FBI Laboratory
Firearms/Toolmarks Unit
Shooting Incident Reconstruction

1 Scope

This procedure outlines the roles and responsibilities for Firearms/Toolmarks Unit (FTU) members deployed on a Laboratory Shooting Reconstruction Team (LSRT) and the methods for the examination of bullet trajectories and documentation of a Shooting Incident Reconstruction (SIR).

2 Equipment/Materials/Reagents

The Shooting Incident Reconstruction Kit (SIRK) is a hard shell case that contains and protects the equipment necessary to perform a SIR. The SIRK case includes the following equipment: Bullet Test Kit (BTK); trajectory and/or dowel rods of various calibers; string; angle finder; smart level; lasers; protractors; tape measures; basic tool kit; plumb bob; appropriate boots/protective clothing; calipers; compass.

3 Standards and Controls

Lead and copper bullets are used as a positive control when performing field processing of gunshot residue for distance determination and presumptive testing for lead and copper residues using the BTK. Chemical reagents for field examinations will be prepared as outlined in the Firearms/Toolmarks Unit, *Comprehensive Gunshot Residue Examinations in Muzzle-to-Target Distance Determination* procedure. Samples generated from these examinations that are used to reach a conclusion are considered secondary evidence and will be turned over to the requesting agency for chain-of-custody purposes.

4 Responsibilities

4.1 The Unit Chief (UC) will:

- Liaison with Evidence Response Team Unit (ERTU) or requesting agency
- Select examiner for Shooting Incident Reconstruction (SIR)
- Track FTU deployments
- Determine if additional firearms analysis will be necessary
- Ensure FTU LSRT members have received training for handling hazardous material

4.2 An LSRT FTU Examiner will:

- Communicate with ERTU or requesting agency
- Inspect SIRK before deployment
- Communicate with Operational Projects Unit (OPU)
- Ensure the proper documentation is collected which will provide an accurate representation for the SIR results of examination
- Write and issue a report containing the SIR results of examination

5 Calibration

Not applicable.

6 Sampling

Not applicable.

7 Procedures (Operations)

7.1 UC (or designee) LSRT Deployment Actions

7.1.1 When a request to support a SIR is received in the FTU, the UC will determine if the FTU has the necessary resources for supporting the operation.

7.1.2 The UC will select an examiner/team from the FTU to perform the SIR. The selection of an examiner/team will be on a rotating basis to ensure an even distribution of assignments. To track deployments, the rotation selection of examiners will be recorded on the FTU Share drive, LSRT folder. The UC will be responsible for maintaining this record.

7.1.2.1 Newly qualified examiners in the FTU will assist in supporting the LSRT on at least three responses before serving as the LSRT FTU examiner lead. Additionally, newly qualified examiners and/or technicians should complete the ERTU Basic Training course before being deployed on a LSRT.

7.1.3 Prior to deployment, communications will be established between the UC, ERTU, OPU, and/or the requesting agency. Pre-deployment communications will attempt to assess the conditions and safety of the scene, possible number of shooters and shots fired, and firearms that may have been involved or present. This information is necessary to evaluate the available resources that will be committed to supporting the operation.

7.1.4 During pre-deployment communications, the UC will determine if the FTU will be deployed in support of a SIR.

7.1.5 If possible, during pre-deployment communications with the requesting agency it should be determined if forensic firearms comparison examinations will be necessary and which agency will perform them.

7.1.6 Prior to deployment the UC will ensure that FTU members supporting the LSRT have successfully completed the Laboratory's safety program for handling hazardous materials.

7.2 FTU Deployment in Support of LSRT

7.2.1 On ERTU supported deployments, the ERTU designee will be the lead for the LSRT deployment.

7.2.2 The ERTU lead is responsible for operational orders and logistical movement of the LSRT during deployment.

7.2.3 While on scene, the ERTU lead manages the expectations of the investigative product being produced by the LSRT and will handle communications between the LSRT, Field responders, and Laboratory management.

7.3 LSRT FTU Examiner Lead

7.3.1 The LSRT FTU examiner lead is responsible for conducting a thorough examination, documenting the shooting scene, and conveying the expectations of the reconstruction capabilities to the ERTU lead and/or requesting agency.

7.3.2 The LSRT FTU examiner lead will be involved with pre-deployment communications and meetings to obtain information about the shooting scene to determine the equipment and FTU members necessary to successfully complete the SIR.

7.3.3 Prior to deployment, the LSRT FTU examiner lead will inspect the SIRK to ensure the necessary equipment is present for processing the scene.

8 LSRT FTU Examiner Lead Scene Responsibilities

8.1 The LSRT FTU examiner lead will provide guidance and information about the SIR to the ERTU lead while he/she consults with the agency in charge of the scene regarding the scope of work and details of the operation.

8.2 The LSRT FTU examiner lead will ensure the appropriate warrants are in place before proceeding with the SIR.

8.3 Prior to entering the scene, the LSRT FTU examiner lead will determine if a crime scene log is in place and sign before entering and leaving the crime scene.

8.4 Before conducting a SIR, the LSRT FTU examiner lead will perform an initial walk through of the crime scene with ERTU lead and/or person in charge to assess the scene and determine the order of operation.

8.5 The LSRT FTU examiner lead is responsible for conducting a thorough examination of the shooting crime scene and should discuss the expected order of operation with members of the LSRT.

9 Conducting/Processing SIR

9.1 Depending on the requirements of the scene, the following actions may be taken:

- Initial scene photographs
- Establish the position of the object being examined by assessing the scene/surroundings to determine the object's position in the local environment
- Search scene for evidence
- Photographs of evidence as found and marked
- Measurements of object(s), car(s), evidence, and room(s), if available, a total station (or similar equipment provided by OPU) may be used to record the position of objects
- The recovery of evidence is conducted by local agents and/or law enforcement – this should only be done after the evidence has been located in the local environment
- Identification and labeling of possible bullet holes and bullet impacts
- Photographs of object/car with holes/impacts labeled
- Measurement of holes/impact positions, if available, a total station (or similar equipment provided by OPU) may be used to record their positions
- Examination of the physical effects around holes/impacts, and possible hole diameters
- If necessary, conduct lead and copper residue tests around holes and impacts, positive and background controls must be performed
- Examination of cracking pattern/craters in automobile glass
- Evaluation of holes/impacts to determine their relationship to trajectories
- Establish trajectory using a trajectory rod, laser and/or string
- Measurement of trajectory angles (horizontal and vertical), either by directly measuring the angles from the rod or by measuring multiple three-dimensional (x, y, z) points on the trajectory rod. If available, a total station (or similar equipment provided by OPU) may be used to record multiple points on a trajectory rod.
- Photograph trajectories
- Close out walk through of the scene
- Scene release photographs

10 Calculations

The following equation can be used to determine a very 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.

11 Uncertainty of Measurement

Not applicable.

12 Limitations

Caution should be exercised in reaching conclusions about common trajectories and in establishing trajectory angles, taking into account appropriate uncertainties, zones or approximate positions. Additionally, due to vehicle glass breakage, bullet fragmentation, bullet deflection and many other factors, not all trajectories can be successfully reconstructed. Consequently, the number of trajectories reconstructed may not indicate the number of shots that were fired.

Presumptive chemical tests are not conclusive and are meant to provide additional information regarding the possibility of a bullet impact or passage. Although, presumptive tests are specific for lead and copper residues, they do not distinguish whether lead and copper are the result of a bullet or by another source.

13 Safety

Protective gloves, eyewear, boots and clothing should be available for protection from blood, broken glass and other environmental hazards. Additionally, due to the conditions present at the scene, it may be necessary to coordinate with ERTU to have a Safety officer present when performing a SIR.

14 References

SWGGUN.org, Guidelines for Projectile Path Reconstruction – Essential Elements

Haag, Lucien C., Shooting Incident Reconstruction, Academic Press, Burlington, MA (2006).

Pejsa, Arthur J., Modern Practical Ballistics, Kenwood Publishing, Minneapolis, MN (1989).

Stein, M., Leist, Y., and Tassa, M., “A New Field Kit for Bullet Hole Identification.” Journal of Forensic Sciences, JFSCA, Vol. 29, No. 1, Jan. 1984, pp. 169-176.

FBI Laboratory, Quality Assurance Manual

FBI Laboratory, Operations Manual

FBI Laboratory, Safety Manual

FBI Laboratory, FTU Quality Assurance Manual

Rev. #	Issue Date	History
0	07/10/06	Original issue for ASCLD/LAB-*International* accreditation
1	11/05/07	Changed Title and Header from Bullet Trajectory Reconstruction. Sections 2 and 6.1.2 replaced BTR kit with Shooting Incident Response Kit (SIRK). Removed smartlevel and angle finder calibration information from section 4. Updated language used in sections 6.2.2 and 6.2.3.
2	04/01/13	Title redacted "Response" for "Reconstruction." Section 1 revised to include LSRT. Section 2 changed the name for SIRK, added BTK and compass. Section 3 was expanded for lead and copper tests controls for BTK and cited FTU practice for GSR. Section 4 changed to "Responsibilities" outlining the roles of members of LRST. Section 5 and 6 were formerly 4 and 5. Section 7 changed to "Operations" (formerly Calculations) outlines the actions steps during pre-deployment of LSRT. Section 8 "On Scene Operations." Section 9 "Conducting/Processing SIR" expanded elements for conducting SIR. Sections 10 through 13 were formerly 7 through 11. Section 13 added safety officer requirement.

Approval

Redacted - Signatures on File