

## FEU05 – SOP for Bullet Examinations and Comparisons

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### 1. Scope

- 1.1. This procedure is designed for the examination of fired bullets, including comparisons of fired bullets with firearms and without firearms.

### 2. Background

- 2.1. To establish the practices for documenting the examination of firearm evidence to conform to the requirements of the Department of Forensic Sciences (DFS) Forensic Science Laboratory (FSL) *Quality Assurance Manual*, the accreditation standards under ISO/IEC 17025:2005, and any supplemental standards.

### 3. Safety

- 3.1. For proper handling of firearm see the FEU01 - SOP for the Safe Handling of Firearms.

### 4. Materials Required

- 4.1. Ammunition; Comparison Microscope; Binocular Microscope; Marker; Electronic Balance; Calipers; Metal Scribe; Gloves; Sonic Cleaner

## 5. Standards and Controls

- 5.1. Known specimens from test fired firearms are control specimens. A control specimen is created during the examination of the firearm.

## 6. Calibration

- 6.1. Not applicable

## 7. Procedures

- 7.1. General Examination of a Bullet

7.1.1. Before any examinations are conducted, ensure that the bullet(s) have been properly labeled. Such markings shall be done so as not to obliterate any marks of value. The nose and base of a bullet most often provide areas suitable for labeling.

7.1.2. Determine and note the physical characteristics of the projectile. The member shall complete the projectile worksheet documenting the projectile characteristics. The following information shall be recorded in the examiner's notes:

7.1.2.1. Weight

7.1.2.2. Diameter

7.1.2.3. Caliber

7.1.2.4. General rifling characteristics (GRCs) (as described below)

7.1.2.5. Type of bullet (hollow point, round nose, jacketed, etc.)

7.1.2.6. Other properties including but not limited to: cannelures, magnetic, base shape, jacket material etc.

- 7.2. General Rifling Characteristics (GRCs)

**7.2.1. The GRCs are the caliber, number of lands and grooves, and the width and direction of twist imparted on a fired bullet by the rifling in the barrel of a firearm.**

### 7.3. Methods for Measuring the GRCs

- 7.3.1. Comparison microscope-reticule eyepiece method: The fired bullet is either held or mounted on a steady surface beneath the microscope. Measure the land and groove impression using the reticule eyepiece and record the measurement to the nearest hundredth or thousandth of an inch.
- 7.3.2. Comparison microscope-stage caliper method: The fired bullet is either held or mounted on a steady surface beneath the microscope. Measure the land and groove impression using the ocular alignment grid and record the measurement to the nearest hundredth or thousandth of an inch.
- 7.3.3. The examiner shall take the physical dimensions of the bullet, and if possible determine the manufacturer of the bullet from comparison made with the Standard Ammunition File (SAF) specimens and use the FBI/AFTE general rifling characteristics file to determine a list of possible firearms that could have fired an evidence bullet when no firearm was submitted.
- 7.3.4. Microscopically examine the bullet to determine if any marks of value are present.

### 7.4. Examination of a Bullet When a Suspect Firearm has been Submitted

- 7.4.1. Refer to the Test Firing SOP for the test firing procedures for a submitted firearm.
- 7.4.2. The Firearms Examiner will test fire utilizing ammunition which is like the evidence ammunition.
- 7.4.3. Before performing a comparison examination, ensure that the comparison microscope is in proper working condition.
- 7.4.4. Using a comparison microscope, examine the test-fired bullets with the submitted bullet. From your examination, determine your conclusion. A conclusion will reflect one of three possibilities:
  - 7.4.4.1. Identified – marks on the evidence were produced by the firearm.
  - 7.4.4.2. Non-Identification – marks on the evidence were not produced by the firearm.
  - 7.4.4.3. Insufficient Markings- marks on the evidence could not be identified or eliminated as having been produced by the firearm.

7.4.5. If the General Rifling Characteristics (GRC) of the evidence are not consistent with those from the test fire, the Firearm Examiner will search the GRC file and obtain a list of possible weapons which could have fired the evidence bullet.

## 8. Sampling

8.1. Not applicable

## 9. Calculations

9.1. Using the following equation, the diameter of a mutilated bullet can be determined using the land and groove measurements (sum of the measurements of the land and groove, multiplied by the number of lands and grooves equals the circumference):

$$\begin{aligned} L &= .000 & \#L+G \times TX &= (c) \text{ circumference} & \frac{3.14(\pi)}{TX} &= \text{caliber} \\ G &= +.000 & & & (c) \text{ circumference} \\ (TX) &= .000 & & & \end{aligned}$$

## 10. Uncertainty of Measurement

10.1. When quantitative results are obtained, and the significance of the value may impact the report, the uncertainty of measurement must be determined. The method used to determine the estimation of uncertainty can be found in the *FSL Quality Assurance Manual – Estimation of Uncertainty of Measurement (Section 5.4.6)* and in the FEU Appendix A, Uncertainty of Measurement Guidelines.

## 11. Limitations

11.1. Test fire ammunition must be like ammunition to the evidence in question, i.e. brand, caliber, cartridge case finish.

11.2. Identifiable microscopic marks may not be reproducing from shot to shot due to changing of the barrel, corrosion, leading, etc. Under such circumstances, it may be impossible to identify the known test bullets to each other. Further, mutilated, corroded, and deformed bullets may be of no value for comparison purposes.

- 11.3. The GRC File is an investigative aid and should not be construed as an all-inclusive list of firearms available with those class characteristics.

## 12. Documentation

- 12.1. Firearm Control Page
- 12.2. Bullet/Projectile Worksheet
- 12.3. NIBIN Image Worksheet
- 12.4. Firearms Worksheet
- 12.5. Case File Review Sheet
- 12.6. Photographs
- 12.7. FEU Report of Examination

## 13. References

- 13.1. Mathews, J.H., Firearms Identification, Vols. I-III, Charles C. Thomas, Springfield, IL (1962)
- 13.2. Gunther, J.D., and Gunther, C.O., The Identification of Firearms, John Wiley, New York (1935)
- 13.3. FBI, General Rifling Characteristics File, (2000)
- 13.4. FBI/AFTE General Rifling Characteristics file, AFTE.org (2011)
- 13.5. Firearms Examination Branch "Safety Protocol for Handling of Firearms", 2011
- 13.6. *Forensic Science Laboratory Quality Assurance Manual* (Current Version)
- 13.7. *DFS Departmental Operations Manual* (Current Version)
- 13.8. *FSL Laboratory Operations Manual* (Current Version)
- 13.9. *FEU01 - SOP for Safe Handling of Firearms* (Current version)
- 13.10. Cyber National, Inc., Bullet Recovery System & Remote Firing Platform Operating Guide (2004)

13.11. Forensic Buddy, Savage Arms Operating Guide, (2008)