

WAI NEWSLETTER

**December 2014 Issue: WAI
Conference, Firearm/Toolmark
Evidence, Officer Survival**

2015 WAI Conference

The 49th annual WAI Educational Conference will take place March 11-13 at the Metropolis Resort in Eau Claire. Classes will be taught by experts in their respective fields. Topics include misconceptions of processing death scenes, general death investigation and gun shot wounds, toxicology and overdose investigations, SWGIT guidelines in photography, crime scene documentation, casting of toolmarks and footwear, using electrostatic film and photographing impressions in dust and deep snow, polygraph investigation, bloodstains and luminol, private sector laboratory technologies and services, child abuse investigation, and photographing bruises on skin. A presentation will also take place regarding the investigation of the homicides that took place in Crandon in 2007.



2015 Host Agency

Social activities include the President's Reception on March 11 and a dinner banquet on March 12, with entertainment provided by Gabriel Holmes, a hypnotist. On March 13, the general membership meeting will take place, at which time elections will be held for WAI officer and director positions.

Cost to attend the complete conference is \$225 for WAI members and \$275 for non-members, with other options also being available. More information, along with online registration, can be found on the WAI website at www.thewai.org.

Conference Photo Contest

Photos are being sought as part of a competition taking place at the 2015 WAI Conference. There will be two categories, forensic and creative, with contest rules being as follows.

- Maximum of two entries per person.
- Any subject matter may be used within the two categories. For example, crime scene photos in the forensic category and nature in the creative category.
- Photos may be black and white or color and must be mounted on foam board with no borders, frames, or matting.
- Photos must be between 8" by 10" minimum and 16" by 20" maximum.
- An 8 1/2" by 11" photo contest entry label must be completed and mounted to the foam board for each photo. The description of the photo should be no longer than 100 words in 16 point type.
- Participants can only win one award in each category.
- Winners will be announced at the general membership meeting.
- One winner in each category will receive a \$50 Visa gift card.

Complete contest information along with entry labels can be found at www.thewai.org.

Newsletter Corrections

The October issue of the Newsletter noted only the Milwaukee and Wausau offices of the State Crime Lab offered a mobile crime scene unit. In fact, all three offices provide this service. Also, the article on Pages 4 and 5 was for products at the 2014 IAI Conference, not 2015.

The Science Behind Firearm and Tool Mark Evidence

By Nancy Ritter



The NIJ-funded study described in “Study Identifies Ways to Improve ATF Ballistic Evidence Program” looked at the operation of the National Integrated Ballistic Information Network (NIBIN), not at the underlying science of firearm and tool mark

examination. This forensic science — sometimes referred to by laypeople as “ballistics — is concerned with the validity of matching a fired bullet to a particular firearm.

So what is the current state of the science of firearm and tool mark examinations? Are these examinations accurate, reliable and valid?

First, the basics: Firearms have numerous metal parts. During the manufacture of a firearm, the machining process leaves unique, microscopic markings (called tool marks) on some of these parts. When most firearms are fired, these tool marks are transferred to the discharged (“spent”)

cartridge casings and bullets. This evidence can be collected from the scene of a crime, such as a homicide or shooting, and firearm and tool mark examiners can compare them with a test-fired firearm that, for example, has been confiscated from a suspect.

Since 2009, NIJ has funded research to determine the accuracy and reliability of firearms examinations — that is, whether a fired bullet (sometimes referred to as a spent projectile) was ejected from a particular firearm or the probability of finding unique patterns on casings that are shared by spent ammunition from the same firearm. NIJ’s most recent findings, released in February 2014, established an error rate of less than 1.2 percent in matching bullets fired from Glock semiautomatic pistol barrels to the actual firearm.

The study — a collaboration between a Florida International University statistician and the Miami-Dade Police Department, which has been studying Glock barrels since 1994 — was designed to answer two basic questions:

- Will trained firearm and tool mark examiners looking at bullets through consecutively manufactured firearms barrels that contain the same barcode-like pattern be able to correctly identify the firearm that fired the bullet?
- What role does an examiner’s level of experience play in accurately identifying the firearm that fired an unknown (or “questioned”) bullet?

The experiment looked at bullets from 10 consecutively manufactured Glock barrels. Here’s the interesting part: During the manufacturing process, specific Glock barrels are imprinted with a barcode-like pattern called the Enhanced Bullet Identification System (EBIS). The idea behind this study was that even though these barrels were consecutively made and cut with the same EBIS pattern, their “signatures” (or

tool marks) should still be different. Consecutively manufactured barrels, as the final report states, “represent the best possibility for the production of two firearms that could produce non-distinguishable marking,” since the same tools and machining processes were used, back to back, on one barrel after another.

Here’s how the experiment worked: One hundred and fifty test sets — with an “open set” design, in which the participants had no expectation that all unknown bullets should match known test sets — were sent to 165 firearm and tool mark examiners in 41 states, the District of Columbia and internationally. This sample was the largest ever used for this type of experiment. Sneh Gulati, with the Department of Mathematics and Statistics at Florida International University, analyzed the results.

The Findings

The examiners correctly matched the spent bullet to the barrel that fired it 98.8 percent of the time.

The study also found that examiners with less than 10 years of experience did not reach different conclusions than examiners with more than 10 years of experience; that is, there was no significant difference between these two groups in their ability to correctly identify which bullets were fired from which consecutively manufactured Glock barrels.

The research stated:

Through examination of the individual striations/impressions, the signature can be positively identified to the firearm/tool that produced it. Such tool mark identifications are made to a practical certainty ... Practical impossibility cannot be expressed in mathematical terms. As a result of extensive empirical research and validation studies such as this one ... an opinion can be justifiably

formed that it is a practical impossibility that another firearm will be found that exhibits as much individual microscopic agreement with test tool marks as the questioned tool marks that have been identified.

It is very important to note, of course, that there are many other types of firearms that have not been studied in this same way, particularly using consecutively manufactured barrels. That said, Gerry LaPorte, Acting Director of NIJ’s Office of Investigative and Forensic Sciences, noted that the findings from this study support the scientific foundation of forensic firearm and tool mark identification through the evaluation of the repeatability and uniqueness of striations of unknown bullets.

“The Glock study provides empirical data to strengthen the foundation of firearms identification, which was among the issues raised in 2009 by the National Academy of Sciences in *Strengthening Forensic Science in the United States: A Path Forward*,” he added.

Read the full Glock report, *An Empirical Study to Improve the Scientific Foundation of Forensic Firearm and Tool Mark Identification Utilizing Consecutively Manufactured Glock EBIS Barrels With the Same EBIS Pattern*, at NCJRS.gov, keyword: 244232. The report includes an extensive review of past studies that have looked at the science of firearm and tool mark identification.

Ongoing Firearm and Tool Mark Examination Research and Development

NIJ is also funding two ongoing studies that could inform the scientific foundation of firearm and tool mark examination as a forensic investigative tool:

- Cadre Research Labs is working on rapid three-dimensional ballistic imaging and matching using a novel gel-based sensor that, when touched, conforms to an object's surface and renders a three-dimensional profile in roughly two minutes. This research includes five "deployment studies" that will gather feedback on the system's functionality, interface and usability from firearm and tool mark investigators with the Oakland Police Department; the San Francisco Police Department; the Contra Costa County Office of the Sheriff; the Walnut Creek Bureau of Alcohol, Tobacco, Firearms and Explosives; and the Illinois State Police.
- NIJ awarded a competitive grant to the National Institute of Standards and Technology to create an open-access ballistics reference database — containing a wide range of two- and three-dimensional data for bullets and cartridge cases — that researchers and vendors will be able to use to improve pattern recognition, or "matching," algorithms. This type of research database has already been created in the field of biometrics (including, for example, fingerprints), leading to advancements in image-based matching algorithms. To stimulate similar technological advancements in pattern-making algorithms for firearms and tool marks, the ballistics database will include a large diversity of breech face, firing pin and bullet land impressions of test fires, providing crucial data for testing the robustness of matching algorithms.

Findings from these studies are expected by 2016.

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Photo by Peter Diaczuk, an adjunct instructor at the John Jay College of Criminal Justice, CUNY.

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Officer Survival Spotlight

Preventing Assaults: Assessing Officer Perceptions

By James J. Sheets

Officers have been victimized due to their misconceptions of offenders. In fact, a groundbreaking study identified this as the primary reason law enforcement personnel were feloniously assaulted. Such incidents can result when officers encounter a compliant subject and then lower their guard. Likewise, offenders form perceptions of law enforcement personnel they encounter, which influence the decision whether to assault an officer.

The FBI's Law Enforcement Officers Killed and Assaulted (LEOKA) Program conducted three studies over a 20-year period: *Killed in the Line of Duty* (1993), *In the Line of Fire* (1997), and *Violent Encounters* (2006). The research examined offenders who had feloniously assaulted police officers. *Killed in the Line of Duty* and *In the Line of Fire* explained that no clear profile



exists for such subjects. *Violent Encounters* noted that some offenders had prior criminal records, some had psychiatric histories, and others could not be categorized. Many subjects were affiliated with gangs, more were exposed to violence at an early age, and most abused alcohol and other drugs. Regarding individuals who might assault or kill an officer, the research concluded that it could be anyone.

Despite the lack of a profile for violent perpetrators, the research offered insight into the offender mind-set. *In The Line of Fire* noted that 33 percent of subjects who feloniously assaulted officers stated their assaults were premeditated and intentional. The study also observed that 64 percent of offenders who assaulted officers stated their assaults were impulsive, unplanned, or opportunistic. A former instructor with a major influence on the development of the LEOKA Program offered this perspective regarding the data: “One-third of the offenders say they are coming after the officer no matter what. The other two-thirds, they are looking for that ‘window of opportunity,’ waiting for the officer to make a mistake.” In other words one-third of subjects will attack without hesitation, but two-thirds will wait until they perceive their assaults will be successful.

Case Review

An example graphically illustrates the mind-set of a “one-third” offender. In the early morning hours in a rural area, a lone officer stopped a subject for a speeding violation. He followed proper police procedure during his approach. The officer used a flashlight in his nonweapon hand while leaving the other hand free. He wore body armor and positioned himself at the center post of the vehicle. As the officer began contact with the driver, shots rang out. The officer disengaged and drew his weapon while moving to the rear of the suspect’s vehicle for cover. The officer returned

fire, and the offender quickly drove off. Body armor worn by the officer stopped two rounds, and the offender was later apprehended without incident.

The officer was at a disadvantage, unaware that the driver was operating a stolen vehicle and in possession of a stolen weapon. When interviewed, the offender stated that he intended to kill the officer. He perceived the officer as a “professional type,” the kind who would wear a vest. The subject admitted to adjusting his point of aim to the officer’s neck because of the potential for body armor. Despite the offender’s intent to kill, he dealt

“...training and adherence to proper police procedures are critical to mitigating officer attacks.”

with a professional police officer who maintained a tactical advantage. The offender still attacked, unsure whether he would be successful.

“Two-thirds offenders” are not as committed to assaulting an officer unless the opportunity presents itself. Their perception of the officer and the circumstances are critical determinants when considering a potential attack. One offender described two separate stops by different officers and why he attacked one but not the other. His description of events provided insight into the mind-set of the two-thirds offender.

Wanted for a felony warrant, the subject was stopped for a speeding violation. The offender stated the officer made direct eye contact with him in the side mirror, maintained visual contact, touched the trunk, and visually inspected the rear passenger area. The offender stated he perceived the officer as professional and attentive. The

subject concluded he could not retrieve the weapon under his seat without getting hurt; therefore, he did not attack the officer. Stopped again in a similar set of circumstances, the offender described the second officer as inattentive. Perceiving this vulnerability, the offender attacked the officer, shooting him several times and seriously wounding him.

Recommendations

Officers must be aware that their nonverbal messages can influence a violent offender. Two of the authors of the previously mentioned LEOKA reports suggested a casual attitude may lead an offender to believe that the officer is mentally or emotionally distracted. If an officer does not follow an offender's body movements, hand movements, or shifts in body position during contact, the subject may perceive that the officer lacks a readiness to act. Much like officers assess offenders for threat potential, subjects also assess officers for vulnerabilities. Research suggested that training and adherence to proper police procedures are critical to mitigating officer attacks.

Trainers and supervisors should work together to assist officers in developing behaviors that project a professional police image. *Violent Encounters* explained that trainers should teach officers to be vigilant, attentive, and mentally prepared to effectively respond to constantly changing situations. The study further noted that trainers should advise officers never to judge individuals on physical characteristics alone. Research recommended that supervisors ensure officer compliance with departmental policies and safety procedures. Following law enforcement training and adhering to safety procedures enable officers to enhance their safety by overcoming the possibility that offenders perceive them as vulnerable or weak.

Conclusion

Offenders assess officers during every contact. No clear established profile exists of a subject willing to commit violence against a police officer. The research suggested that of those who have feloniously assaulted police officers, one-third of these offenders possess the mind-set that they will attack an officer regardless of their perceptions of the officer. Two-thirds of the offenders will attack an officer when they perceive their attack will succeed. Officers should strive to maintain a professional image that sends a signal to offenders that the officers are alert and attentive.

Violent Encounters examined the profile, mind-set, and perceptions of offenders who have feloniously assaulted police officers. Based on the study, the researchers have developed a technique for officers to mentally prepare themselves for contact with potentially violent subjects. The Take A.I.M. (awareness, image, and mind-set) technique consists of officer self-initiated activities that may mitigate the possibility of assault. Officers should be responsible for their own safety; project a neat, clean, and professional image; convey that they are alert, prepared, and formidable opponents; take training seriously; and adhere to safety procedures. The Take A.I.M. pamphlet, along with the studies cited, can be found on the Law Enforcement Online LEOKA Special Interest Group (SIG) website at <http://www.leo.gov>.

James J. Sheets is a former police lieutenant and an officer safety awareness instructor with the FBI's Law Enforcement Officers Killed and Assaulted Program.

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