

# OSAC 2021-N-0012 Requirements and Recommendations for a Firearm and Toolmark Examiner Training Program

Firearm and Toolmark Subcommittee
Physics/Pattern Interpretation Scientific Area Committee
Organization of Scientific Area Committees (OSAC) for Forensic Science





# **OSAC Proposed Standard**

# Requirements and Recommendations for a Firearm and Toolmark Examiner Training Program

Prepared by Firearms and Toolmark Subcommittee

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Keywords: Firearm and Toolmark Examination, Firearm and Toolmark Examiner, Training



# **Foreword**

The following standard identifies the training requirements to become a qualified firearm and toolmark examiner.

This standard was proposed by the Firearms and Toolmarks Subcommittee of the Organization of Scientific Area Committees (OSAC).

This document is intended to provide requirements and recommendations for firearm and toolmark examiner training programs.



# **Acknowledgements**

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# **Table of Contents**

1	Introduction	6
2	Scope	6
3	Normative References	
	6	
4	Terms and Definitions	6
5	Requirements	8
6	Optional Topics	21
Bibliography		24



#### 1 Introduction

- 1.1 This document has been developed with the objective of improving the quality and consistency of firearm and toolmark examination training practices.
- 1.2 This document contains an outline of training topics which serve as minimum requirements for firearm and toolmark examiner training programs. The requirements listed in this standard include the essential skills and knowledge needed to perform successfully in the discipline.
- 1.3 The additional recommended topics are considered by the subcommittee to be highly beneficial and worthy of inclusion should the necessary resources be available. These recommended topics will be explicitly identified as such.
- 1.4 The Forensic Science Services Provider (FSSP) shall determine the required and recommended reading for the topics that are provided in the document. The recommended source for the references is the Association of Firearm and Tool Mark Examiners (AFTE) Training Manual. The AFTE Training Manual is periodically updated and will provide the best source material for the various training topics.

#### 2 Scope

This document provides the minimum requirements and recommendations for a firearm and toolmark examiner training program. Requirements and recommendations include training topics, documentation, casework exercises, and methods for testing competency. The FSSP shall provide training objectives, training manuals, and training assignments. This standard does not preclude agencies from incorporating additional mission-specific requirements.

#### 3 Normative References

none

#### 4 Terms and Definitions

#### **4.1 Competency Test**

A test that demonstrates that a forensic science practitioner has acquired and demonstrated specialized knowledge, skills, and abilities (KSAs) in the standard practices necessary to conduct examinations in a discipline or category of testing prior to performing independent casework.



#### 4.2 Firearm and Toolmark Examination

A discipline of forensic science charged with conducting comparison examinations of tools and toolmarks and reporting the conclusion. When the tool is a firearm, the discipline also seeks to answer relevant questions about the firearms or ammunition components involved in an incident.

#### 4.3 Firearm Examination

A specialized type of firearm and toolmark examination that includes, but is not limited to, the classification and comparison of microscopic toolmarks created by firearms on ammunition components. It may also include the examination of firearms, serial number restoration, and muzzle-to-target distance determinations.

#### 4.4 Firearm and Toolmark Examiner

A person who has completed training in the discipline of firearm and (non-firearm) toolmark examinations and is currently authorized to perform work in these categories of testing at a particular forensic science service provider.

#### 4.5 Qualified Firearm Examiner

A person who has completed training in the discipline of firearm examinations and is currently authorized to perform work in this category of testing at a particular forensic science service provider.

#### 4.6 Forensic Science Services Provider (FSSP)

A forensic science agency or forensic science practitioner providing forensic science services.

#### 4.7 Known Same Source (KSS)

Toolmarks or specimens known to have been made by the same tool.

#### 4.8 Known Different Source (KDS)

Toolmarks or specimens known to have been made by different tools or different working surfaces of the same tool.

#### 4.9 Qualified Toolmark Examiner

A person who has completed training in the discipline of (non-firearm) toolmark examinations and is currently authorized to perform work in this category of testing at a particular forensic science service provider.

#### 4.10 Toolmark Examination

A specialized type of firearm and toolmark examination that includes the classification and comparison of microscopic toolmarks created by non-firearm tools. It may also include the examination of non-firearm tools.

#### 4.11 Trainee

A person who is undergoing, but has not yet completed, training in the disciplines of firearm and/or toolmark examination.

Refer to the Minimum Education Requirements for Firearm and Toolmark Examiner Trainees document.



#### 4.12 Trainer

Instructors who encompass various topics inside or outside of the discipline and should be selected based on their relevant experience in that subject area (i.e - firearm examiner, statisticians, armorers, and other subject matter experts).

#### 4.13 Training Coordinator

A person who is responsible for delivering or monitoring training, or verifying the successful completion of training elements. This person may be a currently qualified or formerly qualified examiner with appropriate expertise who has been authorized by the forensic science service provider to perform training-related duties.

Duties may include, but are not limited to, developing curriculum, delivering training materials, overseeing performance of the trainee, and giving final approval of the training program. The training coordinator may also be the trainer or be a separate individual(s).

#### 5 Requirements

#### 5.1 Administrative

#### **5.1.1 Documentation**

A document describing all training requirements and trainee expectations shall be issued to the trainee at the beginning of the training period. This document shall contain information regarding the training topics that will be covered, the expected timeline of their completion, and the various types of tests that the trainee must successfully complete. The completion of all required elements of training shall be documented and retained as recommended by the FSSP.

#### **5.1.2 Required Elements**

Trainees being trained in firearms, but not toolmarks, shall complete sections 5.1, 5.2.1 - 5.2.11, 5.2.14 - 5.2.19.

Trainees being trained in toolmarks, but not firearms, shall complete sections 5.1, 5.2.1, 5.2.3, 5.2.4, 5.2.8, 5.2.12 - 5.2.19.

Trainees being trained in both firearms and toolmarks shall complete sections 5.1, 5.2.1 - 5.2.19. The requirements for total KSS and KDS comparisons shall not be reduced based upon categories of training.

Trainees being trained in distance determinations (6.1, 6.2), serial number restorations (6.3), and fracture examinations (6.4) or shall also complete the corresponding requirements for those categories.

#### **5.1.3 Training Topics Not Present**

The absence of a particular knowledge area or skill in the training topics listed below is not necessarily intended as an objection to its inclusion in a training plan. FSSPs should add any training topics that are relevant and beneficial.



#### **5.1.4 Training Methods**

For most topics, this document does not endorse particular learning methods. It is the responsibility of each FSSP to determine the most effective approach for training each individual. A successful training program includes readings, lectures, demonstrations, discussions, examinations under the guidance of a qualified examiner, and practical exercises incorporating firearms/tools, toolmarks, and comparison techniques. The order of the topics listed in this document is not intended to be the recommended order of training. Many of the topics are interrelated and do not necessarily need to be taught separately.

#### **5.1.5 Testing**

Assessment tools for the various training topics may include, but are not limited to: written tests, oral examinations, mock casework, practical exercises/examinations (comparisons), presentations, and mock trials.

Answers to the written tests, questions in oral examinations, intercomparison tests, mock casework, and practical examinations shall be known by the FSSP prior to the tests being administered. Standards for successful completion of these tests shall be clearly defined by the FSSP and provided to the trainee prior to the test being administered.

Presentations and mock trials shall be evaluated according to the FSSP standards and the evaluations shared with the trainee upon conclusion.

Competency testing shall be performed with realistic casework elements including case notes, comparison examinations, and written reports. A competency test shall be successfully completed in each sub-discipline prior to assuming casework in that specific sub-discipline.

Successful completion of all assigned topics in the training program shall be required. It is the responsibility of each FSSP to provide the assessment of the trainee and also the pass/fail determination for the test methods they so choose.

If the trainee does not obtain a satisfactory score on any test, the FSSP shall provide training directed toward the observed deficiencies, followed by retesting.

#### **5.1.6 Mentored Casework**

Prior to performing independent casework, the new examiner shall participate in a period of mentored casework. Mentorship shall include actual or simulated casework and should focus on the depth and breadth of cases routinely encountered by the laboratory as determined by the FSSP. The new examiner's trainer, or other qualified examiner may observe and assist the new examiner as needed and shall perform a documented review of all casework including a microscopic review of all comparison conclusions. The FSSP shall determine the duration of mentored casework and the criteria for successful completion.

#### **5.1.7 Evaluation of Training Program**



The FSSP shall establish a formal mechanism for trainees to provide feedback on the effectiveness of the training program. This information shall be used by the FSSP to evaluate, update and improve the training program on a periodic basis.

#### 5.1.8 Continuing Education

After completion of training, examiners shall engage in a minimum of forty hours per year of discipline-specific continuing education (e.g. attending conferences, participating in research, visiting manufacturing facilities, reviewing literature, attending workshops, publishing peer reviewed research projects) FSSPs shall dedicate the necessary resources to ensure compliance. The FSSP shall determine what qualifies as discipline-specific continuing education and how to document compliance.

#### **5.2 Training Topics**

#### 5.2.1 General Manufacturing and Machining

Understanding general manufacturing and machining processes, especially as they pertain to the production of firearms and tools, is of fundamental importance. This understanding will allow the trainee to assess the significance of the toolmarks encountered during initial examinations, during comparison examinations, and when rendering source conclusions.

The following subject areas shall be included in a training program:

```
Gross Forming Techniques
       Forging
              Hand
              Drop
              Press
              Hammer
       Casting
              Sand
              Investment/Lost Wax
       Fine Forming Techniques
              Turning
              Milling
       Drilling
       Boring
       Reaming
       Broaching
       Sawing
       Electrical discharge machining (EDM)
       Electrochemical machining (ECM)
       Metal injection molding
       Finishing Techniques
              Grinding/Sanding
              Etching
              Media blasting
              Tumbling media
       Finishes
              Bluing
```



```
Browning
Oxide (Parkerizing, etc.)
Plating
Coatings/Paint
Key Machining Concepts for Toolmark Identification
Chip formation
Plastic deformation
Tool wear
Built Up edge
```

The following subject areas should be included in a training program:

Tours of machine shops or manufacturers, supplemental to any other firearm, ammunition or tool manufacturer tours, to ensure sufficient exposure to manufacturing/machining methods listed above

General concepts and practices of Additive Manufacturing (e.g. 3-D printing)

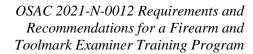
#### 5.2.2 Firearms Manufacturing

In addition to general manufacturing techniques, an understanding of the specific manufacturing and machining processes that pertain to the production of firearms and firearm parts will assist the trainee in understanding both the design concepts and the function of firearms. Additionally, an understanding of the common machining methods used for barrels, breech faces, and other surfaces that contact ammunition components will allow the trainee to understand the sources and nature of toolmarks present on fired and unfired ammunition components.

The following subject areas shall be included in a training program:

```
Barrels
       Blanks
              Deep hole drilling
              Reaming
              Extrusion (Hi-Point)
       Rifling
              Button
              ECM
              EDM
              Gang Broach
              Hammer Forged
              Single Point/Hook/Scrape Rifling
       Finishing
              Straightening
              Chambering
              Throating
              Crowning
              Contouring
              Honing/Lapping/Polishing
```

Common machining techniques that are used to produce the following parts:





Breech faces

Chambers

Hammers/Firing pins/Strikers

Firing pin aperture

**Extractors** 

**Eiectors** 

Feed ramps / forcing cones

Magazines

Ejection port

Common alterations and associated toolmarks

Sawed off barrel

Muzzle attachments

Front sight alteration

The following subject areas should be included in a training program:

**Tours** 

Firearm Manufacturers **Barrel Manufacturers** 

#### 5.2.3 Legal History of Firearm and Toolmark Examinations

An understanding of the legal context of firearm and toolmark examinations requires knowledge of the evolution of firearm and toolmark practice and testimony in courts of law, as well as applicable laws regarding the use of certain firearms and accessories. Recommended articles and references can be located in the AFTE Training Manual.

#### 5.2.4 Theory and Validity of Firearm and Toolmark Examinations

The successful application of examination techniques and any subsequent communication regarding the results of examinations require a complete understanding of the scientific foundation of firearm and toolmark examinations. Theory, nomenclature, research, and statistical methods are all crucial to successful completion of training. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

AFTE Theory of Identification

Class characteristics

Subclass characteristics

Individual characteristics

Types of Toolmarks

**Impressed Toolmarks** 

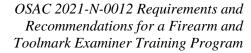
Striated Toolmarks

Concept of Known Same Source Toolmark (KSST) and Known Different Source Toolmark (KDST) comparisons

Research

**Validity Testing** 

Early studies





Black, White, and Gray box studies Error Rates

Expressions of Confidence

**Criticisms of Current Methods** 

Basic concepts of Quantitative Consecutive Matching Stria (QCMS)

The following subject areas should be included in a training program:

Statistics, including likelihood ratios Toolmark topography instruments and correlation algorithms

#### 5.2.5 Ammunition

Successful examinations of both fired and unfired ammunition components require knowledge of industry terminology, the evolution of ammunition designs, and manufacturing methods associated with ammunition. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program: Ammunition manufacturing

Blanking

Cupping

Drawing

Swaging

Punching/Headstamps

Case/primer materials

Assembly

Crimping

Reloading

Terminology associated with both historic and modern ammunition

Caliber naming conventions

Cartridge case design

Terminology associated with shotshell ammunition

Components

Gauge

Pellet sizes

Slug designs

Caliber determination of bullets

Instrumentation used

Caliber determination of cartridges/cartridge cases

Headstamps

Case dimensions

Caliber families

Mismatching and Interchangeability of ammunition and firearm caliber

Wildcat cartridges



Evolution of ammunition

Propellants, black powder to modern smokeless powder

Rimmed and centerfire

Types of primers

Bullet shapes, designs

Current common brands and types of ammunition

The following subject areas should be included in a training program:

Tours of ammunition factories

Manufacturing toolmark examinations and comparisons (e.g. bunter marks, mold marks), including interpretation limitations

#### 5.2.6 Firearm Design and Terminology

The successful examination of firearms requires comprehensive knowledge of terminology, evolution of design concepts, firearm parts, and the cycle of operation of firearms. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

**Evolution of Firearms** 

**Ignition Systems** 

Safeties

Firearms Terminology

Pistol

Revolver

Rifle

Shotgun

Parts and nomenclature associated with types of firearms

Assembly and disassembly of firearms, supplemented with owner's manuals, books and videos

Cycle of fire

Action types

**Break Action** 

Bolt action Lever action

Pump action

Revolver

Semi-Automatic/Automatic Actions

Blowback

Recoil

Gas operated

Modes of Fire

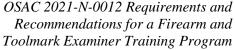
Single Action

**Double Action** 

Burst/Fully Automatic

Post manufacture alterations and accessories

Full Auto conversions





Incomplete firearms ("80%" firearms, receiver blanks, home-built)

Drop-in barrels

Bump stocks

Trigger modifications

#### **5.2.7 Examination of Firearms**

In addition to design and terminology, examiners must know the common examination techniques that are required for a full analysis and documentation of a firearm's design and functional characteristics. This must be coupled with safe handling and firing practices and knowledge of the source of important toolmarks within each firearm and any associated accessories. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training plan:

Safe handling and firing of firearms

**Function Examinations** 

Firearm safety/recall list

Selection and test firing of appropriate ammunition

Safety tests

Trigger Pull

Barrel and overall length measurements

Impact test

Casting of firearm parts/alternate tools for creating test marks

#### Firearms Laws

NFA (National Firearms Act) GCA (Gun Control Act)

Relevant State/Local Specific Laws

Firearm components that potentially create toolmarks:

Lands and grooves

Breech / bolt face

Firing pin

**Ejector** 

Ejection port

Extractor

Chamber

Feed ramp

Barrel extension

Magazine

Evaluation of potential for subclass characteristics in each of the categories above.

#### 5.2.8 Microscope Use and Familiarization

Microscopes are the primary tools with which firearm and toolmark examiners conduct examinations of fired ammunition components and toolmarked surfaces. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.



The following subject areas shall be included in a training program:

Design and use of a stereoscope
Design and use of a comparison microscope
Light sources and lighting techniques
Photographic techniques
Comparison techniques

The following subject areas should be included in a training program:

Focus variation microscopy Interferometric microscopy Confocal microscopy Photometric microscopy Virtual comparison microscopy

#### 5.2.9 Bullet Examinations

Bullets, when fired through the barrel of a firearm, acquire surface features from the internal surfaces of the barrel. Accurate examinations of these characteristics are essential. Additional knowledge of rifling characteristics and bullet design may also allow the examiner to eliminate certain classes of firearms from any association with the fired bullet. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

Caliber determination

Design features

Direction of twist

Land and groove impression measurement techniques

General Rifling Characteristics (GRC) database

Recognition of potential subclass characteristics in both barrels of firearms and areas on bullets

Evaluation and comparison of test fired bullets and selection of appropriate ammunition

Evaluation and comparison of questioned bullets

Range of conclusions for bullet comparisons

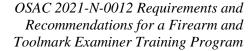
Documentation of examination results and comparisons

#### 5.2.10 Cartridge/Cartridge Case/Shotshell Examinations

Cartridge cases and shotshells, when fired in a firearm, acquire characteristics from the working surfaces of that firearm. Accurate examinations of these characteristics are essential. Additional knowledge of cartridge/shotshell design allows the examiner to eliminate certain classes of firearms from any association with the ammunition component. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

Recognition of marks on cartridges/cartridge cases/shotshells





Firing pin impression Breech face marks

Aperture impression/shear

Extractor

**Ejector** 

Ejection port marks

Firing pin drag

Chamber marks

Barrel extension marks

Magazine lip marks

Loaded chamber indicator impressions

Shell stop marks

**Anvil Marks** 

Caliber/gauge determination

Design features

Recognition of potential subclass marks on fired cartridge cases/shotshells

Recognition of manufacturing marks

Evaluation and comparison of test fired cartridge cases/shotshells and selection of appropriate ammunition

Evaluation and comparison of cartridge cases/shotshells

Range of conclusions for cartridge/cartridge case/shotshell comparisons

Documentation of examination results and comparisons

#### **5.2.11 Shotshell Component Examinations**

Shotshell components, when fired through the barrel of a shotgun, may acquire surface features from the internal surfaces of the barrel. Additionally, shotshell components may be examined for gauge determination, possible manufacture, shot size, and/or composition. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

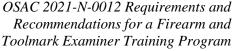
Gauge determination
Design and manufacture features
Shot size and composition determination
Slug examination
Wad examination

#### 5.2.12 Tool Manufacturing

Building upon manufacturing and machining knowledge, examiners must be familiar with the variety of methods used to create tools. Of specific importance are the techniques applied to tool working surfaces that may come into contact with evidentiary items. This understanding will assist the trainee in assigning significance to the toolmarks encountered during examinations, and will therefore assist with source conclusions. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

Definition of tool, both common and in the context of toolmark examination





Common types of hand tools, how they are used, and their associated parts.

Common manufacturing methods for hand tools

Screwdrivers

**Bolt Cutters** 

Knives

Chisels

Hammers

**Diagonal Pliers** 

Tongue and Groove Pliers

Shears/snips

The following subject areas should be included in a training program:

Tours of tool manufacturers

#### **5.2.13 Toolmark Examinations**

Knowledge of common tool actions and the wide variety of ways that tools can leave toolmarks is essential to the toolmark examiner. Additionally, examiners must be able to classify toolmarks, evaluate areas of possible subclass influence, and compare toolmarks for the purpose of rendering source conclusions. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

Categories of tool actions:

Shearing action

Pinching action

Scraping action

Slicing action

Gripping action

Prying action

Crimping action

Class characteristic evaluation of toolmarks

Creating test marks in different substrates

Casting methods

Recognition of potential subclass characteristics

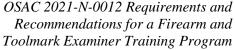
Evaluation and comparison of toolmarks

Range of conclusions for toolmark comparisons

Documentation of examination results and comparisons

#### **5.2.14 Casework Documentation**

Casework documentation is generated during the analysis of evidence. The purpose of this documentation is to support the conclusions that are reached. Casework shall be documented in such a way that, in the absence of the primary examiner, another qualified examiner could understand, evaluate, and interpret the work performed and the conclusions reached.





The following subject areas shall be included in a training program:

Types of information that must be recorded Types of information that may be recorded Acceptable forms of documentation Quality system requirements for casework documentation

#### 5.2.15 Casework Exercises

Casework exercises should be sufficient to impart to the trainee a full knowledge of a FSSP's casework process.

The following subject areas shall be included in a training program:

Evidence assignment and chain of custody Proper evidence handling procedures Simulated casework Supervised casework Verification and review

#### 5.2.16 Known Same Source/Known Different Source Exercises

Comparisons of KSSTs and KDSTs are a core component of training for firearm and toolmark examiners. KSST and KDST comparisons develop a trainee's ability to recognize levels of correspondence that are consistent with toolmarks known to have been created by the same tool or same surface of the tool, and levels of correspondence that are consistent with toolmarks known to have been created by different tools or different areas of the same tool.

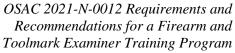
For the purposes of this document, a single KSST or KDST comparison exercise consists of a complete comparison examination of two items (i.e. bullets, cartridge cases, etc.).

Samples for use in KSST and KDST exercises are typically produced by trainers or trainees who are direct witnesses to their creation, thereby establishing ground truth.

The source of the toolmarks used to meet this requirement should reflect the categories of testing included in training. For example, if the training program is exclusively firearms examinations, most of these exercises should be conducted with bullets, cartridge cases, and shotshells. However, some exposure to sources of toolmarks outside of the trainee's expected categories of testing may also be beneficial. This requirement may be met through the cumulative completion of various training exercises and supplemented as necessary to meet the minimum number. Regardless, training records shall clearly document the quantity of each type of comparison completed for this requirement.

The following studies shall be conducted and documented, regardless of which categories of testing the trainee will be qualified in. The numbers listed are a combined total, it is not necessary to repeat the exercise for non-firearm toolmarks:

200 Known Same Source Toolmark comparisons, including both impressed and striated toolmarks.





200 Known Different Source Toolmark comparisons, including both impressed and striated toolmarks.<sup>1</sup>

Some of the KDST comparisons shall include samples created by consecutively manufactured tools/firearms.

In order to familiarize trainees with QCMS, the FSSP should consider documenting runs of consecutive matching striae for a portion or all of the above exercises.

#### 5.2.17 Communication, Legal Issues, Court

These topics address the intersection of science and the law, and the necessity of effective communication with various stakeholders in the legal system. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual as well as the AFTE Admissibility Resource Kit located on the AFTE website.

The following topics shall be addressed in examiner training:

Courtroom procedures (local, state, federal)
Contemporary admissibility issues
Role of expert testimony
Public speaking
Communicating within the judicial system
Courtroom etiquette
Discovery requirements
Moot court exercises

#### 5.2.18 Ethics, Bias, Human Factors

Knowledge of common forms of bias is an essential part of any attempt to limit the influence of bias within a forensic science discipline. Likewise, a sound institutional knowledge of ethical issues related to forensic science helps build and maintain the integrity of the persons and institutions performing forensic analyses.

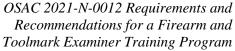
The following topics shall be addressed in examiner training:

Contextual information Confirmation, cognitive, explicit, and implicit bias Task relevant information

Information is task-relevant if it is necessary for drawing conclusions: about the propositions in question, from the physical evidence that has been designated for examination,

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<sup>&</sup>lt;sup>1</sup> The number 200 was chosen after a survey of five training manuals currently in use by federal and state/local FSSPs. Please note that the provision of a minimum number is intended to prevent insufficient exposure to KSST/KDSTs, and should not be construed as the "perfect" number of studies to be qualified as a toolmark examiner. The five agencies surveyed were the Bureau of Alcohol, Tobacco, Firearms and Explosives, the Federal Bureau of Investigation, the Illinois State Police, the Indiana State Police, and the Los Angeles Police Department.





through the correct application of an accepted analytic method by a qualified analyst.

Neutrality in forensic science Codes of ethics

#### **5.2.19 Forensic Science Service Provider Operations**

In the absence of other institutional or FSSP-wide training requirements for examiners in all disciplines, the following topics shall be included in examiner training:

Authority structure within the FSSP
Quality system
Accreditation matters
Laboratory safety
Safe handling of evidence / universal precautions
Evidence tracking / laboratory information managements systems (LIMS)

#### **6 Optional Topics**

#### 6.1 Distance Determination via Gunshot Residues

In this section, "distance determination" refers to any determinations that can be made regarding the distance from the muzzle of the firearm to an impact surface based upon the examination of gunshot residues present on impact surface(s). Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

Factors regarding the deposition of residue from the use of a firearm

Ammunition type

Firearm type

Revolvers

Pistols

Rifles

Shotguns

Substrate type

Visual inspection

Hole

Ripping/tearing

Singeing/burning/melting

Presence of powder/particulate or vaporous lead

Chemistry and examination techniques for:

**Nitrites** 

Lead

Copper

Application of techniques for nitrites and lead

Test known distance patterns using appropriate techniques

Test unknown distance patterns using appropriate techniques



Comparison of known and unknown patterns, documentation, interpretation and conclusions, including limitations.

Measurement of Uncertainty

#### 6.2 Distance Determination via Shot Patterns

In this section, "distance determination" refers to any determinations that can be made regarding the distance from the muzzle of the firearm to the impact surface based upon the examination of impact patterns present on impact surface(s). Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

Factors regarding shot patterns from the use of a firearm

Ammunition types

Pellet sizes

Shotshell wadding

**Buffer Material** 

Firearm type

Shotgun choke systems

Measuring shot patterns

Correcting for non-orthogonal patterns

Creating and measuring shot patterns at known distances

Comparison of known and unknown patterns, interpretation and conclusions, including limitations

Measurement of Uncertainty

#### 6.3 Serial Number / Obliterated Character Restoration

The recovery of an obliterated serial number on a firearm or characters present on other evidence types can be a valuable piece of intelligence for investigators. This section is designed to impart knowledge about common destruction processes and both knowledge of and experience using the many recovery methods available to examiners. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following subject areas shall be included in a training program:

Serial number application processes

Types of destruction methods

Grinding

Over stamping

Peening

Gouging

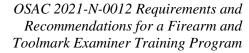
Heating

110001118

Welding

Scratching Drilling

Terminology regarding serial number recovery processes





Chemical methods
Polishing methods
Sanding methods
Electro-chemical methods
Magnetic Particle inspection
Barcode decryption
Lighting techniques

Use of different recovery processes

Application of recovery methods to ferrous firearms Application of recovery methods to non-ferrous firearms Application of recovery methods by barcode decryption

Documentation of recovery of serial numbers
Photography
Casting prior to recovery if toolmarks are present
Note taking
Reporting Conclusions
Alternative sources of serial number recovery

Secondary serial numbers Secondary/hidden manufacturer codes

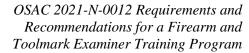
#### **6.4 Fracture Examinations**

The analysis of fractured objects and surfaces to determine if they were once part of the same object is performed by firearm and toolmark examiners in some FSSPs. The list of training topics below is designed only to be used in combination with either firearm examiner or toolmark examiner training, and does not provide sufficient training and skill if it is completed without firearm or toolmark training. Additionally, since this document pertains to firearm and toolmark training, the listed training requirements are for that purpose only; this document imposes no requirements or recommendations on persons training in fracture examinations within other disciplines. Recommended articles and references for the below subject areas can be located in the AFTE Training Manual.

The following topics shall be addressed in examiner training:

Failure modes of brittle materials
Plastic deformation
Elastic deformation
Class characteristics
Physical fit
Reverse lighting techniques, microscopic comparison
Casting or coatings for translucent/transparent materials
Range of conclusions

KSST and KDST studies shall be performed utilizing a variety of substrate materials and object geometries that are typical of casework.





## **Bibliography**

Association of Firearm & Tool Mark Examiners (AFTE) Training Manual, March 3rd, 2001 - current, <a href="https://AFTE.org">https://AFTE.org</a>

Standard Practice for Forensic Science Practitioner Training, Continuing Education, and Professional Development, E2917, ASTM International, 2019

ASTM Standard E2917-19a, "Standard Practice for Forensic Science Practitioner Training Continuing Education, and Professional Development Programs," ASTM International, West Conshoshocken, PA, 2019, DOI: 10.1520/E2917-19a, <a href="www.astm.org">www.astm.org</a>.