



Introduction to Forensic Science – (Criminalistics)

Basic

Crime Scene Investigation Techniques

ITT Technical Institute  School of Criminal Justice 

---

---

---

---

---

---



---

---

Introduction to Forensic Science – (Criminalistics)

Basic

Crime Scene Investigation Techniques

ITT Technical Institute  School of Criminal Justice 

---

---

---

---

---



---

---

---

This week the student will learn:

- Firearms identification through bullet comparison
- Understand rifling, lands and grooves
- Determine distance from residue
- Procedures for harvesting firearms evidence
- Tool mark and impression evidence
- Comparisons of tool marks and impressions
- HOMEWORK
  - Read chapters 12 & 13

ITT Technical Institute  School of Criminal Justice 

---

---

---

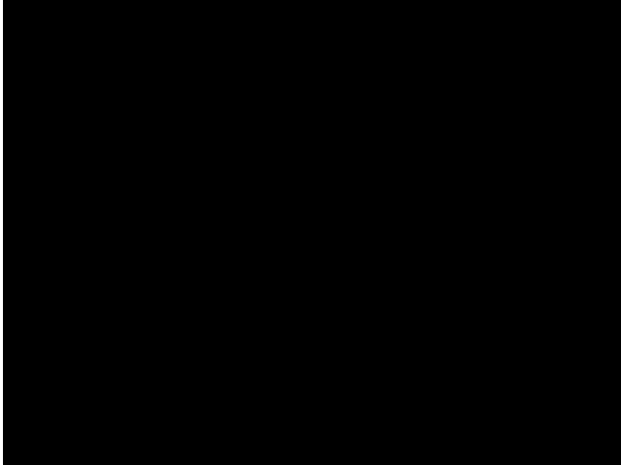
---

---

---

---

---



---

---

---

---

---

---

---

---

### Review – Firearms & Tool Marks

- Just as friction ridges provide human identification, minute random markings on surfaces can provide individual characteristics to inanimate objects.
- On example is gun barrels
- A modern gun barrel is produced from a single bar of steel.
- The rod is drilled out
  - This leaves markings
- The barrel is then put through a process to impart rifling.
  - This leaves more markings.

ITT Technical Institute **ITT**  School of Criminal Justice 

---

---

---

---

---

---

---

---

### Review – Firearms & Tool Marks

- Rifling is a series of grooves placed on the inside of the barrel in a spiral pattern to cause the bullet to spin and stabilize.
- The cuts are called grooves
- The uncut area is called lands



The original drilling is the bore  
Also known as the caliber.

ITT Technical Institute **ITT**  School of Criminal Justice 

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- The caliber is an approximation
  - A 38 is between 0.345 and 0.365 inches.
  - So is a 357 magnum
- The grooves of the modern barrel rifling are made in one of four methods.
- A broach cutter is forced through the barrel and cuts all the grooves at the same time.
- A button process is forced through the raw barrel and compresses the grooves into it.

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- The mandrel rifling process has a mandrel placed into an oversize barrel, and the whole barrel is squeezed from the outside, down to size with grooves formed at the same time.
- Marlin rifles use a technique called microgrooving, no other manufacturer uses this method.
- Caliber is expressed in 100's of an inch, or in millimeters.

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- Class characteristics show that a Smith & Wesson .32 caliber has five lands/grooves with a right twist.
- A Colt .32 caliber has six lands/grooves with a left twist.
- Individual characteristics are imparted by the manufacturing tools and by use.
- No two barrels can be produced with the same imperfections, no matter how hard they try.

---

---

---

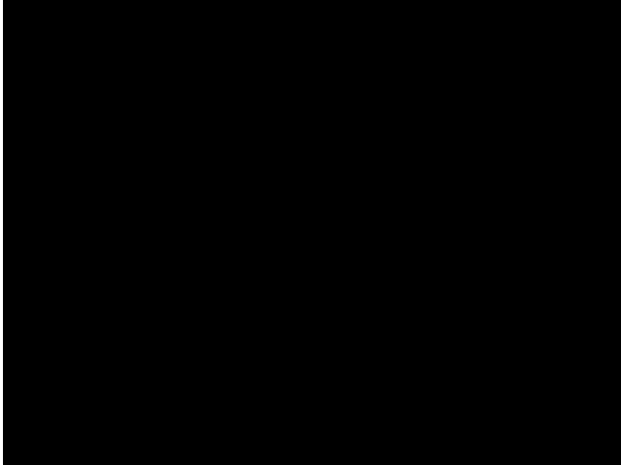
---

---

---

---

---



---

---

---

---

---

---

---

---

### Review – Firearms & Tool Marks

- Any match between two bullets must be made with a comparison microscope
- It is considered the single most important tool of the firearms examiner.
- In a comparison microscope, one bullet is rotated until a well-defined marking is located.
- The other bullet is then rotated until a duplicate marking is located.
- Both are rotated.

ITT Technical Institute  School of Criminal Justice 

---

---

---

---

---

---

---

---

### Review – Firearms & Tool Marks

- Besides the rifling, dirt in the barrel will add additional markings to the bullet.
- The striations in the barrel are not permanent and change constantly with time and use.
- Just like with fingerprints, no accepted rules regarding the minimum number of points for id.
- Shotguns and "smooth bores" have no rifling.

ITT Technical Institute  School of Criminal Justice 

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- Shotguns, smooth bores and black powder guns produce no markings on the projectiles.
- A 12-gauge shotgun has a bore of 0.730 inches.
- A 16-gauge has a bore of 0.670 inches.
- The larger the number, the smaller the bore
  - In shotguns
  - Except the 410 which is 0.410 inches.
- Originally designated by the number of shot balls of full bore that were required to equal one pound.

---

---

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- When a gun is fired:
  - The primer is struck
  - The primer ignites the propellant
  - The propellant produces gases when it burns.
  - The expanding gases push the projectile down the barrel.
- At the same time, the empty cartridge is forced backwards against the breechblock of the gun
- As the projectile passes down the barrel, it is impressed with the rifling marks and spin is induced.
- The projectile exits the barrel.

---

---

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

**How Revolvers Work**

1 Trigger 2 Hammer 3 Cylinder 4 Barrel 5 Magazine

**The Modern Bullet Cartridge**

Bullet, Bullet Case, Propellant, Rim, Primer

©2001 HowStuffWorks

**J** School of Criminal Justice

---

---

---

---

---

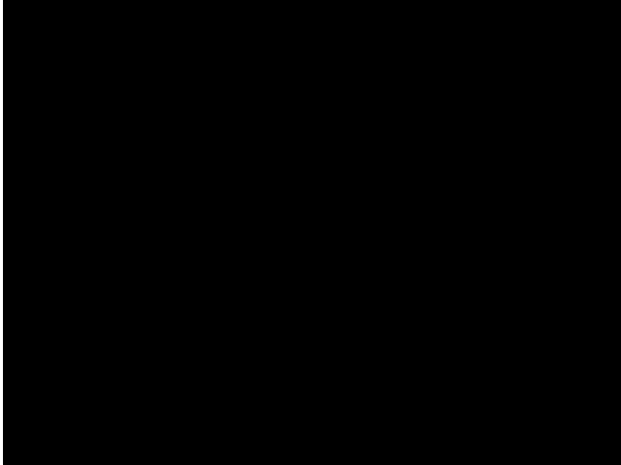
---

---

---

---

---



---

---

---

---

---

---

---

---

### Review – Firearms & Tool Marks

- The shape of the firing pin will have been forced into the soft metal of the primer.
  - This may have enough definition to individualize the weapon
- The rear of the cartridge case may pick up markings from the face of the breechblock
- If a semi-automatic is used:
  - The casing is grabbed by an extractor and pulled from the chamber.

ITT Technical Institute  School of Criminal Justice 

---

---

---

---

---

---

---

---

### Review – Firearms & Tool Marks

- If a semi-automatic is used:
  - The casing is forced from the weapon by an ejector.
  - Both the extractor and the ejector produce markings.
  - In a shotgun, all these markings except the rifling are useful.
- The FBI produced the "Drugfire" system.
  - Developed primarily for cartridge cases
- BATF produced the Integrated Bullet Identification System (IBIS) system.
  - For both cartridges and for bullets.

ITT Technical Institute  School of Criminal Justice 

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- IBIS uses two programs.
  - Bulletproof for analyzing bullets
  - Brasscatcher for analyzing cartridges
- Drugfire and IBIS would not work together.
- In 1999 they joined forces and settled on IBIS, but incorporated both of the older systems.
  - This system has over 800,000 images
  - Is credited with more than 8,000 matches
  - On more than 16,000 cases.

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- Just like with fingerprints and the AFIS system, IBIS serves as a screening tool for the examiner.
- A human makes the final decision as to whether there is a match or not.
- Firing distance determinations
  - Self defense.
  - Suicide
- All of the gunpowder is never totally consumed.
- Requires the same weapon and ammunition.

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- General rules of thumb
  - A heavy concentration of vaporous like smoke residue surrounds the hole
  - A “halo” of residue is indicative of 12-18 inches from skin.
  - Scattered specs and no soot indicates 18 – 25 inches from skin.
  - (with ball ammunition, the distance can be 6-8 feet)
- A brown ring at the entrance to the bullet hole is called a bullet wipe.

---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

---

### Review – Firearms & Tool Marks

- Nitrites are one by-product produced by a fired weapon
- The Greiss Test uses gel coated photographic paper to search for nitrites.
- The paper is pressed onto the garment with an iron.
- The paper is then chemically treated to reveal nitrites.
- In shotguns, the propellant blast will enter the body of the target up to about 5 feet
- This enlarges the entry hole.

ITT Technical Institute  School of Criminal Justice 

---

---

---

---

---

---

---

---

### Review – Firearms & Tool Marks

- A 12-gauge usually increases in pellet spread by about one inch per yard.
- A shotgun has a “choke”
- The choke causes the pellets to hang together, go farther and go faster.
- The dermal nitrate test is old
  - It uses paraffin wax (hot) be brushed onto the suspects hands
  - After cooling, it was peeled off and tested.
- False tests produced by urine, fertilizer, tobacco, cosmetics.

ITT Technical Institute  School of Criminal Justice 

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- Primers contain Lead styphnate, barium nitrate and antimony sulfide. (except .22)
  - Residue of these is found on the web and back of hand
  - Tests seek presence of barium and antimony in these areas
  - Cotton swab method of testing has little effect after two hours post shooting
  - .22 caliber usually cannot be tested for

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- Neutron activation analysis is new method but very expensive. (chapter 6)
- Flameless atomic absorption spectrophotometry is also new method, but much cheaper. (pg 158-159).
- Scanning electron microscope also works well but if manual approach is used, it is too time intensive.

---

---

---

---

---

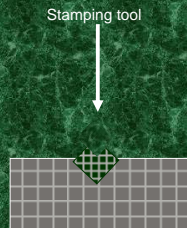
---

---

---

## Review – Firearms & Tool Marks

- Serial number restoration
  - When a number is stamped in metal, it compresses the metal around it.
  - If not ground too deep, or re-stamped with a different character, an etching agent can retrieve the indentation



---

---

---

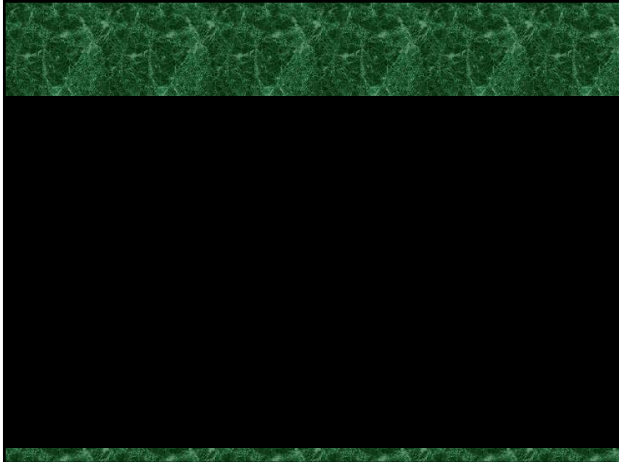
---

---

---

---

---



---

---

---

---

---

---

---

---

### Review – Firearms & Tool Marks

- DO NOT PICK UP A GUN BY INSERTING AN OBJECT INTO THE BARREL
- Mark casing near the mouth of the shell
- Mark bullets on the base (nose if necessary)
- Recover shotgun wads
- Clothing should be collected (dried if required) and submitted to lab.

---

---

---

---

---

---

---

---

### Review – Firearms & Tool Marks

- Tool mark – any impression, cut, gouge, or abrasion caused by a tool coming into contact with another object.
  - The edges of a pry bar, chisel, screwdriver, knife, cutting tool, etc., display microscopic irregularities.
  - In the lab, the tool is usually pressed into soft lead at different angles to obtain a pattern
  - Harvest the entire object possessing a tool marking in it.

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- If harvesting is not possible, photograph and make a cast with dental stone or liquid silicone
- Other impressions include shoes, feet, tires, clothing/fabric
  - Lifting imprints off floors can be accomplished with a Mylar sheet and electricity
    - Pathfinder is the current popular model
    - Can also be done with a Taser gun

---

---

---

---

---

---

---

---

## Review – Firearms & Tool Marks

- Chances of shoes matching:
  - Number of unique markings on sole
    - 2: 1 out of 127,992,000
    - 3: 1 out of 683 billion
    - 4: 1 out of 2.7 quadrillion
    - 5: 1 out of 8.7 quintillion
    - 6: 1 out of 23 sextillion
    - 7: 1 out of 53 septillion
    - 8: 1 out of 106 octillion
    - 9: 1 out of 189 nontrillion
    - 10: 1 out of 300 decillion

---

---

---

---

---

---

---

---

this media proudly hosted by:

[www.orism.net](http://www.orism.net)

---

---

---

---

---

---

---

---



---

---

---

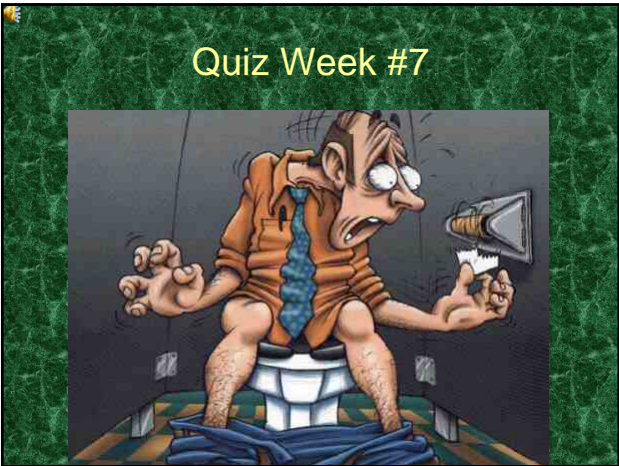
---

---

---

---

---



---

---

---

---

---

---

---

---