
Training Outline for the Examination of Firearms Evidence - Phase I

- 1.0 Purpose** – This document provides an outline to familiarize the trainee with phase one of training which includes firearms and ammunition safety, history, mechanics, serial number restoration, microscopy, comparison microscopy and fired ammunition class characteristics, ammunition, and presentation of evidence in court. Upon completion and final approval the trainee will be permitted to accept casework in the areas of firearm function, projectile caliber determination, and serial number restoration.
- 2.0 Scope** – This training outline shall be followed by all trainees in the Firearms Unit regardless of experience level.
- 3.0 Module 1 – Firearms and Ammunition Safety**
- 3.1 Objectives:** Through completion of this module, the trainee shall have developed and demonstrated knowledge of:
- 3.1.1** The fundamentals of firearm and ammunition safety.
 - 3.1.2** General safety rules that should be followed when handling firearms in any environment.
 - 3.1.3** The proper techniques for clearing/unloading various types of firearms.
 - 3.1.4** Lead exposure awareness.
- 3.2 Reading Assignments**
- National Institute of Justice, Firearms Examiner Training, Module 15: Safety <https://firearms-examiner.dna.gov>
 - National Rifle Association, Gun Safety Rules <http://training.nra.org/nra-gun-safety-rules.aspx>
 - Association of Firearm and Tool Mark Examiners (AFTE) Glossary, current edition.
 - U.S. Department of Labor, Occupational Safety & Health Administration (OSHA) Regulations: 29 CFR 1910.1025, Toxic and Hazardous Substances – Lead https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10030
 - Firearm Safety Fundamentals <www.firearmsid.com>
 - Firearms Safety Depends on You, National Shooting Sports Foundation (NSSF), 2009
 - National Rifle Association, Gun Safety Rules, <<http://training.nra.org/nra-gun-safety-rules.aspx>>
 - Firearms Safety Training (PowerPoint Presentation)
 - Lead Exposure, SBI 2014 In-Service Law Enforcement Firearms Training, Pages 14-16.
 - Dutton, G., Firearms Safety in the Laboratory, AFTE Journal, 1997; 29 (1): 37-41.
 - Safety with Firearms (Parts 1-3), The American Rifleman, February – April, 1965.
- 3.3 Exercises**
- 3.3.1** Read the above literature pertaining to firearm and ammunition safety.

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- 3.3.2 List 10 key rules of safe firearm handling to include the three common fundamental safety rules.
 - 3.3.3 Demonstrate how to render various types of firearms safe in the laboratory utilizing dummy rounds.
 - 3.3.4 Receive instruction from the Unit Training Officer and/or Safety Officer on the safe usage of the laboratory firing range and bullet recovery equipment.
 - 3.3.5 Complete a set of study questions that is reviewed by the Training Officer.

3.4 Evaluation

- 3.4.1 Successfully complete a written test on topics covered in the reading assignments and exercises.

4.0 Module 2 – History

- 4.1 **Objectives:** Through completion of this module, the trainee shall have developed and demonstrated knowledge of:

- 4.1.1 The events that occurred during the development of firearms and ammunition.
- 4.1.2 The various types of historical firearms and/or weapon systems.

4.2 Reading Assignments

- Unit History Notebook
- A History of Firearms - Major H. B. C. Pollard
- A History of Firearms - Harold H. Peterson
- Firearms Encyclopedia - George C. Nonte
- The American Shotgun - David F. Butler
- The Book of Rifles - W. H. B. Smith
- Any other source or book pertaining to the history and development of firearms
- NRA Fact Book
- The Development of Firearms (Parts 1-4), The American Rifleman.

4.3 Exercises

- 4.3.1 Read the above literature pertaining to history.
- 4.3.2 Research the development of firearms beginning with the discovery of gunpowder to the present and given a list of terms, individuals, and events, identify and/or describe and date each one.

4.4 Evaluation

- 4.4.1 Create a timeline placing all terms, individuals, and events in chronological order.

5.0 Module 3 – Mechanics

5.1 Objectives: Through completion of this module, the trainee shall have developed and demonstrated knowledge of:

- 5.1.1 The various firearm actions.
- 5.1.2 The basic steps of firearm operation.
- 5.1.3 The basic safety systems used by different types and makes of firearms.
- 5.1.4 The definition of a gauge and the current gauges offered by the various manufacturers.
- 5.1.5 The definition of a choke and the various chokes presently available on the market.

5.2 Reading Assignments

- Unit Mechanics Notebook
- Unit Shotgun Notebook
- AFTE Glossary
- The Gun Digest Book of Firearm Assembly/Disassembly - Part I, Automatic Pistols
- The Gun Digest Book of Firearm Assembly/Disassembly - Part II, Revolvers
- The Gun Digest Book of Firearm Assembly/Disassembly - Part III, Rimfire Rifles
- The Gun Digest Book of Firearm Assembly/Disassembly - Part IV, Centerfire Rifles
- The Gun Digest Book of Firearm Assembly/Disassembly - Part V, Shotguns
- The Gun Digest Book of Firearm Assembly/Disassembly - Part VI, Law Enforcement Weapons
- The Gun Digest Book of Exploded Firearm Drawings
- NRA Shoulder Arms Assembly
- NRA Handgun Assembly
- NRA Gunsmithing Guide
- Book of Pistols and Revolvers - Smith
- The American Shotgun
- The Modern Shotgun
- American Shotgun Design and Performance
- Firearm Manufacturers' Armorer's Manuals in Firearm Reference Library
- Full Auto - Ar-15 Modification Manual
- Full Auto - Semi-Auto Uzi Modification Manual
- Full Auto - Semi-Auto MAC 10 Modification Manual
- Full Auto - H & K 94
- Full Auto - M1 Carbine to M2 Modification Manual
- Full Auto - Semi-Auto Bingham AK-22 Modification Manual
- National Institute of Justice (NIJ) Firearms Training Modules (online)
- An Introduction to Forensic Firearms Identification - FirearmsID.com
- Firearms Muzzle Attachments – AFTE Journal (Volume 31, Number 1) Winter 1999

5.3 Exercises

- 5.3.1 Read the above literature pertaining to mechanics.
- 5.3.2 Given a list of terms, properly define them as they relate to firearms.
- 5.3.3 List and describe the cycle-of-fire steps involved in discharging a firearm.
- 5.3.4 In the following mechanics exercises, the trainee shall be responsible for completing a Firearms Worksheet for the firearms selected by the Training Officer. The Training Officer shall advise the trainee on the correct procedure for completing the form at this stage in training. Also, the Training Officer shall advise the trainee on how to access these forms in Forensic Advantage (FA).

Additionally, the trainee shall be responsible for describing, in writing, a complete description of the function of firearms selected by the Training Officer using the correct manufacturers terminology for the various internal parts.

The firearms used to complete the Firearms Worksheets shall be different than the firearms used to complete the function write ups.

- 5.3.4.1 Disassemble and assemble a given set of firearms.
- 5.3.4.2 Complete at least two (2) Firearms Worksheets and at least two (2) function write-ups for single action and double action revolvers.
- 5.3.4.3 Given a set of study questions, answer all study questions related to single action and double action revolvers.
- 5.3.4.4 Complete at least four (4) Firearms Worksheets and at least four (4) function write-ups for single action and double action semiautomatic pistols.
- 5.3.4.5 Given a set of study questions, answer all study questions related to single action and double action semiautomatic pistols.
- 5.3.4.6 Complete at least four (4) Firearms Worksheets and at least four (4) function write-ups for rifles and shotguns.
- 5.3.4.7 Given a set of study questions, answer all study questions related to rifles and shotguns.
- 5.3.4.8 Complete at least one (1) Firearms Worksheet and at least one (1) function write-up for automatic firearms.
- 5.3.4.9 Given a set of study questions, answer all study questions related to automatic firearms.

5.3.4.10 Test Firing Firearms:

At least two (2) test bullets shall be fired from each of the firearms in the mechanics exercises. Before any firearm is fired, it shall be examined and approved by the Training Officer or designee and the trainee shall receive instruction on the available bullet trapping devices in the Firearms Unit and the Safety Rules for each device.

Those firearms in calibers that have both lead and jacketed bullets shall have at least two (2) lead and at least two (2) jacketed bullets fired.

The test fires for each firearm shall be placed in an appropriate packing (see Training Officer or designee). The following information shall be placed on the outside of each package:

- FA/FR Number
- State Crime Laboratory Case number
- Manufacturer
- Caliber
- Serial Number (if available)
- Model (if available)
- Item #
- Test Fires - ammunition type and assigned designation
- Initials of Forensic Scientist

5.3.5 Research magazine/clip types and prepare a table containing a brief physical description along with an example of a firearm that utilizes that magazine/clip.

5.3.6 Given a set of study questions, answer all study questions related to suppressors/silencers.

5.3.7 Discuss possible result statements and conclusions with the Training Officer or designee.

5.4 Evaluation

5.4.1 Successfully complete a written test on topics covered in the reading assignments and exercises.

5.4.2 Given a practical problem concerning the function of a firearm, successfully test the weapons function, compile notes, and write a report on the findings.

6.0 Module 4 – Serial Number Restoration

6.1 An approved Serial Number Restoration Course may be substituted for the following exercises; however, a written examination and practical examination shall be completed.

6.2 Objectives: Through completion of this module, the trainee shall have developed and demonstrated knowledge of:

6.2.1 Proof marks and/or stampings and explain their purposes.

6.2.2 The serial numbering practices of the major manufacturers of firearms.

6.2.3 The terminology used in serial number restoration and the basic principles of serial number practices.

6.3 Reading Assignments

- Unit Serial Number Restoration Notebook
- Handbook of Methods for the Restoration of Obliterated Serial Numbers - Richard S. Treptow
- Firearms Identification, Vol I - J. Howard Mathews, Chapter 5
- Firearms Investigation, Identification and Evidence - Hatcher, Jury and Weller, Chapter 5
- Serial Number Restoration Literature, ATF
- AFTE Glossary

6.4 Exercises

6.4.1 Read the above literature pertaining to serial numbers, proof marks, stampings and serial number restoration.

6.4.2 Given a set of terms and study questions, identify terms and answer all study questions as they relate to serial number restoration.

6.4.3 Prepare a listing of the various chemicals used during serial number restorations. Determine the hazards associated with using these chemicals and how to avoid them.

6.4.4 Explain why chemical etching of an obliterated serial number may or may not work under the following situations:

- Serial number was cast with the original gun frame.
- Serial number is engraved in the gun frame.
- Serial number is obliterated by punching the numbers and the area around them deeply with a sharp pointed center punch.
- Laser cut numbers.

6.4.5 Observe as many serial number restorations as possible.

6.4.6 If firearms that are designated for destruction are available, obtain the serial number area of several of these guns. Obliterate the serial number to various degrees and attempt to restore them. In lieu of firearms for destruction, serial number sample blocks may be used.

6.4.7 Discuss possible result statements and conclusions with the Training Officer or designee.

6.5 Evaluation

- 6.5.1 Successfully complete a written test on topics covered in the reading assignments and exercises.
- 6.5.2 Given a practical problem concerning serial number restoration, successfully attempt a serial number restoration, compile notes, and write a report on the findings.

7.0 Module 5 – Microscopy

7.1 **Objectives:** Through completion of this module, the trainee shall have developed and demonstrated knowledge of:

- 7.1.1 The basic theory of microscopy.
- 7.1.2 The fundamental terminology of microscopy.
- 7.1.3 The composition and function of the stereomicroscope.
- 7.1.4 Identify unknown samples based on their morphology.

7.2 Reading Assignments

- Unit Microscopy Notebook
- The Microscope and Its Applications - Hans Gerterman and Friedrich Lepusch, Leitz-Wetzlar
- Polarized Light Microscopy Course manual from McCrone Research Institute
- AFTE Glossary
- An Introduction to the Optical Microscope - Royal Microscopical Society, Saville Bradbury, Oxford Press, 1984.(unit microscopy notebook)
- “Basic Optics” - Claude W. Cook (unit microscopy notebook)
- Wild Stereoscope Instructional Manual

7.3 Exercises

- 7.3.1 Read the above literature pertaining to microscopy and the stereomicroscope.
- 7.3.2 Given a set of terms and study questions, identify all terms and answer all study questions as they relate to microscopy.
- 7.3.3 Given a set of materials commonly associated with fired ammunition components, properly describe their morphological features.

7.4 Evaluation

- 7.4.1 Successfully complete a written test on topics covered in the reading assignments and exercises.
- 7.4.2 Given a practical problem consisting of at least ten (10) unknowns, successfully identify and describe their morphology.

8.0 Module 6 – Ammunition

8.1 Objectives: Through completion of this module, the trainee shall have developed and demonstrated knowledge of:

8.1.1 Ammunition, ammunition components, and related nomenclature.

8.1.2 The identification of various types of ammunition and ammunition components.

8.2 Reading Assignments

- Selected AFTE Articles
- AFTE Glossary
- NRA Fact Book
- Cartridges of the World - Frank C. Barnes.
- Lymon Shotgun Handbook
- Small Arms Design and Ballistics, Vol I and II - Townsend Whelen
- Pistol and Revolver Cartridges, Vol I and II - White and Munshall
- Cartridge Headstamp Guide
- Cartridge for Collectors, Vol I, II, and III - Fred Oatig
- Lemon Case Bullet Handbook
- Small Arms and Ammunition in the United States Services, 1776 – 1865 - Berkeley R. Lewis
- U.S. Cartridges and Their Handguns - Charles R. Suydam
- Ammunition Manufacturers' Brochures
- Firearm Section Reference Files

8.3 Exercises

8.3.1 Read the above literature pertaining to ammunition and ammunition components.

8.3.2 Safety: It may be necessary to disassemble various types of ammunition to complete the Ammunition unit. Be sure to receive proper instructions from the Training Officer or designee on the various methods used to disassemble ammunition.

8.3.2.1 Kinetic Bullet Puller

- Never use the Kinetic Bullet Puller with rimfire cartridges or exploding bullets, tracers, incendiary devices, etc.
- Wear safety glasses and/or goggles at all times.
- Follow the proper procedures for cartridges with heavy crimps or seals.

8.3.2.2 Reloading Press/Bullet Puller (See Training Officer or designee prior to first use of this equipment)

- Never use on rimfire ammunition.
- Follow the charts for correct shell holders and collets.
- Wear safety glasses and/or goggles at all times.

8.3.2.3 Shotshells

- Use extreme care when cutting open shotshells with scalpel or other sharp instruments
- Wear safety glasses and/or goggles at all times.

8.3.2.4 Rimfire

- Use a file to establish opening at mouth of case.
- Do not use a grinder, Dremel or like power tool.
- Never clamp rim of case with pliers.
- Wear safety glasses and/or goggles at all times.

8.3.2.5 Safe Storage of Surplus Powder

- Airtight container.
- Label clear and well marked.

8.3.3 Tour an established American ammunition factory (Federal, Remington, etc.) and prepare a report covering rimfire, centerfire and shotgun shell production methods, markings, and packaging. (Optional)

8.3.4 Given a list of general ammunition terms, correctly define/identify all terms.

8.3.5 Given a set of study questions related to rimfire ammunition, correctly answer all study questions.

8.3.6 Given a list of ammunition manufacturers, research and show past and present head stamps.

8.3.7 Given a set of study questions related to centerfire pistol and revolver ammunition, correctly answer all study questions.

8.3.8 For each of the following calibers, prepare a chart describing the case, the bullet diameter, list of bullet type(s) and weights, as well as the common bullet weight(s) for the given caliber.

- 25 ACP/Automatic
- 32 S&W
- 32 S&W Long
- 32 Automatic
- 32 H&R Magnum
- 380 Auto
- 9mm Luger/Parabellum
- 38 S&W
- 38 Special
- 38 Super Auto
- 357 Magnum
- 40 S&W
- 10 mm

- 44 S&W Special
- 44 Magnum
- 45 Auto

8.3.9 Given a set of study questions related to centerfire rifle ammunition, correctly answer all study questions.

8.3.10 Given a set of study questions related to shotshell ammunition, correctly answer all study questions.

8.3.11 Research and list the various purposes of the different sizes and different compositions of shot and buckshot.

8.3.12 Discuss possible result statements and conclusions with the Training Officer or designee.

8.4 Evaluation

8.4.1 Successfully complete a written test on topics covered in the reading assignments and exercises.

8.4.2 Given a practical problem of at least twenty (20) ammunition or ammunition component unknowns, successfully identify all unknowns.

9.0 Module 7 – Comparison Microscopy and Fired Ammunition Class Characteristics

9.1 Objectives: Through completion of this module, the trainee shall have developed and demonstrated knowledge of:

9.1.1 The composition and function of the comparison microscope.

9.1.2 Bullet and cartridge case class characteristic terminology.

9.1.3 The various class characteristics associated with bullet and cartridge cases.

9.1.4 The use of the FBI General Rifling Characteristic Database.

9.2 Reading Assignments

- Unit Class Characteristics Notebook
- Leica FS C Operating Manual
- Firearms Identification, Vol. I - J.H. Mathews
- Firearms Identification - Jury, Weller, and Hatcher
- Tool Marks and the Striagraph - John Davis
- AFTE Glossary

9.3 Exercises

9.3.1 Read the above literature pertaining to the comparison microscope, and the class characteristics of bullets and cartridge cases.

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- 9.3.2 Given a set of terms and study questions, identify all terms and correctly answer all study questions as they relate to comparison microscopy and fired ammunition class characteristics.
 - 9.3.3 Meet with the Training Officer to determine whether the latest version of the FBI General Rifling Characteristics (GRC) Computer File is loaded on workstation PC/Laptop. The Training Officer or designee shall demonstrate the entry of the required data fields necessary for obtaining a GRC report. Reference the Firearms Unit Technical Procedures, General Rifling Characteristics (GRC) File Protocol, for guidelines in use of the database in examinations.
 - 9.3.3.1 Using the bullets fired during the Mechanics Unit, determine their GRC's, measure the Land and Groove Impressions and record the findings on the Firearm Worksheets used in the Mechanics Unit.
 - 9.3.3.2 Using cartridge cases fired during the Mechanics Unit, determine the class characteristics present, determine whether these class characteristics can be used to ascertain the type and model of the firearm that fired these cartridge cases.
 - 9.3.3.3 Using the bullets and cartridge cases from pistols fired during the Mechanics Unit, access the FBI GRC files and obtain lists of the types and models of firearms that could have fired those bullets and cartridge cases.
 - 9.3.4 Given a set of fired cartridge cases, identify and sort the fired cartridge cases based on the type of breechface impression detail.
 - 9.3.5 Given a set of fired cartridge cases, identify and sort the fired cartridge cases based on type of chamber detail.
 - 9.3.6 Given a set of fired cartridge cases, label the extractor and ejector, when present.
 - 9.3.7 Discuss possible result statements and conclusions with the Training Officer or designee.

9.4 Evaluation

- 9.4.1 Successfully complete a written test on topics covered in the reading assignments and exercises.
- 9.4.2 Given a practical problem of one or more unknown fired bullets, successfully identify the class characteristics, search the FBI GRC Database for possible firearms, and enter all information into Forensic Advantage, and write a report on the findings.

10.0 Module 8 – Presentation of Evidence in Court

- 10.1 **Objectives:** Through completion of this module, the trainee shall have developed and demonstrated knowledge of:

10.1.1 Court related terminology and the various steps in the court process.

10.1.2 General understanding of typical qualifying questions during courtroom testimony.

10.2 Reading Assignments

- Lesson Plan, “Court Preparation Training for NC State Crime Laboratory Personnel”
- Perspectives in Expert Testimony Literature, West Virginia University
- Arrest, Search, and Investigation in North Carolina [Chapter 6 – Rules of Evidence in Criminal Cases] - Robert L. Farb
- Moran, Bruce, “Firearms Examiner Expert Witness Testimony: The Forensic Firearms Identification Process Including Criteria for Identification and Distance Determination,” AFTE Journal, Summer 2000: 231-251
- Scientific Working Group for Firearms and Toolmarks (SWGUN) Admissibility Resource Kit (ARK)
- AFTE Code of Ethics
- Law 101: Legal Guide for the Forensic Expert, 2011 < <http://law101.dna.gov> >
- Overview of Expert Testimony and Being an Expert Witness, 2010
- Ethics in Forensic Science Literature, West Virginia University

10.3 Exercises

10.3.1 Read the above literature pertaining to presentation of evidence in court.

10.3.2 Given a set of terms related to the presentation of evidence in court, correctly define all terms.

10.3.3 Prepare responses to qualifying questions and review with the Training Officer or designee. It should be noted that although it is not possible to provide a list of all the questions that might be posed in a courtroom, the following will provide some insight into the type of questioning an expert witness may experience:

- Please state your full name for the record.
- Where do you work and how are you employed?
- How long have you been employed with the State Crime Laboratory?
- What are your duties?
- What type of education, training, and experience do you have that qualifies you as an expert in the field of forensic firearms identification?
- Have you testified before as an expert witness? If so, how many times?
- What is forensic firearms identification?

10.3.4 The trainee shall attend court and observe the testimony of senior Forensic Scientists as available (coordinate through the Unit Forensic Scientist Manager).

10.3.5 Create/Update Curriculum Vitae.

10.4 Evaluation

10.4.1 Complete a mock case.

10.4.2 Successfully testify as an expert witness in a moot court setting based on the analysis of one or more competency cases. Review moot court testimony with the Training Officer and other senior Forensic Scientists.

10.4.3 Successfully complete a final Phase I written test.

11.0 Records

- Training file
- Training checklist

12.0 Attachments – N/A

Revision History		
Effective Date	Version Number	Reason
04/06/2016	1	Original Document