

1 INTRODUCTION AND ORIENTATION

1.1 Purpose and Scope

- 1.1.1 The purpose of this manual is to provide uniform training of Forensic Scientist NIBINs employed by the Commonwealth of Virginia Department of Forensic Science. This manual is intended to be used in a formal training program that will establish a certain minimum standard of professional competency throughout the statewide branches of the Department of Forensic Science.
- 1.1.2 Certain inherent qualities of firearm evidence prohibit the establishment of a rigid set of standard procedures to cover each and every case. Therefore, enough latitude has been given to allow for independent thought and individual freedom in selecting alternative courses of action. Upon completion of this course the trainee will be thoroughly familiar with the options available to handle most pieces of evidence that will be encountered.
- 1.1.3 The sequence in which the tasks are presented in the outline should not necessarily be considered as a mandatory order of instruction. Exposure to legal aspects and testimony will be continuous throughout the training.

1.2 Coordination of the Program

- 1.2.1 Unless otherwise designated by the Physical Evidence Program Manager (PM), the Training Coordinator (TC) will be the Section Supervisor in each lab.
- 1.2.2 The TC will be responsible for the overall training, but may delegate certain duties and blocks of instruction to other qualified examiners.

1.3 Training Period

- 1.3.1 The length of the training period is approximately 6 months. Certain individuals may require less time than others, depending on experience, education, or learning ability.
- 1.3.2 Under the direct supervision of a qualified examiner, the trainee will assist with casework throughout the training period. This will familiarize the trainee with different forms of case evidence, packaging, applied analytical techniques and note-taking.

1.4 Location Of Training

Whenever practical, the bulk of an individual's training will occur in the lab to which they will be assigned.

1.5 Training Goals

The training shall culminate so that the trainee has the following:

- The ability to properly handle forensic evidence.
- The knowledge of the principles and practices of firearm actions
- The knowledge of the marks imparted by each tool working surface of a firearm.
- The knowledge of the theory and applications of stereo microscope techniques used in the analysis of evidence.
- The ability to enter cartridge cases/shotshell cases into NIBIN and accurately review the correlation results.
- The ability to perform accurate forensic analysis independently and proficiently.
- The ability to complete a Certificate of Analysis following section and Department policies.
- The ability to skillfully present and defend analytical findings in courts.

1.6 Instructions to the Trainee

- 1.6.1 The trainee is expected to keep a notebook of information compiled for each module of this manual. This notebook will be evaluated by the TC throughout the course of the training and by the PM and Quality Assurance Coordinator upon completion of the training.
- 1.6.2 The written answers to the study questions listed in each section will be used as reference material once the trainee is qualified as a Forensic Scientist NIBIN. Therefore, references are to be listed for each answer whenever possible. The completed study questions are to be turned into the TC as scheduled. A list of useful references has been provided in the Reference section of each module.
- 1.6.3 References listed as “Required Reading” are required for an adequate understanding of the subject matter. Required readings are designated by section numbers listed after the assignment.
- 1.6.4 The trainee’s progress will be evaluated with written examinations, practical exercises, practical examinations, oral sessions, mock trials and competency examinations. Passing for a written examination is at least 85% correct responses. Passing for a practical examination is arriving at the expected result.
- 1.6.5 Oral sessions are question and answer sessions that will be conducted throughout the training period. They will be cumulative. There will be two different types of expected responses. First, there will be technical responses. Second, there will also be times where the trainee will need to respond as if speaking to a jury. It will be made clear during the question which type of response is expected. The Oral Session Rubric shows the trainee what will be expected of them in these oral sessions. This rubric will be used to evaluate the trainee during the oral sessions.
- 1.6.6 The trainee should provide a monthly written progress report to the TC.

1.7 Instructions to the Training Coordinator

- 1.7.1 As previously stated, the intent of the manual is to provide a guide that will ensure each and every trainee will receive certain basic principles and fundamentals necessary to the complete education of a Forensic Scientist NIBIN. All of the listed topics must be incorporated into the program. Some of the topics will strongly suggest an order of events and this ranking should be followed. Any significant deviation from the manual must be approved by the PM.
- 1.7.2 The performance of the trainee will be evaluated during the course of the program. The TC must submit monthly written report, per the Quality Manual (QM), to the PM and Laboratory Director. The TC is to discuss this evaluation with the trainee prior to forwarding it to the PM. Any relevant comments by either the trainee or TC are to be included with the report. A copy of the report will be placed in the training file.
- 1.7.3 The TC is responsible for maintaining the Department’s training program documentation during the training period. Each module in the Training Record must be initialed and dated upon completion of the specified task. If any task is not completed, for any reason, this must be explained in the training file and approved by the PM.
- 1.7.4 Written and/or oral examination questions for each module will be selected or derived from the study questions and required readings by the TC.
- 1.7.5 The written and/or oral examination will be given in a “closed book” format.

1.8 Mock Trials

- 1.8.1 The TC is responsible for ensuring that the trainee is thoroughly prepared for legal questioning. This can be done by a combination of practice mock trials, impromptu oral sessions, and observation of courtroom testimony given by experienced examiners.

- 1.8.2 The scheduling of practice mock trials is to be done by the TC. These are to be conducted throughout the training period.

1.9 Guidelines for the Competency Examination

1.9.1 Practical Test

The practical test is a mock case, intended to simulate an average case in difficulty and complexity. The test shall be approved by the PM prior to being presented to the trainee.

1.9.2 Technical Final

The technical final examination will be given by the Laboratory's Firearms and Toolmarks Section Supervisor and TC in the presence of the PM and other Department management (as needed) to ascertain the technical knowledge of the individual. This examination will be limited to three (3) hours. After the examination, the TC, PM and relevant management with input from other attendees, will assess the individual's performance. The performance of the individual will be determined to be either satisfactory or unsatisfactory. The trainee must clearly demonstrate sufficient technical knowledge to perform examinations unaided and to draw correct conclusions. If the performance is deemed to be unsatisfactory, the TC, Section Supervisor, PM and Laboratory Director will determine the appropriate action. After satisfactory completion of the technical oral examination, the individual will be subjected to a final mock trial.

1.9.3 Mock Trial

A mock trial will follow the successful completion of the technical final examination. The QM outlines the roles and responsibilities of the participants as well as evaluation and grading guidelines.

1.9.4 Training Documentation

The following shall be maintained and serve as the technical training file:

- written tests
- description of practical exercises, with results as applicable
- competency practical test
- signed and dated Forensic Scientist NIBIN Training Record
- monthly training reports

At the completion of the training the technical training file should be retained by the trainee or supervisor and be accessible for internal and external quality audits.

1.10 Transition from Trainee to Forensic Scientist NIBIN

- 1.10.1 For at least six months all reports must be technically reviewed prior to release by the supervisor or designee.
- 1.10.2 The supervisor, TC, or designee will accompany and monitor the newly qualified Forensic Scientist NIBIN to court for the first three court appearances.
- 1.10.3 The new Forensic Scientist NIBIN will complete the DFS Training Evaluation Form per the QM.

1.11 Experienced Personnel

A technical assessment interview will be conducted with new employee, Section Supervisor, TC and PM. The interview will contain questions from each module of this training manual.

1.11.1 Individual Training Plan (ITP)

1.11.1.1 The ITP, see Appendix A for template, will address what additional training is needed for each module. The ITP is written by the TC and approved by the PM and Section Supervisor. If no additional training is required for a specific module the plan must contain documentation related what training the new employee received in the subject matter.

1.11.1.2 At a minimum, the new employee should take a written, oral or practical test for each module.

1.11.2 Training Documentation

See Section 1.9.4

1.11.3 Guidelines for Competency Examination

An experienced examiner shall complete a Practical Test, Technical Final and Mock trial as outlined in this manual for a new Forensic Scientist NIBIN.

1.12 Orientation

1.12.1 The required training listed in section 19.4 of the QM shall be completed.

1.12.2 The following documents will be covered:

- Quality Manual
- Firearm/Toolmark Procedures Manual
- Forensic Scientist NIBIN Training Manual

1.12.3 The outline of the training program and the expectations of both the TC and the trainee will be discussed.

1.12.4 The duties of a Forensic Scientist NIBIN, as determined by the classification of the position, will be clarified.

1.12.5 An introduction to the LIMS system will be given.

1.13 Firearms Safety Training

The trainee will be routinely handling a variety of firearms; therefore, it is imperative that the trainee understand how to safely handle a firearm. All firearms must be treated as though they are loaded. This rule cannot be over-emphasized and must be followed at all times.

1.13.1 Safe Firearm Handling

- Always treat firearms as if they are loaded.
- The muzzle of the firearm must always be pointed in a safe direction.
- Always wear appropriate eye and ear protection when shooting.
- Keep your finger out of the gun's trigger guard and off of the trigger until you have made the decision to fire.
- Always be certain that your target and the surrounding area are safe before firing.
- Test firing or any examination of the firearm that utilizes ammunition or an ammunition component, will only be performed in designated test firing areas.
- A firearm will not be returned to any agency in a loaded condition.

1.14 Training Assignments

- 1.14.1 Attend a Basic Firearm Safety Course at a local police department, online or complete a comprehensive review of firearm handling and safety with the TC. Discuss the course with the TC and document information learned.
- 1.14.2 Become familiar with the laboratory bullet recovery tank and firing range with the TC.

1.15 Required Reading

- 1.15.1 DFS Safety Manual as it relates to firearms safety.
- 1.15.2 QM Sections 1-13, 19, 20 and 22.

1.16 Modes of Evaluation

- 1.16.1 Oral Session
- 1.16.2 Written Examination

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2 EVIDENCE HANDLING**2.1 Objectives**

- 2.1.1 For the trainee to understand the fundamentals of evidence security
- 2.1.2 To familiarize the trainee with the chain of custody portion of LIMS

2.2 Modes of Instruction

- 2.2.1 Demonstration by the TC of evidence handling
- 2.2.2 Self-directed study through reading assignments, study questions, and practical exercises

2.3 Assignments

- 2.3.1 Required Reading (2.7)
- 2.3.2 Study questions
- 2.3.3 Practical exercises

2.4 Study Questions

- 2.4.1 Explain the parallel chain of custody documentation methods used by the Department.
- 2.4.2 Define a proper seal.
- 2.4.3 What is the proper way to mark evidence?
- 2.4.4 Who has access to the main evidence storage room in the section? Your personal locker?
- 2.4.5 Who has access to your work area?
- 2.4.6 Describe the procedures for access to your locker in your absence.
- 2.4.7 Explain the lock box procedure.
- 2.4.8 Explain how to handle evidence which also needs a latent print analysis.
- 2.4.9 Explain how to handle evidence which also needs a DNA analysis.
- 2.4.10 Define the following terms:
 - chain of custody
 - lock box
 - evidence seal
 - convenience packaging
 - RFLE
 - FS Lab #
 - LIMS
- 2.4.11 What is the typical pathway that an item of evidence goes through from the time it enters DFS to the time it is returned to the agency?

2.5 Practical Exercises

- 2.5.1 Demonstration of section evidence handling and storage procedures, including evidence transfers to/from Evidence Receiving personnel and other sections within the laboratory.
- 2.5.2 Demonstration of proper chain of custody practices with the TC.

2.6 Modes of Evaluation

- 2.6.1 Written Examination
- 2.6.2 Oral Session

2.7 Required Reading

- 2.7.1 QM Sections 14, 15, and 23
- 2.7.2 Firearm/Toolmark Procedures Manual

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3 REPORT WRITING, EXPERT TESTIMONY, AND PROFESSIONALISM

3.1 Objectives

- 3.1.1 To become familiar with the QM in regards to note taking, chain of custody and report writing.
- 3.1.2 To become familiar with the Firearm /Toolmark Technical Procedures Manual in regards to note taking, chain of custody and report writing.
- 3.1.3 To become familiar with the LIMS.
- 3.1.4 To become familiar with technical and administrative review of case files.
- 3.1.5 To become proficient at presenting findings in court.

3.2 Modes of Instruction

- 3.2.1 Self-directed study through reading assignments, study questions and practical exercises
- 3.2.2 Observations

3.3 Assignments

- 3.3.1 Required Reading (3.7)
- 3.3.2 Study Questions
- 3.3.3 Practical Exercises

3.4 Study Questions

- 3.4.1 Define the following:
 - Expert witness
 - Opinion
 - Voir dire
 - Ethics
 - Bias
 - Forensic science
- 3.4.2 What is the CSI Effect and how has it impacted forensic expert testimony?
- 3.4.3 Discuss non-verbal cues and delivery influences on expert credibility.
- 3.4.4 Discuss the general examination documentation requirements in the QM and the Firearm / Toolmark Procedures Manual.
- 3.4.5 What is the standard for admissibility of expert testimony in Virginia and how would that differ from Federal Court?

3.5 Practical Exercises

- 3.5.1 Discuss with your TC the operation of local, state and federal law enforcement agencies and court systems.
- 3.5.2 When possible, observe examiners testifying; discuss with your TC their demeanor and professionalism.

- 3.5.3 Confer with examiners regarding personal hints and recommendations in regards to courtroom testimony.
- 3.5.4 Using current ASCLD/LAB criteria and the Department's QM and Section Procedures manual, discuss with your TC how the laboratory meets the accreditation standards.
- 3.5.5 Prepare a list of "qualification questions" which can be used by the prosecutor to qualify you as an expert witness. Discuss with your TC.
- 3.5.6 Discuss with the TC the laboratory policies regarding the Department's subpoena policy (to include civil, federal, and state courts).
- 3.5.7 Discuss with the TC the Department's proficiency testing program as it relates to the Firearm/Toolmark section and be able to discuss this topic.
- 3.5.8 Read through copies of reports generated by examiners to become familiar with report formats and phraseology.
- 3.5.9 The trainee should document the review of at least five case files using the appropriate Technical Review Form. Case files should be generated by multiple examiners, if possible. The potential findings of the reviews shall be discussed with the TC. Technical Review forms generated in this capacity shall be marked as Training and retained in their Training File. The case files shall be technically reviewed by an authorized examiner pursuant to QM 17 prior to release.
- 3.5.10 Complete an ASCLD/LAB-*International* Audit Trail Worksheet on at least one case.
- 3.5.11 Complete a technical interview, mock case and mock trial

3.6 Modes of Evaluation

- 3.6.1 Practical Exercises
- 3.6.2 Oral Sessions

3.7 Required Reading

- 3.7.1 Dutton, Gerard, "Ethics in Forensic Firearm Investigation", AFTE Journal, 2005; 37(2): 79-85.
- 3.7.2 Hatcher, J.S., Jury, F.J., and Weller, J., Firearms Investigation, Identification and Evidence, 2nd edition, Stackpole Books, Harrisburg, 1957, pp. 445-460.
- 3.7.3 Hodge, Evan E. and Blackburn, Bobby D., "The Firearms-Toolmark Examiner in Court", AFTE Journal, 1979; 11(4): 70-96.
- 3.7.4 Joling, R.J., and Stern W.W., "An Overview of Firearms Identification Evidence for Attorneys, III: Qualifying and Using the Firearms Examiner as a Witness," AFTE Journal, 1981; 13(4): 140-144.
- 3.7.5 Lucas, Douglas M., M.Sc., "The Ethical Responsibilities of the Forensic Scientist: Exploring the Limits," Journal of Forensic Sciences, 1989; 34(3): 719-729.
- 3.7.6 Moran, Bruce, "Firearms Examiner Expert Witness Testimony: The Forensic Firearms Identification Process Including Criteria for Identification and Distance Determination," AFTE Journal, 2000; 32(3): 231-251.
- 3.7.7 QM Sections 16, 17, 18 and 19
- 3.7.8 Firearm/Toolmark Procedure Manual, referring to Examination Documentation

3.7.9 Technical Review Form

3.8 Additional References

- 3.8.1 Giannelli, Paul C., LL.M., "Evidentiary and Procedural Rules Governing Expert Testimony," Journal of Forensic Sciences, 1989; 34(3): 730-748.
- 3.8.2 "Effective Expert Testimony," AFTE Journal, 1972; 4(4): 8.
- 3.8.3 Joling, R.J., and Stern, W.W., "An Overview of Firearms Identification Evidence for Attorneys, II: Applicable Law of Recent Origin," AFTE Journal, 1981; 13(4):134-139.
- 3.8.4 Joling, R.J., and Stern W.W., "An Overview of Firearms Identification Evidence for Attorneys, IV: Practice and Procedures When Using the Firearms Examiner and Demonstrative Evidence," AFTE Journal, 1981; 13(4): 145-148.
- 3.8.5 Kates, James H. and Henry K. Guttenplan, Ph.D., "Ethical Considerations in Forensic Science Services," Journal of Forensic Sciences, 1983; 28(4): 972-976.
- 3.8.6 Saks, Michael J., Ph.D., M.S.L., "Prevalence and Impact of Ethical Problems in Forensic Science," Journal of Forensic Sciences, 1989; 34(3): 772-793.
- 3.8.7 Schroeder, Oliver C., J.D., "Ethical and Moral Dilemmas Confronting Forensic Scientists," Journal of Forensic Sciences, 1984; 29(4): 966-986.
- 3.8.8 Peterson, Joseph L., D. Crim. and John E. Murdock, M. Crim., "Forensic Science Ethics: Developing an Integrated System of Support and Enforcement," Journal of Forensic Sciences, 1989; 34(3): 749-762.
- 3.8.9 Sereno, Kenneth K., Ph.D., "Source Credibility," Journal of Forensic Sciences, 1983; 28(2): 532-536.
- 3.8.10 Tanton, R.L., "Jury Preconceptions and Their Effect on Expert Scientific Testimony," AFTE Journal, 1980; 12(2): 67-77.
- 3.8.11 Townshend, D.G., "Observation of the Witness," AFTE Newsletter, 1973; 5(4): 26-28.
- 3.8.12 Mogil, Hon. B. Marc, J.D., "Maximizing Your Courtroom Testimony," FBI Law Enforcement Bulletin, May 1989, p. 7-9.
- 3.8.13 Shelton, Donald E. et al., "Studying Juror Expectations for Scientific Evidence," Court Review, 2011; 47(1): 8-18.
- 3.8.14 Scanlon, Timothy, "Influences of the CSI Effect, Daubert Ruling and NAS Report on Forensic Practices", Walden University Scholar Works, 2015; pp. 1-160.
- 3.8.15 Tuthill, Harold, Individualization: Principles and Procedures in Criminalistics, 1994; pp. 2-119.
- 3.8.16 ASCLD/LAB-*International* Supplemental Requirements for Accreditation of Forensic Science Testing Laboratories (2011)
- 3.8.17 ISO/IEC 17025:2005 – accessible through DFS Intranet

4 INSTRUMENTATION**4.1 Objective**

To become proficient in the use of the equipment used in the firearm/toolmark laboratory

4.2 Modes of Instruction

4.2.1 Self-directed study through reading assignments, study questions and practical exercises

4.2.2 Observations

4.3 Assignments

4.3.1 Required Reading (4.7)

4.3.2 Microscopy PowerPoint presentation

4.3.3 Study questions

4.3.4 Practical exercises

4.4 Study Questions

4.4.1 What are the major characteristics of a stereo microscope?

4.4.2 What is a comparison microscope?

4.4.3 Describe the laboratory's QA procedures that are in place to ensure that your stereo microscope and other applicable equipment are performing up to specifications.

4.5 Practical Exercises

4.5.1 Discuss with the TC and demonstrate how to utilize the stereo microscopes and comparison microscopes to evaluate cartridge cases.

4.5.2 Demonstrate the use of the equipment and, as applicable, how to ensure the equipment is in proper working condition.

- Inertia bullet puller
- Remote firing device
- Ammunition recovery system(s)
- Sonicator
- Caliper

4.6 Modes of Evaluation

4.6.1 Practical Exercises

4.6.2 Oral Session

4.7 Required Reading

4.7.1 Dutton, G., "Firearms Identification, Comparison Microscope & the Spencer Lens Co." AFTE Journal, 2002; 34(2):186-198.

4.7.2 Remote Firing Device instructional videos and instructional handout

4.7.3 Firearm/Toolmark Procedures Manual – Section 12

4.7.4 QM Section 21

4.8 Additional References

4.8.1 Cook, C.W., "Basic Optics," AFTE Journal, 1985; 17(4):14-56.

4.8.2 Thornton, J. I., "Some Historical Notes on the Comparison Microscope," AFTE Journal, 1978; 10(1): 7-10.

4.8.3 Delly, John G., "Photography through the Microscope," pages 3 - 19.

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5 AMMUNITION

5.1 Objective

To become knowledgeable about the historical developments and current manufacture of gunpowder and ammunition components.

5.2 Modes of Instruction

5.2.1 Self-directed through reading assignments, training assignments, study questions and practical exercises

5.2.2 Observations

5.3 Assignments

5.3.1 NIJ Firearms Examiner Training on-line Module 5 (Small Arms Ammunition)

5.3.2 Study Questions

5.3.3 Practical Exercises

5.4 Study Questions

5.4.1 Define with the following terms from the current version of the AFTE Glossary:

- | | | |
|---------------|--------------|------------------|
| • Ammunition | • Gunpowder | • Propellant |
| • Buckshot | • Headspace | • Rimfire |
| • Buffer | • Headstamp | • Shot |
| • Bullet | • Obturation | • Shotshell |
| • Cartridge | • Pellet | • Shotshell case |
| • Downloading | • Primer | • Slug |
| • Grain | • Projectile | • Wad |

5.4.2 Define caliber.

5.4.3 Give an example of a caliber designation and explain where it originated from.

5.4.4 List the metric equivalents of the following cartridges: 223 Remington, 25 Auto, 32 Auto, 380 Auto, 9mm Luger, 9mm Makarov.

5.4.5 What does the designation “30” in caliber 30-30 Winchester and 30-06 Springfield indicate?

5.4.6 What do the numerical designations in 7.62 x 39mm each refer to?

5.4.7 What are the differences between 22 Short, 22 Long, and 22 Long Rifle cartridges?

5.4.8 What is a 9mm Corto? 9mm Kurz?

5.4.9 Define gauge.

5.4.10 Explain what the numbers on the shotshell hull markings represent. Explain how to select the appropriate ammunition for test firing.

5.4.11 Discuss specialty ammunition commonly encountered with the TC.

5.5 Practical Exercises

5.5.1 Discuss the following bullet designs with the TC:

Bullet Types:

- Lead Round Nose (LRN)
- Wadcutter (WC)
- Semi-wadcutter (SWC)
- Full Metal Jacket (FMJ)
- Total Metal Jacket (TMJ)
- (Semi-) Jacketed Soft Point (SJSP / JSP)
- (Semi-) Jacketed Hollow Point (SJHP / JHP)

Bullet/Jacket Material:

- Copper-Coated / Lubaloy
- Brass-Coated
- Copper-Jacketed
- Brass-Jacketed
- Nickel-Jacketed
- Aluminum-Jacketed
- Frangible
- Teflon-coated (KTW)

5.5.2 Using available headstamp guide resources, identify the manufacturer of the ammunition provided.

5.5.3 Using the laboratory's ammunition reference collection, look at cartridges in each of the calibers and note their design. (Use worksheet in Appendix B to document the observations)

- | | |
|---------------------------------|-------------------------|
| • 22 Short | • 10 mm Auto |
| • 22 Long | • 40 S&W |
| • 22 Long Rifle | • 44 (Remington) Magnum |
| • 22 Winchester Magnum | • 44 (S&W) Special |
| • 25 Auto | • 45 Auto |
| • 32 Auto | • 45 GAP |
| • 32 S&W | • 45 Colt |
| • 32 S&W Long (Colt New Police) | • 30-30 Winchester |
| • 32 H&R Magnum | • 30-06 Springfield |
| • 380 Auto | • 270 Winchester |
| • 9mm Luger | • 30 Carbine |
| • 9mm Makarov | • 5.56 NATO |
| • 38 Special / 38 Special +P | • 7.62 x 39 Soviet |
| • 357 Magnum | • 308 Winchester |
| • 357 SIG | • 223 Remington |
| • 38 S&W (Colt New Police) | |

5.5.4 Compare the following cartridges and describe their interchangeability:

- | | |
|----------------------------|--|
| • 45 Auto and 45 GAP | • 357 Magnum, 38 Special, and 38 S&W |
| • 10 mm Auto and 40 S&W | • 9mm Luger, 380 Auto, and 9mm Makarov |
| • 44 Magnum and 44 Special | • 32 S&W and 32 Auto |
| • 9mm Luger and 357 SIG | • 22 rimfire class |

5.5.5 Document ten provided cartridges/shotshells on the appropriate worksheets.

5.6 Modes of Evaluation

5.6.1 Practical Examination

The trainee will receive twenty cartridges

The trainee should be able to determine the manufacturer, caliber, bullet load/design of each cartridge.

5.6.2 Oral Session

5.6.3 Written examination

5.7 References

- 5.7.1 Barnes, F.C., Cartridges of the World: 10th Edition, DBI Books, Inc., Northfield, IL, 2003, pp. 7-10.
- 5.7.2 Bussard, M.E., Wormley, S.L., NRA Firearms Sourcebook, National Rifle Association of America, Fairfax, VA, 2006, pp. 255-274, 279-291.
- 5.7.3 NRA Firearms Fact Book Third Edition, National Rifle Association of America, Washington, D.C., 1989, pp. 51-56, 65-70.
- 5.7.4 Taylor, J., Shotshells & Ballistics, Safari Press, Inc., Long Beach, CA, 2003, pp. 25-38.
- 5.7.5 Wallace, J.S., "Chemical Aspects of Firearms Ammunition," AFTE Journal, 1990; 22(4): 364-375.
- 5.7.6 Forker, B., "The 7.62x39," Guns & Ammo, Sept. 2007, pp. 36-38.

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6 FIREARMS

6.1 Objectives

- 6.1.1 Trainee will be able to explain the mechanisms of function and safety features on a variety of firearms.
- 6.1.2 Trainee will be able to field strip and test fire a variety of firearms.
- 6.1.3 Trainee will be able to restore inoperable firearms to mechanical operating condition.
- 6.1.4 Trainee will be able to discuss a variety of common mechanical malfunctions encountered in the examinations of firearms.

6.2 Modes of Instruction

- 6.2.1 Self-directed through reading assignments (all references listed in 6.13 are required reading), study questions and practical exercises.
- 6.2.2 Observations

6.3 Examination of Firearms – Study Questions

- 6.3.1 Define the following terms using the current version of the AFTE Glossary:

- | | |
|-----------------|-----------------------|
| • Revolver | • Percussion firearm |
| • Pistol | • Bolt-action |
| • Rifle | • Slide (pump) action |
| • Shotgun | • Single shot |
| • Semiautomatic | • Submachine gun |
| • Automatic | • Machine gun |
| • Derringer | • Assault rifle |
| • Muzzleloader | |

- 6.3.2 Define the following terms from the current version of the AFTE Glossary:

- | | |
|-----------------------|--------------------|
| • Action | • Function testing |
| • Barrel | • Grip |
| • Bore | • Grooves |
| • Breech | • Hammer |
| • Breechface | • Hammerless |
| • Butt | • Handgun |
| • Chamber | • Hybrid Action |
| • Discharge/Fire | • Muzzle |
| • Double Action | • Safety mechanism |
| • Ejection | • Single action |
| • Extraction | • Test fire |
| • Firearm | • Trigger |
| • Firing pin | • Trigger guard |
| • Firing pin aperture | • Trigger pull |
| • Frame | |

- 6.3.3 Do all firearms have a serial number? Why or why not?

6.3.4 Define the following terms from the current version of the AFTE Glossary:

- Class Characteristics
- Breechface marks
- Cycling marks
- Ejector marks
- Extractor marks
- Firing pin aperture shear
- Firing pin drag mark
- Firing pin impression
- Primer flow back

6.3.5 How do class characteristics apply to firearms and the marks imparted onto the fired ammunition components?

6.3.6 What types of marks are left on a cartridge case during the cycling process?

6.3.7 What types of marks are left on a cartridge case during the firing process?

6.3.8 What are the different types of breechface marks?

6.3.9 What are the different types of firing pin impression shapes?

6.3.10 What are the different types of firing pin impression microscopic characteristics?

6.3.11 How is firing pin drag created and in what type of firearm?

6.3.12 Generally speaking, where is the extractor mark usually located in relation to the firing pin drag mark?

6.4 Revolvers – Study Questions

6.4.1 Define the following terms from the current version of the AFTE Glossary:

- Crane
- Cylinder
- Cylinder Gap
- Cylinder alignment
- Ejector Rod
- Yoke
- Side plate
- Loading gate
- Hammer Notch
- Hammer Shroud
- Hammer Spur
- Rebound slide
- Hammer block
- Transfer bar

6.4.2 Discuss with the TC how the following safeties function and how to check their function:

- Hammer block
- Safety notch/quarter cock, half cock
- Rebounding hammer
- Transfer bar
- Key lock

6.4.3 What are the three main types of revolvers?

6.4.4 Explain the cycle of fire as it relates to single/double action revolvers.

6.4.5 What does the direction of cylinder stop notches on a revolver indicate?

6.5 Revolvers – Practical Exercises

Observe an instructor demonstrate how to safely handle, load, and unload the firearms listed. Demonstrate these safety techniques to the instructor.

Document each firearm on a firearm worksheet. Obtain a copy of an exploded drawing of each of the firearms listed below. Choose appropriate ammunition. Label and maintain the ammunition components produced as a result of the following examinations. Have an instructor function check all firearms before test firing and returning them to the firearm reference collection.

R.G. Industries model RG23, caliber 22 Long Rifle

- Test fire two (2) 22 Long Rifle cartridges

Ruger New Model Single-Six, caliber 22 Magnum

- Test fire two (2) 22 Magnum cartridges

Iver Johnson model Top Break, caliber 32 Smith & Wesson

- Test fire two (2) 32 S&W cartridges
- Test fire two (2) 32 Auto cartridges

Smith & Wesson model 686, caliber 357 Magnum

- Test fire two (2) 357 Magnum cartridges
- Test fire two (2) 38 Special cartridges

Colt model Lawman, caliber 357 Magnum

- Test fire two (2) 38 Special cartridges

Ruger model Security Six, caliber 357 Magnum

- Test fire two (2) 38 Special cartridges

6.6 Pistols – Study Questions

6.6.1 Discuss with the TC the following types of semi-automatic pistols and list several examples of firearms using these mechanisms.

- Blowback action
- Gas operated
- Short recoil action

6.6.2 Define the following terms using the current version of the AFTE Glossary:

- | | |
|-----------------------|----------------------|
| • Backstrap | • Inertia firing pin |
| • Chamber | • Striker |
| • Front Strap | • Magazine follower |
| • Ejector | • Magazine spring |
| • Ejection port | • Magazine well |
| • Extractor | • Recoil spring |
| • Magazine | • Slide |
| • Magazine floorplate | • Slide Stop |
| • Receiver | |

6.6.3 Discuss with the TC how the following safeties function and how to check their function:

- | | |
|-----------------------|----------------------------|
| • Grip safety | • Disconnect |
| • Magazine safety | • Cocking indicator |
| • Thumb/manual safety | • Loaded chamber indicator |
| • Decocker | • Firing pin block |
| • Trigger safety | • Key |

6.6.4 Explain the cycle of fire for a semiautomatic pistol.

- 6.6.5 Where are the serial number locations for Glock, Taurus, Ruger, Hi-Point, and Smith & Wesson pistols?
- 6.6.6 Name some pistol manufacturers that use hidden serial numbers.
- 6.6.7 Describe how to perform a function check on a pistol with an exposed hammer versus a striker fired pistol.
- 6.6.8 Describe the differences between Smith & Wesson model Sigma series and Glock pistols.

6.7 Pistols – Practical Exercises

Observe an instructor demonstrate how to safely handle, load, and unload the firearms listed. Demonstrate these safety techniques to the instructor.

Document each firearm on a firearm worksheet. Obtain a copy of an exploded drawing of each of the firearms listed below. Choose appropriate ammunition. Label and maintain the ammunition components produced as a result of the following examinations. Have an instructor function check all firearms before test firing and returning them to the firearm reference collection.

Test fire at least one firearm using the Remote Firing Device both down range and into the water tank.

Ruger model MKII, caliber 22 Long Rifle

- Test fire two (2) 22 Long Rifle cartridges
- Field Strip

Phoenix Arms model HP 22, caliber 22 Long Rifle

- Test fire two (2) 22 Long Rifle cartridges

Jennings model J-22, caliber 22 Long Rifle

- Test fire two (2) 22 Long Rifle cartridges
- Field strip

Davis Industries model D22, caliber 22 Long Rifle derringer

- Test fire two (2) 22 Long Rifle cartridges

Beretta model 950BS, caliber 25 Auto

- Test fire two (2) 25 Auto cartridges
- Field strip

Raven model P-25 or MP-25, caliber 25 Auto

- Test fire two (2) 25 Auto cartridges
- Field strip

Bersa model Thunder 380, caliber 380 Auto

- Test fire two (2) 380 Auto cartridges

Ruger model LCP, caliber 380 Auto

- Test fire two (2) 380 Auto cartridges

Walther model PPK, caliber 380 Auto

- Test fire two (2) 380 Auto cartridges

Baikal model IJ-70, caliber 9mm Makarov

- Test fire two (2) 9mm Makarov cartridges
- Test fire two (2) 380 Auto cartridges

- Beretta model 92, caliber 9mm Luger
- Test fire two (2) 9mm Luger cartridges
 - Field strip
- Intratec model Tec-9, caliber 9mm Luger
- Test fire two (2) 9mm Luger cartridges
 - Field strip
- Jimenez Arms model J.A. Nine, caliber 9mm Luger
- Test fire two (2) 9mm Luger cartridges
 - Become familiar with limitations of the magazine safety for this firearm
- Hi-Point model C9, caliber 9mm Luger
- Test fire two (2) 9mm Luger cartridges
 - Test fire two (2) 380 Auto cartridges
 - Field strip
- Ruger P-series, caliber 9mm Luger
- Test fire two (2) 9mm Luger cartridges
- Glock model 31, caliber 357 SIG
- Test fire two (2) 357 SIG cartridges
 - Field strip
- Ruger model SR40c, caliber 40 S&W
- Test fire two (2) 40 S&W cartridges
- Smith & Wesson model SD40VE, caliber 40 S&W
- Test fire two (2) 40 S&W cartridges
 - Field Strip
- Springfield Armory model XD-40, caliber 40 S&W
- Test fire two (2) 40 S&W cartridges
- Smith & Wesson model 1006, caliber 10 mm Auto
- Test fire two (2) 40 S&W cartridges
 - Test fire two (2) 10mm Auto cartridges
- IMI/Magnum Research model Desert Eagle, caliber 357 Magnum
- Test fire two (2) 357 Magnum cartridges
- Colt model 1911A1, caliber 45 Auto
- Test fire two (2) 45 Auto cartridges
 - Field strip
- Taurus model PT 145 Millennium Pro, caliber 45 Auto
- Test fire two (2) 45 Auto cartridges
 - Field strip
- Heckler & Koch Model USP, caliber 45 Auto
- Test fire two (2) 45 Auto cartridges

6.8 Rifles – Study Questions

6.8.1 Define the following actions and provide an example of a firearm which uses each mechanism:

- Blowback
- Gas operated (to include direct impingement and gas piston)
- Bolt action
- Lever action

6.8.2 Define the following terms:

- | | |
|------------|-----------------|
| • Long gun | • Stock |
| • Carbine | • Machine gun |
| • Rifle | • Rotating bolt |

6.8.3 Explain the difference between push feed and control feed.

6.8.4 Why can only blunt-nose bullets be used in tubular magazines?

6.8.5 What is selective fire?

6.8.6 What does it mean to fire from an open bolt?

6.8.7 Describe the differences between an AK-47 and SKS.

6.8.8 Describe how to perform a function check on a lever action rifle.

6.9 Rifles – Practical Exercises

Observe an instructor demonstrate how to safely handle, load, and unload the firearms listed. Demonstrate these safety techniques to the instructor.

Document each firearm on a firearm worksheet. Obtain a copy of an exploded drawing of each of the firearms listed below. Choose appropriate ammunition. Label and maintain the ammunition components produced as a result of the following examinations. Have an instructor function check all firearms before test firing and returning them to the firearm reference collection.

Test fire at least one firearm using the Remote Firing Device down range.

Winchester model 94 caliber 30-30 Winchester

- Test fire two (2) 30-30 Winchester cartridges

Savage model 340 Series E caliber 30-30 Winchester

- Test fire two (2) 30-30 Winchester cartridges

Norinco Type 56S (or other AK-type) caliber 7.62x39mm

- Test fire two (2) 7.62x39mm cartridges

Norinco model SKS rifle (or other SKS-type) caliber 7.62x39mm

- Test fire two (2) 7.62x39mm cartridges

Colt model HBAR rifle (or other M16/AR15 type) caliber 223 Remington

- Test fire two (2) 223 Remington cartridges

Ruger model Mini-14 caliber 223 Remington

- Test fire two (2) 223 Remington cartridges

6.10 Shotguns – Study Questions

6.10.1 Define the following actions and provide an example of a firearm which uses each mechanism:

- Pump/Slide action
- Long recoil
- Break open

6.10.2 Define the following terms:

- | | |
|-------------------------|--------------------|
| • Forearm | • Cartridge stop |
| • Forend | • Automatic safety |
| • Shotgun | • Recoil pad |
| • Double barrel shotgun | • Combination gun |
| • Over/under shotgun | • Pistol grip |
| • Side by side shotgun | |

6.10.3 Describe magazine cut off and its purpose.

6.10.4 Describe magazine plug and its purpose.

6.10.5 Describe the function of the front trigger and back trigger in a break open shotgun.

6.10.6 Describe how a gas operated shotgun can malfunction and how the malfunction can be fixed?

6.11 Shotguns – Practical Exercises

Observe an instructor demonstrate how to safely handle, load, and unload the firearms listed. Demonstrate these safety techniques to the instructor.

Document each firearm on a firearm worksheet. Obtain a copy of an exploded drawing of each of the firearms listed below. Choose appropriate ammunition. Label and maintain the ammunition components produced as a result of the following examinations. Have an instructor function check all firearms before test firing and returning them to the firearm reference collection.

Test fire at least one firearm using the Remote Firing Device down range.

Harrington & Richardson Topper Model 158, 12 gauge (shortened barrel)

- Test fire two (2) 12 gauge shotshells

Savage Stevens model 311E, 410 bore, side by side

- Test fire two (2) 410 shotshells

Remington model 1100, 12 gauge

- Test fire two (2) 12 gauge shotshells

Browning model Light Twelve or Auto 5, 12 gauge

- Test fire two (2) 12 gauge shotshells

Remington model 870, 12 gauge

- Test fire two (2) 12 gauge shotshells
- Field strip

Mossberg model 500A, 12 gauge

- Test fire two (2) 12 gauge shotshells

Ithaca model 37R Featherlight, 16 gauge (shortened barrel)

- Test fire two (2) 16 gauge shotshells

6.12 Unique Situations in Firearm Examination – Study Questions

6.12.1 Define the following terms using the current version of the AFTE Glossary:

- | | |
|--------------------|-----------------------------------|
| • Bore obstruction | • Accidental discharge |
| • Broken extractor | • Battery (in and out of battery) |
| • Push off | • Malfunction |
| • Slam fire | • Misfire |
| • Improper timing | • Misfeed |
| • Jar off | • Stove pipe |

6.12.2 What is an air gun? Starter gun?

6.12.3 How are firearms submitted to the laboratory when they have been recovered from water and why?

6.12.4 What are the capabilities, limitations, and reservations, which must be considered when restoring inoperable firearms to operating condition?

6.13 Unique Situations in Firearm Examination – Practical Exercises

6.13.1 Document each firearm on a firearm worksheet. After documentation is complete, fix the firearm. Document this fix on the firearm worksheet. Have an instructor function check prior to test firing. Test fire each firearm twice.

- Raven pistol with broken firing pin
- Glock pistol with missing recoil spring
- Jimenez pistol with sear inserted backwards

6.14 Modes of Evaluation

6.14.1 Oral Sessions

6.14.2 Practical Exercises

6.15 Required Reading

6.15.1 Historical Development of Firearms

NFSTC "Evolution of Firearms". This course of instruction may be found at <http://projects.nfstc.org/firearms/>

6.15.2 Firearms Examination

Firearm/Toolmark Procedures Manual Section 1.

Dutton, G., "Firearms Safety in the Laboratory," *AFTE Journal*, Vol. 29, No. 1, Winter 1997, pp. 37-41.

6.15.3 Revolvers

NFSTC "Examination of Firearms – Handguns – Single Action Revolvers and Double Action Revolvers". This course of instruction may be found at <http://projects.nfstc.org/firearms/>

6.15.4 Pistols

Greenspan, A., "The Case of the Unsafe Magazine Safety," AFTE Journal, 1999, 31(3): 379-381.

6.15.5 Accidental Discharge and Design Problems

Horn, A., Amberger, R., "Firearm Safety Warning for Bryco Arms model Jennings Nine," AFTE Journal, Vol. 33, No. 2, Spring 2001, pp. 145-147.

Chenow, R., "False Half Cock Position in Semiautomatic Handguns," AFTE Journal, Vol. 9, No. 2, pp. 179.

Robinson, M., "Raven Pistol Firing Out of Battery," AFTE Journal, Vol. 20, No. 2, April 1988, pp. 207-208.

Kosachevsky, P., Siso, R., "FN Pistol Accidental Discharge Due to Magazine Safety Mechanism Bypass," AFTE Journal, Vol. 46, No. 1, Winter 2014, pp. 76-79.9.11.9.35

Wolslagel, P., "Case Report: Accidental Discharge Potential of Lorcin, Bryco, and Related Pistols," AFTE Journal, Vol. 33, No. 1, Winter 2001, pp. 48-49.

6.16 Additional References

6.16.1 Peterson, H.L., "The Development of Firearms," American Rifleman, Parts 1 and 2, Mar. and Apr., 1960.

6.16.2 Smith, W.H.B., Small Arms of the World, 10th revised edition: (p. 15-38)

6.16.3 Berg, S.O., "History of Revolver Safeties," AFTE Journal, 1982; 14(4): 29.

6.16.4 Ayooob, M., "Handguns," Guns Magazine, February 2001: 16.

6.16.5 Voth, A., "Testing a Ruptured Shotgun Barrel," AFTE Journal, Vol. 29, No. 2, Spring 1997, pp. 188-189.

6.16.6 Berg, S., "Rifle Barrel Obstruction Tests and Experiments," AFTE Journal, Vol. 23, No. 4, October 1991, pp. 951-957.

6.16.7 Edwards, R., "Circumferential Fractures," AFTE Journal, Vol 23, No. 3, Summer 1991, pp. 806-807.

6.16.8 Ben-Moshe, T., Giverts, P., Hocherman, G., and Schecter, B. "Cracks Observed in Glock Pistols," AFTE Journal, Vol. 42, No. 1, Winter 2010, pp. 74-76.

6.16.9 Kloppers, B., "Unusual Barrel Obstruction," AFTE Journal, Vol. 32, No. 4, Fall 2000, pp. 359-360.

6.16.10 French, M., "Obstructed Barrel Tests Using 25 Caliber Pistols," AFTE Journal, Vol. 33, No. 1, Winter 2001, pp. 58-59.

6.16.11 Lipscomb, J., Harden, L., "Evaluating Trigger Mechanisms for Sensitivity to Shock," AFTE Journal, Vol. 17, No. 4, pp. 4.

6.16.12 Flaskamp, J., "Sympathetic Firing in a Rohm RG10 Facilitates an Identification," AFTE Journal, Vol. 38, No. 4, Fall 2006, pp. 359-361.

7 NIBIN

7.1 Objectives

- 7.1.1 To attend and successfully complete the BATF/FTI NIBIN System Training Course
- 7.1.2 To become proficient in NIBIN entries and NIBIN correlation reviews

7.2 Modes of Instruction

- 7.2.1 Completion of the BATF/FTI NIBIN System Training Course
- 7.2.2 Self-directed study questions and practical exercises
- 7.2.3 Observations

7.3 Assignments

- 7.3.1 Complete NIBIN System pre-course material
- 7.3.2 Study and become familiar with the NIBIN training guide
- 7.3.3 Study questions
- 7.3.4 Practical exercises

7.4 Study Questions

- 7.4.1 Describe (briefly) the history of the NIBIN program.
- 7.4.2 What is IBIS and how does it relate to the NIBIN program?
- 7.4.3 Describe the different components of the IBIS System and how they are used.
- 7.4.4 Describe the proper orientation for NIBIN entry for the following
 - Centerfire: Parallel BFM
 - Centerfire: Arched BFM
 - Centerfire: Circular/Granular BFM
 - Rimfire: Circular FPI
 - Rimfire: Rectangular FPI
- 7.4.5 What is the procedure for documenting and reporting a potential NIBIN association?
- 7.4.6 Explain how the “Rank Sort” score is calculated and its significance.
- 7.4.7 What factors affect the correlation of images in the IBIS BrassTrax system? Explain how each of these factors affects the correlation search and results.

7.5 Practical Exercises

- 7.5.1 Trainee will review 10 correlation results of cases entered by examiners.
- 7.5.2 Trainee will enter 10 cases, review the correlation results and have the results verified by a qualified examiner.

7.6 Modes of Evaluation

7.6.1 Practical Exercises

7.6.2 Oral Session

7.7 References

7.7.1 **IBIS BrassTrax User Guide**

7.7.2 **IBIS Matchpoint User Guide**

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Appendix A - Individual Training Plan (ITP) Template

For each section listed below include the following information:

- List previous documented training received
- Provide detailed plan, including assignments, exercises, exams and presentations to be completed with dates, for each section.

The objectives listed in the Forensic Scientist NIBIN Training Manual should be used as a guide for questions during the assessment to determine the individual's knowledge level.

Quality Manual/Firearms Safety
Evidence Handling
Report Writing, Expert Testimony, and Professionalism
Instrumentation
Ammunition
Firearms
NIBIN

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The expected completion date of this training plan is _____.

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Appendix B – Ammunition Reference Worksheet

Caliber Designation	Other Designations	Bullet diameter	Cartridge design (CC)	Design Features
22 Short				
22 Long				
22 Long Rifle				
22 Win Mag				
25 Auto				
32 Auto				
32 S&W				
32 S&W Long				
32 H&R Magnum				
380 Auto				
9mm Luger				
9mm Makarov				
357 Magnum				
357 SIG				
38 S&W				
40 S&W				
10mm Auto				
44 Special				
44 Magnum				
45 Auto				
45 GAP				
45 Colt				
223 Remington				
5.56mm NATO				
30-30 Winchester				
30-06 Springfield				
7.62x39mm Soviet				
308 Winchester				
30 Carbine				

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