

## **Firearms/Toolmarks Discipline Mission Statement, Administrative, and Operational Guidelines**

### **1 Scope, Mission, Goals and Objectives**

**1.1** This document applies to personnel in the Firearms/Toolmarks Discipline (FTD).

The FBI Laboratory Firearms/Toolmarks Discipline consists of two units:

- Firearms/Toolmarks Unit (FTU)
  - Scientific Analysis Section
- Scientific and Biometrics Analysis Unit – Toolmark Group (SBAU-TG),
  - Terrorist Explosive Device Analytical Center (TEDAC) Section

### **1.2 FTU Mission**

The FTU will apply valid scientific procedures to the forensic examinations of firearms, ammunition components, toolmarks, serial number restoration, gunshot residue (GSR) distance determination, shooting incident reconstruction (SIR), and other closely related physical evidence in support of the FBI and other law enforcement or government agencies. Additionally, the FTU will provide leadership to the forensic Firearms/Toolmarks community through training and research.

### **1.3 SBAU Mission**

To conduct latent print, DNA, trace and toolmark analysis and related instrument operation support to provide actionable intelligence from Improvised Explosive Device (IED) materials to the United States Government and its partners in a continual effort to access, defeat, and counter the IED threat.

### **1.4 Goals and Objectives**

The FTD quality assurance system operates in accordance with the quality practices established in the FBI Laboratory Quality Assurance Manual (QAM) and the FBI Laboratory Operations Manual (LOM). FTD personnel will follow the FBI Laboratory Division's policies regarding administrative matters, staffing, budget, job descriptions, duty hours, and leave time.

The goals and objectives of the FTD include:

- Conducting forensic examinations on firearm and toolmark evidence to support federal, state, local, and international law enforcement or other government agencies, to include evidence processing, report writing, and providing expert testimony.
- Providing information in support of law enforcement and the intelligence community.

- Collaborating with the intelligence community, other government agencies and foreign partners.
- Collaborating with other government agencies and institutions to investigate and support research needs for the FTD.

Additional goals of the FTU include:

- Conducting SIR examinations
- Supporting FBI related training efforts in fundamental of Firearms/Toolmarks Identification and SIR.

Additional goals of the SBAU-TG include:

- Providing pre-deployment briefings to federal and international law enforcement agencies, the intelligence community and military personnel regarding the forensic exploitation of IEDs.
- Supporting the TEDAC Scientific Outreach Program through the international deployment of forensic examiners.

## **2 Organization and Management Structure**

**2.1** The FTU consists of a Unit Chief (UC), Management and Program Analyst (MAPA), Supervisory Physical Scientist-Forensic Examiners (SPSFE), Physical Scientist Forensic Examiners (PSFE), Physical Scientists Non-Examiners (PSNE), an Office Service Specialist (OSS), and contract staff.

**2.2** The SBAU-TG consists of a SPSFE, and PSFEs.

The duties and responsibilities of the FTD personnel are as follows:

### **2.3 Unit Chief**

The UC functions as the head of the respective unit and is responsible for the overall coordination of case examinations, programs, budget, and liaison. The UC duties and responsibilities include:

**2.3.1** Monitors casework performance measures to improve services to casework contributors, law enforcement, other government agencies, international partners and intelligence community partners.

**2.3.2** Ensures compliance with current Laboratory Division (LD) policies, practices, and procedures.

**2.3.3** Ensures that FTD procedures comply with FBI Laboratory QAM and LOM requirements, and that an annual review of applicable FTD controlled documents is performed as outlined in the *LOM - Practices for Document Control*.

**2.3.4** Notifies the Quality Manager of significant conditions adverse to quality as outlined in the *LOM - Practices for Addressing a Nonconformity*.

**2.3.5** Ensures that personnel comply with the applicable FBI Laboratory Health and Safety policies and practices.

**2.3.6** Oversees the management and coordination of all administrative and technical programs within his/her respective unit.

**2.3.7** Serves as a supervisor for SPSFEs and additional unit personnel.

**2.3.8** Ensures that personnel are provided with opportunities for training and continuing education, as appropriate, and are qualified for their assigned work responsibilities.

**2.3.9** The FTU and SBAU UCs will coordinate to designate a qualified Examiner to serve as the FTD Technical Leader (TL).

**2.3.10** Assigns Examiners to case submissions and case records for each request for examination, or ensures that SPSFEs or PSFEs assign the cases.

**2.3.11** Maintains liaison with law enforcement, other government agencies, foreign partners, and the intelligence community to enhance the attainment of unit performance measures.

**2.3.12** Determines unit staffing level needs and prepares formal requests to fill vacancies.

**2.3.13** Coordinates unit meetings to communicate administrative, safety and quality assurance matters, and other general interest matters that impact unit personnel and performance measures.

**2.3.14** Ensures that all appropriate personnel review and sign the *ANAB Guiding Principles of Professional Responsibility for Forensic Service Providers and Forensic Personnel*, and the *Department of Justice Code of Professional Responsibility for the Practice of Forensic Science* on an annual basis.

**2.3.14.1** Coordinates with personnel on the receipt and review of training that covers ethical practices in forensic science.

**2.3.15** Ensures that all personnel with deployment responsibilities receive appropriate training, credentials and medical services for typical deployments.

**2.3.16** Performs administrative reviews of *Laboratory Reports* or ensures that SPSFEs or PSFEs perform these reviews.

**2.3.17** Assigns appropriate personnel in support of deployment operations, requests and briefings.

**2.3.18** Ensures appropriate unit personnel serve as acting UC as necessary.

**2.3.19** Monitors case production and case backlog or ensures that monitoring is completed by SPSFEs.

## **2.4 Supervisory Physical Scientist - Forensic Examiner**

In addition to the duties described under PSFE in section 2.5, the SPSFE's responsibilities include:

**2.4.1** Conducts annual performance reviews for all assigned personnel.

**2.4.2** Ensures, as budget permits, that PSFEs are afforded mission-related continuing education opportunities.

**2.4.3** Evaluates the risks and merits of minor deviations of administrative nature and approves this type of minor deviation.

Additional SPSFE duties within SBAU-TG include:

**2.4.4** Serves as primary authority in Toolmark Group for case assignment, administrative reviews of *Laboratory Reports*, and assignment of Toolmark Group personnel to Scientific Outreach Program requests.

## **2.5 Physical Scientist - Forensic Examiner**

The PSFE duties and responsibilities include:

**2.5.1** Complies with LD, discipline, and unit policies, practices, and procedures.

**2.5.2** Participates in training, continuing education and development as required by the FBI Laboratory QAM.

**2.5.3** Reviews and signs the *ANAB Guiding Principles of Professional Responsibility for Forensic Service Providers and Forensic Personnel*, and the *Department of Justice Code of Professional Responsibility for the Practice of Forensic Science* on an annual basis.

**2.5.3.1** Ensures training is received for ethical practices in forensic science. For a recently hired PSFE trainee, this will be recorded in the training manual.

**2.5.4** Participates in annual proficiency testing as outlined in the *LOM - Practices for Open Proficiency Testing* and FTD QAM - Proficiency Testing.

**2.5.5** Examines evidence, issues *Laboratory Reports*, and testifies to examination results.

**2.5.6** Ensures the integrity of the evidence is maintained for each requested examination.

**2.5.7** Ensures the necessary communications and proper examinations have been performed as outlined in the *LOM - Practices for Assigning Cases and Conducting Examinations*.

**2.5.8** Ensures that any supporting examination records are accounted for and properly labeled.

**2.5.9** Serves as a Training Coordinator for PSFE trainees, when requested.

**2.5.10** Performs administrative and technical reviews of casework in the category of testing, as qualified and authorized.

**2.5.11** Serves as a testimony evaluator, as authorized by the UCs and Technical Leader.

**2.5.12** When assigned, serves as acting UC and evaluates incoming casework and assigns cases to PSFEs.

**2.5.13** Provides information regarding equipment needs, supplies and budget to the UC.

Additional PSFE duties within FTU include:

**2.5.14** Collaborates with Training Division's Defensive Systems Unit (TD DSU) personnel on taking photographs, weights, and measurements of recovered FBI projectiles from Agent Involved Shootings (AIS). This information assists TD DSU in ongoing research, but case notes, identifiers, or examination results will not be provided to TD DSU.

**2.5.15** Provides the FTU Chief awareness of his/her availability for rapid deployments.

Additional PSFE duties within SBAU-TG include:

**2.5.16** Ensures that all necessary foreign travel safety training, medical screenings, vaccinations and passports are acquired and kept current, allowing for short-notice foreign temporary duty assignments.

**2.5.17** Provides 24 hour availability.

## **2.6 Physical Scientist/Non-Examiner**

The PSNE is responsible for assisting the PSFE in the examination and processing of evidence, as well as assisting with the planning and coordinating of forensic science related activities and programs. The PSNE duties and responsibilities include:

**2.6.1** Complies with LD, discipline, and unit policies, practices, and procedures.

**2.6.2** Reviews and signs the *ANAB Guiding Principles of Professional Responsibility for Forensic Service Providers and Forensic Personnel*, and the *Department of Justice Code of Professional Responsibility for the Practice of Forensic Science* on an annual basis.

**2.6.2.1** Ensures training is received for ethical practices in forensic science. For a recently hired PSNE trainee, this will be recorded in the training manual.

**2.6.3** Participates in a training, continuing education, and development program as required by the FBI Laboratory QAM.

**2.6.4** Participates in annual proficiency testing as outlined in the LOM - *Practices for Open Proficiency Testing* and FTD QAM - *Proficiency Testing*.

**2.6.5** Assists PSFEs with case examinations up to the orientation of items undergoing microscopic comparison.

## **2.7 Management and Program Analyst**

A MAPA is responsible for performing administrative tasks and supporting unit/program operations and projects. This can include casework metrics, contracts, procurements, property management, and budgetary matters such as developing cost estimates, purchase justifications, and monitoring the use of unit funds. A MAPA may also assist with unit time and attendance records, visitor notifications, administrative casework records, and travel arrangements made through the Travel Request Initiation and Payment (TRIP) system.

## **2.8 Office Service Specialist**

The OSS is responsible for performing administrative tasks and supporting unit/program operations and projects.

## **2.9 Contractor**

A contractor is employed on a contractual basis and may perform administrative or casework tasks similar to a PSFE or PSNE when working in the FTD. Contractors are required (if conducting casework) to meet the provisions of the FBI Laboratory quality system including successful completion of the appropriate training and proficiency testing program.

### **3 Programs and Representatives**

#### **3.1 Technical Leader**

The Technical Leader (TL) is a designated PSFE who is accountable for the technical operations in the FTD and who is authorized to stop, suspend, and resume operations in that discipline. The TL duties and responsibilities include:

- 3.1.1** Evaluates and records approval of all analytical methods used within the FTD and proposes new or modified analytical procedures as appropriate.
- 3.1.2** Ensures the FTD is in conformance with applicable requirements for accreditation.
- 3.1.3** Ensures nonconformities are appropriately addressed and recorded.
- 3.1.4** Evaluates the risks and merits of a minor deviation that are technical in nature and approves this type of minor deviation.
- 3.1.5** Ensures technical personnel receive necessary training and are qualified for their assigned work, when appropriate.
- 3.1.6** Provides technical assistance to the UC(s) if he/she is not an SME.
- 3.1.7** Serves as an approving official for all FTD procedures and manuals.
- 3.1.8** Serves as a liaison between discipline personnel and the Research and Support Unit (RSU) and Laboratory Senior Level Scientists on projects involving FTD research.
- 3.1.9** Ensures appropriate updates and reviews are completed on entries made into the Research Review Team SharePoint site.
- 3.1.10** Ensures the continuity of technical operations between both locations of the FTD.
- 3.1.10.1** Continuity of technical operations will be achieved through technical and/or case file reviews. At a minimum, three reviews will be conducted per quarter, which will represent a variety of casework and examiners.
- 3.1.11** Provides guidance to the UCs regarding research needs within the FTD, and provides guidance regarding the necessary procurement requirements to achieve success.

#### **3.2 Training Program Manager**

The FTD Training Program Manager (TPM) oversees training matters for the qualification of all new PSFEs and PSNEs within the FTD. The TPM is responsible for periodic revisions of the

FTD Training Manual in coordination with the TL, Training Coordinators (TC), UCs, Quality Assurance Program Managers (QAPM) and Forensic Analysis Support Unit (FASU). The TPM is also responsible, in coordination with the FASU Forensic Examiner Training Program Manager, for the coordination of all FTD trainee oral boards and moot courts. The TPM duties and responsibilities include:

**3.2.1** Administers and maintains a training program for PSFEs and PSNEs that identifies the requirements necessary for achieving qualification in each respective position.

**3.2.2** Provides guidance regarding a logical and organized approach to completing all training requirements.

**3.2.3** Coordinates the delivery and scoring of tests with the TL and TCs.

**3.2.4** Ensures that casework is made available to trainees so that case notes and complete case evaluations can be made.

**3.2.5** Coordinates with the TL and UCs to determine if modifications to the training program are appropriate for new trainees due to previous experience/training.

**3.2.6** Provides the TL with any necessary information needed to compose a trainee's final qualification and authorization Electronic Communication.

**3.2.7** Ensures that all PSFE trainee review forms are completed and maintained in the trainee's training records. As part of their PSFE training, trainees will complete examination notes which will be reviewed by a qualified PSFE and recorded on the *FTD Trainee Notes Review Form* (Appendix A). PSFE trainees will also complete casework examinations which will be reviewed by a qualified PSFE and recorded on the *FTD Casework Training Review Form* (Appendix B).

**3.2.8** Ensures that training records are maintained at the trainee's location.

**3.2.9** Ensures that newly qualified PSFEs have their first 10 cases reviewed by a GS-14 PSFE qualified in the applicable category of testing. This includes the review of all technical and administrative records, handling of evidence, and verification of all comparison results.

**3.2.10** Ensures that any deficiencies in a newly qualified PSFE's examinations are recorded on the *FTD Internal Case Review Form* (Appendix C), and any necessary additional training is provided within the category of testing in question. If a scientific or technical disagreement occurs during the case evaluation phase, the *LOM - Practices for Resolution of Scientific or Technical Disagreement* will be followed.



**3.2.11** Ensures training is provided for ethical practices in forensic science and that trainees review *The Application of Ethical Practices in Forensic Sciences* PowerPoint which is available in Virtual Academy.

The following Program Manager/Representative/Administrator roles are PSFEs and/or PSs who coordinate and are responsible for specified unit programs in addition to the assigned duties listed above.

### **3.3 Quality Assurance Program Managers**

The QAPMs oversee quality assurance matters that affect their respective units. Each QAPM ensures compliance with current LD policies, practices and procedures. Additionally, the QAPMs ensure compliance with FTD quality documents. The QAPM duties and responsibilities include:

**3.3.1** Coordinates with UCs, TL, and other QAPM within the FTD to ensure that the applicable FTD QAM, SOPs, and Training Manuals are reviewed annually and revised when necessary.

**3.3.1.1** Serves as the Quality Assurance Representative for the respective units.

**3.3.2** Assists in assembling records for internal audits.

**3.3.3** Ensures applicable quality documents are in compliance with the *LOM - Practices for Document Control*.

**3.3.4** Ensures quality assurance continuity between both locations of the FTD.

**3.3.5** Ensures unit-specific nonconformities are in compliance with the *LOM - Practices for Addressing a Nonconformity*, to include maintaining the unit concession/correction log.

**3.3.6** Ensures unit-specific controlled documents are maintained, updated, and reviewed in compliance with the *LOM - Practices for Document Control*.

### **3.4 Proficiency Test Representative**

The FTD Proficiency Test Representatives (PTRs) are responsible for administering proficiency tests in their respective units in accordance with the *FTD QAM - Proficiency Testing*. The PTR's duties and responsibilities include:

**3.4.1** Ensures compliance with the responsibilities for the unit PTR as outlined in the *LOM - Practices for Open Proficiency Testing*.

**3.4.2** Maintains proficiency test records (physical and/or within Forensic Advantage) in the respective unit as outlined in the *LOM - Practices for Open Proficiency Testing* and *FTD QAM - Proficiency Testing*.

Additional Programs within the FTU include:

### **3.5 Calibration and Maintenance Administrator**

The Calibration and Maintenance Administrator (CMA) is responsible for coordinating the necessary calibration, maintenance, and performance checks on equipment used in the FTU. The CMA duties and responsibilities include:

**3.5.1** Ensures that all equipment used for examination in the FTU is labeled, properly maintained, calibrated, and in compliance with the *LOM - Practices for the Calibration and Maintenance of Equipment*.

**3.5.2** Ensures that information captured in Resource Manager is updated and binders containing maintenance and performance checks are maintained.

### **3.6 Intelligence Program Manager**

The Intelligence Program Manager (IPM) is responsible for the FTU knowledge base regarding military weapons. The IPM will provide guidance regarding the reporting and tracking of FTU intelligence. The duties and responsibilities of the IPM include:

**3.6.1** Ensures a working knowledge of the operation and firing of common military and foreign small arms to include crew-served weapon systems. Training and familiarity will be maintained through public and government training sources.

**3.6.2** Maintains liaison with military and government agencies specializing in weapon and intelligence programs.

**3.6.3** Provides training to FBI personnel and other government agencies regarding program subject material(s).

**3.6.4** Maintains records and ensures compliance with FBI Laboratory Intelligence Program(s) and expanded Science & Technology Branch (STB) Intelligence initiative(s).

### **3.7 General Rifling Characteristics File Program Manager**

The General Rifling Characteristics File Program Manager (GRCPM) oversees the General Rifling Characteristics (GRC) program, which involves the collection and analysis of test-fired bullets and cartridge cases for entry into the internationally distributed GRC database. The duties and responsibilities of the GRCPM include:

**3.7.1** Receives test fired items, verifies measurements, marks individual items, enters the information into the database, and retains those items as outlined in the *FTU SOP - General Rifling Characteristics Database Entries and Searches*.

**3.7.2** Ensures the GRC database is published on a regular basis and distributed to national/international forensic laboratories and law enforcement agencies.

**3.7.3** Responds to queries from the field, performs searches, updates the database, and performs software updates as required.

**3.7.4** Ensures the necessary GRC instrument performance checks are conducted on a routine basis and recorded in an organized manner.

### **3.8 National Integrated Ballistic Information Network Program Manager**

The National Integrated Ballistic Information Network Program Manager (NIBINPM) oversees the maintenance and operation of the FTU NIBIN system. The duties and responsibilities of the NIBINPM include:

**3.8.1** Receives Expedited NIBIN (ENIBIN) cases, performs inventory of submitted items, test fires the submitted items, and enters the test fired specimens in the NIBIN system as outlined in the *FTU SOP - Individual Characteristic's Database Searches* and *FTU QAM - Procedures for the Expedited National Integrated Ballistics Information Network (ENIBIN)*. The ENIBIN program will maintain a one-month turnaround time for these types of submissions.

**3.8.2** Coordinates NIBIN training for new users through the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF).

**3.8.3** Maintains records regarding the verification check and maintenance of the Matchpoint® and Brasstrax® systems.

### **3.9 Operational Response Program Manager**

The Operational Response Program Manager (ORPM) is responsible for equipping, maintaining and conducting an inventory of all FTU deployment needs, to include kits, equipment, and FTU response vehicles. In addition, the ORPM will coordinate with the Evidence Response Team Unit (ERTU) and Technical Hazards Response Unit (THRU) for training and provide instruction during any FTU sponsored SIR courses.

### **3.10 Reference Ammunition File Program Manager**

The Reference Ammunition File Program Manager (RAFPM) oversees the Reference Ammunition File (RAF) program, which involves the acquisition, documentation, and filing of ammunition specimens in the RAF database for use in FTU case examinations. The RAFPMP provides guidance to maximize the FTU resources for the acquisition of new samples. Examples

are decisions about brands, calibers, and amounts of ammunition to purchase, which ammunition types to dispose of, and the organizational structure of ammunition storage. These decisions require knowledge of trends in firearms and ammunition manufacturing, trends regarding the submission of firearms and ammunition in casework, and direct knowledge of which types of ammunition are most useful for conducting forensic examinations of firearms and ammunition. The duties and responsibilities of the RAFPM also include:

**3.10.1** Purchases and receives ammunition for entry into the RAF and for use in conducting forensic casework.

**3.10.2** Ensures the RAF database is kept up-to-date and maintained. At a minimum, the bullet type, caliber, jacket material, cartridge case material, and the manufacturer will be included with each entry.

**3.10.3** Prepares specimens for the RAF by dismantling and packaging the components in the standard RAF containers. Each container will be assigned an identifier for inclusion into the RAF database.

**3.10.4** Researches, identifies, and obtains new ammunition not previously included in the RAF.

### **3.11 Reference Firearms Collection Program Manager**

The Reference Firearms Collection Program Manager (RFCPM) is responsible for coordinating the acquisition of firearms for the Reference Firearm Collection (RFC). The RFCPM will use his/her experience as a PSFE to identify which models and types of firearms will provide maximum benefit to the mission of the FTU. The RFCPM will attempt to develop communication with the military and other government agencies to facilitate the acquisition of firearms of forensic value for inclusion in the RFC. The duties and responsibilities of the RFCPM also include:

**3.11.1** Responds to queries from the field.

**3.11.2** Ensures an identifier is assigned to each firearm entered into the RFC. At a minimum, the caliber, make, model, type of weapon, serial number (if present), and FBI Case Identifier will be included with each entry.

**3.11.3** Ensures the RFC is kept up-to-date and maintained.

**3.11.4** Conducts periodic inventories of the RFC. This inventory will be recorded via email to the FTU Chief.

**3.11.5** Purchases and receives firearms and firearm components deemed essential to operations and casework when not obtained through the Firearms Disposition Program. Also,

provides purchasing information to the FTU MAPA for entry into the Asset Management System (AMS).

**3.11.6** Maintains and ensures FTU Disposition firearms are properly stored.

**3.11.7** Organizes and manages destruction of disposition firearms.

### **3.12 FTU Instrument Specialist**

The FTU Instrument Specialist (IS) is responsible for evaluating instruments used for 3D toolmark topography acquisition and analysis for firearm and toolmark examinations. The duties and responsibilities of the FTU IS also include:

**3.12.1** Assists with validations, uncertainty of measurement calculations, development of control charts, calibrations and maintenance performed on instruments being used for casework.

**3.12.2** Ensures reference standards and research specimens are properly maintained and catalogued.

**3.12.3** Assists with training users and serves as a proctor for any validation or competency tests involving a new instrument.

**3.12.4** Ensures records and data supporting validation and instrument performance are properly organized and maintained for review.

Additional Program within the SBAU-TG:

### **3.13 SBAU Toolmark Group Instrument Program Manager**

The Toolmark Group Instrument Program Manager (TGIPM) is responsible for evaluating instruments used for toolmark imaging and topography acquisition to determine best uses for toolmark examinations within the SBAU for counter-IED purposes. The duties and responsibilities of the TGIPM include:

**3.13.1** Works with the FTD TL to ensure that all necessary validations, development of control charts, uncertainty of measurement calculations, calibrations and maintenance are performed on instruments being used for casework in the Toolmark Group.

**3.13.2** Assists with the procurement of maintenance contracts for Toolmark Group instruments.

## 4 Continuing Education

Continuing education and training are identified as courses, instruction, on the job training, web-based training, and professional conferences/seminars which assist personnel in meeting the mission of the FTU and SBAU. Training received by FTD personnel will be recorded in the FBI Virtual Academy under “My Training Records”. The evaluation of training will be recorded on the FTD Training Course Assessment Form (TCAF) (Appendix D), and the effectiveness of this training and the number hours received by FTD personnel will be evaluated by the appropriate UC during his/her review of the TCAF.

## 5 Security

**5.1** FTD personnel will follow the FBI Laboratory QAM and the security procedures set out in the *Security Reference Guide (SRG) for Laboratory Division Personnel*. These documents can be found on the LD intranet website.

**5.2** FTU personnel have unrestricted access to all FTU Laboratory areas by means of a Security Access Control System (SACS) badge and/or assigned FTU-specific keys. SBAU-TG personnel have access to discipline-specific Laboratory areas by means of a SACS badge.

**5.3** FTD personnel will ensure that any visitor under their care is escorted at all times while in the laboratory. When a visitor needs access to evidence storage rooms, he/she must sign the visitor’s log located near the door.

**5.4** All FTD examination areas must be locked when the space is unoccupied.

## 6 Document Control

FTD personnel will follow the *LOM - Practices for Document Control* when preparing controlled documents. It is the end user’s responsibility to ensure that any uncontrolled document being used is the current, most recent revision.

## 7 Retention of Records and Evaluations

**7.1** All proficiency test records, as outlined in the *LOM - Practices for Open Proficiency Testing*, will be retained permanently in the FTU or SBAU, and/or within FA.

**7.2** Concession and correction records including annual reviews, as outlined in the *LOM - Practices for Addressing a Nonconformity* are retained in the FTU and SBAU for one accreditation cycle or five years, whichever is longer.

**7.3** Minor deviation records including annual reviews, as outlined in the *LOM - Practices for Authorizing Deviations* are retained in the FTU and SBAU for one accreditation cycle or five years, whichever is longer.

**7.4** Court Testimony Monitoring records are retained as outlined in the *LOM - Practices for Testimony Related Activities*.

**7.5** Continuing education records are maintained electronically in Virtual Academy and/or on the TCAF.

## **8 Validation**

All new or novel methods and instrumentation intended for use during analysis by FTD personnel will be validated in accordance with the *LOM - Practices for Developing Methods and Validating Technical Procedures*, and *FTD QAM - Development and Validation of New Technical Procedures*. Such validation testing will be completed and approved by the TL prior to the implementation of the procedural modification. All developmental validation, internal validation, or material modification records will be retained in the FTU and SBAU, as appropriate.

## **9 Standard Operating Procedures**

All technical procedures produced by FTD personnel will be prepared in accordance with the *LOM - Practices for Writing Standard Operating Procedures* and *LOM - Practices for Document Control*.

## **10 Proficiency Testing**

Open proficiency testing will be used to monitor the performance of PSFEs and other appropriately trained employees in the FTD. Proficiency tests will be administered in accordance with the *LOM - Practices for Open Proficiency Testing* and *FTD QAM - Proficiency Testing*.

## **11 Abbreviations, Discovery Requests and Request for Quality System Documents**

**11.1** Abbreviations and notations may be used in the FTD examination records provided they are clearly recorded and readily comprehensible to the reviewer. A list of commonly used abbreviations in the FTD is available in the *FTD QAM - Case Assignment, Records, Results and Verifications*.

**11.2** Discovery requests for examination records are handled through the FBI Laboratory's Office of General Counsel (OGC).

**11.3** Requests for FBI Laboratory QAM/LOM and FTD QAM/SOP documents are handled through the FASU and/or QAPMs depending on the dates of the examinations.

## **12 Court Testimony Review**

All FTD personnel who provide testimony will follow the *LOM - Practices for Testimony Related Activities* and *LOM - Practices for Moot Court and Admissibility Hearing Exercises*.

## **13 Safety**

Not Applicable.

## **14 References**

FBI Laboratory Quality Assurance Manual

FBI Laboratory Operations Manual

FBI Laboratory Safety Manual, Federal Bureau of Investigation, Laboratory Division, latest version.

Security Reference Guide (SRG) for Laboratory Division Personnel, Federal Bureau of Investigation, Laboratory Division, latest version.



Rev #	Issue Date	History
10	04/25/19	Updated Section 1 to use State abbreviations. Formatting changes in Section 1.4. Removed Physical Science Technician role from Section 2.1 and 2.6. Included authorization reference in Sections 2.5.10 and 2.5.11. Section 3.1.10.1 updated TL responsibility to include technical and/or case file reviews for continuity between FTU and Toolmark Group. Sections 3.3 and 3.4 were combined and renumbered. Removed QAWG reference from Section 3.4.1 and renumbered. Updated LOM titles for Sections 12 and 14.
11	03/02/20	Revised to align SAU references with SBAU reorganization. Truncated Section 2.2 to include only FTD personnel at TEDAC. Updated multiple sections for grammar and clarity. Details regarding firearms safety from Section 13 was moved to <i>FTD SOP Firearm Examinations</i> . Appendix E titled <i>FTU Safety Protocols for the Handling of Firearms and Ammunition</i> was removed and incorporated into <i>FTD SOP Firearm Examinations</i> .

### **Approval**

Redacted - Signatures on File

Firearms/Toolmarks  
 Technical Leader

Date: 02/28/2020

Firearms/Toolmarks  
 Unit Chief

Date: 02/28/2020

Scientific and Biometrics  
 Analysis Unit Chief

Date: 02/28/2020

### **QA Approval**

Quality Manager

Date: 02/28/2020

**Appendix A: *FTD Trainee Notes Review Form***

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**Appendix B: *FTD Casework Training Review Form***

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**Appendix B: *FTD Casework Training Review Form* continued**

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**Appendix C: *FTD Internal Case Review Form***

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**Appendix D: *FTD Training Course Assessment Form***

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## **Firearms/Toolmarks Discipline Marking and Examination of Evidence**

### **1 Scope**

This procedure applies to Firearms/Toolmarks Discipline (FTD) personnel conducting forensic examinations in the following categories of testing:

- |            |             |                                |                                                |
|------------|-------------|--------------------------------|------------------------------------------------|
| • Firearms | • Toolmarks | • Serial Number<br>Restoration | • Gunshot Residue<br>Distance<br>Determination |
|------------|-------------|--------------------------------|------------------------------------------------|

### **2 Introduction**

**2.1** The nature and extent of marking, recording, and examining evidence, including secondary evidence (referred to as evidence in the remaining document), will be determined by the type of evidence, the requested examinations, and the requirements contained in the FBI Laboratory Quality Assurance Manual (QAM) and the FBI Laboratory Operations Manual (LOM). This document supplements the latter.

**2.2** Specific procedures for the examination of evidence within the FTD can be found in the FTD Standard Operating Procedures Manual.

### **3 Marking and Recording Secondary Evidence**

**3.1** Any FTD personnel conducting forensic examinations will adhere to the following practices, at a minimum, where appropriate:

- *LOM – Practices for Processing a Single Unit Submission (SUS)*
- *LOM – Practices for Processing a Submission and Evidence Breakdown*
- *LOM – Practices for Shipping and Returning Evidence*
- *LOM – Practices for Assigning Cases and Conducting Examinations*
- *LOM – Practices for Transferring and Storing Evidence*

**3.2** Secondary evidence in the FTD is defined as material derived from the examination of submitted evidence that includes:

- |                                       |                                           |
|---------------------------------------|-------------------------------------------|
| • Test fired bullet                   | • Casts of evidentiary surface            |
| • Test fired cartridge/shotshell case | • Processed cloth/fabric                  |
| • Test marks from tool                | • Processed photographic paper            |
| • Electronic files                    | • Processed bullet hole testing kit paper |

**3.3** Secondary evidence will be marked in accordance with the the *LOM – Practices for Assigning Cases and Conducting Examinations*. Additionally, FTD secondary evidence will be physically marked/scribed, at a minimum, with the:

- Item identifier associated with the primary evidentiary item, preceded by an ‘f’ (meaning *from*)
- (e.g., Item 4 screwdriver - test marks produced from Item 4 will be marked *f* Item 4)
- Laboratory Number
- Initials

**3.3.1** FTD secondary evidence scanned for Virtual Comparison Microscopy (VCM) will be labeled with the following:

- Unique identifier for instrument acquisition (e.g., *f* Item 4-a, *f* Item 4a, or *f* I4a)

**3.3.2** For secondary evidence that has insufficient surface area for this information or that resists visible markings (such as casting material), a subset of this information can be imparted to the secondary evidence as long as the primary container bears all of the information.

**3.3.3** Identifiers may be placed on the substrate to become a permanent part of the cast, or a paper label may be placed in the back of the cast. See Section 3.3 of this document for the minimum required information.

**3.4** Secondary evidence will be itemized and recorded on the *FTD Secondary Evidence Log* (Appendix A). At a minimum, the *FTD Secondary Evidence Log* will include the following required fields:

- Laboratory Number
- When applicable, Item Number generated in Forensic Advantage (FA) for secondary evidence
- Item identifier associated with the primary evidentiary item, preceded by an ‘f’
- Quantity of secondary evidence type derived from the primary evidentiary item
- Description of secondary evidence (e.g., list provided in Section 3.2)
- Indication if secondary evidence contains hazardous materials
- Page Count
- Name of preparer

**3.5** Secondary evidence will be packaged in accordance with the *LOM – Practices for Assigning Cases and Conducting Examinations*. At a minimum, the packaging will bear the following:

- Laboratory Number
- Case Identifier



- Item identifier
- When applicable, Item Number generated in FA for secondary evidence
- Unit/Group name or acronym and “Secondary Evidence”

**3.5.1** The case identifier is not required for TEDAC secondary evidence.

**3.6** Additional items (e.g., test fired bullets/cartridge cases, test marked lead, casts of toolmarks) that are retained in the FBI Laboratory solely for research, training, or inclusion in the General Rifling Characteristics (GRC) database are not considered secondary evidence and will not contain the Laboratory Number.

## **4 Examination of Evidence**

**4.1** Multiple discipline examination requests require that examinations be conducted in their proper sequence. FTD personnel should ensure that other examinations (e.g., DNA, latent, trace) have been completed prior to the commencement of FTD examinations. Necessary precautions should be taken when handling the evidence before beginning the appropriate examinations.

**4.2** FTD personnel will follow the appropriate *FBI LOM* practices when processing, storing, or conducting examinations on evidence, including secondary evidence, and when evidence is left unattended.

**4.3** FTD evidence is considered under active examination for a period of up to six months.

**4.3.1** FTD evidence under active examination may be maintained without proper seal, and the appropriate *FBI LOM* practices will be followed.

**4.4** Prior to the six month active examination period ending, the status of the evidence will be reevaluated by communication with the contributor to determine case status, trial dates, or whether the request should remain active. This communication is not required for TEDAC evidence; however, examiners must still ensure that evidence meets the requirements specified in Sections 4.2 and 4.3 above.

**4.4.1** Records of all communication related to the status of examinations, including any attempted communication, will be retained in the case record.

**4.4.2** Reevaluation of the evidence may also be conducted by FTD personnel to determine priority.

## **5 Returning Secondary Evidence**

**5.1** Secondary evidence will be inventoried and packaged, and the disposition of the evidence will be determined in accordance with the appropriate QAM requirements and LOM practices.

**5.2** Secondary evidence that contains hazardous materials (e.g., cartridges, live primers) will be packaged and returned to the appropriate Unit/Group for proper shipping.

**5.3** Secondary evidence for the Scientific and Biometrics Analysis Unit /Toolmark Group (SBAU-TG) will be retained for future examinations. This evidence will be packaged separately and marked appropriately.

## **6 Marking and Recording Subdivided Evidence**

**6.1** FTD personnel conducting forensic examinations will adhere to the appropriate FBI LOM practices for marking and recording subdivided evidence.

**6.2** When FTD personnel encounter legacy subdivided evidence containing alpha characters, the specimen will be relabeled with the next logical item identifier using current FBI LOM practices for subdividing legacy evidence. A note of the change will be placed in the Communication and Activity Log and on the appropriate *FTD Worksheets* located in Appendix B of the *FTD QAM Case Assignment, Records, Results and Verifications*.

## **7 References**

FBI Laboratory Quality Assurance Manual

FBI Laboratory Operations Manual

Rev. #	Issue Date	History
5	10/02/17	Original issue for Firearms/Toolmarks Discipline, which includes the Firearms/Toolmarks Unit and Scientific Analysis Unit/Toolmark Group. Existing document modified to include the Huntsville, AL satellite location.
6	03/02/20	Grammatical changes throughout, Sections 3.3.1 and 3.3.3 added, addition made to table in Section 3.5, Section 3.5.1 added, Section 4.2 and 4.3 were combined and renumbered, Section 4.5 updated and Section 4.5.1 added, removed references to Scientific Analysis Unit (SAU) and replaced with Scientific and Biometrics Analysis Unit (SBAU) to reflect unit realignment. Section 6 added and renumbered. Section 7 updated. Appendix A updated.

### **Approval**

Redacted - Signatures on File

Firearms/Toolmarks  
Technical Leader

Date: 02/28/2020

Firearms/Toolmarks  
Unit Chief

Date: 02/28/2020

Scientific and Biometrics  
Analysis Unit Chief

Date: 02/28/2020

### **QA Approval**

Quality Manager

Date: 02/28/2020

**Appendix A: *FTD Secondary Evidence Log***

Redacted - Form on File

## **Firearms/Toolmarks Discipline**

### **Case Assignment, Records, Results, and Verifications**

#### **1 Purpose**

This document establishes the procedures for case assignment, records, conclusions rendered, and verifications that are specific to the Firearms/Toolmarks Discipline (FTD) of the FBI Laboratory. This document supplements the FBI Laboratory Quality Assurance Manual (QAM) and the FBI Laboratory Operations Manual (LOM).

#### **2 Scope**

The methodology utilized by the FTD is Evaluation, Classification, Comparison, Conclusion and Verification (E3CV). This methodology is utilized by trained, qualified and authorized personnel who handle evidence, perform classifications and comparisons, render conclusions, complete verifications, and issue results through the examination of evidence.

#### **3 Casework Assignment**

**3.1** Case assignment in the FTD will be handled as outlined in the LOM *Practices for Assigning Cases and Conducting Examinations*.

**3.2** Case assignment, as applied to Blind Verification (BV), will be handled as outlined in the FTD Quality Assurance Manual (QAM) *Blind Verification Procedure*.

**3.3** The person performing routine casework assignments will review the incoming submission and make the appropriate assignment based on Examiner caseload and category of testing qualifications.

**3.4** For new submissions directly related to a previous submission, the original Examiner should be assigned when practical. However, if an alternate Examiner assignment is necessary, it will be based upon Examiner caseload and category of testing qualifications. The person performing casework assignments may reassign a submission if the original Examiner is unavailable.

**3.5** Legacy casework information for the Scientific and Biometrics Analysis Unit / Toolmark Group (SBAU/TG) is maintained in the FBI Explosives Reference Tool (EXPeRT) database.

## 4 Case File Records

### 4.1 Legacy Records

**4.1.1** Examination records consist of all case-related documentation that supports the results and/or conclusions presented in a *Laboratory Report*. In the FTD, examination records include:

- Information captured from test fired bullets/cartridge cases and test toolmarks
- Completed FTD Worksheets (*FTD QAM Case Assignment, Records, Results, and Verifications, Appendix B*)
- Attachments that accompany FTD Worksheets

**4.1.2** Administrative records consist of case-related information that do not support the results and/or conclusions. In the FTD, administrative records include:

- Laboratory Work Sheet
- *Activity and Communication Log* (7-245)
- *Chain-of-Custody Log* (7-243 and/or 7-243a)
- *Case Record Report*
- Secondary Evidence Log
- *FTD Technical and Administrative Review Form (TARF, FTD QAM Report Writing and Review, Appendix B)*
- Copy of incoming requests

**4.1.3** Each Examiner is responsible for ensuring a 1A envelope is generated that will become a serialized portion of the case file in Sentinel. At the time of an administrative review (see *FTD QAM Report Writing and Review*), all records generated under one request for examination must be accounted for in their entirety. Each page of the examination records (e.g., *FTD Worksheets*) will be numbered sequentially, and the number of examination and administrative records, in total, will be recorded on the 1A envelope.

**4.1.4** Where appropriate, envelopes may be used to contain voluminous case notes, photographs, or charts. The envelope will bear the laboratory number, initials of the Examiner, and a description of the contents (e.g., the totality of the contents of 34 photographs enclosed).

**4.1.5** If personnel are unavailable to sign a *Chain-of-Custody Log*, the Unit Chief (UC) may sign on their behalf to maintain the continuity of the chain-of-custody. A record of the circumstances describing this necessity must be included in the *Activity and Communication Log*.

### 4.2 Forensic Advantage Records

**4.2.1** Forensic Advantage (FA) can generate administrative and examination records. When preparing examination records, the *LOM - Practices for Assigning Cases and Conducting Examinations*, *LOM - Practices for Processing a Submission and Evidence Breakdown*, *LOM -*

*Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records in Forensic Advantage (FA) and LOM - Practices for Processing a Single Unit Submission (SUS)* will be followed.

**4.2.1.1** Examination records consist of all case-related documentation that supports the results and/or conclusions presented in a *Laboratory Report*. In the FTD, examination records include:

- Information captured from test fired bullets/cartridge cases and test toolmarks
- Completed FTD Worksheets ((*FTD QAM Case Assignment, Records, Results, and Verifications, Appendix B*)
- Attachments that accompany FTD Worksheets

**4.2.1.2** Administrative records consist of case-related information that does not support the results and/or conclusions. In the FTD, administrative records not already captured in FA will be maintained as described in section 4.1.3.

**4.2.1.2.1** At the completion of an FA case, the Examiner will generate and retain the Case Record Report (CRR) to record the Technical and Administrative Reviewer's approvals and/or comments. This record must be retained electronically by uploading to Sentinel or printed and retained in the physical 1A as an administrative record.

## **5 Examination Records**

**5.1** When applicable, examinations performed will be recorded on the appropriate *FTD Worksheet* and will include the relevant description of the class and microscopic characteristics of the evidentiary item being examined.

**5.1.1** When conducting examinations, the data fields on the *FTD Worksheets* represent the minimum amount of information required for examination records and cannot be eliminated from the form. For data fields not relevant to an examination, "not applicable" (or its derivative) will be entered into the field.

**5.1.2** Examination records pertaining to items of evidence (unknown) shall be completed to identify characteristics suitable for comparison prior to the actual comparison to a known item or to test samples from the known item.

**5.2** For records not captured on an *FTD Worksheet*, the laboratory number, date of examination(s), and Examiner's handwritten initials will be placed on each page.

**5.3** If a source identification or fracture match conclusion is reached, a photograph and/or image will be taken to illustrate and record the area(s) that supports the Examiner's conclusion.

**5.3.1** A photograph and/or image produced through light comparison microscopy (LCM) and/or virtual comparison microscopy (VCM) that supports an Examiner's comparison conclusions will be included in the *FTD Results Worksheet*.

**5.3.2** If a suitable photograph and/or image cannot be produced that supports an Examiner's conclusion, then a detailed description of the marks used to support the conclusion will be included in the *FTD Results Worksheet*.

**5.3.3** If an item is too large for LCM photography, a photograph using a DSLR or equivalent camera may be used for the documentation.

**5.4** Abbreviations used in examination records must be defined or appear in the *FTD QAM Case Assignment, Records, Results, and Verifications, Appendix A*.

**5.5** Examination records must be sufficient in detail that, without the benefit of the evidence itself, another qualified Examiner can understand what was being examined and how the Examiner arrived at the reported conclusions.

## **6 Results / Conclusions**

**6.1** The conclusions that can be reached within the FTD are described in sections 6.3 to 6.4. The FTD Report Language (*FTD QAM Report Writing and Review*) outlines the methods and limitations statements that must be included in a *Laboratory Report*.

**6.2** All conclusions will be recorded on the *FTD Results Worksheet*. Documentation of a conclusion will include a listing of the items compared, the corresponding conclusion(s), and date and initial (to include print name) or signature of the Examiner.

### **6.3 Conclusions for Pattern Match Examinations**

#### **6.3.1 Source Exclusion (i.e., Excluded, Elimination)**

Source exclusion is an Examiner's conclusion that two toolmarks (firearm or non-firearm) did not originate from the same source.

**6.3.1.1** The basis for a source exclusion is an Examiner's decision that two toolmarks can be differentiated by their class characteristics<sup>1</sup>.

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<sup>1</sup> The Department of Justice Uniform Language for Testimony and Reports for Forensic Firearms/Toolmarks Discipline – Pattern Match Examination allows for a source exclusion to be based upon differences in individual characteristics. A source exclusion based upon differences in individual characteristics is not approved by the FBI Laboratory Firearms/Toolmarks Discipline. This determination is based on the observations that indicate individual characteristics may not be permanent.



**6.3.1.2** A source exclusion is reached when there is a discernable or measurable difference in class characteristics. Class differences may result from intentional design decisions made by the manufacturer or from minor variations in tool dimensions or finishing methods that are within acceptable manufacturing tolerances for a particular tool.

### **6.3.2 Source Identification (i.e., Identified, Identification)**

Source identification is an Examiner's conclusion that two toolmarks (firearm or non-firearm) originated from the same source. This conclusion is an Examiner's decision that all observed class characteristics are in agreement and that the quality and quantity of corresponding individual characteristics is such that the Examiner would not expect to find that same combination of individual characteristics repeated in another source, and has found insufficient disagreement of individual characteristics to conclude they originated from different sources.

**6.3.2.1** The basis for a source identification conclusion is an Examiner's decision that the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks came from the same source and extremely weak support for the proposition that the two toolmarks came from different sources.

**6.3.2.2** A conclusion of source identification is reached when the comparison of the microscopic marks demonstrates sufficient agreement. Sufficient agreement is related to the significant duplication of random toolmarks as evidenced by the correspondence of a pattern or combination of patterns of surface contours. Agreement is significant when the agreement in the microscopic marks exceeds the best agreement demonstrated between toolmarks known to have been produced by different tools and is consistent with agreement demonstrated by toolmarks known to have been produced by the same tool.

**6.3.2.3** A source identification is the statement of an Examiner's opinion (an inductive inference<sup>2</sup>) that the probability that the two toolmarks were made by different sources is so small that it is negligible. A source identification is not based upon a statistically-derived or verified measurement or an actual comparison to all firearms, tools, or toolmarks in the world.

### **6.3.3 Inconclusive (i.e., No Conclusion)**

Inconclusive is an Examiner's conclusion that all observed class characteristics are in agreement but there is insufficient quality and/or quantity of corresponding individual characteristics such

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<sup>2</sup> Inductive reasoning (inferential reasoning):

A mode or process of thinking that is part of the scientific method and complements deductive reasoning and logic. Inductive reasoning starts with a large body of evidence or data obtained by experiment or observation and extrapolates it to new situations. By the process of induction or inference, predictions about new situations are inferred or induced from the existing body of knowledge. In other words, an inference is a generalization, but one that is made in a logical and scientifically defensible manner. OXFORD DICTIONARY OF FORENSIC SCIENCE 130 (Oxford Univ. Press 2013).

that the Examiner is unable to identify or exclude the two toolmarks (firearm or non-firearm) as having originated from the same source.

**6.3.3.1** The basis for an inconclusive conclusion is an Examiner's decision that there is an insufficient quality and/or quantity of individual characteristics to identify or exclude. Reasons for an inconclusive conclusion include the presence of microscopic similarity that is insufficient to form the conclusion of source identification; a lack of any observed microscopic similarity; or microscopic dissimilarity that is insufficient to form the conclusion of source exclusion.<sup>1</sup>

**6.3.3.2** An inconclusive conclusion indicates that the microscopic marks in question may or may not have originated from the same or known source.

## **6.4 Conclusions for Fracture Match Examinations**

### **6.4.1 Exclusion**

Exclusion is an Examiner's conclusion that two or more fractured items did not originate from the same object. When an exclusion decision is reached between fractured items from the same object, it is based on a one-to-one comparison of those fractured items.

**6.4.1.1** The basis for an exclusion conclusion is an Examiner's decision that two or more fractured items exhibit substantially dissimilar observed characteristics that would not be expected from fractured items that originated from the same object.

### **6.4.2 Fracture Match**

Fracture match is an Examiner's conclusion that two or more fractured items were once part of the same object. This conclusion is an Examiner's decision that all observed class characteristics are in agreement and the quality and quantity of corresponding individual characteristics of the fractures is such that the Examiner would not expect to find that same combination of individual characteristics repeated in another object, and has found insufficient disagreement in individual characteristics to conclude they originated from different objects. This conclusion can only be reached when two or more fractured items physically fit together or when a comparison of the corresponding fractured surfaces reveals a fit.

**6.4.2.1** The basis for a fracture match conclusion is an Examiner's decision that the observed class characteristics and corresponding individual characteristics of the two or more fractured items provide extremely strong support for the proposition that they were once part of the same object and extremely weak support for the proposition that the fractured items originated from different objects.

**6.4.2.2** A fracture match conclusion is the statement of an Examiner's opinion (an inductive inference<sup>2</sup>) that the probability that two or more fractured items were not part of the same object

is so small that it is negligible. A fracture match conclusion is not based upon a statistically-derived or verified measurement or an actual comparison to all fractured items in the world.

### 6.4.3 Inconclusive

Inconclusive is an Examiner's conclusion that no determination can be reached as to whether two or more fractured items could have originated from the same object.

**6.4.3.1** The basis for an inconclusive conclusion is an Examiner's decision that there is an insufficient quantity and/or quality of observed characteristics to determine whether two or more fractured items could have originated from the same object. Reasons for an inconclusive conclusion include the presence of physical or microscopic similarity that is insufficient to form the conclusion of fracture match; a lack of any observed similarity; or physical or microscopic dissimilarity that is insufficient to form the conclusion of exclusion.<sup>3</sup>

## 7 Verifications

**7.1** Verifications will be performed by a second Examiner who is qualified and authorized in the same category of testing. For field examinations in which a verification may be necessary, another qualified and authorized Examiner within the same category of testing must be available to complete the verification.

**7.1.1** Verifications involve the physical and/or virtual examinations of the items listed in the corresponding result statement.

**7.1.1.1** Verifications utilizing LCM will involve the physical examinations under a comparison microscope.

**7.1.1.2** Verifications utilizing VCM will involve the virtual observations through the use of an approved 3D topographical instrument(s).

**7.1.2** Results of the verification will be recorded on the *FTD Results Worksheet*.

**7.1.2.1** The Examiner conducting the verification is responsible for ensuring that the item designations listed on the *FTD Results Worksheet* are correct.

**7.1.2.2** If the verifying Examiner agrees with the conclusions of the original Examiner, he/she will record the item identifiers and the conclusions on the *FTD Results Worksheet*. The verifier will also date and initial (to include print name) or sign the *FTD Results Worksheet*.

**7.1.3** In the event the second Examiner disagrees with an identification, fracture match or elimination opinion, the original Examiner is prohibited from requesting a verification from a

third Examiner. The original Examiner and verifier will follow the *LOM - Practices for Resolution of Scientific or Technical Disagreement*.

**7.1.3.1** If the original Examiner chooses to agree with the Examiner conducting the verification, and changes his/her conclusion, the reason for the change, the identity of the Examiners making the change, and the date of the change shall be recorded on the *FTD Results Worksheet*. See *LOM - Practices for Resolution of Scientific or Technical Disagreement*.

## **7.2 Identification**

Verifications will be performed on all source identification and fracture match conclusions.

## **7.3 Exclusion (Elimination)**

**7.3.1** Verifications will not be performed for elimination conclusions when there is a difference in general features.

**7.3.2** Verifications will be performed when a minor difference in a measured class characteristic is the basis for the exclusion.

**7.3.3** Verifications are not required when an exclusion is based on a noticeable measured difference in class characteristics or the physical comparison of a discernible difference in class characteristics.

**7.3.3.1** The exclusion will be recorded in the examination records and may be accompanied with a photograph.

## **7.4 Serial Number Restoration Verifications**

Complete (non-transitory in nature) serial number restorations effected by a qualified Examiner must be verified by a second qualified and authorized Examiner. Verifications will involve physical observations and if necessary, stereoscopic examinations. The results of the verification will be recorded on the *FTD Serial Number Restoration Worksheet (FTD QAM Case Assignment, Records, Results, and Verifications, Appendix B)*.

## **7.5 Gunshot Residue and Shot Pattern Distance Determination Verifications**

Distance approximations (brackets) determined for muzzle-to-garment or shot pattern distances will be verified by a second qualified and authorized Examiner. Verifications will involve physical observations of test exemplars and evidence. The results of the verification will be recorded on the *FTD Gunshot Residue Distance Determination Worksheet (FTD QAM Case Assignment, Records, Results, and Verifications, Appendix B)*.

## 7.6 Verification for Expedited Results

If expedited examination results are provided to a contributor prior to any technical or administrative reviews, the instructions outlined in the LOM - *Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records in Forensic Advantage (FA)* or the LOM - *Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records for Legacy Cases*, as appropriate, will be followed.

**7.6.1** When an expedited result is requested of the FTD and a verification is necessary for the result, the expedited result will not be released until a verification has been performed and recorded as outlined in Sections 7.1 through 7.5.

## 8 References

Association of Firearm and Tool Mark Examiners (AFTE) Journals, July 1992, Vol. 24, No. 3 and Fall 2011, Vol. 43, No. 4.

FBI Laboratory Quality Assurance Manual

FBI Laboratory Operations Manual

Glossary of the Association of Firearm and Tool Mark Examiners, AFTE Training and Standardization Committee, 6<sup>th</sup> Edition, Version 6.030317.1.

“SWGGUN Admissibility Resource Kit (ARK).” Resources, The Association of Firearm and Tool Mark Examiners. Web, accessed 5 February 2020.

United States. Department of Justice. Office of Legal Policy. Forensic Science. (2019, January) *Department of Justice Uniform Language for Testimony and Reports for the Forensic Firearms/Toolmarks Discipline – Fracture Match Examination*. Retrieved from the Department of Justice Web site: <https://www.justice.gov/olp/page/file/1083666/download>

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Rev. #	Issue Date	History
0	03/02/2020	Original issue for Firearms/Toolmarks Discipline, which includes the Firearms/Toolmarks Unit and Scientific and Biometrics Analysis Unit/Toolmark Group. Portions of an existing document ( <i>FTD Case Assignment, Records, Report Writing and Review, Rev 14, 02/13/2019</i> ) were excerpted or modified to create this document. The Scope of the document was expanded to add the E3CV methodology. Edits were made to titles of referenced documents where those titles have changed. Edits were made to reflect the May 26, 2019 reorganization. Minor changes for grammar and clarity were made throughout the document and sections were re-numbered. The FTD BV form was removed as an administrative document and the CRR was added. Additions were made to comply with requirements of ANAB and FBI Laboratory QAM and LOM in sections 5.1.2 and 7.1.3.1. Sections 4.2.1.2.1, and 5.3.3 were added. Sections 5.3 and 7.2 updated to comply with ULTR language. Section 6.3.1.2 was updated to align with reporting language. Section 7.1.3.1 was added for ANAB compliance. Removed Pressure Plate worksheet and updated remaining FTD Worksheets. SWGGUN ARK reference updated. Footnote 2 reference updated and errors in definition corrected.

### **Approval**

Redacted - Signatures on File

Firearms/Toolmarks  
 Technical Leader

Date: 02/28/2020

Firearms/Toolmarks  
 Unit Chief

Date: 02/28/2020

Scientific and Biometrics  
 Analysis Unit Chief

Date: 02/28/2020

### **QA Approval**

Quality Manager

Date: 02/28/2020

## Appendix A: FTD Abbreviations

Agent Involved Shooting	AIS
appears to be	ATB, atb
aluminum	Al
All the Physical Characteristics of Functional Ammunition	APCFA
autoloading	auto
Bureau of Alcohol, Tobacco, and Firearms	ATF, BATF
Barrel length	BL
brass	Br
breechface	bf
bullet	bul
caliber	cal
capacity	cap
cartridge case	CC, C.case, cart. case
Cascade Cartridge Inc.	CCI
Combined Explosives Exploitation Cell	CEXC
consistent with	con/w
could not determine	CND
copper	cu
double action	DA
diameter	dia
directionally focused fragmentation charge	DFFC
Redacted	
elimination	elim
ejector	ejt, ejr
electronic tracing system	eTrace
evaluation of microscopic marks	EOMM
Redacted	
extractor or extremely	ext
extractor mark	EM
Federal cartridge co.	Fed, FC, FCC
feet	ft
full metal case	FMC
full metal jacket(ed)	FMJ
firing pin	fp
firing pin impression	fpi
fragment	frag
firearms/toolmarks discipline	FTD
firearms/toolmarks unit	FTU
function	func
function when test fired	FNWTF
gauge	ga
groove impression(s)	GI, gimp(s)

grains	gr
general rifling characteristics	GRCs
gunshot residue	GSR
hollow point	hp
Hydrochloric Acid	HCl
identification	ID
impression	imp
improvised explosive device	IED
inches	in
initialed	init
initials	inits
inside diameter	IND
insufficient	insuff
jacketed hollow point	JHP
jacketed soft point	JSP
Lead	Pb
left twist	L
land impression(s)	LI, limp(s)
loaded into/extracted from	Lief
light comparison microscopy	LCM
limited	lim, ltd
limited marks of value	LMOV
long rifle	LR
Luger	Lug
magazine marks	MM
magazine, magnum	mag
modified griess	MGriess, Mod Griess
manila envelope	me
marks	mks
marked	mkd
millimeters	mm
model	mod
marks of value	MOV
no conclusion	NC
nickel	Ni
National Crime Information Center	NCIC
National Integrated Ballistic Information Network	NIBIN
National Institute of Standards and Technology	NIST
no marks of value	NMOV
observable physical characteristics	OPCs
outside diameter	OD
overall length	OAL
plastic bag	plb
pressure plate	pp



right twist	R
Remington	Rem
Reference Ammunition File	RAF
Reference Firearms Collection	RFC
render safe procedure	RSP
resealable plastic bag	rp lb
round nose	RN
sandal foam	sf
Scientific and Biometrics Analysis Unit	SBAU
sealed plastic bag	sp lb
single action	SA
Sporting Arms and Ammunition Manufacturers Institute	SAAMI
Secondary	2°
semi-jacketed hollow point	SJHP
submachine gun	SMG
Sodium Rhodizonate	SoRho
serial number	SN, S#
special	spl
Springfield	sprg
stainless steel	ssteel
semi-wadcutter	SWC
semi-wadcutter HP	SWCHP
Terrorist Explosive Device Analytical Center	TEDAC
test fired okay	TFOK
three-dimensional	3D
toolmarks	TM
Total Metal Jackets	TMJ
toolmarks of value	TMOV
Toolmark Group	TG
trigger pull weight	tp
unable to determine	utd
virtual comparison microscopy	VCM
with	w/
wadcutter	WC
Winchester	Win
weight	wt

## **Appendix B: Worksheets – *Bullet***

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## **Appendix B: Worksheets – Cartridge Case**

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## **Appendix B: Worksheets – *Firearm Function***

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## **Appendix B: Worksheets – *Firearm***

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## **Appendix B: Worksheets – General Examination**

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## **Appendix B: Worksheets – *Gunshot Residue***

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## **Appendix B: Worksheets – Results**

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## **Appendix B: Worksheets – Serial Number Restoration**

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## **Appendix B: Worksheets – Tool**

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## **Appendix B: Worksheets – Toolmark**

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## **Firearms/Toolmarks Discipline Development and Validation of New Technical Procedures**

### **1 Scope**

This procedure applies to Firearms/Toolmarks Discipline (FTD) personnel conducting development and validation of new technical procedures or methods for use in the following categories of testing:

- Firearms
- Toolmarks
- Serial Number Restoration

### **2 Internally Developed Technical Procedures**

The development and technical reviews will be recorded using the *FTD Development & Validation of New Technical Procedures Review Form* (Appendix A) and will include the supporting records for the procedures being developed and/or validated. At a minimum, development procedures and validation studies will address the criteria as outlined in the *LOM Practices for Developing Methods and Validating Technical Procedures*. In addition, FTD personnel using, internally developed procedures will be competency tested prior to conducting casework. Technical review, FTD Technical Leader review, approval records and validation study records, including competency tests, will be maintained at the appropriate laboratory location(s).

### **3 Externally Developed Technical Procedures**

Prior to applying an externally developed procedure into casework, FTD personnel must demonstrate and record that the technical procedures are valid and perform as expected in the FBI Laboratory location(s). This will be done in accordance with the *LOM Practices for Developing Methods and Validating Technical Procedures* and recorded under the Review of the Validation of a New Procedure section of Appendix A. In addition, FTD personnel using externally developed procedures will be competency tested prior to use in casework. Technical reviews, approval records, and validation study records, including competency tests, will be maintained at the appropriate laboratory location(s).

### **4 Procedure Modifications**

Any modifications to procedures will be recorded in the examination records or on a *Major Deviation Request* (7-258) depending on the nature of the change. This will be performed in accordance with the *LOM Practices for Authorizing Deviations*. If the modification will be permanent, it will be incorporated into a revised issue of the standard operating procedures.

## 5 References

ASCLD/LAB-International Supplemental Requirements for the Accreditation of Forensic Science Testing Laboratories, American Society of Crime Laboratory Directors/Laboratory Accreditation Board, Garner, NC, 2011.

ISO/IEC 17025 – General Requirements for the Competence of Testing and Calibration Laboratories, International Organization for Standardization, Geneva, Switzerland, 2005.

FBI Laboratory Quality Assurance Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.

FBI Laboratory Operations Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.

Rev. #	Issue Date	History
3	06/01/15	Changed document to record throughout. Added practice to Section 1. Included methods in Section 1. Changed technician to appropriately trained employees in Sections 2 and 3. Removed library from Sections 2 and 3. Updated references. Updated form (Appendix A)
4	10/02/17	Original issue for Firearms/Toolmarks Discipline, which includes Firearms/Toolmarks Unit and Scientific Analysis Unit - Toolmark Group. Existing document modified to include the Huntsville, AL satellite location.

**Approval**

Redacted - Signatures on File

**Appendix A: *FTD Development & Validation of New Technical Procedures Review Form***

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## **Firearms/Toolmarks Discipline Purchasing Supplies and Services**

### **1 Scope**

This procedure applies to the appropriate Firearms/Toolmarks Discipline (FTD) personnel, to include unit purchase card holder, who are responsible for purchasing any supplies and services or administering the services of the unit equipment. This procedure applies to the procurement of supplies and services that affect the quality of examinations performed in the following categories of testing:

- Firearms
- Toolmarks
- Serial Number Restoration

### **2 Procurement of Supplies/Services**

- Consult with the unit purchase card holder on the methods for completing the appropriate request and documentation of supplies/services utilized during examination. In the absence of a purchase card holder, the Unit Chief (UC) will ensure another unit purchase card holder or a member of the Planning & Budget Unit is consulted.
- Supplies must comply, where appropriate, with specifications defined within specific standard operating procedures.
- Consult with the unit purchase card holder for any supplies/services utilized during examinations that require a purchase requisition.
- When in-store purchases are made, an inventory of the supplies purchased will be recorded on the receipt, where appropriate.

### **3 Receipt of Supplies**

- Purchased supplies will be inventoried when received. Satisfactory inventory of supplies received will be recorded on the shipping invoice or receipt.
- When delivered supplies are received in the laboratory, the unit purchase card holder or designee will check the original Purchase Request or appropriate record to ensure they are in agreement. Notation of this inventory will be made on the receipt or appropriate record with the initials of the recipient.
- Purchasing records will be retained electronically by the unit purchase card holder or designee in the Enterprise Process Automation System (EPAS).



#### **4 Receipt of Equipment from Service**

- The receipt and/or shipping invoice of requested services will be inventoried upon receipt of the equipment at the appropriate laboratory location. Satisfactory inventory of the equipment returned and records of the services provided will be recorded on the receipt.
- The unit purchase card holder or designee may conduct an additional check against the original Purchase Request or appropriate record to ensure they are in agreement. Notation of this inventory will be made on the receipt or appropriate record.
- Purchasing records will be retained by the unit purchase card holder or designee in the EPAS.

#### **5 Storage**

Purchased chemicals or reagents made in-house will be stored in appropriate storage containers/locations until they are used. Additionally, chemicals or reagents described in an FTD Standard Operating Procedure will undergo a performance check prior to use. Records of these performance checks will be maintained in the appropriate laboratory location, specifically those designated areas where gunshot residue distance determination and serial number restoration examinations are routinely performed.

#### **6 Evaluation of Distributors and/or Service Providers**

The Calibration Maintenance Administrator will ensure a list of approved providers of critical services for instruments/equipment is maintained. The list can include records of service evaluation when appropriate.

Rev. #	Issue Date	History
1	04/18/11	Updated title. Updated section 1 to reflect title change. Section 2 revised to include in person purchases. Section 3 revised to include the documentation of supplied received. Section 5 revised to indicate where list of critical service providers is located and their evaluations.
2	10/02/17	Original issue for Firearms/Toolmarks Discipline, which includes the Firearms/Toolmarks Unit and the Scientific Analysis Unit/Toolmark Group. Existing document modified to include the Huntsville, AL satellite location.

**Approval**

Redacted - Signatures on File

## **Firearms/Toolmarks Discipline**

### **Estimating Uncertainty for Reported Quantitative Measurements**

#### **1 Purpose**

The result of a measurement is an approximation or estimate of the value of the specific quantity subject to measurement (measurand) and is only complete when accompanied by a quantitative statement of its uncertainty. The following steps describe the method for estimating the measurement uncertainty within the FBI Laboratory, Firearms/Toolmarks Discipline (FTD) in accordance with the *FBI Laboratory Quality Assurance Manual* and are based on the National Institute of Standards and Technology's (NIST) eight-step process for estimating uncertainty.

#### **2 Scope**

This procedure applies to FTD personnel who use standard operating procedures wherein a quantitative measurement is reported, such as barrel and overall length measurements. Additionally, this document applies to FTD personnel when the estimation of uncertainty is requested by the contributor. This procedure does not apply to approximate ranges, such as those reported in gunshot residue examinations and shooting incident reconstructions.

#### **3 Estimating Measurement Uncertainty**

Estimating the uncertainty for quantitative procedures follows the NIST eight-step process:

- Define what is being measured
- Identify sources of uncertainty
- Quantify uncertainty sources
- Convert factors to standard uncertainties
- Calculate combined standard uncertainties
- Expand the uncertainty by coverage factor (k)
- Evaluate the expanded uncertainty
- Report results with uncertainty

Uncertainty estimates involve the development of an uncertainty budget. The uncertainty budget for a procedure will include both *Type A* uncertainties which are directly calculated from repeated measurements of some quantity and *Type B* uncertainties which are estimated using other information such as instrument calibration reports provided by a vendor. An uncertainty budget will be recorded on the *FTD Uncertainty Budget Form* (Appendix A) and the appropriate Unit Quality Assurance Representative will ensure that a copy of the *FTD Uncertainty Budget Form* is maintained and made available.

### 3.1 Define What is Being Measured (Measurand)

The first step requires the Examiner to state what is being measured. This information is recorded on an *FTD Uncertainty Budget Form* which includes information about the procedure, date, sources of uncertainty, and name of preparer(s).

### 3.2 Identified Sources of Uncertainty (Budget)

The Examiner must first attempt to identify sources of uncertainty associated with the process of measuring. It is recognized that identifying “all” uncertainty components which contribute to the measurement uncertainty may not be achievable. In order to identify possible sources of uncertainty when collecting a measurement, the following potential sources of uncertainty should be considered. Not all will be applicable in every measurement situation.

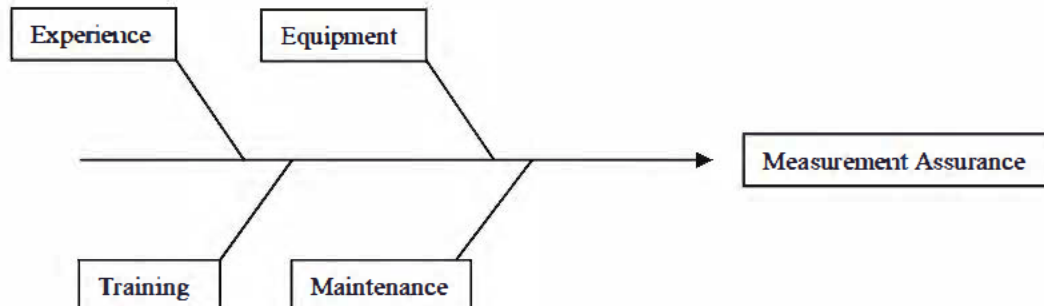
- Sampling
  - a. Homogeneity
  - b. Effects of specific sampling strategy (e.g. random, stratified random, proportional)
  - c. Temperature and pressure
- Sample preparation
  - a. Homogenization and/or sub-sampling effects
  - b. Contamination
- Presentation of Certified Reference Materials (CRM) to measuring system
  - a. Uncertainty of CRM
  - b. CRM match to sample
- Calibration of Instrument
  - a. Instrument calibration errors using CRM
  - b. Reference material and its uncertainty
  - c. Instrument precision
- Analysis (data acquisition)
  - a. Operator effects
  - b. Instrument parameter settings
  - c. Run-to-run precision
- Data processing
  - a. Averaging
  - b. Effects of rounding and truncating
  - c. Statistics
  - d. Processing algorithms (model fitting, e.g., linear least squares)
- Presentation of results
  - a. Final results
  - b. Estimation of uncertainty
  - c. Confidence level
- Interpretation of results
  - a. Against limits/boundaries
  - b. Regulatory compliance
  - c. Fitness for purpose

Another way to identify and sort sources of uncertainty is to use a cause and effect diagram. This method helps to visualize how the different sources of uncertainty relate to one another and to reduce the possibility of counting the same source of uncertainty more than once.

### 3.2.1 Cause and Effect Diagram

The initial step in creating a cause and effect diagram involves brainstorming the main sources of uncertainty. This determines the main branches of the diagram. Next, consider each step of the method and add any additional factors to the diagram. For each branch, add contributing factors. Do not add contributing factors that you believe to be remote possibilities. Resolve the duplications as outlined below:

- C Cancelling Effects - when the source's effect is shown to have no net effect on the result, it can be cancelled/removed from the diagram.
- Same effect/same time - when a similar source is uncovered on multiple branches of a cause and effect diagram, they can be combined into a single source happening at the same time. A common occurrence is that reproducibility appears on many branches; these can be combined into a single source.
- Different Instances/Re-labeling - if there are similarly named effects that refer to different instances of similar measurements, these effects will be re-labeled to clearly distinguish them from each other.



### 3.2.2 Reconciliation of Uncertainty Components

The process of reconciliation simplifies the uncertainty budget. In this step, a review is conducted to determine whether a listed uncertainty source is adequately accounted for by the existing data. The basis for this step lies in the fundamental assumption that if an effect is representatively varied during the course of a series of observations, the uncertainty associated with that effect is adequately accounted for in the standard deviation of those observations.

### 3.3 Quantifying Uncertainty Sources

Once the sources of uncertainty have been established, the Examiner must measure or estimate the magnitude of the uncertainty. Once the available information has been collected, each potential source of uncertainty is evaluated and categorized as *Type A* or *Type B* uncertainty data.

- *Type A* is a method of evaluation of uncertainty by statistical analysis of a series of observations.
- *Type B* is a method of evaluation of uncertainty by means other than the statistical analysis of a series of observations.

#### 3.3.1 Type A Uncertainties

The inability to exactly reproduce all parameters of a measurement, combined with precision limits of measurement devices, leads to measurement values being randomly dispersed. This random dispersion of measured values is referred to as *Type A* uncertainty. *Type A* uncertainties are estimated using statistics from repeated measurements.

$$S \text{ (Sample)} = \sqrt{(\sum_{i=1}^n (X_i - \bar{x})^2 / (n - 1))}$$

The random uncertainty of a population is determined by evaluating the standard deviation of the mean. This is obtained by dividing the standard deviation of the sample by  $\sqrt{\text{(number or "n")}}$ .

$$\sigma \text{ (Standard deviation of the mean)} = S/\sqrt{n}$$

This is the *Type A* uncertainty:  $U_{A1} = S/\sqrt{n}$ . If there is more than one contributor to the *Type A* uncertainties, repeat the above process for each one of them. Then the random uncertainty is  $U_A = \sqrt{(U_{A1}^2 + U_{A2}^2 + U_{A3}^2 + \dots)}$ . Prior to combining factors, it is important to ensure that all values are expressed in the same units.

#### 3.3.2 Type B Uncertainties

*Type B* uncertainties occur due to sources of uncertainty and bias in a measuring system and/or method that are evaluated by means other than direct statistical evaluation. These uncertainties can be minimized by optimizing the design of a measuring system and/or method to reduce their contribution. Additionally, it is acceptable for systematic uncertainties to be estimated.

Systematic uncertainties are those where the same influence affects the result for each repeated measurement. Although these factors may contribute insignificantly to the overall uncertainties, they need to be considered for *Type B* evaluation. When evaluating *Type B* sources of uncertainty for a measurement process, the list below highlights the more common sources:

- *Equipment* – The equipment chosen to conduct measurements will be NIST traceable and calibrated at a minimum to the manufacturer(s)' designated calibration intervals to reduce the source of uncertainty.

- *Personnel* – The differing physical capabilities, experience and abilities of the personnel performing a given measurement can affect the observed values. These contributions to the uncertainty may be treated as a Type B effect.
- *Readability* – Readability is defined as the smallest increment that can be detected by the measuring equipment. Due to its typically small contribution to the uncertainty, readability is usually not considered to be an issue relative to the practical certainty involved with the measurements.
- *Calibration/Calibration Bias* – The uncertainty associated with calibration is located on the calibration certificate. The uncertainty associated with calibration is expressed as an expanded uncertainty and is assumed to be a normal distribution.
- *Facility/Environment* - The environmental conditions in the Laboratory are typically maintained at a relatively constant conditions. However, some evaluation is required to verify their effects have been appropriately accounted for.
- *Pressure* – When taking dimensional measurements the effect of applied pressure from the instrument on the measurand should be considered.

Many *Type B* uncertainty contributions can be determined using sources of information such as calibration certificates, reference data, and manufacturer(s) specifications. Such contributions include:

- Uncertainty contributed due to the deviation of the reference standard from its nominal value. (Assume a rectangular distribution and a coverage factor of  $k=\sqrt{3}$ )
- Uncertainty due to the calibration of reference standard. (The coverage factor is obtained from the certificate and is usually  $k=2$ , for normal distribution)
- Uncertainty contribution due to resolution of the unit under calibration ( $\frac{1}{2}$  resolution and  $k=\sqrt{3}$ )
- Uncertainty contribution due to the resolution of the temperature measuring device ( $\frac{1}{2}$  resolution and assume distribution is rectangular so that  $k=\sqrt{3}$ )
- Uncertainty contribution due to uncertainty of the temperature measuring device (this value and the coverage factor,  $k$ , are obtained from the calibration certificate)

When these systematic uncertainties are unavailable, they can be estimated using the experience or general knowledge of the behavior and properties of relevant materials and instruments.

Calibration certificates which are generated by NIST or another accredited laboratory with traceability to a NIST standard will typically provide a 95% confidence level ( $2\sigma$ ). This must be

compensated for in the systematic uncertainty calculations (divide by 2).

If a non-accredited laboratory or manufacturer(s)' specifications are used to determine the systematic uncertainty of a measurement or an estimate must be made outside the limits of the uncertainty of a measurement, a rectangular distribution should be assumed. With a rectangular distribution, the range of the outer limit (2a) is used to estimate the standard deviation using the  $\sigma = a/\sqrt{3}$ .

### 3.4 Convert Factors to Standard Uncertainty

Standard deviation is also known as the estimated standard uncertainty. In this step, all previous standard deviations are expressed as standard uncertainties. However, to facilitate this step, it is necessary that common units are used throughout the budget. If this is not possible, conversion of units into percentages (i.e., relative standard uncertainty) is necessary; keeping in mind that the reverse conversion will be necessary later in the process.

### 3.5 Calculate Combined Standard Uncertainty

The individual standard uncertainties quantified by *Type A* and *Type B* evaluations are now combined to calculate the combined standard uncertainty. The Root Sum Square technique is used to calculate the combined standard uncertainty ( $U_{\text{combined}}$  or  $U_c$ ) which is expressed as follows:  $U_c = \sqrt{(U_{\text{SD}}^2 + U_{\text{resolution}}^2 + U_{\text{calibration}}^2 + U_{\text{tempcoef}}^2 \dots)}$ .

### 3.6 Expand the Uncertainty by Coverage Factor ( $k$ )

The coverage factor ( $k$ ) is a number that, when multiplied by the combined standard uncertainty ( $U_{\text{combined}}$ ), produces an interval around the average measurement result that is expected to include a large specified percentage (usually 95% or 99.7%) of the values. Usually  $k$  is set to a value of 2 to represent 95% confidence level and 3 to represent 99.7% confidence level. Within the FTD, a confidence level of 99.7% or greater is used in reporting a quantitative result.

When the *Type A* uncertainty component is dominant **and** the number of measurements used to calculate the standard deviation is less than 100, there is a reduced confidence in the calculated standard deviation. Since a normal distribution model indicates that the results close to the mean are more probable than results far from the mean, when only a few measurements are made, it is likely an underestimation of the true standard deviation. To account for this, a correction factor can be applied based on the Student t-distribution. The following table shows the corrected values for  $k$  as a function of degrees of freedom ( $n-1$ ) where  $n$  is the number of measurements (*For the FTD the minimum number of measurements is ten*).



Student-t Table distribution for  $k$  correction factor at a 99.7% Confidence Level

<b>n-1</b>	<b><math>k</math> correction</b>	<b>n-1</b>	<b><math>k</math> correction</b>
1	212.2	16	3.49
2	18.22	17	3.46
3	8.89	18	3.43
4	6.44	19	3.40
5	5.38	20	3.38
6	4.80	25	3.29
7	4.44	30	3.23
8	4.20	35	3.19
9	4.02	40	3.16
10	3.89	50	3.12
11	3.79	60	3.09
12	3.71	70	3.08
13	3.64	80	3.06
14	3.58	90	3.05
15	3.54	100	3.04
		$\infty$	3.0

Finally, if standard uncertainties were converted to percentages, the final combined uncertainty should be converted back to the units of measurement of the material in question.

### 3.7 Evaluate the Expanded Uncertainty

The estimation uncertainty determined from the preceding steps will be evaluated to determine if it “makes sense” and is “reasonable” for the procedure being evaluated.

### 3.8 Reporting Results with Uncertainty

The coverage probability will be no less than the approximated 99.7% confidence level and the numerical value of the expanded uncertainty will be reported to no more than two significant digits. When reporting the uncertainty of a measurement, rounding the uncertainty upwards rather to the nearest digit will be performed (Section 7, Guide to the expression of uncertainty in measurement- GUM). Additionally, the reported measurement result will only be quoted to the level of precision that the uncertainty is reported.

*Laboratory Reports* containing reported quantitative values will include the measured value with the calculated expanded uncertainty and an indication of the confidence level. For example, a report may state the barrel length of the Item 13 shotgun was measured to be  $16.56'' \pm 0.07''$  ( $k=3$  for 99.7% confidence level).

## **4 Records**

Records/documents related to the estimation of uncertainty of reported measurements will be maintained appropriately within the Firearms/Toolmarks Unit (FTU)/Scientific Analysis Unit (SAU). Sources of measurement uncertainty and limitations which may significantly affect the results will be identified within the standard operating procedure and/or in estimation of uncertainty records maintained.

## **5 Measurement Assurance/Schedule Maintenance/Recalculated Measured Uncertainty**

Estimations of uncertainty reported will be recalculated once every accreditation cycle. The results and records of this recalculation will be maintained.

## **6 References**

United States Department of Commerce Technology Administration, National Institute of Science and Technology (NIST), NIST Technical Note 1297, 1994 Edition, Guidelines for Evaluation and Expressing the Uncertainty of NIST Measuring Results.

National Physical Laboratory, Measurement Good Practice Guide No. 11 (Issue 2), March 2001.

Guide for Evaluation of Uncertainty in Calibration, International Accreditation Service, Inc., September 2008

[www.eurachem.org/guide](http://www.eurachem.org/guide) (last visited June 8, 2017)

ASCLD/LAB Guidance on the Estimation of Measurement Uncertainty – ANNEX A, Details on the NIST 8 Step Process, ASCLD/LAB Document Control Number: AL-PD-3056 Ver. 1.0 (Currently Under Review).

Joint Committee for Guides in Metrology (JCGM), Evaluation of measurement data – Guide to the expression of uncertainty in measurement (GUM) (GUM 1995 with minor corrections). (Serves, France: International Bureau of Weights and Measures [BIPM]-JCGM 100], September 2008).

ASCLD/LAB Policy on Measurement Uncertainty, Document Control Number AL-PD-3051, Ver. 1.0

ASCLD/LAB Policy on Measurement Traceability, Document Control Number AL-PD-3057, Ver. 1.3.

[www.surstat.anu.edu.au](http://www.surstat.anu.edu.au). (last visited 07/17/2017)

Rev. #	Issue Date	History
1	12/19/12	Document was revised to be in compliance with the QAM and NIST.
2	10/02/17	Original issue for Firearms/Toolmarks Discipline, which includes the Firearms/Toolmarks Unit and Scientific Analysis Unit/Toolmark Group. Existing document modified to include Huntsville, AL satellite location.

**Approval**

Redacted - Signatures on File

**Appendix A: *FTD Uncertainty Budget Form***

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## Firearms/Toolmarks Discipline Proficiency Testing

### 1 Scope

This procedure outlines the methods for administering and recording Proficiency Tests (PT). This procedure applies to any Firearms/Toolmarks discipline (FTD) personnel conducting forensic examinations in the following categories of testing:

- Firearms
- Toolmarks
- Serial Number Restoration

### 2 Testing Areas and Frequency

Each PT participant will complete at least one proficiency test annually in each category of testing that appears on the FBI Laboratory's American Society of Crime Laboratory Directors/Laboratory Accreditation Board-*International* (ASCLD/LAB-*International*) Scope of Accreditation in which he/she is qualified to perform testing. Approved external proficiency tests will be obtained by FTD.

The following categories will be tested according to the stated frequency:

Category of Testing	Frequency	Source
5.1 Firearms	One per calendar year	External
5.1 Firearms / Gunshot Residue-Distance Determination	One per calendar year	External
5.2 Toolmarks	One per calendar year	External
10.2 Serial Number Restoration	One per calendar year	External

### 3 External Proficiency Tests

**3.1** PT participants will follow the *LOM Practices for Open Proficiency Testing*. External proficiency tests will be administered and distributed using Forensic Advantage (FA).

**3.2** An Examiner at each laboratory location will serve as the Proficiency Test Representative (PTR). In the absence of an Examiner, the affected Unit Chief (UC) will assign the appropriate personnel to serve as the PTR.

**3.3** The PTR will generate a *FTD Proficiency Test Evaluation Form* (Appendix A) with the distribution of proficiency test packets. Additionally, the PTR will ensure that proficiency test information is entered into FA according to the *LOM Practices for Open Proficiency Testing*.

**3.4** Each PT participant will be responsible for completing the appropriate examination records for the assigned test to the same extent performed in routine casework.

**3.4.1** An Examiner will review the examination records of a PT participant not authorized to issue a *Laboratory Report* and complete the remaining examinations as necessary.

**3.5** PT results that require a verification will be performed by another Examiner who is qualified in the same category of testing.

**3.5.1** The verifying Examiner must have completed and submitted his/her own proficiency test results within that test cycle, or not be participating in that PT cycle.

**3.6** The technical review will be performed by an Examiner who:

**3.6.1** Is qualified in the same category of testing.

**3.6.2** Has completed his/her assigned proficiency test in that same PT cycle.

**3.6.3** Is not a PT participant in the same PT cycle.

**3.7** The administrative review will be performed by the UC or an Examiner that has completed 3.6.2 and 3.6.3.

**3.8** Technical and administrative reviews will be recorded according to the *FTD QAM Case Assignment, Records, Report Writing, and Review*.

**3.9** PT packets will be sealed and returned to the appropriate storage area when completed.

**3.10** PT records, to include completed external data forms, should be returned to the PTR or designee one week prior to the manufacturer's due date.

**3.11** Completed PT results will be submitted to the external test provider (data sheets can be completed electronically online).

## **4 Proficiency Test Evaluation**

**4.1** The PTR will retain external proficiency test packets until the results from the test provider have been received and evaluated.

**4.2** Upon receipt of the manufacturer's information and/or summary report, the appropriate UC and/or PTR will conduct an initial assessment of the proficiency test results/supporting documentation, and record any observations and/or inconsistencies on the *FTD PT Evaluation Form* as required in the *LOM Practices for Open Proficiency Testing*.

**4.3** Upon receipt of the individual reports, the PTR and affected Unit Chief (s) and/or FTD Technical Leader (TL) will conduct a further assessment and evaluation of the PT results. If it is determined the PT results are 'satisfactory', the evaluation will be recorded on the PT Evaluation Form. If an inconsistency or non-consensus result is noted, the UC and FTD TL will continue to Section 4.4.

**4.3.1** If the PTR or FTD TL is the source of the inconsistency or non-consensus result, the affected Unit Chief(s) will assign an evaluator, who is qualified in the same category of testing to conduct the evaluation.

**4.4** If an inconsistency or non-consensus result is noted during the assessment of the PT results, the appropriate UC and FTD TL will determine the type of inconsistency and initiate any required action in accordance with the *LOM Practices for Open Proficiency Testing* and *LOM Practices for Addressing a Nonconformity*.

**4.5** If an analytical/interpretive inconsistency is identified, the appropriate UC and FTD TL will review the external proficiency test packet and supporting examination records of the affected PT participant. Any required action, as a result of this review, will be completed in accordance with the *LOM Practices for Open Proficiency Testing* and *LOM Practices for Addressing a Nonconformity*.

**4.6** Upon completion of the PT Evaluation by the appropriate UC and/or FTD TL, the PT results will be made available to the PT participant as outlined in the *LOM Practices for Open Proficiency Testing* and recorded on the *FTD PT Evaluation Form*.

## **5 Internal Proficiency Tests**

**5.1** Internal proficiency tests are administered when an external proficiency test cannot be provided. An internal proficiency test will utilize a retained external proficiency test sample which was never assigned to a proficiency test participant. The PTR will follow the appropriate procedures outlined in the *LOM Practices for Open Proficiency Testing*.

**5.2** The PTR will ensure a *FTD Internal Proficiency Test Preparation Form* (Appendix B) and *FTD Internal Proficiency Test Results Form* (Appendix C) are completed. These forms will be completed and included in each test packet to fulfill the requirements for test preparation and ensure the necessary information is recorded as outlined in the *LOM Practices for Open Proficiency Testing*.

## **6 Proficiency Test Records**

**6.1** All proficiency test records as outlined in the *LOM Practices for Open Proficiency Testing* will be retained permanently within the appropriate laboratory location.

**6.2** PT information will be entered in FA by the PTR as outlined in the *LOM Practices for Open Proficiency Testing*.

## 7 References

ASCLD/LAB-International Supplemental Requirements for the Accreditation of Forensic Science Testing Laboratories, American Society of Crime Laboratory Directors/Laboratory Accreditation Board, Garner, NC, 2011.

ISO/IEC 17025 – General Requirements for the Competence of Testing and Calibration Laboratories, International Organization for Standardization, Geneva, Switzerland, 2005.

FBI Laboratory Quality Assurance Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.

FBI Laboratory Operations Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.



Rev. #	Issue Date	History
6	06/01/15	Added appropriately trained employee throughout. Updated PTS to PTR throughout. Updated Scope in Section 1. Specified the categories of testing, frequency, and source in Section 2. Specified FA training database in Section 3.1. Changed appendix identifier for Proficiency Test Evaluation Form in Section 3.3. Specified appropriately trained employee's responsibility for completing proficiency tests in Section 3.4. Renumbered following Section 3.4. Reworded sections 3.5, 3.5.1, and 3.6. Specified assessment by UC or PTR and record details in Section 3.8. Reworded and specified return of tests and records in Section 3.10. Updated FASU reference in Section 3.10. Reworded section 3.12. Changed error to inconsistency and specified review in Section 3.13. Specified details and references for review in Section 3.13.1. Changed appendix identifier for Proficiency Test Preparation Form and Internal Proficiency Test Results Form in Section 4.2. Specified proficiency test records are also retained in FA training database in Section 5.1. Reworded and changed UC to designee in Section 5.2. Updated referenced and forms (Appendices A-C).
7	10/02/17	Original issue for Firearms/Toolmarks Discipline, which includes the Firearms/Toolmarks Unit and the Scientific Analysis Unit/Toolmark Group. Existing document modified to include Huntsville, AL satellite location.

**Approval**

Redacted - Signatures on File

**Appendix A: *FTD Proficiency Test Evaluation Form***

Redacted - Form on File

**Appendix B: *FTD Internal Proficiency Test Preparation Form***

Redacted - Form on File

**Appendix C: *FTD Internal Proficiency Test Results Form***

Redacted - Form on File

## Firearms/Toolmarks Discipline Blind Verification

### 1 Purpose

This procedure outlines the criteria and methods used by qualified Examiners for performing blind verification (BV) examinations to comply with the *LOM - Practices for Blind Verification*.

### 2 Scope

This procedure applies to examiners who are qualified to conduct forensic examinations of firearms/toolmark evidence for pattern match and/or fractured items for fracture and/or physical match conducted in the firearms/toolmarks discipline. The procedure covers the Firearms and Toolmarks categories of testing and the range of conclusions as follows:

- Pattern Match Examinations to include source identification, source exclusion, and inconclusive.
- Fracture Match Examinations to include fracture match, exclusion and inconclusive.

BV consists of an independent examination of evidentiary items by a second qualified Examiner (referred to as BV Examiner throughout remaining document), who is prohibited from knowing the result(s) generated by the original Examiner. The Unit Chief (UC) and/or Examiner may select a submission, case record and examination request (referred to as case throughout the remaining document) for BV when it meets one of the following criteria:

- The case contains two items (one questioned and one known) for comparison.
- The case contains a limited number of items for comparison.
- The case contains a limited number of inconclusive results as identified by the Administrative reviewer.

### 3 Responsibilities

#### 3.1 The Unit Chief will:

- Select cases with a limited number of items for BV.
- Select cases that represent the range of possible conclusions for BV.
- Maintain a list of assigned and performed BVs.
- Evaluate the number of BVs performed annually.
- Generate an *FTD Blind Verification Evaluation Form* (Appendix A).
- Assign a BV Examiner on a rotating basis.
- Maintain completed *FTD Blind Verification Evaluation Forms*.

- Review Examiner and BV Examiner's examination records and results.

**3.2** The Examiner performing the original examination will:

- Evaluate item listing to determine if the submission meets the criteria for BV.
- Perform the requested examinations.
- Reach examination results independently and without consultation with other FTD Examiners.
- Provide examination records and results to the UC.

**3.3** The BV Examiner will:

- Perform the necessary examinations for the BV.
- Generate examination records.
- Reach examination results independently.
- Provide examination records to the UC.

**3.4** The FTD Technical Leader (TL) will:

- Assist the UC in completing the evaluation of the examination records and results provided by the Examiner and BV Examiner.

## **4 Procedures**

### **4.1 Blind Verification Assignment by the Unit Chief**

**4.1.1** The UC will maintain a list of assigned and performed BVs and evaluate the number of BVs performed annually.

**4.1.2** When a case is received, the UC will ensure a review of the item listing is completed to determine if the case is suitable for BV.

**4.1.2.1** If a case is selected for BV during case assignment, the UC will inform the Examiner that his/her case has been selected for BV. The UC will initiate an *FTD Blind Verification Evaluation Form* during the case assignment.

**4.1.2.1.1** During case assignment, the UC can select limited items within a case for BV. The UC will inform the Examiner that selected items within a case have been designated for BV.

**4.1.3** When conducting an administrative review on casework that has not been selected for BV, the UC can select to resubmit the case for BV, when the casework contains a limited number of inconclusive results.

**4.1.3.1** If a case is selected for BV that contains a limited number of inconclusive results, the UC will inform the Examiner that his/her case has been selected for BV.

**4.1.3.2** The UC will instruct the Examiner to transfer the evidence to the appropriate evidence storage room/location and collect the original Examiner's examination records and results.

**4.1.4** The UC will assign another Examiner, qualified in the same category of testing, to perform the BV. The selection of an Examiner for BV will be on a rotating basis, as appropriate, or at the UC's discretion.

**4.1.5** The BV Examiner will proceed to section 4.2.9 to conduct the BV.

## **4.2 Examination of Evidence for Blind Verification**

**4.2.1** An Examiner will evaluate evidence received in each Laboratory submission or case record to determine if it meets the FTD criteria for BV (see section 2). This evaluation can occur during the examination process prior to any verification.

**4.2.1.1** The Examiner will inform his/her UC when a case has been received that meets the FTD criteria for BV.

**4.2.2** The Examiner will conduct the necessary examinations as outlined in the FBI Laboratory Firearms/Toolmarks Discipline quality documents.

**4.2.3** The Examiner will perform the requested examinations and generate the appropriate examination records.

**4.2.4** The Examiner will not obtain a verification and consultation on any result and is prohibited from discussing the results of their examination with other FTD Examiners.

**4.2.5** The Examiner will return the evidence, including secondary evidence, to the appropriate evidence storage room/location.

**4.2.6** The Examiner will provide the UC with the generated examination records and results.

**4.2.7** The UC will initiate an *FTD Blind Verification Evaluation Form*.

**4.2.8** The UC will assign a second Examiner to perform the BV.

**4.2.9** The BV Examiner will retrieve the evidence from the appropriate evidence storage room/location. This evidence transfer will be recorded. The BV Examiner will perform the necessary examinations and generate the appropriate examination records and results.

**4.2.10** The BV Examiner is prohibited from discussing the results of their examination with other FTD Examiners.

**4.2.11** The BV Examiner is prohibited from obtaining a verification and consultation on any result.

**4.2.12** Upon completion of the examination(s) by the BV Examiner, the BV Examiner will return the evidence to the appropriate evidence storage room/location, record the evidence transfer and provide the UC with his/her examination records and results.

**4.2.13** The UC and TL will evaluate the results of the Examiner and BV Examiner, unless the TL is participating as the Examiner or BV Examiner. In cases where the TL is a participant, the UC will select a SME to assist with the evaluation. The evaluation of the results will be recorded on the *FTD Blind Verification Evaluation Form*. If the Examiner and BV Examiner reach the same comparison conclusion, the results of the BV Examiner will serve as the verification for this examination. If there is a disagreement in the results of the Examiner and BV Examiner and consultation does not resolve the differences, the UC will refer to the *LOM - Practices for Resolution of Scientific or Technical Disagreement*. A record of the Examiner and BV Examiner's discussions regarding their disagreement will be recorded on the *FTD Blind Verification Evaluation Form*.

**4.2.14** Upon successful completion of the BV, the BV Examiner's examination records will be retained with the Examiner's examination records and serve as the verification.

**4.2.15** A total of six source conclusion blind verifications will be performed in the FTD per quarter. A source conclusion blind verification is based on a one-to-one examination of two items of evidence. If this total is not reached during the quarter, the SBAU and/or FTU Chief(s) will record the reason(s).

## 5 Records

The following records will be generated and/or retained as a result of these procedures and the *LOM - Practices for Blind Verification*:

- *FTD Blind Verification Evaluation Forms*.
- List of assigned and performed BVs.
- Record of reason(s) for total number of BVs not completed per quarter.
- Any notes derived from consultation during the resolution of differences in results of examinations.
- Record of the number of blind verifications performed annually, including the FBI Laboratory number, category of testing, the type of source conclusion blind verification, evaluation of BVs and any noted differences in results of examinations between the Examiner and the BV Examiner.



## 6 References

ISO/IEC 17025 - General Requirements for the Competence of Testing and Calibration Laboratories, International Organization for Standardization, Geneva, Switzerland, 2017.

ISO/IEC 17025:2017 - Forensic Science Testing and Calibration Laboratories Accreditation Requirements (AR 3125), ANAB, Milwaukee, WI, April 29, 2019.

FBI Laboratory Quality Assurance Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.

FBI Laboratory Operations Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.

United States. Department of Justice. Office of Legal Policy. Forensic Science. (2019, January) *Department of Justice Uniform Language for Testimony and Reports for the Forensic Firearms/Toolmarks Discipline – Fracture Match Examination*. Retrieved from the Department of Justice Web site: <https://www.justice.gov/olp/page/file/1083666/download>

United States. Department of Justice. Office of Legal Policy. Forensic Science. (2019, January) *Department of Justice Uniform Language for Testimony and Reports for the Forensic Firearms/Toolmarks Discipline – Pattern Match Examination*. Retrieved from the Department of Justice Web site: <https://www.justice.gov/olp/page/file/1083671/download>

Rev. #	Issue Date	History
6	10/02/17	Original issue for the Firearms/Toolmarks Discipline, which includes the Firearms/Toolmarks Unit and the Scientific Analysis Unit/Toolmark Group. Existing document modified to include Huntsville, AL satellite location.
7	12/02/19	Updated to reflect the issuance of the DOJ ULTR for Pattern Match and Fracture Match Examinations. The scope and Section 3.1 was updated to reflect the range of source conclusion examinations that are covered within the Firearms/Toolmarks Discipline and also clarified the selection of cases to cover the range of source conclusions by an administrative reviewer. Updated Section 3.2 to clarify involvement of any consulting Examiner. Delineated the records being provided to UC in Section 3.3. Section 4.1.2 was clarified to reflect a case is reviewed to determine BV selection. Section 4.1.2.1.1 was expanded to allow UC flexibility on item selection. The evidence transfer was clarified in Sections 4.2.9 and 4.2.12. Clarified the TL and/or SME involvement with the BV evaluation in Section 4.2.13. Section 4.2.15 was updated to include the total number of source conclusions that would be achieved by the discipline. Section 6 was updated to include the updated accreditation documents and DOJ ULTR references. The form in Appendix A was also updated to include range of source conclusions.

### **Approval**

Redacted - Signatures on File

Firearms/Toolmarks  
 Technical Leader

Date: 11/27/2019

Firearms/Toolmarks  
 Unit Chief

Date: 11/27/2019

Scientific and Biometric  
 Analysis Unit Chief

Date: 11/27/2019

### **QA Approval**

Quality Manager

Date: 11/27/2019

**Appendix A: *FTD Blind Verification Evaluation Form***

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Redacted - Form on File

## **Firearms/Toolmarks Discipline FBI Approved Standards for Scientific Testimony and Report Language**

### **1 Purpose**

This document provides examples of the scientifically-supported conclusions and opinions approved for reporting examination results and conveying expert opinion statements during testimony by qualified Examiners within the Firearms/Toolmarks Discipline (FTD). It should be noted that these examples are not intended to be all-inclusive and may be dependent upon a precedent set by the judge or locality in which a testimony is provided. Further, these standards are not intended to serve as requirements for other forensic laboratories and do not imply that statements by other forensic laboratories are incorrect, indefensible, or erroneous.

### **2 Scope**

These standards apply to qualified Examiners, within the FTD, who conduct examinations, issue *FBI Laboratory Reports*, and provide court testimony.

### **3 Responsibilities**

**3.1** The Examiner will ensure the *Laboratory Report* is consistent with the approved standards outlined in this document.

**3.2** The Examiner will ensure any FTD testimony is consistent with the approved standards outlined in this document.

**3.3** The Examiner will review this document prior to any FTD testimony. A record of this review will be recorded in the Testimony Tracker, under the comments section.

*Example: FBI FTD ASSTR reviewed on 00/00/00, (initials)*

**3.4** The Unit Chief or Technical Leader will ensure the *Laboratory Report* is in compliance with the approved standards outlined in this document.

**3.5** The Unit Chief or Technical Leader will monitor and ensure FTD testimony is in compliance with the approved standards outlined in this document.

## **4 Statements Approved for FBI FTD Pattern Match and Fracture Match Examinations, Testimony and/or Laboratory Reports**

### **4.1 Conclusions for Pattern Match Examinations**

#### **4.1.1 Source Exclusion (i.e., Excluded, Elimination)**

An Examiner may state or imply the examination result as a *source exclusion* when there is a discernible or measurable difference in class characteristics.<sup>1</sup>

#### **4.1.2 Source Identification (i.e., Identified)**

Source Identification is an examiner's conclusion that two toolmarks originated from the same source.

An Examiner may state or imply the examination result as a *source identification* when the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks came from the same source and extremely weak support for the proposition that the two toolmarks came from different sources. A source identification is reached when the comparison of the microscopic marks are in sufficient agreement.

Sufficient agreement is related to the significant duplication of random toolmarks as evidenced by the correspondence of a pattern or combination of patterns of surface contours. Agreement is significant when the agreement in the microscopic marks exceeds the best agreement demonstrated between toolmarks known to have been produced by different tools and consistent with agreement demonstrated by toolmarks known to have been produced by the same tool.

A *source identification* is the statement of an Examiner's opinion (an inductive inference<sup>2</sup>) that the probability that the two toolmarks were made by different sources is so small that it is

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<sup>1</sup> The Department of Justice Uniform Language for Testimony and Reports for Forensic Firearms/Toolmarks Discipline – Pattern Match Examination allows for a source exclusion to be based upon differences in individual characteristics. A source exclusion based upon differences in individual characteristics is not approved by the FBI Laboratory Firearms/Toolmarks Discipline. This determination is based on the observations that indicate individual characteristics may not be permanent.

<sup>2</sup> Inductive reasoning (inferential reasoning):

A mode or process of thinking that is part of the scientific method and complements deductive reasoning and logic. Inductive reasoning starts with a large body of evidence or data obtained by experiment or observation and extrapolates it to new situations. By the process of induction or inference, predictions about new situations are inferred or inducted from the existing body of knowledge. In other words, and inference is a generalization, but one that is made in a logical and scientifically defensible manner. OXFORD DICTIONARY OF FORENSIC SCIENCE 130 (Oxford Univ. Press 2012).

negligible. A source identification is not based upon a statistically-derived or verified measurement or an actual comparison to all firearms or toolmarks in the world.

#### **4.1.3 Inconclusive (i.e., No Conclusion)**

An Examiner may state or imply the examination result as an *inconclusive* when there is an insufficient quality and/or quantity of corresponding individual characteristics to identify or exclude. Reasons for an *inconclusive* conclusion include the presence of microscopic similarity that is insufficient to form the conclusion of source identification; a lack of any observed microscopic similarity; or microscopic dissimilarity that is insufficient to form the conclusion of source exclusion.<sup>1</sup> An *inconclusive* conclusion indicates that the microscopic marks in question may or may not have originated from the same or known source.

### **4.2 Conclusions for Fracture Match Examinations**

#### **4.2.1 Exclusion**

An Examiner may state or imply the examination result as an *exclusion* when it is the Examiner's decision that two or more fractured items exhibit substantially dissimilar observed characteristics that would not be expected from fractured items that originated from the same object. When an exclusion decision is reached between fractured items from the same object, it is based on a one-to-one comparison of those fractured items.

#### **4.2.2 Fracture Match**

An Examiner may state or imply the examination result as a *fracture match* when the observed class characteristics and corresponding individual characteristics of the two or more fractured items provide extremely strong support for the proposition that they were once part of the same object and extremely weak support for the proposition that the fractured items originated from different objects. This conclusion can only be reached when two or more fractured items physically fit together or when a comparison of the corresponding surfaces of the fractured items reveals a fit.

A fracture match conclusion is the statement of an Examiner's opinion (an inductive inference<sup>1</sup>) that the probability that two or more fractured items were not part of the same object is so small that it is negligible. A fracture match conclusion is not based upon statistically-derived or verified measurement or an actual comparison to all fractured items in the world.

#### **4.2.3 Inconclusive**

An Examiner may state or imply the examination result as an *inconclusive* when there is an insufficient quantity and/or quality of observed characteristics to determine whether two or more

fractured items could have originated from the same object. Reasons for an *inconclusive* conclusion include the presence of physical or microscopic similarity that is insufficient to form the conclusion of fracture match; or a lack of any observed similarity. An *inconclusive* conclusion indicates that no determination can be made as to whether two or more fractured items could have originated from the same object.

## **5 Statements Not Approved For FBI FTD Pattern Match and Fracture Match Examinations, Testimony and/or Laboratory Reports**

### **5.1 Absolute Certainty**

When offering a pattern match conclusion, an Examiner will not assert that two toolmarks originated from the same source to the exclusion of all other sources. This may wrongly imply that a *source identification* conclusion is based upon statistically-derived or verified measurement or an actual comparison to all other toolmarks in the world, rather than an Examiner's expert opinion.

- This includes the statement "to the exclusion of all other tools in the world."

When offering a fracture match conclusion, an Examiner will not assert that two or more fractured items originated from the same source to the exclusion of all other sources. This may wrongly imply that a fracture match conclusion is based upon a statistically-derived or verified measurement or an actual comparison to all other fractured items in the world, rather than an Examiner's expert opinion.

An Examiner will not assert that two or more fractured items were once part of the same object unless they physically fit together or when a microscopic comparison of the surfaces of the fractured items reveals a fit.

### **5.2 Numerical Certainty**

An Examiner will not assert that examinations conducted in the forensic firearms/toolmarks discipline are infallible or have a zero error rate.

An Examiner will not provide a conclusion that includes a statistic or numerical degree of probability except when based on relevant and appropriate data.

### **5.3 Measure of Accuracy**

An Examiner will not cite the number of examinations conducted in forensic firearms/toolmarks discipline performed in his or her career as a direct measure for the accuracy of a proffered

conclusion. An Examiner may cite the number of examinations conducted in the forensic firearms/toolmarks discipline performed in his or her career for the purpose of establishing, defending, or describing his or her qualifications or experience.

An Examiner will not use the expressions ‘reasonable degree of scientific certainty,’ ‘reasonable scientific certainty,’ or similar assertions of reasonable certainty in either reports or testimony unless required to do so by a judge or applicable law.<sup>3</sup>

## 6 Laboratory Report Reviews

*Laboratory Reports* will be reviewed following the *FTD Procedures for Case Assignment, Records, Report Writing and Review* to ensure compliance with the approved statements in this document.

## 7 Testimony Reviews

Testimony records will be reviewed following the *FBI Laboratory Practices for Testimony Related Activities*. The review will ensure compliance with the approved statements in this document.

## 8 References

ASCLD-LAB-International Supplemental Requirement for the Accreditation of Forensic Science Testing and Calibration Laboratories. American Society of Crime Laboratory Directors/Laboratory Accreditation Board, Garner, NC, 2011.

FBI Laboratory Quality Assurance Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.

FBI Laboratory Operations Manual, Federal Bureau of Investigation, Laboratory Division, latest revision.

FBI Laboratory Firearms/Toolmarks Discipline, Quality Assurance Manual, Case Assignment, Records, Report Writing and Review, latest revision.

United States. Department of Justice. Office of Legal Policy. Forensic Science. (2019, January) *Department of Justice Uniform Language for Testimony and Reports for the Forensic*

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<sup>3</sup> See *Memorandum from the Attorney General to Heads of Department Components* (Sept. 9, 2016), <https://www.justice.gov/opa/file/891366.download>.



*Firearms/Toolmarks Discipline – Fracture Match Examination*. Retrieved from the Department of Justice Web site: <https://www.justice.gov/olp/page/file/1083666/download>

United States. Department of Justice. Office of Legal Policy. Forensic Science. (2019, January) *Department of Justice Uniform Language for Testimony and Reports for the Forensic Firearms/Toolmarks Discipline – Pattern Match Examination*. Retrieved from the Department of Justice Web site: <https://www.justice.gov/olp/page/file/1083671/download>

Rev. #	Issue Date	History
0	12/02/14	New Document.
1	10/02/17	Original issue for Firearms/Toolmarks Discipline, which includes the Firearms/Toolmarks Unit and the Scientific Analysis Unit/Toolmark Group. Existing document modified to include Huntsville, AL satellite location.
2	02/13/19	Sections 4 and 5 were updated to reflect the issuance of the DOJ ULTR for Pattern Match and Fracture Match Examinations. The conclusion were expanded in Section 4. Measurement of accuracy was added to Section 5. The LOM title was updated in Section 7 and the ULTR was added to Section 8.

**Approval**

Redacted - Signatures on File

Firearms/Toolmarks  
 Technical Leader

Date: 02/12/2019

Firearms/Toolmarks  
 Unit Chief

Date: 02/12/2019

Acting Scientific Analysis  
 Unit Chief

Date: 02/12/2019

**QA Approval**

Quality Manager

Date: 02/12/2019

## **Firearms/Toolmarks Discipline Report Writing and Review**

### **1 Purpose**

This document establishes the procedures for report writing, reviews of casework, and conclusions rendered that are specific to the Firearms/Toolmarks Discipline (FTD) of the FBI Laboratory. This document supplements the FBI Laboratory Quality Assurance Manual (QAM) and the FBI Laboratory Operations Manual (LOM).

### **2 Scope**

This procedure applies to FTD personnel in the Firearms/Toolmarks Unit (FTU) and Scientific and Biometrics Analysis Unit/Toolmark Group (SBAU/TG) who are trained, qualified, and authorized to handle evidence, perform examinations, complete verifications and reviews, and issue results that are rendered through the examination of evidence.

### **3 Report Language and Issuing *Laboratory Reports***

**3.1** Reports generated in the FTD will contain the required information as described in the *LOM - Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records in Forensic Advantage (FA)* or the *LOM - Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records for Legacy Cases*, as appropriate. The language used in *Laboratory Reports* will be consistent with the *FTD Report Language (Appendix A)*, except when warranted by specific examination circumstances. When issuing a *Laboratory Report*, the appropriate LOM Practices will be followed.

**3.2** The *FTD Report Language (Appendix A)* outlines the corresponding report language, methods, and limitations for common examination types. If an examination is performed in the FTD and a methods and limitations statement does not exist, the Examiner will confer with the FTD Technical Leader. This consultation will be recorded in the Communication Log.

**3.2.1** If a methods and limitations statement for an examination performed contains information not applicable to an examination on a case, the unrelated portion may be redacted.

**3.3** When more than one methods and limitations statement appears in the *Laboratory Report*, a header will be inserted for each examination that is referenced.

**3.4** When reporting a pattern match and/or fracture match examination result, the *Laboratory Report* will contain a statement referencing the applicable Department of Justice Uniform Language and Report document(s).

## 4 Technical and Administrative Review

**4.1** When conducting technical and administrative reviews, the *LOM - Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records in Forensic Advantage (FA)* or the *LOM - Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records for Legacy Cases*, as appropriate, will be followed.

**4.1.1** When an Examiner submits a *Laboratory Report* and supporting examination and administrative records for technical review, the Examiner is prohibited from acquiring these records back from the technical reviewer until the review is completed or returned to the Examiner for editing.

## 4.2 Technical Review

**4.2.1** Examinations conducted in the FTD will be technically reviewed by another Examiner who is qualified and authorized in the applicable category of testing and who has at least three months of FTD casework experience in the FBI Laboratory. Technical reviews will not be conducted by the Examiner who authored the examination records or the *Laboratory Report*. If necessary, the technical reviewer can review the evidence to ensure the completeness of the examination record. Unless a case is a priority, the Examiner will ensure the evidence is not returned until the technical review has been completed.

**4.2.2** The technical reviewer will complete the designated portion of the FTD Technical and Administrative Review Form (*TARF*) for both FA and legacy casework during the review. Questions on the *TARF* requiring a response applicable to FA casework will be completed; the remaining fields pertaining to legacy casework will have “NA” selected, unless the case is a legacy case. During the technical review, comments or required feedback may be recorded in the ‘feedback’ window of the review screen in FA or on the *TARF*.

**4.2.2.1** If the technical reviewer determines that a question(s) on the *TARF* must be answered with a “N/No” the technical reviewer will circle that response at the time of the review.

**4.2.2.1.1** If a “N/No” response is recorded on the *TARF* and/or another inconsistency is noted in the examination records by the technical reviewer, the technical reviewer will return the completed *TARF* and the examination records to the Examiner for possible revision. For FA cases, the reviewer will mark the review as ‘Returned’ in FA.

**4.2.2.2** If the Examiner agrees with the technical reviewer, the Examiner will make the necessary changes, single strike-out, date and initial the examination records, and return them to the technical reviewer. For FA cases, the Examiner will mark the review as ‘Continued’ in FA.

**4.2.2.2.1** If the Examiner chooses to reprint a page(s) of the notes due to corrections, the original page(s) with the completed corrections must be retained as part of the examination records in order to track the changes.

**4.2.2.3** Once the necessary changes have been made to the case file, the technical reviewer will single strike-out, date and initial the original “N/No” response on the *TARF* and circle “Y/Yes” to indicate the correction has been made. For FA cases, the reviewer will select ‘pass’ in FA to mark the review as ‘Completed’.

**4.2.2.4** If the Examiner does not agree with the technical reviewer, the Examiner will discuss the topic(s) with the technical reviewer to reach an agreement. If an agreement is reached the technical reviewer will single strike-out, date and initial the original “N/No” response on the *TARF* and circle “Y/Yes.” If agreement cannot be reached between the Examiner and the technical reviewer, the LOM *Practices for Resolution of Scientific or Technical Disagreement* will be followed.

**4.2.3** For legacy cases, when the technical reviewer determines the examination records are complete with no inconsistencies, the technical reviewer will indicate approval by signing the last page of the file copy of the *Laboratory Report*, on the technical review line. At this point, the examination records review can proceed to section 4.3 for administrative review.

## **4.3 Administrative Review**

**4.3.1** To ensure the accuracy and completeness of the *Laboratory Report*, all examination and administrative records will be administratively reviewed by individuals who are qualified and authorized to perform the review. Administrative reviews will not be conducted by the Examiner(s) who authored the *Laboratory Report*.

**4.3.2** The administrative reviewer will complete the designated portion of the *TARF* for both FA and legacy casework during the review. Questions on the *TARF* requiring a response applicable to FA casework will be completed; the remaining fields pertaining to legacy casework will have “NA” selected, unless the case is a legacy case. During the administrative review, comments or required feedback may be recorded in the ‘feedback’ window of the review screen in FA or on the *TARF*.

**4.3.2.1** If the administrative reviewer determines that a question(s) on the *TARF* must be answered with a “N/No,” the administrative reviewer will circle that response at the time of the review.

**4.3.2.1.1** If an unsatisfactory response is recorded on the *TARF* or another inconsistency is noted in the case file by the administrative reviewer, the completed *TARF* and case file will be returned to the Examiner for possible revision. For FA cases, the administrative reviewer will mark the review as ‘Returned’ in FA.

**4.3.2.2** If the Examiner agrees with the administrative reviewer, the Examiner will make the necessary changes to the case file and return it to the administrative reviewer. For FA cases, the Examiner will mark the review as ‘Continued’ in FA.

**4.3.2.3** If the necessary changes have been made to the case file, the administrative reviewer will single strike-out, date and initial the original “N/No” response and circle “Y/Yes” to indicate the correction has been made. For FA cases, the administrative reviewer will select ‘pass’ to mark the review as ‘Completed’ in FA.

**4.3.2.4** If the Examiner does not agree with the administrative reviewer, the Examiner will discuss the topic(s) with the administrative reviewer to reach an agreement. If the discussion involves a technical matter, the Technical Leader may be called upon for assistance. If an agreement is reached the administrative reviewer will single strike-out and initial the original “N/No” response and circle “Y/Yes”.

**4.3.3** For legacy cases, when the administrative reviewer determines the examination and administrative records are complete with no inconsistencies, the administrative reviewer will indicate approval by signing the last page of the file copy of the *Laboratory Report*, on the administrative review line.

## **5 Field Examination Reviews**

**5.1** For Shooting Incident Reconstructions (SIR), a *Laboratory Report* will be prepared and a technical and administrative review will be performed.

**5.2** If circumstances require that an FD-302 (Form for Reporting Information That May Become the Subject of Testimony) or other form of electronic communication be drafted in the field or prior to the issuance of a *Laboratory Report*, the *LOM - Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records in Forensic Advantage (FA)* or the *LOM - Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records for Legacy Cases*, as appropriate, will be followed.

**5.2.1** The contents of such communications will set forth the activities of the Laboratory SIR Team and should be intended for investigative guidance.

**5.2.2** These communications will not contain technical conclusions.

## **6 References**

Association of Firearm and Tool Mark Examiners (AFTE) Journals, July 1992, Vol. 24, No. 3 and Fall 2011, Vol. 43, No. 4.

Fact Sheet – eTrace: Internet-Based Firearms Tracing and Analysis. Retrieved from the ATF website: <https://www.atf.gov/resource-center/fact-sheet/fact-sheet-etrace-internet-based-firearms-tracing-and-analysis>. Web. Access 5 February 2020.

FBI Laboratory Quality Assurance Manual

FBI Laboratory Operations Manual

Glossary of the Association of Firearm and Tool Mark Examiners, AFTE Training and Standardization Committee, 6<sup>th</sup> Edition, Version 6.030317.1.

National Crime Information Center (NCIC) Details. Retrieved from the FBI website: <https://www.fbi.gov/services/cjis/ncic>. Web. Accessed 5 February 2020.

“SWGGUN Admissibility Resource Kit (ARK).” Resources, The Association of Firearm and Tool Mark Examiners. Web. Accessed 5 February 2020.

United States. Department of Justice. Office of Legal Policy. Forensic Science. (2019, January) *Department of Justice Uniform Language for Testimony and Reports for the Forensic Firearms/Toolmarks Discipline – Fracture Match Examination*. Retrieved from the Department of Justice Web site: <https://www.justice.gov/olp/page/file/1083666/download>

United States. Department of Justice. Office of Legal Policy. Forensic Science. (2019, January) *Department of Justice Uniform Language for Testimony and Reports for the Forensic Firearms/Toolmarks Discipline – Pattern Match Examination*. Retrieved from the Department of Justice Web site: <https://www.justice.gov/olp/page/file/1083671/download>

Rev. #	Issue Date	History
0	03/02/2020	Original issue for Firearms/Toolmarks Discipline, which includes the Firearms/Toolmarks Unit and Scientific and Biometrics Analysis Unit/Toolmark Group. Portions of an existing document ( <i>FTD Case Assignment, Records, Report Writing and Review, Rev 14, 02/13/2019</i> ) were excerpted or modified to create this document. Minor changes for grammar and clarity were made throughout the document and sections were re-numbered. Section 3.4 was modified to allow for laboratory macro to be used in place of web address. Section 4.2.2.2.1 was added. Association Examinations were re-titled to Physical and Visual Evaluations. Section 6 References updated. Report writing language was added/modified where needed (Physical and Visual Examinations, Firearms Function Examinations). Additional edits for ANAB compliance. General format update to Appendix B Technical & Administrative Review Form.

### **Approval**

Redacted - Signatures on File

Firearms/Toolmarks  
 Technical Leader

Date: 02/28/2020

Firearms/Toolmarks  
 Unit Chief

Date: 02/28/2020

Scientific and Biometrics  
 Analysis Unit Chief

Date: 02/28/2020

### **QA Approval**

Quality Manager

Date: 02/28/2020



## Appendix A: FTD Report Language

• <a href="#"><u>Accidental Discharge</u></a>
• <a href="#"><u>Physical and Visual Examination</u></a>
• <a href="#"><u>Barrel &amp; Overall Length Measurement</u></a>
• <a href="#"><u>Bullet Examination</u></a>
• <a href="#"><u>Bullet Testing Kit</u></a>
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### ***Accidental Discharge (Results)***

#### ***Negative Result***

[#] is a 20 gauge Jing An (China) shotgun, Model SPM-20, Serial Number [#]. The [#] shotgun functioned normally when tested in the Laboratory and could not be made to fire without a pull of the trigger.

#### ***Positive Result***

[#] is a 20 gauge Jing An (China) shotgun, Model SPM-20, Serial Number [#]. During testing in the Laboratory, the [#] shotgun could be made to fire without a pull of the trigger.

---

### ***Accidental Discharge (Methods & Limitations)***

#### **Methods:**

##### Accidental Discharge

An accidental discharge test is conducted in all modes of fire for a firearm, utilizing a primed cartridge case or shotshell case. The firearm is struck with a rawhide or similar styled mallet on its six planes: front of muzzle, butt plate, top of breech and chamber, bottom of trigger guard and frame and both sides of the receiver/frame. If necessary, tests can be undertaken in order to attempt to duplicate the conditions under which the firearm discharged.

#### **Limitations:**

##### Accidental Discharge

When an accidental discharge examination is performed, it may not be possible to recreate or duplicate all of the circumstances which led to the discharge of a firearm without a pull of the trigger.

---

### ***Physical and Visual Examinations– Ammunition/General (Results)***

[#] consists of [number] [caliber] cartridges that [are loaded with bullet type and] bear the headstamp of [name] ammunition and are physically consistent with functional ammunition.

[#] consists of [number] [caliber] cartridges that bear the headstamp of [name] ammunition and is physically consistent with functional ammunition.

[#] is a [caliber] cartridge that is physically consistent with functional ammunition.

The [#] is labeled with the trade names "[name]" and "[name]" and contains fifteen 9mm Luger (9x19mm) cartridges, all of which bear the headstamp of [name] and have design characteristics that are physically consistent with functional ammunition sold under these trade names. [#] are 9mm Luger (9x19mm) cartridges that also bear the headstamp of [name]. [#] are physically consistent with functional ammunition and bear all of the same observable design characteristics as the cartridges in the [#] box; however, there is no method of determining whether or not the [#] originated in the [#] box.

Due to the agreement of class characteristics and the presence and alignment of similar post-manufacture features, Item [ ] and Item [ ] are physically consistent with having been part of the same object. However, due to a lack of suitable fractured surfaces, no fracture match could be made.

---

### ***Physical and Visual Examinations – Ammunition/General (Methods & Limitations)***

#### **Methods:**

##### Physical and Visual Examinations

Physical and visual evaluations compare the physical and class characteristics of evidence items. A conclusion of “physically consistent with” is reached if the observable or measurable physical dimensions and/or design features of two items are in agreement, or are "physically consistent." If these dimensions and features are clearly different, an elimination conclusion is reached. If there is a lack of observable design features or measurable dimensions, the result is inconclusive.

#### **Limitations:**

##### Physical and Visual Examinations

A Physical and Visual Evaluation examination is unsuitable for determining a source identification conclusion. A conclusion of “physically consistent with” signifies a restricted group source, based on class characteristics and/or observable features, from which evidence may have originated. Post-manufacture features cannot be used for elimination purposes.

Examinations of electronic evidence may be impacted by data quality and size of the item(s) in question.

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### ***Physical and Visual Examinations – Electronic Evidence (Results)***

#### *Photographs*

[#] is a compact disc that contains bank surveillance photographs. An object depicted in image 180211.tif, is consistent with a dark colored pistol. An object depicted in image

180155.tif, is consistent with a silver colored revolver. Due to inadequate image quality, no further information could be obtained from the images from the [#] compact disc.

OR

The object depicted in the [#] physically consistent with the [model(s)] pistols/revolvers/rifles/shotguns manufactured by [name].

---

### ***Physical and Visual Examinations – Electronic Evidence (Methods & Limitations)***

#### **Methods:**

##### Physical and Visual Examinations – Electronic Evidence

The physical characteristics of an unknown object depicted in a photograph and/or electronic media are compared to known reference materials to determine if there are any consistencies.

#### **Limitations:**

##### Physical and Visual Examinations – Electronic Evidence

Due to poor image quality or a lack of observable physical characteristics, it may not be possible to determine if an object depicted in a photograph is a functional firearm, a replica firearm, or a toy firearm.

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### ***Barrel Length and Overall Length Measurement (Results)***

The barrel of the [#] rifle was examined and determined to have been shortened to a length of [0.00] inches (+/- [0.00] inches, k=3 for a 99.73% confidence level).

The overall length of the [#] shotgun is [0.00] inches (+/- [0.00] inches k=3 for a 99.73% confidence level).

Examination of the [#] rifle determined that the barrel had been shortened making the overall length [0.00] inches (+/- [0.00] inches k=3 for a 99.73% confidence level).

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### ***Barrel Length and Overall Length Measurement (Methods & Limitations)***

#### **Methods:**

##### Barrel Length and Overall Length Measurement

Barrel length is measured using a ruler or measuring rod and overall length of a firearm is

measured using a measuring platform with a ruler. The rulers and measuring rods are traceable to a National Institute of Standards and Technology (NIST) standard.

## **Limitations:**

### **Barrel Length and Overall Length Measurement**

The accuracy of barrel length and overall length measurements are limited by the straightness of the measuring device, the ability to delineate the furthest point of a barrel in relation to the measuring device, proper alignment of the firearm in the measuring platform, environmental conditions, and the measuring ability of the person making the measurement.

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### ***Bullet Examination (Results)***

#### *Identification*

The [#] bullet was identified as having been fired from the barrel of the [#] pistol.

#### *Inconclusive (no conclusion)*

Due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the [#] bullet was fired from the barrel of the [#] pistol.

#### *Elimination*

The [#] bullet was excluded as having been fired from the barrel of the [#] pistol.

---

### ***Bullet Examination (Methods & Limitations)***

## **Methods:**

### **Bullet Examination**

Two bullets, either two evidence items or one evidence item and one bullet test fired in the Laboratory, undergo two stages of comparison. First, the bullets are examined to determine and compare their class characteristics. The class characteristics of fired bullets include diameter, number of land and groove impressions, direction of twist, and the widths of the land and groove impressions. If the class characteristics of the two bullets are not clearly different, the examination moves to a second stage using comparative microscopy.

A microscopic comparison examination consists of a search of the striated marks present on two bullets to determine if patterns of similarity exist. At the completion of these comparisons, one of the following three opinions is issued:

### 1) Source Exclusion

Source exclusion is an Examiner's conclusion that two bullets did not originate from the same source. The basis for a source exclusion conclusion is an Examiner's decision that two bullets can be differentiated by their class characteristics. A source exclusion based on general differences does not require a verification. However, a source exclusion based on a minor difference in a measured class characteristic requires a verification.

### 2) Source Identification

Source identification is an Examiner's conclusion that two bullets originated from the same source. Conditions for a source identification include the degree of similarity being greater than the Examiner has ever observed in previous evaluations of bullets known to have been fired from different barrels; and the degree of similarity is equivalent to that normally observed in bullets known to have been fired from the same barrel. The basis for a source identification conclusion is an Examiner's decision that the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks came from the same source and extremely weak support for the proposition that the two toolmarks came from different sources. Before being reported, a source identification requires a verification to be completed.

### 3) Inconclusive (No Conclusion)

Inconclusive is an Examiner's conclusion that all observed class characteristics are in agreement but there is insufficient quality and quantity of corresponding individual characteristics such that the Examiner is unable to identify or exclude the two bullets as having originated from the same source. The basis for an inconclusive conclusion is an Examiner's decision that there is an insufficient quality and/or quantity of individual characteristics to identify or exclude. Reasons for an inconclusive conclusion include the presence of microscopic similarity that is insufficient to form the conclusion of source identification; a lack of any observed microscopic similarity; or microscopic dissimilarity that is insufficient to form the conclusion of source exclusion.

### **Limitations:**

#### Bullet Examination

Firearms/Toolmark Identification is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to random changes in barrels such as wear, corrosion and lead and jacket material accumulation, bullets fired from the same barrel are sometimes not identifiable as such. Additionally, some barrel manufacturing methods routinely produce barrels that leave limited microscopic marks of value on fired bullets. Additionally, damaged, corroded or fragmented bullets may be of little or no value for comparison purposes.

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### ***Bullet Testing Kit (Results)***

#### *Positive*

A presumptive chemical test for the presence of lead and copper was performed on [#]. The test was positive for both lead and copper.

#### *Negative*

A presumptive chemical test for the presence of lead and copper was performed on [#]. The test was negative for both lead and copper.

#### *Positive/Negative*

A presumptive chemical test for the presence of lead and copper was performed on [#]. The test was [positive/negative] for lead and [positive/negative] copper.

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### ***Bullet Testing Kit (Methods and Limitations)***

#### **Methods:**

##### Bullet Testing Kit

Suspected bullet impacts or holes are examined visually and/or microscopically for the presence of physical effects that might have been produced by a bullet. If these conditions are noted, a series of presumptive chemical tests for the presence of lead and copper may be performed. Each of these tests is chemically specific and produces a colored reaction when in the presence of the specific chemical.

#### **Limitations:**

##### Bullet Testing Kit

Presumptive chemical tests are not conclusive and are meant to provide additional information regarding the possibility of a bullet impact or passage. The presumptive test does not distinguish whether lead and copper are deposited by a bullet or by another source.

---

### ***Cartridge/Shotshell Case Examination (Results)***

#### Identification

The [#] cartridge case was identified as having been fired in the [#] pistol.

*Inconclusive (no conclusion)*

Due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the [#] cartridge case was fired in the [#] pistol.

*Elimination*

The [#] cartridge case was excluded as having been fired in the [#] pistol.

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***Cartridge/Shotshell Case Examination (Methods & Limitations)***

**Methods:**

Cartridge/Shotshell Case

Two cartridge cases, either two evidence items or one evidence item and one cartridge case test fired in the Laboratory, undergo two stages of comparison. First, the cartridge cases are examined to determine and compare their class characteristics. The class characteristics of fired cartridge cases include caliber, shape of firing pin impression, shape and orientation of breech face marks, and relative locations of extractor and ejector marks. If the class characteristics of the two cartridge cases are not clearly different, the examination moves to a second stage using light and/or virtual comparison microscopy.

A microscopic comparison examination consists of a search of the impressed and striated toolmarks present on two cartridge cases to determine if patterns of similarity exist. At the completion of these examinations, one of the following three opinions is issued:

1) Source Exclusion

Source exclusion is an Examiner's conclusion that two cartridge cases did not originate from the same source. The basis for a source exclusion conclusion is an Examiner's decision that two cartridge cases can be differentiated by their class characteristics. A source exclusion based on general differences does not require a verification. However, a source exclusion based on a minor difference in a measured class characteristic requires a verification.

2) Source Identification

Source identification is an Examiner's conclusion that two cartridge cases originated from the same source. Conditions for a source identification include the degree of similarity, between two samples, being greater than the Examiner has ever observed in previous evaluations of cartridge cases known to have been fired in different firearms; and the degree of similarity is equivalent to that normally observed in cartridge cases known to have been fired in the same firearm. The basis for a source identification conclusion is an Examiner's decision that the observed class characteristics and corresponding individual characteristics provide extremely



strong support for the proposition that the two toolmarks came from the same source and extremely weak support for the proposition that the two toolmarks came from different sources. Before being reported, a source identification requires a verification to be completed.

### 3) Inconclusive (No Conclusion)

Inconclusive is an Examiner's conclusion that all observed class characteristics are in agreement but there is insufficient quality and quantity of corresponding individual characteristics such that the Examiner is unable to identify or exclude the two cartridge cases as having originated from the same source. The basis for an inconclusive conclusion is an Examiner's decision that there is an insufficient quality and/or quantity of individual characteristics to identify or exclude. Reasons for an inconclusive conclusion include the presence of microscopic similarity that is insufficient to form the conclusion of source identification; a lack of any observed microscopic similarity; or microscopic dissimilarity that is insufficient to form the conclusion of source exclusion.

### **Limitations:**

#### Cartridge/Shotshell Cases

Firearms/Toolmark Identification is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to possible changes in firearm operating surfaces from wear, corrosion, and ordinary fouling and differences in ammunition design and construction, cartridge cases fired in the same firearm are sometimes not identifiable as such. Additionally, some firearm manufacturing methods routinely produce working surfaces that leave limited microscopic marks of value on fired cartridge cases.

Virtual comparison microscopy (VCM) is restricted to the surface that the three-dimensional toolmark topographical instrument is capable of measuring to produce a digital reproduction. Additionally, individual characteristics may be present on the evidentiary item(s) and may not be reproduced during a scan. This may be due to interference from lacquer/sealant, environmental damage, debris, or measuring limits for an instrument. Furthermore, physical characteristics that are not measurable, such as the metallic qualities of an item, may not be available for evaluation.

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Redacted

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#### ***Ejection Pattern (Results)***

Ejected cartridge cases from the [#] pistol were found to strike the ground [0.00] feet (+/- [0.00] ft., k=3 for a 99.73% confidence level) to the right and [0.00] feet (+/- [0.00] ft., k=3 for a 99.73% confidence level) to the front of the [#] ejection port.

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## ***Ejection Pattern (Methods & Limitations)***

### **Methods:**

#### Ejection Pattern

The floor/ground is marked with two intersecting lines that form a coordinate axis. The firearm is fired from a position directly above the origin. The point of each cartridge case's first impact with the floor/ground is marked for each shot that is fired. When the test firing has concluded, all of the markers are measured for their position from the axis. These measurements are used to calculate an average point of impact on both axes as well as the uncertainty.

### **Limitations:**

#### Ejection Pattern

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 are only valid for the firearm tested along with the magazine and type of ammunition used.

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## ***eTrace (Results)***

### *eTrace submission by FTU*

An eTrace request was submitted using the serial number from the [#] [type] and the results can be found under the Trace number [#].

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## ***eTrace (Methods & Limitations)***

### **Methods:**

#### eTrace

The make, model, serial number from a firearm, to include other investigative information, is submitted to the Department of Justice electronic tracing system (eTrace) internet-based database. Firearm tracing can provide systematic tracking information of a recovered firearm from its manufacturer or importer to its point(s) of purchase and recovery.

## **Limitations:**

### eTrace

The eTrace database will only return a firearms trace report if the information about the recovered firearm is available.

---

## ***Firearms Function (Results)***

### *Functionality*

Item [#] is a .223 Remington caliber Colt rifle, Model [#], which functioned normally when tested in the Laboratory with the submitted magazine.

Item [#] is a 9x19mm Glock pistol, Model [#], which functioned normally when tested in the Laboratory using the [#] magazine.

Item [#] is a .357 Magnum caliber Smith & Wesson revolver, Model [#], which functioned normally when tested in the Laboratory.

### *Functionality with use of RFC*

[#] is a .40 S&W caliber Hi-Point pistol, Model JCP, which functioned normally when tested in the Laboratory using a magazine from the Reference Firearms Collection.

### *80% frame and/or receiver*

Item [#] is a .40 S&W caliber pistol using a [Manufacturer e.g., Polymer 80] frame, Model [#], and a Glock 22 slide and barrel. The frame is consistent with unfinished or “80%” frame commercially produced by the [Manufacturer e.g., Polymer 80 Company] and are manufactured without a serial number.

Item [#] is a [caliber] “80 %” rifle, which functioned normally when tested in the Laboratory with the submitted magazine. Examination of the Item [#] rifle determined the upper receiver was manufactured by [Manufacturer e.g., Del-Ton Inc.] located in [city, state] and the lower receiver was manufactured by [Manufacturer i.e., Polymer 80] Model [#] located in [city, state]. The “80%” refers to an item that has not reached a stage of manufacture that meets the definition of a firearm frame or receiver and is designed to be completed by the purchaser. Additionally, “80%” lower receivers, such as the one on the Item [#] rifle, are not serialized.

Item [#] is a [caliber] “80 %” rifle, which functioned normally when tested in the Laboratory with the submitted magazine. Examination of the Item [#] rifle determined the upper receiver was manufactured by [Manufacturer e.g., Del-Ton Inc.] located in [city, state] and the lower receiver was manufactured by [Manufacturer i.e., Polymer 80] Model [#] located in [city,

state]. The “80%” refers to an item that has not reached a stage of manufacture that meets the definition of a firearm frame or receiver and is designed to be completed by the purchaser. Additionally, “80%” lower receivers, such as the one on the Item [#] rifle, are not serialized.

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### ***Firearms Function (Methods & Limitations)***

#### **Methods:**

##### Firearms Function

The make, model, and caliber of a firearm are normally determined by directly observing manufacturer markings on the firearm in question. When these are not present, published materials and firearms in the Laboratory's Reference Firearms Collection may be used to make determinations.

Unless otherwise noted, submitted firearms are test fired:

- 1) in the condition they are received in the Firearms/Toolmarks Unit,
- 2) with ammunition from the Laboratory's Reference Ammunition File,
- 3) in a manner that allows for testing of available modes of fire such as manual safety engaged, manual safety disengaged, single action, double action, semi-automatic, fully automatic, etc.

#### **Limitations:**

##### Firearms Function

The results of firearms function examinations describe the operating condition of the firearm as received in the Firearms/Toolmarks Unit.

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### ***Fracture Match (Results)***

#### ***Fracture Match – Comparative Microscopy***

Through a fracture match examination, utilizing comparative microscopy, it was determined that the Item [#] piece of hasp and the Item [#] piece of hasp were once joined.

#### ***Fracture Match - Physical Fit***

Through a fracture match examination, utilizing physical fit evaluation, it was determined that the Item [#] piece of hasp and the Item [#] piece of hasp were once joined.

#### *Inconclusive (No Conclusion) – Fracture Match*

The Item [#] piece of screwdriver and Item [#] screwdriver were microscopically examined and compared. Due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the [#] piece of screwdriver and the [#] screwdriver were joined at one time.

#### *Inconclusive (No Conclusion) – Physical Fit*

The Item [#] piece of screwdriver and Item [#] screwdriver were examined and compared. Due to a lack of sufficient corresponding fractured surfaces, utilizing physical fit evaluation, no conclusion could be reached as to whether the [#] piece of screwdriver and the [#] screwdriver were joined.

#### *Exclusion – Fracture Match*

Due to a difference in the class characteristics [e.g., size and shape] of the material, the Item [#] piece of screwdriver and the Item [#] screwdriver were excluded as having been joined at one time.

#### *Exclusion – Physical Fit*

Through fracture match examination, utilizing physical fit evaluation, it was determined that the Item [#] piece of hasp and Item [#] piece of hasp were not originally connected due to a difference in class characteristics.

---

### ***Fracture Match (Methods & Limitations)***

#### **Methods:**

##### Fracture Match

Fracture match examinations undergo two stages of comparison. First, the fractured items are examined to determine and compare their class characteristics. The class characteristics of marks on fractured items include, but are not limited to, the shape and size of the material. If the class characteristics of the fractured items are not clearly different, the examination moves to a second stage where the fractured items are examined utilizing physical fit evaluation and/or comparative microscopy to determine if the fractured items were at one joined.

The comparison examination consists of an evaluation of the fracture marks/contours present in two items to determine if patterns of similarity exist. At the completion of these comparisons, one of the following three opinions is issued:

### 1) Exclusion

Exclusion is an Examiner's conclusion that two or more fractured items did not originate from the same object. The basis for an exclusion is an Examiner's decision that two or more fractured items exhibit substantially dissimilar observed characteristics that would not be expected from fractured items that originated from the same object.

### 2) Fracture Match

Fracture Match is an Examiner's conclusion that two or more fractured items were once part of the same object. This conclusion is an Examiner's decision that all observed class characteristics are in agreement and the quality and quantity of corresponding individual characteristics for the fractures is such that the Examiner would not expect to find that same combination of individual characteristics repeated in another object. A fracture match can only be reached when two or more fractured items physically fit together or when a comparison of the corresponding surfaces of the fractured items reveals a fit. The basis for a fracture match conclusion is an Examiner's decision that the observed class characteristics and corresponding individual characteristics of the two or more fractured items provide extremely strong support for the proposition that they were once part of the same object and extremely weak support for the proposition that the fractured items originated from different objects. Before being reported, a fracture match requires a verification to be completed.

### 3) Inconclusive (No Conclusion)

Inconclusive is an Examiner's conclusion that no determination can be reached as to whether two or more fractured items could have originated from the same object. The basis for an inconclusive conclusion is an Examiner's decision that there is an insufficient quantity and/or quality of observed characteristics to determine whether two or more fractured items could have originated from the same object. Reasons for an inconclusive conclusion include the presence of physical or microscopic similarity that is insufficient to form the conclusion of fracture match; or a lack of any observed similarity; or physical dissimilarity that is insufficient to form the conclusion of exclusion.

### **Limitations:**

#### Fracture Match

Fracture Match is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to corrosion and abuse, fracture/contour marks created from the fracture of an object are not always identifiable as such.

---

### ***General Rifling Characteristics (Results)***

[#] is a .40 caliber/10mm [bullet type] that was fired from a barrel rifled with six grooves, right twist. A check of the FBI Laboratory's General Rifling Characteristics (GRC) database produced a list of [firearm type] with GRCs like those present on the [#] that includes pistols marketed by [manufacturer] and revolvers marketed by [manufacturer].

---

### ***General Rifling Characteristics (Methods & Limitations)***

#### **Methods:**

##### GRC

The appropriate GRC measurements are entered in the database, which then returns a list of all firearms in the database with compatible GRCs.

#### **Limitations:**

##### GRC

The GRC database contains information obtained from firearms at the FBI Laboratory and from voluntary submissions of test-fired specimens from law enforcement agencies around the world. It is not a comprehensive list of all firearms, and contains no information about the numbers of each type of firearm present in the general population. The firearms listed in the report are typically those considered to be more common and are included at the discretion of the examiner authoring the report.

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### ***Gunshot Residue and Shot Pattern Examination (Results)***

#### ***Negative Results***

The [#] shirt was microscopically examined and chemically processed for gunshot residues, and none were found.

#### ***Bullet wipe***

The [#] shirt was microscopically examined and chemically processed for gunshot residues. Lead and/or copper residues consistent with the passage of a bullet were found surrounding a hole below the right front pocket of the shirt. No other residues were detected.

*Negative Griess, positive particulate lead or copper (bullet hole optional)*

The [#] shirt was microscopically examined and chemically processed for gunshot residues. Particulate lead and/or copper residues consistent with the discharge of a firearm were found on the collar of the shirt, but these residues are unsuitable for muzzle-to-target distance determinations. No other residues were detected.

*Positive Griess but no pattern, no vaporous lead or copper*

The [#] shirt was microscopically examined and chemically processed for gunshot residues. Nitrite residues were found near a hole below the right front pocket of the shirt, but a muzzle-to-target range could not be determined due to the lack of a measurable pattern of deposition. However, during testing of the [#] pistol and the [#] through [#] cartridges in the Laboratory, nitrite residues were only deposited at a muzzle-to-target distance of less than five feet. No other residues were detected.

*Positive Griess but no pattern, no vaporous lead or copper, no firearm/cartridges*

The [#] shirt was microscopically examined and chemically processed for gunshot residues. Nitrite residues were found near a hole below the right front pocket of the shirt, but a muzzle-to-target range could not be determined due to the lack of a measurable pattern of deposition. Please note that residues like those found on the [#] shirt are rarely deposited at a distance of six feet or greater. No other residues were detected.

*Positive results, no Griess pattern but with vaporous lead or copper*

The [#] shirt was microscopically examined and chemically processed for gunshot residues. Nitrite and vaporous lead and/or copper residues were found near a hole below the right front pocket of the shirt. These residues were compared to residues present on test-fired exemplars produced using the submitted firearm and ammunition at a variety of muzzle-to-target distances. The residues present on the [#] shirt could only be duplicated at a distance of twenty-four inches or less. No other residues were detected.

*Positive results, no Griess pattern but with vaporous lead or copper, no firearm/cartridges*

The [#] shirt was microscopically examined and chemically processed for gunshot residues, and vaporous lead and/or copper residue deposits were found. Although a muzzle-to-target distance could not be determined, it should be noted that residues like those found on the [#] shirt are rarely deposited at a distance of twenty-four inches or greater. No other residues were detected.



### *Positive and reproducible Griess pattern*

The area around the hole in the [#] shirt was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of Nitrite and lead/copper residues was found. The pattern of residues present on the [#] shirt was reproduced at a muzzle-to-target range of greater than eight and less than sixteen inches when using the submitted [#] pistol and [#] through [#] cartridges. No other residues were detected.

### *Contact Shot*

The area around the hole in the [#] shirt was microscopically examined and chemically processed for gunshot residues, and Nitrite/lead/copper residues were found these residues and physical effects are consistent with the muzzle of the firearm being in contact or near contact with the [#] shirt.

### *Shot Pattern*

The [#] metal panel bears a pattern of nine distinct impact marks that is typical of damage created by buckshot pellets. The pattern of impact marks present on the [#] metal panel was reproduced at a muzzle-to-target range of greater than twenty-four feet and less than thirty-two feet when using the submitted [#] shotgun and the [#] through [#] shotshells.

---

## ***Gunshot Residue and Shot Pattern Examination (Methods & Limitations)***

### **Methods:**

#### Gunshot Residue

Items submitted for gunshot residue testing are examined visually and microscopically for the presence of suspected bullet holes, physical effects from a firearm discharge such as singeing or tearing of fabric, and embedded particles of gunpowder, lead, and copper. If some or all of these conditions are noted, a series of chemical tests for the presence of nitrites (a component of gunpowder), lead, and copper may be performed. Each of these tests are chemically specific and produce a color reaction when in the presence of the specific chemical. The tests used for nitrite compounds, lead, and copper are the Modified Griess Test, the Sodium Rhodizonate Test, and the Dithiooxamide Test, respectively.

If a suspect firearm and ammunition are submitted, test-fired exemplars are created at a variety of muzzle-to-target distances, are visually examined and chemically processed in the same manner as the evidence, and are compared directly with the submitted evidence. When test results at specific distances are distinctly different than the results on the submitted evidence, this is used as the basis for excluding an appropriate range of distances ("could not be reproduced at a distance of four inches or less").

When no suspect firearm and/or ammunition is submitted, results are more general and are based on common maximum distances for the deposition of gunshot residues ("residues like those found on the [Item #] are rarely deposited at a distance of six feet or greater").

If the only reaction produced in testing is a small ring of lead and/or copper around a suspected bullet hole, this is considered consistent with the passage of a bullet, but no distance determination can be made.

### Shot Pattern Testing

Items submitted for shot pattern testing are initially examined for physical effects consistent with the discharge of shot pellets. If these effects are found and a suspect firearm and shotshells have been submitted, test-fired exemplars are created at a variety of muzzle-to-target distances. These test patterns are compared directly with the pattern present on the submitted evidence. When the test patterns at specific distances are distinctly different than the pattern on the submitted evidence, this is used as the basis for excluding an appropriate range of distances.

### **Limitations:**

#### Gunshot Residue

While firearms are known to produce consistent gunshot residue pattern results under controlled conditions, variables including shooting environment, barrel condition and ammunition design can all influence the results of tests conducted on the submitted evidence and test-fired exemplars. Accordingly, gunshot residue test results are primarily used to exclude particular muzzle-to-target ranges and should only be considered valid for the particular combination of firearm and ammunition type used during testing in the Laboratory. The use of the phrase "consistent with" in this report is meant to indicate physical effects that are commonly found in a given shooting environment. No conclusions can be drawn when residues are absent due to the possibility of intervening objects or environmental and handling conditions.

When a bullet impacts an intervening object, vaporous lead residue deposits can be produced that are occasionally dispersed onto neighboring items.

Distance determinations involving a wound and/or injury are outside the scope of this procedure.

### Shot Pattern Testing

While shotguns are known to produce consistent shot pattern results under controlled conditions, variables including barrel length, barrel choke and shotshell design can all influence the size and distribution of shot patterns present on the submitted evidence and test-fired exemplars. Accordingly, shot pattern test results are primarily used to exclude particular muzzle-

to-target ranges and should only be considered valid for the particular combination of shotgun and type of shotshell used during testing in the Laboratory.

Distance determinations involving a wound and/or injury are outside the scope of this procedure.

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### ***NCIC (Results)***

#### ***Positive Result NCIC***

A query of the National Crime Information Center (NCIC) database returned a NCIC record with the same serial number as the [#]. The firearm was reported stolen in [location], [state] on [date]. More information can be obtained by direct inquiry of NCIC by your office or by contacting the [name] Police Department at [phone number].

#### ***Negative Result NCIC***

A query of the National Crime Information Center (NCIC) database was performed and no records were found at this time.

#### ***NCIC query utilizing serialized items with Negative Results***

Utilizing the serial number [#] from the [Part e.g., slide and barrel] of the Item [#] pistol, a query of the National Crime Information Center (NCIC) database was performed and no records were found at this time.

---

### ***NCIC (Methods and Limitations)***

#### **Methods:**

##### NCIC

The serial number from a firearm is queried against the Department of Justice National Crime Information Center (NCIC) stolen gun record database. This database contains records on stolen, lost, and recovered firearms and firearms used in the commission of crimes.

#### **Limitations:**

##### NCIC

The NCIC stolen gun record will only return a record if the serial number queried matches a database entry and the information is available. Additionally, an NCIC search may return a record containing information that does not match the description of the firearm being queried.

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## ***NIBIN (Results)***

### ***NIBIN – No Association, test fire***

Images of a test-fired specimen from the [Item # firearm type] were entered into the National Integrated Ballistic Information Network (NIBIN) and searched within the zone(s) that includes [state]. No associations were found at this time.

### ***NIBIN - Association***

Images of a test-fired specimen from the [Item # firearm type] were entered into the National Integrated Ballistic Information Network (NIBIN) and searched within the zone(s) that includes [state]. An image of a cartridge case from the [Item # firearm type] is similar to an image that was entered in connection with [originating agency, case number]. This evidence needs to be submitted to the Laboratory for a direct comparison to determine if an association exists with the [Item # firearm type].

### ***NIBIN – No Association, evidence cartridge case***

Images of the [Item # cartridge case] were entered into the National Integrated Ballistic Information Network (NIBIN) and searched within the zone(s) that includes [state]. No associations were found at this time.

### ***NIBIN – Association, evidence cartridge case***

Images of the [Item # cartridge case] were entered into the National Integrated Ballistic Information Network (NIBIN) and searched within the zone(s) that includes [state]. An image of the [Item # cartridge case] is similar to an image that was entered in connection with [originating agency, case number]. This evidence needs to be submitted to the Laboratory for a direct comparison to determine if an association exists with the [Item # cartridge case].

### ***NIBIN – No entry***

A National Integrated Ballistic Information Network (NIBIN) search was not conducted due to revolver-type cartridge case images not being entered into the database.

A National Integrated Ballistic Information Network (NIBIN) search was not conducted due to bullet images not being entered into the database.

A National Integrated Ballistic Information Network (NIBIN) search was not conducted due to [caliber] cartridge cases not normally being entered into the database.

## ***NIBIN (Methods and Limitations)***

### **Methods:**

#### NIBIN

When a NIBIN entry is performed for a submitted firearm, an image of a test-fired cartridge case from that firearm is entered in the NIBIN database. An image of a representative sample of any submitted cartridge cases that have not been associated with a specific firearm are also entered in the NIBIN system. Entries are searched against the appropriate regional database(s), and correlation results are viewed to determine possible associations.

### **Limitations:**

#### NIBIN

Due to a number of variables regarding image capture and data entry, NIBIN searches may not always locate entries that were fired in the same firearm.

Additionally, the algorithm used in NIBIN merely provides a sorting capability for potentially associated toolmarks represented on cartridge cases and provides no statistical confidence in possible matching results.

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## ***Reference Ammunition File (Results)***

### Reference Ammunition File (RAF) Examination

[#] is a .38 caliber/9mm full metal jacketed bullet fired from a barrel rifled with 8 lands and grooves, right twist. The weight and design characteristics of the [#] bullet are consistent with bullets typically loaded in .38 Special caliber cartridges, although other possibilities could not be eliminated. A search of the FBI Laboratory's Reference Ammunition File (RAF) located a sample with a bullet of similar weight and design. This .38 Special caliber ammunition is sold under the trade name Remington UMC and bears product code L38S11.

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## ***Reference Ammunition File (Methods and Limitations)***

### **Methods:**

#### Reference Ammunition File

The weight and design characteristics of submitted bullets are searched against the RAF database to determine possible manufacturer and trade name information.

## **Limitations:**

### Reference Ammunition File

The RAF database contains information obtained from ammunition purchased by the FBI Laboratory and is not a comprehensive representation of all types of ammunition present in the general public. Therefore, the results of RAF searches may not include the actual brand and type of ammunition represented by the questioned item.

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### ***Serial Number Restoration (Results)***

#### *Partial Restoration*

Examination and processing of the obliterated [area or serial number] on the [#] pistol restored the [area or serial number] to read “\*702182.” The asterisk represents a character that was partially restored but could not be conclusively determined. The Bureau of Alcohol, Tobacco and Firearms Serial Number Structure Guide indicates that the first character on firearms like the [#] pistol is typically a “T”.

The examination and processing of the obliterated serial number on the [#] pistol was partially restored to read “77?\*182”. The question mark represents a character that could not be determined. The asterisk represents a number that was partially restored and is most likely a “2” or a “7”.

#### *Complete Restoration*

The examination and processing of the obliterated serial number on the [#] pistol was restored to read “7702182”.

#### *Negative Restoration*

The examination and processing of the obliterated serial number was unsuccessful in restoring the serial number on the [#] pistol.

---

### ***Serial Number Restoration (Methods & Limitations)***

## **Methods:**

### Serial Number

Magnetic, thermal, and chemical methods may be used for the restoration of serial numbers. Conclusions regarding restored characters are made by visual examination of the restored surface under a variety of lighting conditions. Information regarding the alpha-numeric

structure or the general location of serial numbers is obtained when necessary from reference sources or from firearms in the Laboratory's Reference Firearms Collection.

### **Limitations:**

#### Serial Number

Except for the magnetic method, serial number restoration is a destructive examination and it is possible that the obtained results may not be reproduced in any subsequent examinations. Restored serial numbers are sometimes only visible during a portion of the reconstruction process, and are not necessarily visible at the conclusion of the process.

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### ***Shooting Incident Reconstruction / SIR (Results)***

Predicated on a request to the Laboratory Division from [name], a Laboratory Shooting Reconstruction Team (LSRT) was deployed to [location], on [date] to perform a Shooting Incident Reconstruction (SIR). The members of the LSRT were Physical Scientist/Forensic Examiner [name], Visual Information Specialist [name] of the Operational Projects Unit, and Supervisory Special Agent [name] of the Evidence Response Team Unit. These examinations were conducted on [date] at the [address].

Graphical depictions of the results of SIR examinations have been prepared by the Laboratory Division's Operational Projects Unit and are included in this report.

(Optional) For the purpose of this report [insert identifier] represents holes that were generated when a bullet and/or debris punctured an object. The letter [insert identifier] represents impacts that were generated when a bullet and/or debris struck an object.

(Optional) For the purpose of this report the origin of a trajectory will be referred to by compass direction.

(Optional) For the purpose of this report the origin of a trajectory will be referred to by vehicle quadrants.

(Optional) Information regarding the locations of the vehicles at the shooting scene was provided to the Operational Projects Unit by [name] and was not determined through Laboratory examination.

Black and White Dodge Monaco

Five bullet trajectories were reconstructed, with two originating from the front-driver quadrant and three from the front-passenger quadrant. Four additional holes/impacts (three exterior, one interior) could not be associated with a specific trajectory.

## Red Chevrolet

Four bullet trajectories were reconstructed, with all of them originating from the rear-driver quadrant. One additional hole in the windshield could not be associated with a specific trajectory, but has damage consistent with the passage of a bullet from the inside of the vehicle to the outside.

### Results of Examinations near 1060 West Addison Street:

Two bullet trajectories were reconstructed on the exterior of Wrigley Field immediately adjacent to the left field bleachers above Waveland Avenue. These trajectories come from the direction of the seating area on the roof of the apartment building at 1049 Waveland Avenue. Three additional holes consistent with having been caused by a bullet were examined, but were unsuitable for trajectory reconstruction or directional determinations.

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## *Shooting Incident Reconstruction / SIR (Methods & Limitations)*

### **Methods:**

#### Vehicle Examinations

For manual measurements, a Cartesian coordinate system is established by using tape measures to create an x-y dimension grid around the vehicle. A series of 3-D measurements (x,y,z) is recorded that establishes the vehicle's basic dimensions and its location within the grid. Points of interest (suspected bullet holes or impacts) on the exterior or in the interior of the vehicle are identified and labeled. These holes and impacts are examined to determine whether they have physical effects consistent with having been caused by a bullet. They are then examined to determine specific trajectories (holes caused by the same bullet) and to identify the direction the bullet was traveling. The direction of travel can be determined by the nature of the damage around the hole(s), the direction of transport of additional materials from a hole, the lack of an exit hole on one end of the trajectory, or by the recovery of a bullet or bullet fragments at one end of the trajectory. Holes and impacts of importance are labeled and measured from a position within the grid system. Manual measurements may be supplemented with or replaced by data from surveying equipment or laser scanning devices operated by the Operational Projects Unit.

#### Non-vehicle Examinations

Areas of interest for Shooting Incident Reconstruction are measured and/or surveyed and documented to allow for 3-D computer reconstruction of the shooting scene. Suspected bullet holes/impacts are examined to determine whether they have physical effects consistent with having been caused by a bullet and/or debris. They are then examined to determine specific trajectories (holes caused by the same bullet) and to identify the direction the bullet was traveling. The direction of travel can be determined by the nature of the damage around the



hole(s), the direction of transport of additional materials from a hole, the lack of an exit hole on one end of the trajectory, or by the recovery of a bullet or bullet fragments at one end of the trajectory. For manual measurements, coordinate systems are established within the shooting scene to allow for all holes/impacts of importance to be measured within the overall scene. Manual measurements may be supplemented with or replaced by data from surveying equipment or laser scanning devices operated by the Operational Projects Unit.

### Shooting Incident Reconstruction

Trajectories can be determined by either measuring the (x,y,z) coordinates of at least two points along each trajectory, or by measuring the position of one hole/impact and taking horizontal angle (azimuth) and vertical angle (declension) measurements of the trajectory rods. These measurements can either be taken manually or by surveying equipment or laser scanning devices operated by the Operation Projects Unit.

### **Limitations:**

### Shooting Incident Reconstruction

Due to vehicle glass breakage, bullet fragmentation, bullet deflection, intervening objects that are movable, 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.

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### ***Silencer/Suppressor (Results)***

#### *Visual examination of silencer/suppressor with no test firing*

[#] is a silencer (suppressor) with the design and components for diminishing the report of a firearm.

#### *Silencer/Suppressor test with no reported quantitative decibel reduction*

[#] is a silencer (suppressor) with the design and components for diminishing the report of a firearm. The [#] silencer is threaded and will attach to the muzzle of the [#] pistol. When the [#] pistol was test fired in the Laboratory using the [#] silencer, an audible difference with and without the silencer was produced.

#### *Silencer/suppressor test with reported quantitative decibel reduction*

[#] is a silencer (suppressor) with the design and components for diminishing the report of a firearm. The [#] silencer is threaded and will attach to the muzzle of the [#] pistol. Sound attenuation tests were conducted by firing the [#] pistol using the [#] silencer. An average sound

reduction of approximately [number] decibels (+/- [0.00] dB, k=3 for a 99.73% confidence level) was measured using the [#] silencer with the [#] pistol.

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### ***Silencer/Suppressor (Methods & Limitations)***

#### **Methods:**

##### Silencer

Silencers are visually inspected to determine if they can be classified as a silencer by design. Reference material is used to assist in this determination and the use of an X-ray machine allows for an internal inspection of a silencer.

(Quantitative Result) Sound attenuation tests are conducted using a decibel meter. The mean and the uncertainty (three standard deviations) are calculated after measuring a minimum of ten shots with and without the silencer.

#### **Limitations:**

##### Silencer

Physical sound attenuation tests conducted in the FBI Laboratory are intended to determine if there was audible difference with and without the use of a silencer. These tests are not intended to quantify the reduction in sound.

(Quantitative Result) Sound attenuation tests conducted in the FBI Laboratory are not intended to measure an absolute value for sound reduction, but rather the measured difference with and without a silencer installed.

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### ***Tool (Results)***

[#] is a [brand/manufacturer] [type of tool], that uses a [insert type of action].

[#] is a [brand/manufacturer] [type of tool].

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### ***Tool (Methods & Limitations)***

#### **Methods:**

##### Tool

The type, action, and manufacturer of a tool are normally determined by directly observing the function and manufacturer markings on the tool in question. When these are not present, published materials and tool literature in the Firearms/Toolmarks Discipline reference

library may be used to make determinations. When a microscopic comparison is necessary using a questioned tool, test samples are created using a test material that is softer or similar in quality to the item being compared.

## **Limitations:**

### Tool

The results of tool examinations describe type and/or operating condition of the tool as it was received in the Firearms/Toolmarks Discipline.

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## **Toolmarks (Results)**

### *Identification*

Toolmarks present on the [#] hasp were identified as having been produced by the [#] bolt cutters.

[#] through [#] are drill bits bearing a symbol associated with the trade name Vermont American. The [#] drill bit was identified as having created the toolmarks present on the [#] padlock.

### *Inconclusive (no conclusion)*

[#] is a key-operated padlock displaying the trade name "Schlage." The [#] padlock has toolmarks present in the keyway with class characteristics similar to those produced by ¼ inch drill bits.

Due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the toolmarks present on the [#] padlock were created by the [#] drill bit.

### *Elimination*

The [#] through [#] drill bits have a cutting diameter consistent with ¼ inch drill bits or larger and therefore were excluded as having created the toolmarks present on the [#] lock.

### *Bunter Marks*

Due to many unknown variables in ammunition manufacturing and distribution, no conclusive determination could be made for whether the [Item #] cartridge cases originated from the same box of ammunition as the [Item #] cartridges.

This result limits the number of ammunition boxes from which [Item #] could have originated. However, because in ammunition manufacturing and distribution there exist numerous unknowns, to what degree this result limits the number of possible boxes of origin cannot be conclusively determined.

---

## ***Toolmarks (Methods & Limitations)***

### **Methods:**

#### Toolmark Examination

Toolmarks, whether they are present on two evidence items or on one evidence item and one test-mark created in the Laboratory, undergo two stages of comparison. First, the toolmarks are examined to determine and compare their class characteristics. The class characteristics of toolmarks include type of cutting action and the size and orientation of gripping or cutting surfaces. If the class characteristics of the toolmarks are not clearly different, the examination moves to a second stage using comparative microscopy.

A microscopic comparison examination consists of a search of the impressed and striated marks present in two toolmarks to determine if patterns of similarity exist. At the completion of these comparisons, one of the following three opinions is issued:

#### 1) Source Exclusion

Source exclusion is an Examiner's conclusion that two toolmarks did not originate from the same source. The basis for a source exclusion conclusion is an Examiner's decision that two toolmarks can be differentiated by their class characteristics. A source exclusion based on general differences does not require a verification. However, a source exclusion based on a minor difference in a measured class characteristic requires a verification.

#### 2) Source Identification

Source Identification is an Examiner's conclusion that two toolmarks originated from the same source. Conditions for a source identification include the degree of similarity being greater than the Examiner has ever observed in previous evaluations of toolmarks known to have been created by different tools; and the degree of similarity being equivalent to that normally observed in toolmarks known to have been created by the same tool.

The basis for a source identification conclusion is an Examiner's decision that the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks came from the same source and extremely weak support for the proposition that the two toolmarks came from different sources. Before being reported, a source identification requires a verification to be completed.

### 3) Inconclusive (No Conclusion)

Inconclusive is an Examiner's conclusion that all observed class characteristics are in agreement but there is insufficient quality and quantity of corresponding individual characteristics such that the Examiner is unable to identify or exclude the two toolmarks as having originated from the same source. The basis for an inconclusive conclusion is an Examiner's decision that there is an insufficient quality and/or quantity of individual characteristics to identify or exclude. Reasons for an inconclusive conclusion include the presence of microscopic similarity that is insufficient to form the conclusion of source identification; or a lack of any observed microscopic similarity.

Bunter Mark Examinations (Use Toolmark Examination Methods)

#### **Limitations:**

#### Toolmark Examination

Firearms/Toolmark Identification is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to changes in tool working surfaces from wear, corrosion and abuse or the employment of unusual tool/work piece orientations, toolmarks created by the same tool are not always identifiable as such.

#### Bunter Mark Examination

Please note that no known method exists for accurately assessing the probability that these cartridges originated from the same box of ammunition.

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### ***Administrative Section of Laboratory Report***

#### *Amended Report*

This report amends an FBI Laboratory Report [Laboratory #] dated [date]. The results of the [examination type] examination[s] are included in this report.

#### *Introduction Sentences*

The results of the [type] examinations are included in this report.

The results of the [type] examination(s) and national database searches are included in this report.

#### *Listing Introduction for Legacy Cases*

The following [#] was/were received in the [Unit]:

### *Listing Combined Report*

The items listed below were submitted under cover of communication dated [date] and in FBI Case ID [ ] and assigned Laboratory number [#]:

### *Supplemental Report*

This report supplements an FBI Laboratory Report [Laboratory #] dated [date]. The results of the [examination type] examination[s] are included in this report.

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### ***Remarks Section of Laboratory Report***

#### Defense Systems Unit Assisted Examinations

The requested [examination] of the [#] [pistol] cannot be performed at the FBI Laboratory due to a lack of the appropriate expertise and equipment. Arrangements have been made to have this test performed by the Defensive Systems Unit of the FBI Training Division. Any questions about this test or requests for testimony regarding the results of this test should be directed to Defensive Systems Unit personnel, [phone number].

To facilitate the requested [examination], the [Item #] was test fired at the Ballistic Research Facility of Defensive Systems Unit, Training Division. The [Item #] was fired using the attached [list accessories] provided by the Ballistic Research Facility. The shooting was performed by [name] of the Ballistic Research Facility, who can be contacted for information about the results of these tests or for any further shooting accuracy requests.

#### Discontinued Examination/Request

Per communication with SA [name] on [date], the [type] examinations were discontinued and the Item [#] will not be examined at the FBI Laboratory.

Per email communication between [name] and SA [name] on [date], the request for [type] examination has been discontinued.

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**Appendix B: *FTD Technical & Administrative Review Form***

Redacted - Form on File

**Appendix B: *FTD Technical & Administrative Review Form* continued**

Redacted - Form on File