

# Firearm and Toolmark Overview

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The **Firearm and Toolmark discipline** is a versatile, well-equipped unit offering a number of services that can be useful to investigators.



Firearm and Toolmark Examiners provide reliable scientific support to all law enforcement personnel. Services are provided at both the investigation and trial-preparation stages of criminal cases involving the use of a firearm or other tool.

- The type of firearm that a bullet or cartridge case was fired from
- Whether a bullet was, or was not fired from a suspected firearm\*\*\*
- Whether a cartridge case was, or was not fired in a suspected firearm
- Whether a tool found in a suspect's possession was, or was not used to cut, scrape, pry, or pinch evidence material seized from a crime scene\*
- The original serial number of a firearm or other metal object after the number has been obliterated
- If gunpowder is present on a victim's clothing or on other evidence that may have been the target of the suspect
- The distance from the muzzle of the firearm to the target at the time the firearm was fired\*\*

*\*Tools found at the scene of a crime that cannot be associated with a suspect **will not** be examined.*

*\*\*No muzzle-to-target distance tests can be done without the firearm that was involved in the shooting. **Note: It cannot be determined "how long" it has been since a firearm was fired.***

*\*\*\*The analysis of bullets will be limited to those recovered from a gunshot victim (recovered at autopsy/hospital, ect.). Scene bullets **will not** be routinely analyzed with out the approval of the Firearms Discipline manager or designee.*

# Firearms Analysis

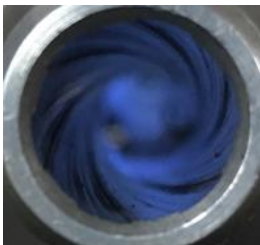
## Basics of Firearms Comparisons



Inside the barrels of handguns and rifles are spiral impressions called rifling. The raised portions of the rifling are known as lands and the recessed portions are known as grooves. When a firearm is fired, these lands and grooves cut into the bullet, putting spin on it as it travels through the barrel of a firearm. Because bullets have an oblong shape, spin is necessary for accurate flight.



The impressions of lands and grooves are transferred to the bullet when it is fired.



Since rifling characteristics can differ from one firearm manufacturer to another, firearms examiners can determine the type of firearm that fired a bullet by examining the impressions of the lands and grooves on the bullet. They examine the width, the number, and the direction of the twist of the lands and grooves. For example, a 9mm pistol made by one company might have a barrel with 6 lands and grooves that twist to the right and another company's 9mm might have 6 that twist to the left. In addition, the width of the lands and grooves may differ.

Because each barrel will have imperfections left by the manufacturing process that will leave unique marks on a bullet, firearms examiners can determine whether a bullet recovered from a crime scene or victim was fired from a firearm taken from a suspect.

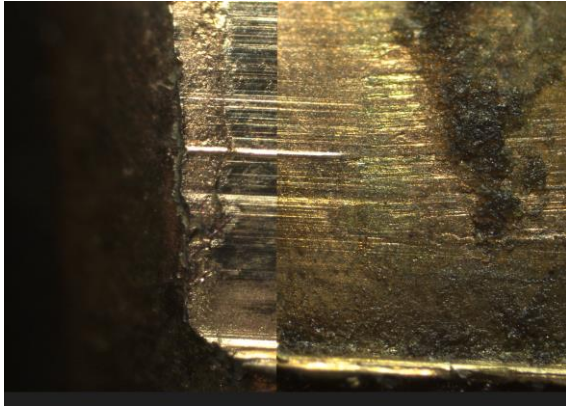
## Comparison Process



The first step in the **Comparison Process** is to test fire the firearm into a water tank in the lab.

## Bullets

The second step involves using a comparison microscope to compare the test bullet to the bullet recovered from the victim or crime scene.



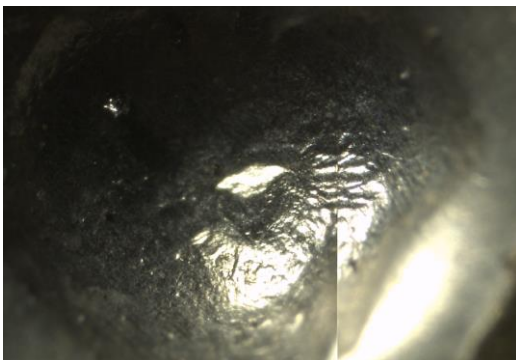
The photo on the left shows the split screen image the scientist sees using the comparison microscope. The right side of the photo shows the test bullet fired from the suspect's firearm into the water tank and the left side, the bullet recovered from the crime scene. The marks or striations on the evidence bullet were identified as being made by the suspect's firearm.

## Cartridge Cases



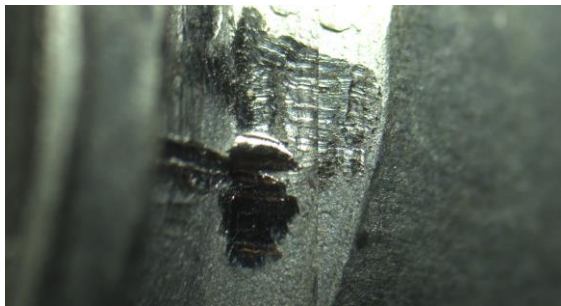
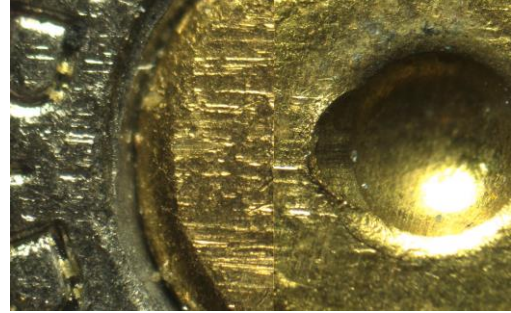
Since a firearm will also leave unique marks on cartridge cases; cartridge cases left at crime scenes can link a suspect's firearm to the crime.

The following photographs of split screen images from a comparison microscope show three different types of markings left on cartridge cases that firearms examiners can use in determining if the cartridge cases were fired from the same firearm.



**Firing pin impressions** - When a firearm's trigger is pulled, the firing pin will move forward striking the primer cup located at the rear center of the cartridge.

**Breech face marks-** These marks come from the breech face area of the firearm. This is the portion of the firearm that supports the cartridge when loaded in the chamber. After the cartridge powder is ignited by the firing pin striking the primer cup, tremendous pressure is exerted in the chamber of the firearm, forcing the back of the cartridge case against the breech face.



**Extractor marks** - After a semi-automatic pistol has been fired, an extractor pulls the cartridge from the chamber and ejects it from the pistol.

## **IBIS/NIBIN**

The Integrated Ballistic Identification System (IBIS) is used to potentially associate evidence in previously unlinked crimes. IBIS is a highly technical, computerized image analysis system that records images from bullets and cartridge cases and compares them to a national database of images called the National Integrated Ballistic Information Network (NIBIN). The GBI Firearms section only has the capability to enter cartridge cases for search against the NIBIN database.

Cartridge cases recovered from crime scenes are imaged into the system and searched to find potential associations with other evidence in the database or from test fires from firearms that are submitted to the laboratory for testing.

The images from the test fires and evidence are correlated automatically against the database in a matter of minutes; an impossible task for a firearms examiner using conventional procedures. The images are correlated by the system and given a score as to a possible association. The results of this correlation are called NIBIN leads. Agencies will be notified of any NIBIN Leads within 24 hours of discovery.

The firearms examiner makes a final determination by conducting a microscopic examination of the evidence generating the NIBIN Lead. If an association is confirmed, it becomes a NIBIN Hit. When a Hit has occurred, the involved law

enforcement agencies are notified, and they can then take the appropriate investigative and legal actions.

Evidence cartridge cases and test fires remain in the system to be searched indefinitely. The images from the test fires and evidence are correlated automatically against the entire database for the NIBIN region encompassing the host site. Manual searches outside the region can be made at the request of the submitting agency.

In order to provide timely investigative lead information, the GBI Firearms section has implemented a screening process for all submitted evidence to the laboratory.

- For cases in which two (2) or more cartridge cases and/or shotshell cases are submitted:
  - Submitted evidence will be screened and grouped based on similar characteristics
  - At least one (1) cartridge case and/or shotshell case representing each group shall be imaged.
  - Appropriate NIBIN system searches will be conducted.
- For cases in which only one cartridge case and/or shotshell is submitted, appropriate NIBIN system searches will be conducted.

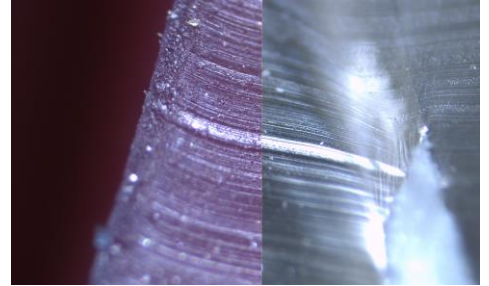
All submitted evidence will be screened on entry into the laboratory system and submitted to the NIBIN database. Further microscopic comparisons will be performed on evidence from generated NIBIN leads. If no NIBIN lead is generated following the completion of this initial screening, only evidence for the following offenses will remain at the laboratory for further examination and comparative analysis: Homicide, Crimes against Children, and other expedited requests. Evidence screened for all other offenses will be returned to the agency after screening completion.

## Toolmark Examination

The Firearm and Toolmark discipline accepts tools suspected of being associated with a crime scene. Cutting, pinching, prying, and striking tools are all examined by this discipline. Great care must be taken by the officer to protect the marking surfaces on the tool. If the entire tool cannot be wrapped, the tool's marking surface should be protected using whatever materials are available to the officer. Tools found at the crime scene that cannot link a person to the scene will not be examined. Tools must be associated with a suspect by means of DNA, Latent Prints, or recovery on their person, in their home, vehicle, or other limited access location. Materials recovered from the crime scene that are suspected of being marked by the recovered tool should be carefully removed from the scene so that the marks are not disrupted. Any cuts made by the officer to remove the suspect areas should be clearly marked so as not to be confused with the suspect areas. Any suspected tool collected **SHOULD NOT** be used for this purpose, as this can

damage or change the characteristics of the tool. Each item should be packaged separately and submitted to the laboratory.

Tools also leave unique marks that can provide important clues in linking a suspect to a crime. The photo on the right is a split screen comparison of a knife mark in plastic tubing compared to a break line that had been cut



A maul recovered from a burglary suspect is compared against the indentation left in the victim's doorjamb.

The maul fits the indentation perfectly, providing local investigators with evidence to charge the suspect in the burglary.



## Evidence Submissions

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The following are general requirements for officers and other law enforcement personnel in collecting and submitting evidence for Firearm and Toolmark analysis. As in all cases, common sense should be used when attempting to protect the integrity of evidence.

## Firearms

Firearms should be collected carefully so that no parts of the firearm are damaged. Officers should make sure that nothing comes in contact with either the inside of the barrel or the breech face, which is where the head of the cartridge rests before firing. All firearms **MUST** be unloaded prior to submission to the laboratory. If the firearm cannot be unloaded prior to submission, you **MUST** contact DOFS personnel for instructions **prior to submitting the firearm**. Firearms should be made secure in gun boxes so that it can be easily confirmed that the firearm is unloaded. When securing firearms in the box, please follow these guidelines for placement of zip ties.



The use of zip ties in the position(s) pictured will allow lab staff to see that the weapon is unloaded in addition to securing it to the box. The use of commercially available gun boxes with a window is **required** for all handgun submissions.

- The magazine must be removed from all handguns and fastened separately to the box bottom with a zip tie. It is acceptable to leave cartridges in the magazine.
- If loose cartridges are being submitted in the box with the gun, they **MUST** be contained in a **separate** sealed package within the box.

## Firearms Recovered From Water

Firearms removed from **fresh** water **must** be placed in the same water for submission to the laboratory. Small lunch coolers work very well for handguns. If a rifle or shotgun is removed from a lake or pond but cannot fit into a container, the firearm should be sprayed heavily with WD-40 or other lubricant and taken to the laboratory immediately. The slightest bit of rust to the inside of the barrel will alter the individual characteristics necessary to make identification. If the firearm is removed from the water, it must be oiled, making sure that the inside of the barrel is sprayed or filled with oil. This will slow the oxidation process. Firearms removed from **saltwater** should be rinsed, heavily oiled and brought to the crime laboratory immediately. Heavily bloodstained firearms should be packaged in boxes with a biohazard label.

## **Protecting the Firearm from Damage**

Do not insert foreign objects into any part of the firearm such as the barrel or ejection port apart from the required zip tie. In the event the firearm will be dusted for fingerprints or super glued, block both ends of the barrel gently with tape. This will prevent residue from building up inside of the barrel. Do not dry fire or work the action of any firearm that is to be submitted to the crime lab. Leaving empty cartridge cases in the chamber of a revolver when submitted might assist the examiner in determining from which chamber the round was fired.

## **Bullets, Cartridge Cases and Cartridges**

When bullets and cartridge cases are submitted for analysis, they should be individually packaged in their own envelope or other small container.

- Do not mark or engrave any surface on a bullet or cartridge case as this may damage individual characteristics. If evidence must be marked, mark the container itself.
- Do not let any metal object such as forceps, knives or screwdrivers come into contact with a bullet. Metal objects will scratch the surface and alter the markings used for identification.
- Numerous cartridge cases recovered from the same area may be packaged together in one container to save time and supplies.
- Be sure to collect any wads or pellets in cases involving a shotgun. Under certain circumstances a wad can be compared to the barrel of a shotgun, especially if it has a sawed-off barrel.
- Please submit bullets in separate packaging from any collected cartridge cases or firearms. This will help expedite the NIBIN screening process.

## **Clothing**

Clothing submitted to the laboratory for distance determination should be packaged in a paper bag or box. Do not package wet or bloody clothes until they have air-dried, taking care to not cross contaminate items. Wet clothes will mold, making them difficult to examine. Inform the firearms examiner of how the layers of clothing were worn in order to assist in determining the path of the bullet. This information should be written on the evidence bag or the submission form.

Analysis for Muzzle to Target Distance Determination cases will only be performed after consultation and approval of the Firearms Discipline manager or designee. For this service to be performed, a firearm identified as being used in the shooting must also be submitted. If no firearm has been submitted, no distance determination can be rendered unless there is a clear indication of a contact gunshot hole of entry.