

# FEU09 – SOP for Trajectory Analysis in a Shooting Incident Response

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### 1. Scope

- 1.1. This procedure is designed for the examination of shooting scenes, to determine the trajectory / path of the bullet.

### 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*.
- 3.2. Protective gloves, eyewear, footwear, and clothing shall be available for protection from blood substance, broken glass and other environmental hazards.

### 4. Materials Required

- 4.1. The Shooting Incident Response Trajectory Kit (SIRT Kit) includes but not limited to the following equipment: dowel rods; angle finder; lasers; tape measures; calipers, chemicals (SORO), camera.

## 5. Standards and Controls

- 5.1. Not applicable

## 6. Calibration

- 6.1. Not applicable

## 7. Procedures

- 7.1. Preparation

- 7.1.1. The lead firearms examiner shall contact the requesting detective, attorney, crime scene search technician, or outside agency and obtain as much information as possible about the shooting incident.

- 7.1.2. The lead firearms examiner shall inspect the *Shooting Incident Response Trajectory Kit* (SIRT Kit) before leaving the Laboratory to ensure the necessary equipment for processing a shooting scene is present in the kit.

- 7.1.3. In conjunction with the Branch supervisor, the lead firearms examiner shall ensure the Crime Scene Technician(s) will be on scene as necessary.

- 7.2. Initial Arrival on Scene

- 7.2.1. The lead firearms examiner should consult with the person in charge of the scene to determine the scope of necessary work.

- 7.2.2. The lead firearms examiner should make an initial assessment of the scene to determine the order of operations.

- 7.3. Processing of the Scene

- 7.3.1. Depending on the requirements of the scene, the following actions may be taken:

- 7.3.1.1. Measurements of the location of the object being examined to the local environment to fix objects when applicable

- 7.3.1.2. Measurement of object/car/room(s)
- 7.3.1.3. Identification and labeling of impact holes
- 7.3.1.4. Photographs of object/car with holes labeled
- 7.3.1.5. Field lead test around impact holes Sodium Rhodizonate (SORO)
- 7.3.1.6. Examination of physical effects around impact holes
- 7.3.1.7. Determination of which impact holes form a common trajectory path
- 7.3.1.8. Measurement of impact hole(s), positions, diameters
- 7.3.1.9. Determination of trajectory angles
- 7.3.1.10. Scene photographs with trajectory rods and or laser(s)

#### 7.4. Results

- 7.4.1. For this protocol, a trajectory is the path followed by a bullet/ projectile that is determined by examining and measuring the position and orientation of the impact hole(s) or impact points of a scene.
- 7.4.2. The types and calibers of firearms used can sometimes be determined from recovered bullets and cartridge cases.
- 7.4.3. The total, minimum, or maximum number of possible shots fired can sometimes be determined from recovered bullets and cartridge cases.
- 7.4.4. The analysis of the bullet path through objects such as an automobile can sometimes be determined by examining the physical effects around impact hole(s).

## 8. Sampling

- 8.1. Not applicable

## 9. Calculations

- 9.1. The following equation can be used to determine an approximate angle of impact for a bullet hole:

$$\text{Angle} = \sin^{-1}(\text{width/length})$$

Where width equals the short dimension of the elliptical hole and length equals the long dimension of the elliptical hole.

## 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. Caution shall be exercised in reaching conclusions about common trajectories and establishing trajectory angles, taking into account appropriate uncertainties, zones or approximate positions.
- 11.2. For quality assurance and safety purposes, the Lead Firearms Examiner handling the trajectory must be assisted by another Firearms Examiner or Crime Scene Sciences personnel.

## 12. Documentation

- 12.1. FEU Examination Worksheets  
12.2. Photograph(s)  
12.3. Drawings, if applicable  
12.4. FEU Report of Results

## 13. References

- 13.1. Haag, Lucien C., *Shooting Incident Reconstruction*, Academic Press, Burlington, MA (2006)
- 13.2. *Forensic Science Laboratory Quality Assurance Manual (Current Version)*
- 13.3. *FSL Departmental Operations Manuals (Current Versions)*
- 13.4. *FSL Laboratory Operations Manuals (Current Versions)*
- 13.5. *FEU01 - SOP for Safe Handling of Firearms (Current Version)*