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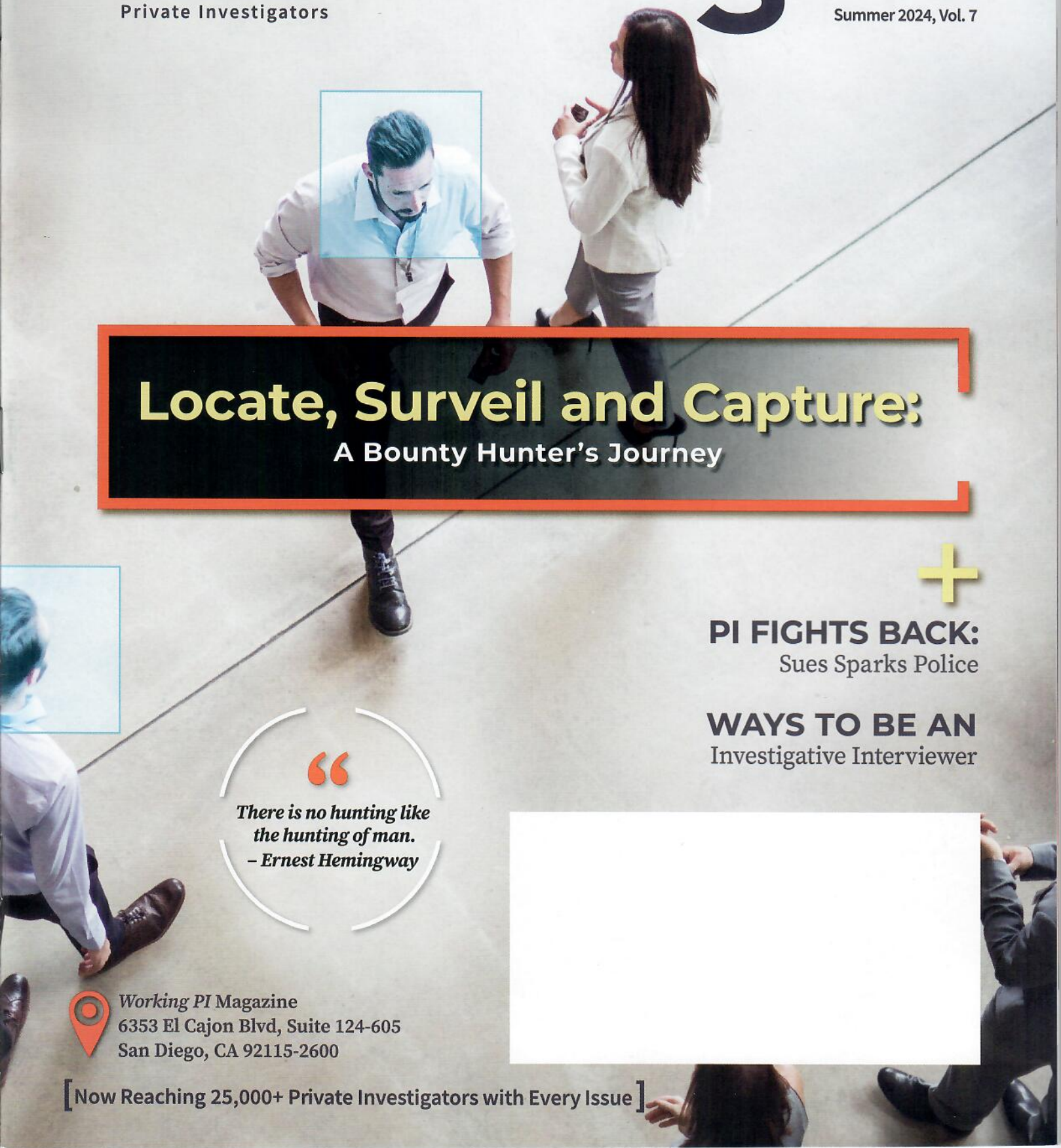

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Forensic Firearms Facts for Investigators

by Deborah Stonebarger, Analytic Investigations

"Forensic firearms identification can help solve crimes by associating firearms evidence between multiple crime scenes or between a specific firearm and evidence from one or more crime scenes."

The topic of firearms, particularly as it relates to criminal casework, is one private investigators are likely to encounter frequently. In this article, we'll discuss relevant firearms-related terminology and testing to help you better comprehend discovery and other information you review for your cases.

For starters, did you know that the term "ballistics" is often inaccurately used to describe the practices encompassing firearms evidence testing? As defined by the Association of Firearm and Toolmark Examiners, ballistics is the science of projectiles in motion. Interior ballistics refers to the projectile's motion within the firearm, while exterior ballistics studies the projectile's motion between exiting the firearm and its target. Terminal ballistics encompasses the projectile's impact at the target, while trajectory refers to the path the projectile takes between the muzzle of the firearm and its target.

The terms "ballistics" and "trajectory" are relevant to crime scene reconstruction but have nothing to do with determining whether evidence at a scene, such as a bullet or a cartridge case, was fired by a specific weapon. Forensic firearms identification is the correct terminology that answers important questions, such as whether two bullets recovered from separate crime scenes were fired by the same weapon or whether the bullet recovered from a victim was fired by the suspect's firearm.

Foundational Terms

Let's take a step back and review some basic terminology related to firearms and ammunition that will lay a foundation for understanding forensic firearms identification. First, there are the components of the ammunition. The main components of a cartridge, or a round of ammunition, are the cartridge case, the primer, the gun powder, and bullet.

The bullet refers to the projectile only. Using the word "bullet" to refer to a cartridge is technically incorrect, but quite

common. The cartridge case holds the bullet (or projectile), gunpowder and the primer. The primer is a small cap that, when struck by the firing pin, sets off a spark that ignites the gunpowder inside the cartridge case. Ignition of the gunpowder causes a rapid expansion of gases inside the confines of the cartridge case, which propels the bullet out of the cartridge case and down the barrel of the firearm.

While there are a lot of components and terminology related to firearms, I am going to limit this discussion to items related to forensic firearms identification. Thus, what follows are some of the components from handguns (many of which are also present in rifles and shotguns) that leave marks on bullets and cartridge cases that are commonly used in forensic firearms identification: chamber, breech face, firing pin, ejector, extractor and barrel.

The chamber holds the cartridge prior to being discharged in the firearm. The breech face is part of an assembly that locks into place at the rear of the chamber prior to firing the gun, and it is seated against the base of the cartridge. A firing pin is the part that strikes the primer of the cartridge causing the spark that ignites the gun powder. The projectile detaches from the cartridge case and travels down the barrel of the firearm prior to exiting. Extractors and ejectors are components found in semi-automatic handguns. The extractor pulls the recently fired cartridge case out of the chamber, and the ejector pushes the cartridge case out of the firearm.

Function Test

A common type of firearm examination in the laboratory is a function test. This includes examination and documentation of the firearm in question. The firearms examiner will note the type of firearm, including the manufacturer, model, serial number, the type or size of cartridge the firearm is chambered for, the action of the firearm, rifling characteristics like the number of lands and grooves and direction of twist, and other relevant information. The condition of the firearm is also documented, paying particular attention to anything that may alter the functionality of the gun.

After documentation, the firearm will be fired to ensure that it operates appropriately. If functionality is the sole purpose of the examination, the firearm can be fired into a berm or backstop from which the bullets cannot be recovered. If firearms identification will be required, the firearm will be discharged most commonly into a water tank, so that bullets can be recovered for further examination. Cartridge cases are usually collected, even if they aren't needed for firearm identification purposes.

NIBIN Hits

Depending on the circumstances of a case, photographs of a fired cartridge case will be entered into the National Integrated Ballistic Information Network (NIBIN), a database maintained by the Bureau of Alcohol, Tobacco, Firearms and Explosives. NIBIN automates the comparison of some features of fired cartridge cases. A NIBIN "hit" can give an investigative lead, indicating whether cartridge cases from different crime scenes may have been fired from the same weapon or whether cartridge cases from a crime scene were fired from a firearm recovered in a case.

It must be stressed that a NIBIN hit gives an investigative lead only, not an identification. NIBIN can give results showing multiple possible "hits" among fired cartridge cases with similar markings, but not all of the possible hits will be true identifications. In addition, sometimes none of the cartridge cases selected by NIBIN will lead to identifications.

Only a qualified forensic firearms examiner is capable of determining if a true identification exists. Private investigators should be cautious when reviewing discovery that mentions NIBIN hits and make sure that evidence listed as a NIBIN hit is further examined by the lab.

Keep in mind, there are law enforcement and prosecution agencies that report a NIBIN hit as an identification. This may be due to ignorance or a deliberate attempt to mislead the defense.

'No-Gun' Cases

Another type of forensic firearms examination is known as a "no-gun" case. In this instance, expended bullets recovered from a crime scene or victim are examined to determine rifling characteristics. These characteristics include the number of lands and grooves, the direction of twist, and the width of the land and groove impressions.

The characteristics can be entered into another platform known as the General Rifling Characteristics database, which is maintained by the FBI. The database provides a list of firearms, including manufacturer and model, that possess the same general rifling characteristics. This information can be shared with law enforcement, so they know what type of gun was used in a crime, even when the gun is not recovered immediately.

Lab Work

Forensic firearms identification examination in the laboratory encompasses the examination and documentation of the evidence firearm, function test, test-firing the gun and collecting the expended bullets and cartridge cases, as well as subsequent microscopic examination of the toolmarks made on the expended bullets and cartridge cases. Generally there are three to four test-fires created from a firearm. The test-fires are considered to be the "known" standard because it is known that they were fired in the evidence firearm.

The toolmarks on the test-fires are intra-compared to ensure that the marks are reproducible. A representative test-fire, or known, is then compared to each expended evidence bullet or cartridge case (the unknown).

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The primary toolmarks that forensic firearms examiners analyze and compare on expended bullets are striated markings on the land impressions. The primary toolmarks that examiners analyze and compare on expended cartridge cases are those made by the firing pin/firing-pin aperture and breech face marks. Firearms examiners also analyze extractor and ejector marks on expended cartridge cases, but these marks are not often used for identification purposes. Toolmarks can also be made by other parts of the firearm that were previously discussed.

Drawing Conclusions

Forensic firearms examiners have five main conclusions they can reach after examination. The conclusions are based on class and individual characteristics. Class characteristics are features that indicate a restricted group size. Barreling with five lands and grooves with a right twist is an example of a class characteristic. Not all guns have these rifling characteristics, thus the group of firearms is narrowed into one that's more restrictive. Individual characteristics are random and unique marks that can be caused by wear, corrosion and damage of firearms surfaces.

An identification means that the expended bullet or cartridge case was fired by the firearm that was test-fired. To reach the conclusion of identification, all class characteristics must be the same between the known test-fire and the evidence, or unknown, item, and there must be sufficient corresponding unique, individual marks. An elimination means that the expended evidence bullet or cartridge case was not fired by the firearm that was test-fired. Disagreement of class characteristics is an instant elimination, and disagreement of individualizing marks would also lead to an elimination.

The other possible conclusion is inconclusive, in which the class characteristics are the same but there isn't a suf ficient amount of individual marks to reach either an identification or an elimination. There can be an inconclusive result leaning toward an identification in which there are some corresponding individual marks but not quite enough to reach an identification. There can also be an inconclusive result leaning toward an elimination where there are some observed differences in individual marks but not enough for an elimination.

Bringing Value

Forensic firearms identification can help solve crimes by associating firearms evidence between multiple crime scenes or between a specific firearm and evidence from one or more crime scenes. Ballistics and trajectory can help solve crimes by providing information to help reconstruct the events surrounding a crime. Forensic firearms identification can also provide exculpatory evidence.

PIs who understand fire-arms-related evidence provide a better ability to assist their attorneys and clients, and ultimately the justice system.

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