trigonometry was applied to calculate the ricochet angles. The water depth was then varied and the results of additional shooting documented. It was surprising at just how shallow the water level could be lowered yet ricochets were still possible without impacting the bottom of the tank. In addition to providing information for the application of trigonometry, the witness panels also confirmed that bullets that ricocheted were in destabilized flight, resulting in somewhat unpredictable trajectories, especially as the distance measured from the impact point became greater. **Bullet, Ricochet, Water**

 ** Presenting Author*