Idaho State Police
Forensic Services

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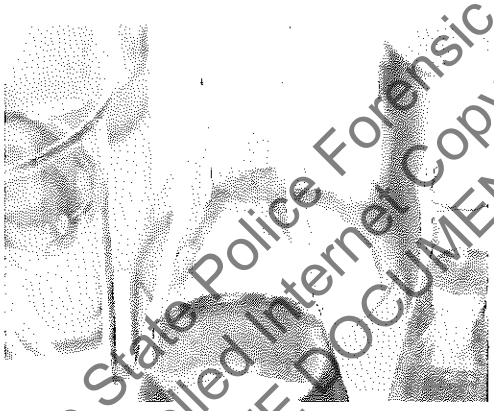

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Idaho State Police Forensic Services

FIREARMS & TOOL MARK EXAMINER TRAINING Manual

Revision #	Issue Date	History
00	11/15/06	Original Issue based on AFTE training guide From February 24 1995.
01	5/9/2007	Section 1.1 added requiring training to affirm reading and understanding the quality procedure manual. History page moved to the front of the manual. Section 12 testimony training added.
02	9/1/07	Added Section 14 NIBIN Entry
03	5/25/2010	Revised Section 13 requiring supervised cases instead of cosigned. Added section 15.
04	9/29/2010	Added new manufacturing methods.

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INTRODUCTION

The following syllabus will allow you as an examiner trainee to guide yourself through the various areas of knowledge integral to the field of firearms/toolmark identification. This syllabus is generic in its layout and allows some modification by the individual Discipline Leader/on-site trainer or lab manager to meet local conditions. It is paramount that you keep before you the primary and ultimate objective of this training period: to independently and completely examine and compare evidence relating to firearms and toolmark identification; to independently and competently render an opinion and reach conclusions relating to your examinations and comparisons; and to give expert testimony in court in matters encompassed within the broad definition of firearms/toolmark identification and to do this in a professional, competent and impartial manner. The obligation is yours to maximize on the effectiveness of the training period as an opportunity to learn everything possible in this field. The extent to which you exert yourself during this training and evaluation period will bear directly on the quality of your performance in the laboratory and on the witness stand. Note well that your technical abilities and your testimony will, in turn, bear directly on the future situations of accused persons, and especially in the discipline of firearms/toolmark identification, the lives of accused persons can hang in the balance. You have a moral and ethical obligation to prepare yourself technically and professionally during training in order to be able to perform according to the most rigid standards.

You will be expected to carry out a study of all pertinent lab equipment, the Analytical Methods, the Safety Manual, as well as the physical reference files.

It is required that you keep a loose-leaf notebook of your study notes on each of the items shown in the syllabus for research, discussion, demonstration, study or practical work. Your notebook can include handwritten notes, charts, graphs, photographs, brief photocopied material, etc., at your discretion, but it must address and broaden on each of the required items of study set out in the syllabus. Organization of your notebook in a format which parallels the syllabus is suggested. This notebook will serve as a ready reference in the months and even years following your qualification, and will assist in documenting your progress during training.

Your training will be monitored and assisted by the Discipline Leader/on-site trainer, who has responsibility for training matters. All outside schools, tours, lectures and contacts will be coordinated by the lab manager. You will be expected to meet the standards set by the Discipline Leader/on-site trainer for your successful completion of your training.

Section 1.0 ADMINISTRATIVE MATTERS AND PROCEDURES

1.1 Obtain a copy of the Quality Procedure Manual. Familiarize yourself with its contents and indicate you understand the rules and procedures contained therein by your signature below.

_____ _____
Trainee Date

1.2 Discuss with your Lab Manager the laboratory Quality Assurance Program and the Proficiency Testing Program.

_____ _____
Lab Manager Date:

1.3 Discuss with your Lab Manager the laboratory policy regarding the reexamination of evidence.

_____ _____
Lab Manager Date

1.4 Discuss with your Lab Manager the laboratory policies regarding the following:

(a) Providing telephonic results prior to issuance of a final laboratory report.
(b) Inquiries from the press and other media.
(c) Request to give a deposition in a criminal case.
(d) Request to testify in a civil case.
(e) Request to testify in a grand jury proceeding or a preliminary hearing.
(f) Providing a laboratory report to other agencies.

_____ _____
Lab Manager Date

1.5 Become familiar with the requirements and the facilities available for the secure storage of evidence within the lab. Discuss this with the Lab Manager and an examiner from the lab.

_____ _____
Lab Manager Date

_____ _____
Discipline Leader/on-site trainer Date

1.6 Become familiar with the requirements of lab security in regards to firearms, electrical appliances, evidence while under examination, and lab space security. Discuss this with an examiner from the lab.

Discipline Leader _____ Date _____

1.7 Familiarize yourself with the Firearms Reference Collection (FRC):

(a) Learn how to locate firearms in the FRC using the FRC printed inventory listings, and obtain up-to-date copies of this inventory for your use.
(b) Know the correct procedure for checking a firearm out of the FRC.

Discipline Leader _____ Date _____

1.8 Be briefed by the Lab Manager in regard to their files, records and procedures in regard to delinquent (unaddressed) cases, annual and sick leave, time and attendance, report files, ordering expendable supplies, purchase orders and obtaining necessary tools, equipment and protective clothing.

Lab Manager _____ Date _____

1.9 Obtain a copy of the Safety Manual. Familiarize yourself with its contents and indicate you understand the rules and procedures contained therein by your signature below.

Trainee _____ Date _____

Section 2 BACKGROUND/HISTORY OF FIREARMS IDENTIFICATION

2.1 Define the following terms:
(a) firearms identification
(b) ballistics

_____ _____
Discipline Leader/on-site trainer Date

2.2 Read the applicable sections from the basic references and prepare a report on the history, principles, evolution and scope of firearms identification in its broadest sense. Support your report by data accumulated in your notebook. Discuss this with the Discipline Leader/on-site trainer who will review your report.

_____ _____
Discipline Leader/on-site trainer Date

2.3 Formulate an answer to the following questions:
(a) Is firearms identification an art or science?
(b) What are the types of conclusions that can be reached in firearms identification comparisons?
(c) What is the basis for each of the above conclusions?
(d) Can experts in the field of firearms identification disagree regarding their conclusions? Why?
(e) How does "probability" relate to firearms identification?

_____ _____
Discipline Leader/on-site trainer Date

2.4 Familiarize yourself with the "Association of Firearms and Toolmark Examiners" (AFTE) to include its history, criteria for membership, committees, the AFTE glossary and the AFTE journal and be able to discuss them.

_____ _____
Discipline Leader/on-site trainer Date

2.5 Discuss with system operators the status of the ongoing research initiatives to link shootings using computer imagery such as NIBIN/IBIS.

_____ _____

Discipline Leader/on-site trainer Date

2.6 Visit and tour the various laboratories that provide firearms and toolmark examinations within your region. Coordinate this visit with the Lab Manager.

_____ _____

Discipline Leader/on-site trainer Date

2.7 Become knowledgeable about the proficiency testing program administered by the outside independent testing services. Particularly be aware of testing and the results of testing conducted within the field of firearms and toolmark identification by this organization. Discuss this with the Discipline Leader/on-site trainer.

_____ _____

Discipline Leader/on-site trainer Date

2.8 Be able to demonstrate a practical working knowledge of firearms terminology using the AFTE Glossary as the standard.

_____ _____

Discipline Leader/on-site trainer Date

Section 3 FIREARMS & AMMUNITION DEVELOPMENT AND CURRENT TRENDS

3.1 Review the history of early firearms and ammunition development up to the advent of metallic cartridges, with particular emphasis on lock mechanisms, early rifling techniques, percussion systems, priming methods and pre-metallic cartridges. Prepare a chronological outline of this early development and discuss it with the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

3.2 Study the firearms reference collection noting in particular the types of firearms which are representative of commercial and military firearms development since the advent of metallic cartridges.

_____ _____
Discipline Leader/on-site trainer Date

3.3 Trace the evolution of the rimfire cartridge from the mid-nineteenth century to the current generation of modern .22 caliber rimfire cartridges.

_____ _____
Discipline Leader/on-site trainer Date

3.4 Study the history of centerfire cartridge development starting with black powder cartridges to the current generation of modern centerfire cartridges. Make notes to show the chronological history of this development and discuss it with the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

3.5 Study the Standard Ammunition File (SAF), in particular cartridges and shotshells which are representative of commercial and military ammunition development during the past three decades.

_____ _____
Discipline Leader/on-site trainer Date

3.6 Conduct a study of exterior bullet coatings. Discuss with the trainer how this new technology impacts the firearms examiner.

_____ _____

Discipline Leader/on-site trainer Date

Section 4 MANUFACTURE OF MODERN FIREARMS

4.1 Numerous techniques are used in the manufacture of modern firearms. Research in detail these processes and set these out in your notes. Include but do not restrict your study to the following machining methods:

(a) shaping
(b) planning
(c) Drilling
(d) reaming
(e) turning
(f) boring
(g) milling-include both face milling and peripheral (slab) milling
(h) broaching
(i) abrasive machining-include honing, lapping, grinding, sanding, and ultrasonic methods
(j) sawing
(k) filing
(l) swaging
(m) electrochemical machining (ECM)
(n) electrodischarge machining (EDM)
(o) investment casing
(p) metal injected molding (MIM)

Discipline Leader/on-site trainer Date

4.2 Demonstrate your knowledge of the basic nomenclature of handguns, rifles, and shotguns.

a. Include, but do not restrict your study, to the following: breechface, breechbolt, bolt, bolt face, extractor, ejector, firing pin, rifling, barrel, lands, grooves, ramp, magazine, clip, ejection port, receiver.
b. Point out these parts in several handguns, rifles and shotguns as applicable.
c. Discuss the manufacturing techniques which would have been used to fabricate and finish each of the parts and note the machining marks on each part.
d. Point out any "mark of abuse" which could contribute to the uniqueness of each part.
e. Identify areas that machining marks might "carry over" to another firearm.

Discipline Leader/on-site trainer Date

4.3 Research in detail the following rifling techniques:

(a) broach
(b) button
(c) hammer forging
(d) hook method
(e) scrape method
(f) ECM/EDM

_____ _____

Discipline Leader/on-site trainer Date

4.4 Obtain broaches and buttons for study from the lab training materials. Determine the difference between barrels which have been button rifled and those which have been broach rifled.

_____ _____

Discipline Leader/on-site trainer Date

4.5 Discuss and define the following terms as they relate to firearms manufacture or firearms identification.

(a) chambering
(b) crowning
(c) ballizing
(d) bore slugging
(e) forcing cone
(f) bore
(g) choke
(h) choke tubes

_____ _____

Discipline Leader/on-site trainer Date

4.6 Research the history and current significance of proof marks as they relate to the manufacture of firearms. Discuss this with the Discipline Leader/on-site trainer.

_____ _____

Discipline Leader/on-site trainer Date

4.7 Visit the manufacturing facilities of at least two firearms and/or barrel manufacturers such as Wilson barrels, Ruger, Smith and Wesson, Mossberg, Marlin and US Repeating Arms. Record notes in your notebook on each visit and produce a written report of your visit for lab files and an oral report for lab members. Particular emphasis should be placed on manufacturing and rifling techniques used by each manufacturer, noting methods and procedures which leave unique manufacturing toolmarks on firearms parts which, in turn, produce individual microscopic marks on bullets, cartridge cases and shotshell casings. Coordinate these visits with the Discipline Leader/on-site trainer.

_____ _____

Discipline Leader/on-site trainer Date

Section 5 MANUFACTURE OF MODERN AMMUNITION

5.1 Define in your notebook and know the meaning of the following terms as they relate to modern ammunition and its manufacture:

(a) cartridge
(b) cartridge case
(c) primer
(d) shotshell
(e) shotshell casing
(f) bottleneck cartridge
(g) rebated-rim cartridge
(h) rimless cartridge
(i) rimmed cartridge
(j) semi-rimmed cartridge
(k) shoulder
(l) neck
(m) mouth
(n) head
(o) headstamp
(p) proof cartridge
(q) tapered cartridge
(r) extractor groove
(s) gauge
(t) battery cup
(u) brass
(v) "Rule of 17"
(w) wadding
(x) shot collar
(y) crimp
(z) bunter

(aa) bullet
(bb) round-nosed bullet
(cc) "hollow-point" bullet
(dd) jacketed bullet
(ee) bullet sizing
(ff) wadcutter bullet
(gg) semi-wadcutter bullet
(hh) soft point bullet
(ii) spitzer bullet
(jj) swaging
(kk) cast lead bullet
(ll) mold marks
(mm) truncated cone bullet
(nn) cannelure
(oo) ogive
(pp) brass-coated lead bullet
(qq) copper-coated lead bullet
(rr) nylon-coated lead bullet
(ss) "silvertip" bullet
(tt) antimony
(uu) arsenic
(vv) chilled shot
(ww) high brass, low brass
(xx) lubaloy
(yy) dram equivalent
(zz) single base, double base

_____ _____
Discipline Leader/on-site trainer Date

5.2 Sketch the cross-section of Berdan and Boxer primers, showing their relationship to the head of the cartridge.

_____ _____
Discipline Leader/on-site trainer Date

5.3 Discuss the purpose and essential ingredients of priming mixture used in modern cartridges.

_____ _____

Discipline Leader/on-site trainer Date

5.4 Know and discuss the difference between caliber and caliber type. Illustrate this difference by relating these terms to a discussion of the .22 caliber, .30 caliber and .38 caliber families of cartridges.

_____ _____

Discipline Leader/on-site trainer Date

5.5 Visit at least two ammunition-manufacturing facility such as Remington, Federal or Winchester to observe the manufacture of rimfire and centerfire cartridges and shotshells. Make detailed notes of the manufacturing processes and generate a written report for lab files. Also prepare an oral presentation for lab members upon your return. Particular emphasis should be placed on pellet and bullet manufacture, shotshell casing and cartridge case manufacture and the steps involved in the loading of cartridges and shotshells. Coordinate this visit with the Discipline Leader/on-site trainer.

_____ _____

Discipline Leader/on-site trainer Date

Section 6 INSTRUMENTATION

6.1 Differentiate between the following:

(a) compound microscope
(b) stereo microscope
(c) comparison microscope

_____ _____

Discipline Leader/on-site trainer Date

6.2 Study the instruction manual for our stereomicroscopes. Determine how to insert a reticule and how to check the calibration of the microscope.

_____ _____

Discipline Leader/on-site trainer Date

6.3 Familiarize yourself with the instruction manuals and the mechanical and optical aspects of our microscopes in the lab. Note the differences and similarities in each, both mechanically and optically.

_____ _____

Discipline Leader/on-site trainer Date

6.4 Familiarize yourself with the following types of light sources which are in use in the lab on the comparison microscopes.

(a) fluorescent
(b) fiber optics (with and without filters)

_____ _____

Discipline Leader/on-site trainer Date

6.5 Using each type of light source in the field of view on a comparison microscope, note the differences in the quality of each using the following different surfaces: lead bullets, jacketed bullets, various types of cartridge cases, and various types of surfaces containing toolmarks. Manipulate the above light sources with respect to angle and vary the intensity of the light source if possible. Gain an appreciation for the effects of varying the angle and intensity for each light source on each type of surface. Discuss this with the Discipline Leader/on-site trainer.

_____ _____

Discipline Leader/on-site trainer Date

6.6 Set up a comparison microscope for your vision requirements and focus the "hairline". Prepare the microscope for your personal use, and familiarize yourself with each set of objective lenses on your comparison microscope. Become familiar with the various digital camera systems in the lab.

Discipline Leader/on-site trainer _____ Date _____

6.7 Become familiar with and demonstrate the use of the following equipment:

(a) speed micrometer
(b) inertia bullet puller
(c) steel rule
(d) reticle in ocular lens of binocular microscope
(e) balances and scales located in the lab

Discipline Leader/on-site trainer _____ Date _____

6.8 Review the maintenance and calibration of the balances in the firearms lab.

Discipline Leader/on-site trainer _____ Date _____

Section 7 EXAMINATION OF FIREARMS

7.1 Define each of the following types of firearms and explain in detail the operation of each type to include the loading of cartridges and the subsequent movement of the cartridge case and/or bullet after firing.

(a) revolver, single and double action
(b) auto-loading pistol, single and double action
(c) derringer and single shot pistols
(d) bolt-action rifle
(e) auto-loading rifle
(f) pump-action rifle
(g) various single shot rifles
(h) submachine gun
(i) assault rifle

_____ _____
Discipline Leader/on-site trainer Date

7.2 Explain and illustrate the differences between a gas-operated and a recoil-operated auto-loading shotgun.

_____ _____
Discipline Leader/on-site trainer Date

7.3 Explain and illustrate the differences between the following types of auto-loading pistols:

(a) blowback action
(b) delayed blowback action
(c) gas-delayed blowback action
(d) short recoil action
(e) long recoil action

_____ _____
Discipline Leader/on-site trainer Date

7.4. Partially disassemble and reassemble a representative sample of revolvers from the reference collection. Photograph and note the differences in their mechanisms. Identify each part by name.

_____ _____

Discipline Leader/on-site trainer Date

7.5 Field strip and reassemble a representative sample of the semiautomatic firearms in the firearm reference collection. Note the differences in their mechanisms. Be able to identify the parts using the specific manufacturers nomenclature

_____ _____

Discipline Leader/on-site trainer Date

7.6 Field strip and reassemble a representative sample of submachine guns in the firearms reference collection. Note differences in the mechanism and operation of each. Identify the major parts by name.

_____ _____

Discipline Leader/on-site trainer Date

7.7 Familiarize yourself with the operation of a representative sample of military and civilian center fire rifles from the firearms reference collection. Be able to identify the major components and action types of the various samples.

_____ _____

Discipline Leader/on-site trainer Date

7.8. Familiarize yourself with the operation of each of a representative sample of shotguns in the firearms reference collection. Identify the major parts by name and make appropriate notes. Be able to discuss the various action types in the collection.

_____ _____

Discipline Leader/on-site trainer Date

7.9. Familiarize yourself with the operation of a representative sample of the rimfire revolvers, pistols and rifles. Identify the major parts by name and make appropriate notes. Be able to discuss the various action types in the collection.

Discipline Leader/on-site trainer _____ Date _____

7.10. Using the firearms in No. 4 through No. 9 above, study the various safety mechanisms employed in each design. Include thumb safety, grip safety, magazine safety, firing pin block, transfer bar, and any other mechanical safety. Illustrate how the firing mechanisms are blocked, interrupted, or otherwise stopped from operating.

Discipline Leader/on-site trainer _____ Date _____

7.11. Familiarize yourself with the Range Rules and Safety Rules regarding firearms. Demonstrate, using firearms from No. 4 through No. 9 above and others, how to place firearms in a safe condition, how to load and unload each, how to handle and carry these firearms in the laboratory, and how to safely test fire each of these different types of firearms.

Discipline Leader/on-site trainer _____ Date _____

7.12. Familiarize yourself with the lab equipment used for measurement of trigger pull. Determine the trigger pull on at least one firearm from each of the No. 4 through No. 9 groups of firearms above.

Discipline Leader/on-site trainer _____ Date _____

7.13. Discuss with the Discipline Leader/on-site trainer from the unit the protocol to be used in determining whether a firearm "can be made to fire without pulling the trigger". Demonstrate, using one firearm from each of the No. 4 through No. 9 groups of firearms above, how to conduct this type of examination.

Discipline Leader/on-site trainer _____ Date _____

7.14. Research, define, and/or determine the implications of the following terms as they relate to safety in the operation of a firearm.

(a) excessive headspace
(b) barrel obstruction
(c) barrel bulge
(h) defective safety
(i) high primer
(j) rail splitting

(d) broken extractor
(e) push off
(f) trigger shoe
(g) false half-cock
(k) hairline cracks
(l) improper timing
(m) excessive pressure
(n) dented barrel

_____ _____
Discipline Leader/on-site trainer Date

7.15. Become familiar with the lab's firearms range including its physical dimensions, construction of walls and backstop, and bullet velocity limitations. Know how to test fire firearms thought to be possibly unsafe. Become familiar with the use of all the equipment on the range. Know the range rules and emergency medical treatment procedures.

_____ _____
Discipline Leader/on-site trainer Date

7.16. Attend Armorer's training offered by various manufacturers of firearms, at their manufacturing facilities if possible. Coordinate these with the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

7.17. Explore the capabilities in restoring an inoperable evidence firearm to operating condition and also know the limitations and reservations which must be considered. Discuss this with the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

7.18. Review and record the references in the lab library which can be used to identify the manufacturer and/or source of a firearm using the following criteria:

(a) proof marks
(b) inspector marks
(c) factory numbers and markings

(d) serial number
(e) part numbers
(f) company logos

Discipline Leader/on-site trainer _____ Date _____

7.19. Discuss the following topics with the Discipline Leader/on-site trainer and become familiar with the capabilities and limitations of the lab in regard to these areas:

(a) marking evidence firearms
(b) determining whether an evidence firearm has been fired since it was last cleaned
(c) determining the manufacturer of a firearm from an examination of a part from a firearm
(d) Determining the manufacturer of a firearm from a photograph and comparing an evidence firearm to a photograph

Discipline Leader/on-site trainer _____ Date _____

7.20. Become knowledgeable about how to submit evidence firearms to the laboratory when they have been recovered from water or when they are in a rusted condition. Also become familiar with the capabilities, limitations, and reservations which must be considered when restoring such firearms to operating condition to obtain test specimens from them.

Discipline Leader/on-site trainer _____ Date _____

7.21. Discuss with the Discipline Leader/on-site trainer how to conduct an examination to determine if a firearm has been altered to fire full automatic. Using a firearm which has been altered to fire full automatic, conduct this type of examination and verbally report your findings.

Discipline Leader/on-site trainer _____ Date _____

Section 8.1 BULLET EXAMINATIONS AND COMPARISONS

8.1.1. Obtain a copy of and familiarize yourself with the lab protocol for the examination of fired bullets.

_____ _____

Discipline Leader/on-site trainer Date

8.1.2. Define what is meant by or determine the significance of the following terms or phrases as they relate to the examination and comparison of fired bullets. Discuss with the Discipline Leader/on-site trainer.

(a) slippage
(b) shaving
(c) obturate
(d) leading edge and trailing edge
(e) melting
(f) blow-by
(g) striation
(h) individual microscopic marks
(i) ogive
(j) bearing surface
(k) class characteristics
(l) general rifling characteristics
(m) "insufficient individual microscopic marks"
(n) corrosion
(o) leading
(p) "limited individual microscopic marks"
(q) "single-action" firing
(r) "double-action" firing

_____ _____

Discipline Leader/on-site trainer Date

8.1.3. As they relate to the examination and comparison of fired bullets or bullet fragments, know the

importance of and limitations of determining the following:

(a) weight
(b) caliber
(c) caliber type
(d) manufacturer
(e) general rifling characteristics
(f) pitch of rifling
(g) depth of rifling

Discuss with the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

8.1.4. Familiarize yourself with the Standard Ammunition File (SAF). Know how to search this file manually and by use of the computer in order to determine the manufacturer of fired bullets. Demonstrate your proficiency in using this file to the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

8.1.5. Become familiar with the Known Specimen File (KSF). Know its location, composition, filing system, and uses as a reference file. Discuss with the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

8.1.6. Familiarize yourself with the General Rifling Characteristics (GRC) file. Know how to use this file to compile a list of firearms in a "no-gun case". Demonstrate your proficiency in using the GRC file to the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

8.1.7. Using test bullets and other fired bullets and bullet fragments provided to you, demonstrate your proficiency in accurately determining caliber, caliber type, manufacturer, and rifling

characteristics of these fired bullets. Also prepare a list of firearms which could have been used to fire these bullets provided to you. As necessary, use the KSF, SAF, and GRC files in conducting these examinations.

_____ _____

Discipline Leader/on-site trainer Date

8.1.8. Using test bullets fired from polygonal rifled barrels, demonstrate your proficiency in accurately determining the rifling characteristics of these fired bullets. Compile a list of firearms which could have been used to fire these bullets using the GRC file.

_____ _____

Discipline Leader/on-site trainer Date

8.1.9. Become knowledgeable about the facilities in the lab for the recovery of fired test bullets. Know when and how to use the horizontal recovery tank and fiber box and their limitations. Observe and assist the Discipline Leader/on-site trainer from the lab in the recovery of fired bullets using each of these methods. Know and observe all safety rules.

_____ _____

Discipline Leader/on-site trainer Date

8.1.10. Familiarize yourself with the ammunition storage areas in the lab. Know how to locate test ammunition after correctly selecting test ammunition using the SAF. Discuss with the Discipline Leader/on-site trainer the reasons for using substitute ammunition or down-loading ammunition for test firing. Know the proper procedure for down-loading ammunition for test firing. Under supervision of the Discipline Leader/on-site trainer prepare and fire down-loaded test ammunition.

_____ _____

Discipline Leader/on-site trainer Date

8.1.11. Test fire "consecutively-made" barrels and/or microscopically compare test bullets from "consecutively-made" barrels. Observe the differences and similarities in the striations and discuss with the Discipline Leader/on-site trainer.

_____ _____

Discipline Leader/on-site trainer Date

8.1.12. Using the same .22 caliber firearm, test fire two each of at least three brands of 22 LR caliber ammunition, using both plated (copper and brass washed) and lead bullets. Attempt to identify the test bullets to each other. Take appropriate photographs and notes.

_____ _____

Discipline Leader/on-site trainer Date

8.1.13. Using the same .357 Magnum caliber revolver, test fire two each of at least three brands of 38 special and .357 Magnum caliber ammunition, using jacketed, plated and lead bullets. Attempt to identify the test bullets to each other. Take appropriate photographs and notes.

_____ _____

Discipline Leader/on-site trainer Date

8.1.14. Using the same 9mm Luger pistol, test fire two each of at least 3 brands of 9mm ammunition, using both jacketed and plated bullets. Attempt to identify the test bullets with each other. Take appropriate photographs and notes.

_____ _____

Discipline Leader/on-site trainer Date

8.1.15. Microscopically compare bullets before and after that have been fired from a gun and then the barrel of the gun was cut and the muzzle end was crowned.

_____ _____

Discipline Leader/on-site trainer Date

8.1.16. Using a .30 caliber rifle, test fire at least two different brands of ammunition and compare the tests with each other. Conduct this test with the Discipline Leader/on-site trainer.

Discipline Leader/on-site trainer Date

8.1.17. Using a .32 S & W caliber revolver, test fire two each of the following cartridges and compare the test bullets with each other. Conduct this test with the Discipline Leader/on-site trainer.

(a) .32 S & W caliber Remington with lead bullet
(b) .32 Auto caliber Remington with full metal case jacketed bullet

Discipline Leader/on-site trainer Date

8.1.18. Test fire a representative sample of Polygonal or Hexagonal rifling profile pistols. Using two test bullets from each pistol, make microscopic comparisons of the test bullets. Conduct this test with the Discipline Leader/on-site trainer.

Discipline Leader/on-site trainer Date

8.1.19. Compile a list of reasons as to why bullet identifications cannot be made in some cases, and why some barrels and bullets can preclude or tend to preclude identifications. This list should include, but not be limited to, the results of the above testing.

Discipline Leader/on-site trainer Date

8.1.20. Discuss the significance of identifying manufacturing toolmarks on a fired bullet from a victim with those on unfired bullets loaded into cartridges from the suspect. Read the article in the April 1985 issue of the Crime laboratory Digest concerning "Manufacturing Toolmark Identification on the Base of Jacketed Bullets".

Discipline Leader/on-site trainer Date

8.1.21. Discuss the feasibility of determining caliber and/or the rifling characteristics of a fired bullet from an examination of a bullet hole in metal.

Discipline Leader/on-site trainer Date

8.1.22. Compare test bullets with each other before and after from a barrel that has been "Slugged".

Discipline Leader/on-site trainer Date

8.2. **CARTRIDGE/CARTRIDGE CASE EXAMINATIONS AND COMPARISONS**

8.2.1. Obtain a copy of and be familiar with the lab protocol for the examination of cartridges and cartridge cases.

Discipline Leader/on-site trainer Date

8.2.2. Describe "class characteristics" as the phrase applies to markings on a cartridge or a fired cartridge case. Determine the types of marks which can be left on a cartridge case/cartridge during loading/extracting and firing. Review a videotape regarding the slow motion of firing sequences using semiautomatic firearms.

Discipline Leader/on-site trainer Date

8.2.3. Test fire 6 semiautomatic firearms at least twice. Using the test fired cartridge cases, visually relate the markings imparted to the fired cartridge case with the part on the firearm which produced these markings. Also load and extract at least two cartridges from each of the following firearms and visually relate the markings imparted to the unfired cartridges with the part on the firearm which produced these markings.

Discipline Leader/on-site trainer Date

8.2.4. Using the test cartridge cases and cartridges from paragraph 2, above, microscopically intercompare all of the markings with each other. Include the following types of markings in your microscopic comparisons: firing pin impression, breechface marks, chamber marks, anvil marks, extractor marks, ejector marks, ramp marks, and magazine marks. Photograph the

results of your comparisons.

_____ _____

Discipline Leader/on-site trainer Date

8.2.5. Test fire the following firearms using comparable CCI, Remington, Federal, and Winchester ammunition of the appropriate caliber type for each firearm. Select ammunition with both nickel and brass primers. Test fire each firearm at least twice using each brand of ammunition. Microscopically intercompare and photograph the markings as in paragraph 3, above.

(a) .38 Special caliber Smith & Wesson revolver
(b) .357 Magnum caliber Smith & Wesson revolver
(c) 9mm Smith & Wesson, , pistol
(d) .22 long Rifle caliber Ruger pistol

_____ _____

Discipline Leader/on-site trainer Date

8.2.6. Test fire a .22 Long Rifle caliber Smith and Wesson revolver, fire six .22 Long Rifle caliber cartridges, six .22 Long caliber cartridges, and six .22 Short caliber cartridges of the same manufacturer. Mark each cartridge to note the chamber in which it is fired. Intercompare and photograph the markings imparted to the fired cartridge cases.

_____ _____

Discipline Leader/on-site trainer Date

8.2.7. Discuss the possibility of comparing and identifying reloading-type marks on cartridges/cartridge cases. Identify the various types of marks which may be indicative of reloaded ammunition. Become familiar with the reloading equipment in the lab and the procedures used in reloading cartridges. Reload several cartridges and compare reloading-type marks on these cartridges with each other.

_____ _____

Discipline Leader/on-site trainer Date

8.2.8. Discuss the feasibility of comparing and identifying manufacturing toolmarks on a fired cartridge case from the scene of a crime with cartridges which can be associated with the suspect. Identify the various types of manufacturing toolmarks which may be present on cartridges or cartridge cases.

Discipline Leader/on-site trainer _____ Date _____

8.2.9. Test fire a .30 Carbine caliber U.S. Carbine and compare the test cartridge cases with each other. Compare all of the marks imparted to the fired cartridge cases. Load and extract cartridges from this same firearm. Note and compare all of the marks imparted to the test cartridges.

Discipline Leader/on-site trainer _____ Date _____

8.2.10. Read the following two articles in the October 1989 issue of the AFTE journal and discuss them with the Discipline Leader/on-site trainer in the lab.

(a) "Firing Pin Impressions - Their Measurement and Significance"
(b) "Firing Pin Impressions - Their Relation to Hammer Fall Conditions"

Discipline Leader/on-site trainer _____ Date _____

8.3. SHOTSHELL AND SHOTSHELL COMPONENT EXAMINATIONS AND COMPARISONS

8.3.1. Determine what type of examinations can be conducted and what conclusions can be reached from an examination of the following components. Discuss this with the Discipline Leader/on-site trainer.

(a) shot, deformed and undeformed
(b) fired card or fiber wads
(c) fired plastic wads
(d) fired shotshell casings
(e) unfired shotshells
(f) shot buffer material

(g) shot collar and shot cup

_____ _____

Discipline Leader/on-site trainer Date

8.3.2. Familiarize yourself with the use of the SAF in regard to the determination of gauge and manufacturer of fired shotshell components. Know the limitations in regard to making such determinations. Demonstrate your proficiency in using the SAF to conduct this type of search to the Discipline Leader/on-site trainer.

_____ _____

Discipline Leader/on-site trainer Date

8.3.3. Using a shotgun, saw off a portion of the barrel. Test fire this shotgun using a Remington shotshell with a power piston wad. Recover the test shotshell wads and make microscopic comparisons of marks imparted to the test wads.

_____ _____

Discipline Leader/on-site trainer Date

8.3.4. Test fire 4 shotguns using at least two test shotshell casings from each shotgun and microscopically compare the marks imparted to these shotshell casings. Include in your comparisons the following types of marks: firing pin impression, breechface marks (primer, battery cup, and head), extractor marks, ejector marks, chamber marks, and any other mechanism marks. Photograph these marks and discuses the significance of identifying any of these types of marks.

_____ _____

Discipline Leader/on-site trainer Date

8.3.5. Using a 12 gauge semiautomatic shotgun, obtain at least two test shotshell casings with a representative sample of 12 gauge shotshell ammunition. Use small size shot, mediums size shot, buckshot and slugs for this test. Also recover a representative number of the fired pellets and fired wadding from each test firing. Compare markings on these test shotshell casings with each other. Examine the fired components which were recovered and compare them to unfired components of the same type. Discuss the significance of your findings.

_____ _____

Discipline Leader/on-site trainer Date

8.3.6. Discuss in detail the procedures used in reloading shotshells and familiarize yourself with the shotshell reloading equipment in the lab. Know how to recognize reloaded shotshells from an examination of the shotshell casing and/or its components. Reload shotshells using the shotshell reloading equipment in the lab and examine the reloaded shotshells for reloading-type marks.

_____ _____

Discipline Leader/on-site trainer Date

8.4 Successfully perform a competency test that includes at least one cartridge case comparison, one bullet comparison and a shotshell or shotshell component examination and comparison.

_____ _____

Discipline Leader/on-site trainer Date

8.5 Successfully complete a mock court dealing with firearm examination.

_____ _____

Discipline Leader/on-site trainer Date

Section 9. GUNSHOT RESIDUE EXAMINATIONS AND DISTANCE DETERMINATIONS

9.1. Demonstrate your proficiency in preparing the chemicals used in the modified Griess test and the Sodium Rhodizonate test including the test media and the photographic paper.

_____ _____

Discipline Leader/on-site trainer Date

9.2. Described in detail the chemical reactions which take place in the burning of smokeless powder, the modified Griess test and the Sodium Rhodizonate test.

_____ _____

Discipline Leader/on-site trainer Date

9.3. Demonstrate your proficiency in conducting the following techniques, using the techniques set out in the lab protocol manual:

(a) conventional Griess test
(b) reverse Griess test
(c) sodium rhodizonate test
(d) Bashinsky transfer
(e) blotting transfer

_____ _____

Discipline Leader/on-site trainer Date

9.4. Read the article entitled "Graphical Analysis of the Shotgun/Shotshell Performance Envelope in the Distance Determination Cases" in the AFTE Journal, October, 1989 issue. Discuss this article with the Discipline Leader/on-site trainer.

_____ _____

Discipline Leader/on-site trainer Date

9.5. Perform a competency test conducting "muzzle-to-garment" distance tests, with at least one sample involving the deposition of gunshot residues and one sample involving shot patterns. Your examination should include note taking, microscopic and chemical examinations, test firing to produce test patterns and accurately determining "muzzle-to-garment" distance.

_____ _____

Discipline Leader/on-site trainer Date

9.6 Successfully complete a mock court dealing with distance testing.

_____ _____

Discipline Leader/on-site trainer Date

Section 10. TOOLMARK EXAMINATIONS AND COMPARISONS

10.1. Obtain a copy of and familiarize yourself with the lab protocol for the examination toolmarks.

_____ _____
Discipline Leader/on-site trainer Date

10.2. Review your notes in reference to the section entitled "Manufacture of Modern Firearms". Those machining methods are the basis for toolmark identification as they were for firearms identification. However, it should be noted that in the broad definition of toolmarks identification, certain other related types of examinations are also performed. Discuss your review with the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

10.3 Define the word "tool" and toolmarks identification in the narrow sense of the expression. Also define toolmark identification in its broadest sense, and determine the kinds of conclusions which may be reached in the toolmark identification. Set these out in detail and discuss these with the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

10.4. Discuss the significance of examining submitted tools first for foreign deposits and itemize several types of such deposits.

_____ _____
Discipline Leader/on-site trainer Date

10.5. In a case involving a toolmark examination wherein no tool is submitted, determine the types of conclusions which can be reached. Consider such things as the type of tool, size of tool, action employed by tool, value of toolmark for comparison purposes, and unusual tool features. Discuss the "no tool" case with the Discipline Leader/on-site trainer.

_____ _____
Discipline Leader/on-site trainer Date

10.6. Define the following terms as they relate to toolmark identification and give three examples of tools or methods which could produce each category:

(a) shearing
(b) pinching
(c) fracture
(d) scrape mark
(e) impression
(f) slicing

_____ _____
Discipline Leader/on-site trainer Date

10.7. Define the term "class characteristics" as it applies to toolmark identification. Using the tools of methods selected as examples in the paragraph above, describe their respective class characteristics in detail.

Select at least two tools representative of each category in paragraph 5 above from the lab. Produce toolmarks with each tool and observe the class characteristics of the toolmark. Very the angle and force with which each tool is used.

_____ _____
Discipline Leader/on-site trainer Date

10.8. Using soft copper wire of approximately 1/4-inch diameter, make cuts through it with the tools which employ a shearing, pinching and slicing action. Make test cuts in lead using the same tools. Attempt to identify the cuts in the copper wire as having been made by the same tool as that which cut the test lead. Support your results with photographs and note any lighting considerations made necessary by the color difference between copper and lead.

_____ _____
Discipline Leader/on-site trainer Date

10.9. Select a flat-bladed tool such as a screwdriver, and a pry bar and make marks in a piece of copper or brass sheeting. Make the same type of marks in lead with both tools. Microscopically compare those in the brass or copper sheeting with the test marks in the lead. Attempt to identify the appropriate marks with the appropriate tool. Photograph your results and comment on the difference in the quality of marks made by each tool.

_____ _____
Discipline Leader/on-site trainer Date

10.10. Using a drive pin punch, produce an impression in a piece of brass sheeting. Produce a set of

test marks in lead and intercompare these two marks. Attempt to identify these as having been made by the same tool. Support your results by photographs.

Discipline Leader/on-site trainer _____ Date _____

10.11. Using a junked doorknob and a serrated-jawed tool, have the Discipline Leader/on-site trainer produce impressions and scrape marks like those produced by an attempt at an entry. Devise a method of obtaining test marks in lead like those produced by the serrated-jawed tool on the doorknob. Microscopically compare the marks on the doorknob with those on the test material. Identify the tool with the marks on the doorknob and reproduce the tool-doorknob orientation and relate each mark to its respective serration on the tool.

Discipline Leader/on-site trainer _____ Date _____

10.12. Learn the technique of reverse lighting. Obtain a piece of brittle metal as from an automobile bumper or fragment of pot metal and fracture it into two fragments. Attempt to identify the two fragments as having once been a single object. Take notes and support your results by photographs.

Discipline Leader/on-site trainer _____ Date _____

10.13. Obtain an ax blade which contains numerous defects. Cut a piece of seasoned wood such as a dowel rod with the ax blade and attempt to identify the blade with the cut. Insure that your test cuts are consistent with your "unknown" with respect to the orientation of the ax to the wood and the direction of the grain. Support your results with sketches and photographs.

Discipline Leader/on-site trainer _____ Date _____

10.14. Obtain a section of large-diameter telephone cable and cut it with the ax used above and study the effects of a slicing action on a multi-stranded cable. Note the quality and extent of microscopic marks of each strand and comment on the problems involved in identifications of this sort. Photograph the sliced end of the cable.

Discipline Leader/on-site trainer _____ Date _____

10.15. Discuss the fact that generally saws, files, and abrasive tools are not identifiable with the marks they produce. Cite any exceptions to this rule.

_____ _____

Discipline Leader/on-site trainer Date

10.16. Obtain a used tire and make cuts and stabs into the sidewall with a fixed blade knife. Attempt to make comparisons of the toolmarks produced by the knife. Support your results with photographs and notes. Discuss how the results of your examinations might be altered if the knife had been sharpened after making the questioned cuts, or if the knife had been used for an extended period of time after making the initial questioned cuts.

_____ _____

Discipline Leader/on-site trainer Date

10.17. Investigate pressure/contact examinations in regard to objects which may have been in contact with each other for an extended time. Research several cases of this type and set these out in your notes.

_____ _____

Discipline Leader/on-site trainer Date

10.18. Discuss and demonstrate the making of casts of toolmarks. Also discuss the potential of such casts and of photographs alone in making toolmarks identifications.

_____ _____

Discipline Leader/on-site trainer Date

10.19 Successfully perform a toolmark competency test.

_____ _____

Discipline Leader/on-site trainer Date

10.20 Successfully complete a mock court dealing with toolmark examination.

_____ _____

Discipline Leader/on-site trainer Date

Section 11. SERIAL NUMBER RESTORATION

11.1 Read the Handbook of Methods for the Restoration of Obliterated Serial Numbers by Tretow. Be prepared to discuss the theory of number restoration.

_____ _____
on-site trainer Date

11.2 Sketch the entire stressed area above and below the indentation of a stamped item and depict what remains when the indented area is removed.

_____ _____
on-site trainer Date

11.3 Make a list of the various methods used to mark items by private industry. This list should include but not be restricted to: casting, stamping, dot matrix, laser and electrical discharge machining.

(a) Discuss with the Discipline Leader/on-site trainer the effect each of these marking techniques has on the subsurface of the marked area.

(b) Discuss with the Discipline Leader/on-site trainer how the marking methods used can directly affect the ability of the examiner to restore any obliterated markings and why.

_____ _____
on-site trainer Date

11.4 Define in your notebook the term "plastic deformation" of metal.

_____ _____
on-site trainer Date

11.5 Briefly discuss in your notebook and the Discipline Leader/on-site trainer the difference between cold rolled steel and cast iron metal.

on-site trainer Date

11.6 Discuss with the Discipline Leader/on-site trainer the effect that the following types of alterations will have on the subsurface of the marked item and how it will impact on the results of the examiner.

(a) grinding
(b) restamping
(c) pinging
(d) gouging
(e) drilling
(f) welding
(g) filing
(h) combinations of the above

11.7 Determine the telltale signs that can be left by the various alteration methods. Discuss how these signs will determine your specific approach to the restoration attempt.

on-site trainer Date

11.8 Discuss with the Discipline Leader/on-site trainer the different types of lighting (e.g., incandescent and fluorescent) and how they can improve or enhance the restoration results. Be prepared to explain how the angle of incidence of these lighting techniques might vary the results.

on-site trainer Date

11.9 Discuss the various methods of surface preparation such as sanding and polishing and how they will affect the results in the restoration attempt.

on-site trainer Date

11.10 Determine the chemical reaction that takes place when etching is done and place in your notebook the appropriate chemical formulations for the general reactions of acid with steel and aluminum.

on-site trainer Date

11.11 Determine whether the reaction rate for the stressed area is faster or slower than the etching rate of the rest of the surface and why.

on-site trainer Date

11.12 Determine the specialized equipment that might be used in number restoration and discuss these with the Discipline Leader/on-site trainer.

on-site trainer Date

11.13 Determine the various ways photography can be utilized to document the process of serial number restoration. Also discuss its limitations.

on-site trainer Date

11.14 Research the various kinds of magnifying and enhancing equipment used for number restoration and explain when and why each would be used.

on-site trainer Date

11.15 Become familiar with the following chemicals:

(a) CuNH4Cl
(b) CuCl2
(c) NaOH
(d) Hcl
(e) HNO3
(f) KCN
(g) K2SO4
(h) Aqua Regia
(i) H2SO4

(j) FeCl3
(k) H202
(l) Tartaric acid
(m) Ammonium Persulfate

_____ _____
on-site trainer Date

11.16 Obtain the proper safety equipment (e.g., eyewear, masks, gloves, and lab coats) before attempting any chemical restorations. Review the chemical hygiene policies to insure proper safety precautions are used.

_____ _____
on-site trainer Date

11.17 Define and place in your notebook these common chemical terms:
(a) Frys Reagent
(b) Arais Reagent
(c) Hydrofluoric acid
(d) Turner's Reagent
(e) Davis' Reagent

_____ _____
on-site trainer Date

11.18 Become knowledgeable of the numbering systems and methods used by various firearms manufacturers including but not limited to Colt, Ruger, Smith & Wesson, US Repeating Arms (Winchester) and Remington.

_____ _____
on-site trainer Date

11.19 Discuss the best chemicals and techniques to use in number restoration of the following firearms:

(a) Colt pistol
(b) Smith & Wesson revolver
(c) RG Industries revolver
(d) Ruger stainless steel revolver

(e) chrome/nickel 25 caliber auto-loading pistol
(f) shotgun alloy receiver
(g) shotgun case hardened receiver
(h) Winchester rifle

_____ _____
on-site trainer Date

11.20 Obtain several sample serial numbers from the Discipline Leader/on-site trainer; alter the serial numbers using different methods and then attempt to restore them. Prepare notes and photographs to substantiate your conclusions and results.

_____ _____
on-site trainer Date

11.21 Be prepared to discuss with the Discipline Leader/on-site trainer the methods used and lessons learned during the restoration process.

_____ _____
on-site trainer Date

11.2. Obtain several pieces of aluminum that have had stamped numbers removed. Attempt to restore these numbers using various techniques. Prepare notes and photographs to substantiate your conclusions and results.

_____ _____
on-site trainer Date

11.23 Discuss with the Discipline Leader/on-site trainer how the combination of brief application of CuNH4C12 followed by normal NaOH application can shorten the processing time on aluminum.

_____ _____
on-site trainer Date

11.24 Discuss with the Discipline Leader/on-site trainer why alternating HNO3 and HCl can work so well on chrome or nickel-plated firearms.

on-site trainer _____ Date _____

11.25 Research the effect of electricity on the reaction time of the different chemical techniques you have learned. Conduct restorations using this method.

on-site trainer _____ Date _____

11.26 Successfully complete a serial number restoration competency test.

on-site trainer _____ Date _____

11.27 Successfully complete mock court dealing with serial number restoration.

Discipline Leader/on-site trainer _____ Date _____

Section 12 Testimony Training

12.1 Courtroom Decorum

Discuss appropriate eye contact, gestures, voice volume, and approach for visual aides during testimony.

Describe proper attire for courtroom appearances.

on-site trainer _____ Date _____

12.2 Admission of Evidence

Discuss the ramifications of *Daubert v. Merrell Dow Pharmaceutical and Frye v. United States.*

Discuss the factors that help assure a scientific testing procedure to be established as reliable.

on-site trainer _____ Date _____

Section 13 Supervised cases

13.1 Upon successful completion of competency testing and the Quality Manager having reviewed and approved the training documentation, the Trainee will be responsible for the analysis of casework under close supervision. Analysis notes for supervised casework will be signed by the trainer. The onsite trainer will determine when the need for close supervision is completed based on the analysts ability to work independently and the types of cases completed. Upon completion of this required the trainee can begin unsupervised casework.

Discipline Leader/on-site trainer _____ Date _____

Section 14 NIBIN entry

14.1 The trainee must complete section 1 of this training manual with the exception of 1.7, which does not apply to NIBIN entry.

_____ _____

on-site trainer Date

14.2 The trainee will attend a training class that covers the use and understanding of the methods used for NIBIN entry. The class will also include training on the theory, operation, maintenance and troubleshooting of equipment used and the class will include entry of training samples into the system.

_____ _____

on-site trainer Date

14.3 The trainee will successfully complete a competency test prior to entering casework.

_____ _____

on-site trainer Date

14.4 The first five entries the trainee does will be reviewed by a competent analyst. The review of these entries will replace the requirement for co-signed cases, since reports are not issued for NIBIN entry.

_____ _____

on-site trainer Date

14.5 Mock court and presentation of evidence are not applicable to NIBIN entry and are not required as part of the NIBIN training plan.

Section 15 Training in Other Forensic Science Disciplines

15.1 The trainee shall have a general understanding of the other disciplines offered by the Idaho State Police Forensic Services. This understanding can be gained from school course work, reading about each discipline in a General Forensic Science book, reviewing the methods of each discipline and/or talking with or observing other Forensic Scientists working in those areas.

_____ _____

on-site trainer Date

Basic References:

Policies and procedure manuals for the laboratory

Manufacturers procedure and operation manuals

"AFTE Glossary" AFTE Standardization Committee

"Basic Firearms/Toolmarks Course" California Department of Justice

"Cartridges of the World" BARNES

"Encyclopedia of Modern Firearms, Parts and Assembly, Vol I." BROWNELL

"Firearms and Ammunition Fact Book" NRA STAFF

"Firearms Identification" Vol. I, MATHEWS

"Firearms Investigation, Identification and Evidence" HATCHER, JURY, and WELLER

"Gun Digest Book of Exploded Firearms Drawings" MUNTZ

"Gunshot Wounds" DiMAIO

"Handbook of Firearms and Ballistics" HEARD

"Handbook of Forensic Science" FBI

"Handbook of Methods for the Restoration of Obliterated Serial Numbers" TREPTOW

"Handgun and Shoulder Arms Assembly" NRA

"Hatcher's Notebook" HATCHER

"History and Development of Small Arms Ammunition, Vol. 1-3, HOYEM

"Hodgdon's Reloading Data Manual" HODGDON POWDER CO.

"Hornaday Handbook of Cartridge Reloading" HORNADAY STAFF

"Introduction to Tool Marks, Firearms, and the Striagraph" DAVIS

"Identification of Firearms and Forensic Ballistics" BURRARD

"Machine Shop Practice Vol 1 & 2" K. H. MOLTRECHT

"Military Small Arms of the Twentieth Century" HOGG and WEEKS

"NRA Firearms Source Book" BUSSARD & WORMLEY

"NRA Guidebook to Shoulder Arms" NRA STAFF

"Silencer History and Performance" PAULSON

"Small Arms of the World" W.H.B. Smith

"Speer Reloading Manual" SPEER STAFF

"The Book of Rifles" SMITH & SMITH

"The Identification of Firearms and Forensic Ballistics" BURRARD

"The Illustrated Encyclopedia of Handguns" ZHUK

"The Microscope A Practical Guide", G. H. NEEDHAM

"The Guide for The Integrated Ballistics Identification System", Forensic Technology