

# **FBI Laboratory Firearms/Toolmarks Unit Ejection Pattern Testing**

## **1 Scope**

This procedure is designed to provide a basis for defining the approximate position of a shooter's firearm in the reconstruction of a shooting scene environment.

## **2 Equipment/Materials/Reagents**

Steel tape measure; test ammunition; hearing protection; safety glasses; firearm; marking materials for floor (tape, chalk, string, etc.); graph paper; pen; laboratory coat.

## **3 Standards and Controls**

Not applicable.

## **4 Calibrations**

Not applicable.

## **5 Sampling**

Not applicable.

## **6 Procedures**

### **6.1 General Procedures**

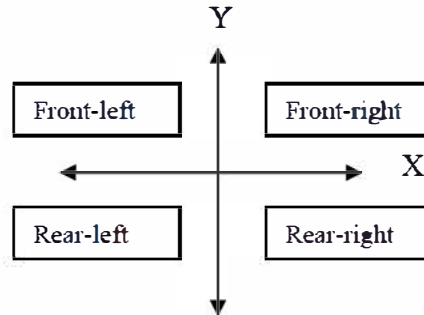
**6.1.1** Before conducting this test, ensure that all other requested firearms examinations have been conducted.

**6.1.2** The ejection pattern test will be conducted on a firing range that is clear of any previously fired ammunition components.

### **6.2 Specific Procedures**

**6.2.1** The floor/ground will be marked in some manner with two intersecting lines to form a

Cartesian coordinate plane. One line is from the shooting line traveling down the center of the shooting lane. The second line will cross this line at a right angle, and these lines may be extended as needed. The suggested "grid" divides the area into four quadrants (front-left, front-right, rear-right, rear-left).



**6.2.2** This test requires two people; one person to be the shooter, and the other person to act as the spotter. The shooter will stand so that the intersecting lines on the floor are below the ejection-port of the firearm. The shooter will hold the firearm at a normal height and fire on a level trajectory.

**6.2.3** The shooter will fire the suspect firearm a minimum of ten (10) shots.

**6.2.4** It is the spotter's responsibility to mark where each ejected cartridge case first strikes the floor/ground. This may be done with tape or some other marking device. The spotter will also make notes as to the shooter's position and firearm height as well as any functional problems.

**6.2.5** After all shots are fired and their respective strikes marked, measurements and notes will be made as to the location of the ejected cartridge cases. The ejected position will be determined using the Cartesian coordinate plane (i.e., 3 feet right and 4 feet rear).

**6.2.6** Conclusions will be drawn based on the shots fired and the positioning of the ejected cartridge cases.

**6.2.7** The ten (10) recorded locations will be calculated three standard deviations from the mean for determining ejection pattern.

## 7 Calculations

$$\text{Mean} = x_m = (\sum_i x_i) / n$$

$$\text{Standard Deviation} = S =$$



## 8 Uncertainty of Measurement

If a quantitative numerical measurement result is included in an FBI Laboratory *Report of Examination* (7-1), the uncertainty of measurement must be reported. The method used to determine the estimation of uncertainty can be found in the FTU's Quality Assurance Manual - *Uncertainty of Measurement*.

## 9 Limitations

Several conditions (orientation of the firearm when fired, walls or intervening objects, floor or ground surface variability, inadvertent movement of cartridge cases by first responders) may affect the final location of fired cartridge cases at a shooting scene. The test results establish an approximate ejection pattern boundary and are only valid for the firearm tested along with the magazine and type of ammunition used.

## 10 Safety

Hearing and eye protection must be worn by all participants and observers when test firing. Safety protocols and range rules will be followed at all times.

## 11 References

William J. Lewinski, Ph.D., William B. Hudson, Ph. D., David Karwoski, Christa J. Redmann, "Fired Cartridge Case Ejection Patterns From Semi-Automatic Firearms," Investigative Science Journal, Volume 2, Number 2, November 2010.

Garrison, D.H., "Reconstructing Drive-By Shootings from Ejected Cartridge Case Location," AFTE Journal, 1993;25(1):15.

FBI Laboratory Quality Assurance Manual

FBI Laboratory Operations Manual

FBI Laboratory Safety Manual

FTU Quality Assurance Manual

Firearms/Toolmarks Unit, FBI Laboratory, FTU Controlled Document FTU007, "Safety Protocol for Handling of Firearms and Ammunition."

Rev. #	Issue Date	History
0	07/10/06	Original issue for ASCLD/LAB- <i>International</i> accreditation.
1	07/14/10	Updated references.
2	05/02/13	Section 1 included statement about approximate position a firearm. Section 2 deleted "pencil." Section 6.2.1 added Cartesian plane with diagram. Section 6.2.5 added Cartesian plane with measurement example. Section 6.2.7 added calculation of standard deviation. Section 9 included limitation from report writing language and ejection pattern boundary. Section 11 updated and deleted date from FTU007.

**Approval**

Redacted - Signatures on File