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FA-TM training Manual
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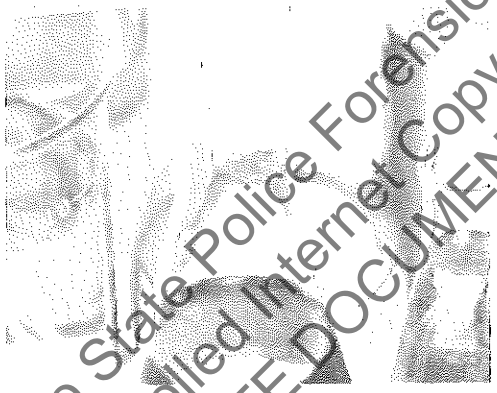



Discipline/Name of Document: Firearms & Tool Mark Examiner Training Manual

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State of Idaho
Department of Law Enforcement
Bureau of Forensic Services



# FIREARMS & TOOL MARK EXAMINER TRAINING Manual

Adopted from AFTE draft manual of February 24, 1995

Introduction

A. Administrative Matters and Procedures

B. Background/History of Firearms Identification and Current Trends

C. Firearms & Ammunition Development and Current Trends

D. Manufacture of Modern Firearms

E. Manufacture of Modern Ammunition

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I. Cartridge/Cartridge Case Examinations and Comparisons

J. Shotshell/Shotshell Component Examinations and Comparisons

K. Gunshot Residue Examinations and Distance Determinations

L. Toolmark Examinations and Comparisons

M. Serial Number Restoration

# Section 9 Maintenance and Calibration

## 9.0 Scope and Background

To insure accurate data, all equipment that has a direct effect upon the comparison and measurement processes is kept in proper working order. Measurement devices and reference standards receive periodic calibration. Other equipment is examined and maintained periodically to verify safe/effective operation. Calibration / maintenance intervals may be adjusted based upon past performance, where the item has demonstrated that it will remain within specifications throughout the calibration interval.

Any equipment that appears to be damaged, out-of calibration or functioning improperly is removed from service, until the nature of the problem can be determined and corrected.



## 9.1 Procedures

### 9.1.1 Balances

Maintenance and repairs performed on the balance will be recorded in a maintenance log.
Balances will be calibrated annually by a certified outside vendor. The documentation of the calibration will be kept in the front office in the Quality Control Instruments file. If the balance is taken out of service for repair or an event occurs (such as moving the balance) an intermediate check will be performed and documented. In order to pass the intermediate check the accuracy of the balance will be +/- 2%. The weights used in intermediate checks will be cleaned and calibrated annually by an outside vendor. The documentation for the calibration of the weights will be kept in the front office in the Quality Control Instruments file.

### 9.1.2 Comparison microscopes

The comparison microscopes will be cleaned and checked annually by an outside vendor.
Each microscope will have a maintenance log and any maintenance or repair will be recorded.

### 9.1.3 Micrometers and Calipers

Each micrometer or caliper will be annually checked against a certified gauge block or micrometer disk. These checks will be documented and the micrometer or caliper must demonstrate accuracy within (+/-) 0.001" of the intended measurement.

### 9.1.4 Rulers, and other measuring devices.

#### 9.1.4.1 NIST traceable devices

The measuring specifications and accuracy for the NIST traceable measuring devices and the certified measuring rods are determined during

certification of these devices and can be found in each laboratory's maintenance log. The NIST traceable measuring device will be calibrated and recertified every three years.

**9.1.4.2 Rulers and tape measures**

Measuring devices will be checked against the NIST traceable measuring device every three years.

The device will be checked against a NIST traceable device and should read 1:1. If it does not the device will be taken out of service.

The checks will be documented in a maintenance log.

**9.1.4.3 Damage or malformation**

If damage or a malformation (i.e. breakage or melting) occurs that may affect the measuring device, it will be taken out of service and checked against the NIST certified measuring device before being put back into use. If the NIST certified measuring device is damaged or malformed, the NIST certified measuring devices will be taken out of service and calibrated before being put back into service.

**9.1.5 Gage blocks**

Gage blocks will be calibrated by an outside vendor every three years.

**9.1.6 Trigger Pull Weights**

Trigger pull weights will be checked annually. The weights will be checked using a certified balance. Tolerance for each weight is +/- 5% of the expected value. If a weight does not fall within the expected value it will be taken out of service. Rectification may include cleaning the weight or replacing the weight. The weight must be checked and have satisfactory results before being put back in service.



**9.2 Safety Considerations**

This procedure involves hazardous materials, operations and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution must be exercised and the use of personal protective equipment must be considered to avoid exposure to hazardous conditions.

## 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 training examiner 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 Technical Protocol Manual, 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 month and even years following your qualification, and will assist in documenting your progress during training.

Your training will be monitored and assisted by the training examiner, 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 training examiner for your successful completion of your training.

## A. ADMINISTRATIVE MATTERS AND PROCEDURES

1. Discuss with your Bureau Chief/Lab Manager the laboratory Quality Assurance Program and the Proficiency Testing Program.

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BUREAU CHIEF DATE

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LAB MANAGER DATE

2. Discuss with your Bureau Chief/Lab Manager the laboratory policy regarding the reexamination of evidence.

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BUREAU CHIEF DATE

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LAB MANAGER DATE

3. Discuss with your Bureau Chief/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.

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Bureau Chief Date

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Lab Manager Date

4. Become familiar with the requirements and the facilities available for the

secure storage of evidence within the lab. Discuss this with the Bureau Chief/Lab Manager and an examiner from the lab.

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Bureau Chief Date

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Lab Manager Date

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Criminalist/Examiner Date

5. 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 the Bureau Chief and an examiner from the lab.

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Bureau Chief Date

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Lab Manager Date

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Criminalist/Examiner Date

6. 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.

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Bureau Chief Date

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Lab Manager Date

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Criminalist/Examiner Date

7. Be briefed by the Lab Manager in regard to his 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.

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Bureau Chief Date

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Lab Manager Date

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Criminalist/Examiner Date

8. Know the procedures used in the lab for handling and examining evidence that may be or is known to be infected by the AIDS virus and/or other diseases.

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Criminalist/Examiner Date

9. Obtain a copy of the "Technical Protocols for Handling of Firearms and Ammunition" which includes safety rules and procedures. Familiarize yourself with its contents and indicate you understand the rules and procedures contained therein by your signature below.

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Criminalist/Examiner Date

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Training Examiner Date

Basic References:

Policies and procedure manuals for the laboratory.

"AIDS/HIV Carriers, An Organizational Response" FBI Law Enforcement Bulletin, June, 1989.

## B. BACKGROUND/HISTORY OF FIREARMS IDENTIFICATION AND CURRENT TRENDS

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

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Training Examiner Date

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Lab Manager Date

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 Training Examiner who will review your report.

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Training Examiner Date

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Lab Manager Date

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?

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

5. Discuss with system operators the status of the ongoing research initiatives to link shootings using computer imagery such as DRUGFIRE and BULLETPROOF. Prepare a report on each system.

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

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 Training Examiner.

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Training Examiner Date

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Lab Manager Date



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

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Training Examiner Date

Lab Manager Date

9. Select a topic for a research project to be completed during your training period. Obtain approval from the Training Examiner before initiation of the project. This project should contribute to the overall fund of information in the field of firearms identification. These results will be shared with the lab upon completion. The results should be formulated in such a way to be a formal scientific paper ready for publication and/or a formal presentation at a professional meeting.

Training Examiner Date

Lab Manager Date

Basic References:

"Firearms Identification" Vol. I, MATHEWS

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

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

"The Identification of Firearms and Forensic Ballistics" BURRARD

"The Identification of Firearms" GUNTHER and GUNTHER

"Hatcher's Notebook" HATCHER

"Basic Firearms/Toolmarks Course" California Department of Justice

"AFTE Journal" Association of Firearm and Toolmark Examiners staff

"AFTE Glossary" AFTE Standardization Committee

"A Statistical Study of the Individual Characteristics of Fired Bullets" Journal of Forensic Science, January, 1959, BIASOTTI

## C. FIREARMS & AMMUNITION DEVELOPMENT AND CURRENT TRENDS

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 Training Examiner.

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Training Examiner Date

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Lab Manager Date

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.

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

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 Training Examiner.

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

6. Conduct an in-depth study of exterior bullet coatings which have been developed in the last decade. Prepare a report concerning how this new technology impacts the firearms examiner.

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Training Examiner Date

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Lab Manager Date

7. Obtain a copy of the recent studies concerning cartridge effectiveness conducted by the FBI. Prepare a report listing trends you see unfolding in cartridge development and show any historical significance to these findings.

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Training Examiner Date

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Lab Manager Date



Basic References:

"U.S. Martial Pistols and Revolvers" GLUCKMAN

"The Book of Rifles" SMITH

"Small Arms and Ammunition in the U.S. Service, 1776-1865" LEWIS

"Civil War Guns" EDWARDS

"Arms and Armor in Colonial America, 1526-1783" PETERSON

"History of Firearms from Earliest Times to 1914" CARMAN

"The Development of Firearms" PETERSON in AMERICAN RIFLEMAN, March, April, May, June, 1960

"Firearms and Ammunition Fact Book" NRA STAFF

"Cartridges of the World" BARNES

"Cartridge Headstamp Guide" MUNHALL and WHITE

"Handgun and Shoulder Arms Assembly" NRA

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

"Encyclopedia of Firearms" H. L. Peterson

"The Gun and its Development" GREENER

"Guns" POPE

## D. MANUFACTURE OF MODERN FIREARMS

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) planing
(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
(n) EDM
(o) investment casing



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Training Examiner Date

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Lab Manager Date

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.

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Training Examiner Date

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Lab Manager Date

3. Research in detail the following rifling techniques:
   (a) broach
   (b) button
   (c) hammer forging
   (d) hook method
   (e) scrape method
   (f) ECM/EDM

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Training Examiner Date

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Lab Manager Date



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.

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

6. Research the history and current significance of proof marks as they relate to the manufacture of firearms. Discuss this with the Training Examiner.

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Training Examiner Date

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Lab Manager Date



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 Training Examiner.

Training Examiner Date

Lab Manager Date



Basic References

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

"Machinery's Handbook Revised 21st Edition" OBERG, JONES & HORTON

"Firearms Identification" Part 1, Vol. 1, MATHEWS

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

"The Book of Rifles" SMITH & SMITH

"Shooters Bible, Small Arms Lexicon and Concise Encyclopedia" MUELLER and OLSON



## E. MANUFACTURE OF MODERN AMMUNITION

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

| | |
|---|---|
| (a) cartridge | (aa) bullet |
| (b) cartridge case | (bb) round-nosed bullet |
| (c) primer | (cc) "hollow-point" bullet |
| (d) shotshell | (dd) jacketed bullet |
| (e) shotshell casing | (ee) bullet sizing |
| (f) bottleneck cartridge | (ff) wadcutter bullet |
| (g) rebated-rim cartridge | (gg) semi-wadcutter bullet |
| (h) rimless cartridge | (hh) soft point bullet |
| (i) rimmed cartridge | (ii) spitzer bullet |
| (j) semi-rimmed cartridge | (jj) swaging |
| (k) shoulder | (kk) cast lead bullet |

(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

(ll) mold marks
(mm) truncated-nosed 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) cram equivalent
(zz) single base, double base

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

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.

Training Examiner Date

Lab Manager Date

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 Training Examiner.

Training Examiner Date

Lab Manager Date



Basic References

"Cartridges" Herschel C. LOGAN

"Cartridges of the World" BARNES

"SAAMI Technical Committee Manuals" SAAMI

"History of Modern U.S. Military Small Arms Ammunition" HACKLEY, WOODIN & SCRANTON

"Military Small Arms Ammunition of the World 1945-1980" P. LABBETT

## F. INSTRUMENTATION

1. Differentiate between the following:

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

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Training Examiner Date

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Lab Manager Date

2. Study the instruction manual for the various brands of stereomicroscopes. Determine how to insert a reticule and how to check the calibration of the microscope.

Training Examiner Date

Lab Manager Date

3. Familiarize yourself with the instruction manuals and the mechanical and optical aspects of the various brands of comparison microscopies in the lab. Note the differences and similarities in each, both mechanically and optically.

Training Examiner Date

Lab Manager Date

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)

Training Examiner Date

Lab Manager Date

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 Training Examiner.

Training Examiner Date

Lab Manager Date

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 different types of Polaroid film used in the lab with the comparison microscopes. Master the use of the Polaroid Land film holder. Using all of the objective lenses, make time exposures of the same objects while varying the intensity and angle of the light sources. Calculate the magnification for each set of objective lenses on your comparison microscope.

Training Examiner Date

Lab Manager Date

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) Ainsworth scale
(f) balances and scales located in the lab

Training Examiner Date

Lab Manager Date

Basic References:

"The Stereomicroscope Instrumentation and Techniques" Schlueter & Gumpertz American Laboratory, April 1976

"The Leica Universal Forensic Microscope" LEICA

"Procedure for Bullet Comparison" AMERICAN OPTICAL

Manufacturers procedure and operation manuals

"Microscope Optics", Dr. P. BARTELS

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

## G. EXAMINATION OF FIREARMS

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

Training Examiner Date

Lab Manager Date

2. Explain and illustrate the differences between a gas-operated and a recoil-operated autoloading shotgun.

Training Examiner Date

Lab Manager Date



3. Explain and illustrate the differences between the following types of autoloading pistols:

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

Training Examiner Date

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4. Partially disassemble and reassemble the following revolvers. Photograph and note the differences in their mechanisms. Identify each part by name.

(a) Smith & Wesson double-action revolver
(b) Colt double-action revolver
(c) Ruger double-action revolver
(d) "Old style" Ruger single-action revolver
(e) "New style" Ruger single-action revolver

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Training Examiner Date

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Lab Manager Date

5. Field strip and reassemble the following pistols. Note and photograph differences in their mechanisms. Identify each part by name.

(a) 9mm Luger Browning, Hi-power, pistol
(b) .45 Auto caliber U. S. Pistol, Model 1911A1, pistol
(c) 9mm Luger Steyr, GB, pistol
(d) 9mm Luger Glock, Model 17, pistol
(e) 9mm Luger Beretta, Model 92F, pistol
(f) 9mm Luger SIG-Sauer, Model 226, pistol
(g) 9mm Luger Smith & Wesson, Model 669, pistol
(h) 9mm Luger H&K, P7, pistol
(i) 357 Magnum Desert Eagle pistol
(j) 9mm Luger Walther P38 pistol
(k) 380 Automatic Walther PPK pistol
(l) 8mm Arisaka Type 14 pistol
(m) 9mm Luger Luger P08 pistol

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Training Examiner Date

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Lab Manager Date

6. Field strip and reassemble the following submachine guns. Note differences in the mechanism and operation of each. Make appropriate photographs for your notes and identify the major parts by name.

(a) .45 Auto caliber RPB Industries, M10, submachine gun (open bolt and

closed bolt)
(b) 9mm Luger SWD Inc., M11/Nine, submachine gun
(c) 9mm UZI submachine gun
(d) 9mm H&K, MP5, submachine gun
(e) .45 Auto caliber US M3 submachine gun
(f) 9mm Intratec, TEC 9, submachine gun
(g) .45 Auto caliber Thompson submachine gun

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Training Examiner Date

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Lab Manager Date

7. Familiarize yourself with the operation of each of the following firearms. Identify the major parts by name and make appropriate notes.

(a) .30-06 Springfield caliber U. S. Rifle, Model M1
(b) .308 Winchester caliber U.S. Rifle, Model M14
(c) .223 Remington caliber U.S. Rifle, Model M16
(d) .300 Savage caliber, Savage, Model 99, rifle
(e) .30-30 Winchester caliber Winchester Model 94 rifle
(f) 7.62x39mm caliber AK47/SKS rifle
(g) .30-40 Krag caliber U.S. Rifle 1898
(h) .303 British caliber Lee Enfield rifle

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Training Examiner Date

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Lab Manager Date

8. Familiarize yourself with the operation of each of the following shotguns. Identify the major parts by name and make appropriate notes.

(a) Remington, Model 870, shotgun
(b) Winchester, Model 12, shotgun
(c) Ithaca, Model 37, shotgun
(d) Browning, Model A5, shotgun
(e) Remington, Model 1100, shotgun

(f) Harrington & Richardson, Topper Model 158, shotgun
(g) L.C. Smith, side-by-side, double-barrel, shotgun
(h) Savage, Model 311, side-by-side, double-barrel, shotgun
(i) Beretta, Silver Snipe, over-under, double-barrel, shotgun

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Training Examiner Date

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9. Familiarize yourself with the operation of each of the following firearms. Identify the major parts by name and make appropriate notes.

(a) .22 caliber Browning autoloading rifle
(b) .22 caliber Winchester, Model 62, rifle
(c) .22 caliber Remington, Model 582, rifle
(d) .22 caliber Ruger, Model 10/22, rifle
(e) .22 caliber Ruger, MKII, pistol
(f) .22 caliber Colt, Woodsman, pistol

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Training Examiner Date

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10. 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.

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Training Examiner Date

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Lab Manager Date

11. 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.

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Training Examiner Date

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Lab Manager Date

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, using various methods and compare the results.

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Training Examiner Date

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Lab Manager Date

13. Discuss with the Training Examiner 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.

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

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.

_____
Training Examiner Date

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Lab Manager Date

16. Attend Armorer's training offered by various manufacturers of firearms, at their manufacturing facilities if possible. Coordinate these with the Training Examiner.

_____
Training Examiner Date

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Lab Manager Date

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 Training Examiner.

Training Examiner Date

Lab Manager Date

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

Training Examiner Date

Lab Manager Date

19. Discuss the following topics with the Training Examiner 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 "recently" fired
(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

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Training Examiner Date

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Lab Manager Date

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.

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Training Examiner Date

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Lab Manager Date

21. Discuss with the Training Examiner 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.

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Training Examiner Date

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Lab Manager Date

Basic References:

"The Book of Pistols and Revolvers" W.H.B. SMITH

"Small Arms of the World" W.H.B, SMITH

"The NRA Guidebook to Handguns" NRA STAFF

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

"The World's Assault Rifles" MUSGRAVE and NELSON

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

"Gun Digest Book of Exploded Firearms Drawings" MUNTZ

"Stoeger Gun Parts Catalog" STOEGER ARMS

"NRA Guidebook to Shoulder Arms" NRA STAFF

"Component Parts Catalog, Savage, Stevens, Fox, Springfield Sporting Arms" SAVAGE ARMS

"Mossberg Component Parts Catalog" MOSSBERG & SONS

"Remington Component Parts Catalog" REMINGTON ARMS

"Smith & Wesson Component Parts Catalog" SMITH & WESSON

"Shooter's Bible" STOEGER ARMS

"The World's Submachine Guns" NELSON

"The Machine Gun, Vols. I - IV" CHINN

"NRA Firearms Handling Handbook" NRA STAFF

"U.S. Military Firearms" J.E. HICKS

"The Firearms Dictionary" STIENDLER

"Jane's Weapons Systems" JANE'S ANNUALS

Basic References (continued):

"The Standard Directory of Proof Marks" WIRNSBERGER

"Firearms Silencers" McLEAN

"U.S. Rifle, 7.62 mm, M14" DEPARTMENT of the ARMY

"Air Gun Digest" BEEMAN

"Air Guns and Air Pistols" WESLEY

"Gunsmithing Simplified" MACFARLAND

"The Book of Rifles" SMITH & SMITH

"Automatic and Repeating Shotguns" ARNOLD

"Shotguns" KEITH

"NRA Illustrated Shotgun Handbook" NRA STAFF

"The World's Fighting Shotguns" SWEARENGEN

"The Modern Shotgun" BURRARD

## H. BULLET EXAMINATIONS AND COMPARISONS

1. 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 Training Examiner.

   (a) slippage
   (b) shaving
   (c) obturation
   (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



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Training Examiner Date

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Lab Manager Date

2. 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 Training Examiner.

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Training Examiner Date

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Lab Manager Date

3. 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 Training Examiner.

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Training Examiner Date

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Lab Manager Date

4. Become familiar with the Known Specimen File (KSF). Know its location, composition, filing system, and uses as a reference file. Discuss with the Training Examiner.

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Training Examiner Date

Lab Manager Date

5. 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 Training Examiner.

Training Examiner Date

Lab Manager Date

6. 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.

Training Examiner Date

Lab Manager Date

7. 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.

Training Examiner Date

Lab Manager Date

8. 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 cotton boxes and their limitations. Observe and assist the Training Examiner from the lab in the recovery of fired bullets using each of these methods. Know and observe all safety rules.

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Training Examiner Date

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Lab Manager Date

9. 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 Training Examiner 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 Training Examiner prepare and fire down-loaded test ammunition.

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Training Examiner Date

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Lab Manager Date

10. 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 Training Examiner.

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Training Examiner Date

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Lab Manager Date

11. Using the same .22 caliber firearm, test fire two each of the following cartridges and attempt to identify the test bullets with each other. Take appropriate photographs and notes.

(a) .22 Long Rifle caliber Remington with lead bullets
(b) .22 Long Rifle caliber Winchester with lead bullets
(c) .22 Long Rifle caliber Remington with brass-coated lead bullets
(d) .22 Long Rifle caliber Winchester with copper-coated lead bullets
(e) .22 Long caliber Remington with lead bullets

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Training Examiner Date

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Lab Manager Date

12. Using the same .357 Magnum caliber revolver, test fire two each of the following cartridges and attempt to identify the test bullets with each other. Take appropriate photographs notes.

(a) .38 Special caliber Remington lead round-nosed bullet
(b) .38 Special caliber Remington jacketed bullet
(c) .357 Magnum caliber Remington jacketed bullet
(d) .357 Magnum caliber Winchester silvertip bullet
(e) .357 Magnum caliber Federal Nyclad bullet

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Training Examiner Date

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Lab Manager Date

13. Using the same 9mm Luger pistol, test fire two each of the following cartridges and attempt to identify the test bullets with each other. Take appropriate photographs and notes.

(a) 9mm Luger Federal Hydro-shok
(b) 9mm Luger PMC Starfire
(c) 9mm Luger Remington Full metal jacket
(d) 9mm Luger Winchester Silvertip
(e) 9mm Luger CCI total metal jacket

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Training Examiner Date

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Lab Manager Date

14. Using a .22 caliber rifle, test fire and recover two test bullets and identify these bullets with each other. Cut off approximately three inches of the muzzle of the barrel and crown the muzzle end of the barrel. Test fire and recover two test bullets using the same ammunition as above. Microscopically compare these bullets with each other and with the previously-fired test bullets.

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Training Examiner Date

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Lab Manager Date

15. Using a .30 caliber rifle, test fire two each of the following cartridges and compare the tests with each other. Conduct this test with the Training Examiner.

(a) .30 caliber Remington jacketed soft-point bullet
(b) .30 caliber Remington Accelerator cartridges

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Training Examiner Date

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Lab Manager Date

16. Using a .32 S & W caliber Harrington & Richardson revolver, test fire two each of the following cartridges and compare the test bullets with each other. Conduct this test with the Training Examiner.

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

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Training Examiner Date

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Lab Manager Date

17. Test fire each of the following pistols. Using two test bullets from each pistol, make microscopic comparisons of the test bullets. Conduct this test with the Training Examiner.

(a) 9mm Glock pistol
(b) 9mm H&K, Model P7, pistol
(c) 9mm Steyr, Model GB, pistol

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Training Examiner Date

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Lab Manager Date

18. 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.

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Training Examiner Date

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Lab Manager Date

19. 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".

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

21. Test fire a .22 caliber firearm. Compare and identify test bullets with each other. Using this same firearm, "slug" the barrel and compare the previously-fired test bullets with the bullets used to "slug" the barrel. Cut off approximately 25 percent of the barrel at the muzzle and "slug" this portion of the barrel and compare these tests with the previous test bullets . Conduct this exam with the Training Examiner.

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

Basic References:

"Firearms Identification" Vol. I, MATHEWS

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

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

"Identification of Firearms and Forensic Ballistics" BURRARD

"The Identification of Firearms" GUNTHER and GUNTHER

"Hatcher's Notebook" HATCHER

## I. CARTRIDGE/CARTRIDGE CASE EXAMINATIONS AND COMPARISONS

1. 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 video tape regarding the slow motion of firing sequences using semiautomatic firearms.

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Training Examiner Date

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Lab Manager Date

2. Test fire each of the following 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.

   (a) 9mm SWD Inc., M11/Nine, submachine gun
   (b) 9mm Glock pistol
   (c) .45 Auto caliber U.S. Pistol, Model 1911A1
   (d) 9mm H&K, P7, pistol
   (e) .22 long Rifle caliber Ruger, MKII, pistol
   (f) .22 Long Rifle caliber Ruger, 10/22, rifle

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Training Examiner Date

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Lab Manager Date



3. 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.

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Training Examiner Date

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Lab Manager Date

4. 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, Model 10, revolver
   (b) .357 Magnum caliber Smith & Wesson, Model 19, revolver
   (c) 9mm Smith & Wesson, Model 669, pistol
   (d) .22 long Rifle caliber Colt, Woodsman, pistol

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Training Examiner Date

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Lab Manager Date

5. 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.

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Training Examiner Date

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Lab Manager Date

6. 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.

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Training Examiner Date

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Lab Manager Date

7. 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.

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Training Examiner Date

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Lab Manager Date

8. 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.

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Training Examiner Date

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Lab Manager Date



9. Read the following two articles in the October, 1989 issue of the AFTE journal and discuss them with the Training Examiner in the lab.

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

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

Basic References:

"Firearms Identification" Vol. I MATHEWS

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

"Introduction to Toolmarks, Firearms and the Striagraph" DAVIS

"Identification of Firearms and Forensic Ballistics" BURRARD

"The Identification of Firearms" GUNTHER AND GUNTHER

"Hatcher's Notebook" HATCHER

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

"The NRA Handloader's Guide" NRA STAFF

"Speer Reloading Manual" SPEER STAFF

"Reloader's Guide" SHOOTER'S BIBLE

"Hornaday Handbook of Cartridge Reloading" HORNADAY STAFF

"Sierra Bullets Reloading Manual" SIERRA STAFF

"Complete Guide to Hand Loading" SHARPE

"Lyman Cast Bullet Handbook" RUMAGE

"Handbook for Shooters & Reloaders" P. O. ACKLEY



## J. SHOTSHELL AND SHOTSHELL COMPONENT EXAMINATIONS AND COMPARISONS

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 Training Examiner.

   (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

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Training Examiner Date

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Lab Manager Date

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 Training Examiner.

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

4. Test fire the following 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.

(a) 12-gauge Remington, Model 870, shotgun
(b) 12-gauge Remington, Model 1100, shotgun

(c) 12-gauge Mossberg, Model 195K, shotgun
(d) 12-gauge Harrington & Richardson, Topper, shotgun
(e) 12-gauge Beretta, Silver Snipe, shotgun
(f) 12-gauge Charles Daly, Model 500, shotgun

Training Examiner Date

Lab Manager Date

5. Using a 12-gauge Remington, Model 1100, shotgun obtain at least two test shotshell casings with each of the following types of ammunition. 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.

(a) 12-gauge Remington, 2 3/4" Magnum, 00 Buck
(b) 12-gauge Remington, 2 3/4" Shur-Shot, #8 shot
(c) 12-gauge Federal, 2 3/4" Magnum, 00 Buck
(d) 12-gauge Federal, 2 3/4" Field load, #9 shot
(e) 12-gauge Activ, 2 3/4" Field load, #7 ½shot
(f) 12-gauge Activ, 2 3/4" Magnum, BB shot
(g) 12-gauge Winchester, 2 3/4" Xpert, #6 shot
(h) 12-gauge Winchester, 2 3/4" Super-X, #7 ½shot

Training Examiner Date

Lab Manager Date

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.

Training Examiner Date

Lab Manager Date



Basic References:

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

"Lyman Shotshell Hand Book" Third Edition, REMAGE

K. GUNSHOT RESIDUE EXAMINATIONS AND DISTANCE DETERMINATIONS

1. Successfully complete a course pertaining to gunpowder and primer residues.

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Instructor Date

Training Examiner Date

Lab Manager Date

2. 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.

Training Examiner Date

Lab Manager Date

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

Training Examiner Date

Lab Manager Date



4. 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

Training Examiner Date

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Lab Manager Date

5. Using specimens provided to you by the Training Examiner, demonstrate your proficiency in conducting "muzzle-to-garment" distance tests in cases involving the deposition of gunshot residues. Your examination should include note taking, microscopic and chemical examinations, test firing to produce test patterns and accurately determining "muzzle-to-garment" distance.

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Training Examiner Date

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Lab Manager Date

6. Using specimens provided to you by the Training Examiner, demonstrate your proficiency in conducting "muzzle-to-garment" distance tests in cases involving shot patterns. Your examination should include note taking, microscopic and chemical examinations, test firing of shot patterns, gunshot residue patterns and accurately determining "muzzle-to-garment" distance.

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Training Examiner Date

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Lab Manager Date



7. 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 Training Examiner.

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Training Examiner Date

Lab Manager Date

8. Attend an autopsy of a shooting victim at an autopsy facility. Document any indications of gunshot residue deposits photographically. Also document the physical effects of the projectile on the body. Prepare a report on your observations and include any information obtained by the pathologist concerning his opinion on distance determination and bullet effects, cause of death, direction of bullet travel and other information pertinent to firearms identification.

Training Examiner Date

Lab Manager Date



Basic References:

"Gunpowder and Gunshot Residue" FBI Manual

"Homicide Investigation Techniques" WILSON

"Crime Investigation" KIRK

"Gunshot Wounds" DiMAIO



## L. TOOLMARK EXAMINATIONS AND COMPARISONS

1. 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 Training Examiner.

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Training Examiner Date

Lab Manager Date

2. 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 Training Examiner.

Training Examiner Date

Lab Manager Date

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

Training Examiner Date

Lab Manager Date

4. 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 Training Examiner.

Training Examiner Date

Lab Manager Date

5. 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

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Training Examiner Date

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Lab Manager Date

6. 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.

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Training Examiner Date

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Lab Manager Date



7. 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.

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Training Examiner Date

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Lab Manager Date

8. 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.

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Training Examiner Date

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Lab Manager Date

9. 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.

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Training Examiner Date

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Lab Manager Date



10. Using a junked doorknob and a serrated-jawed tool, have the Training Examiner 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.

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Training Examiner Date

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Lab Manager Date

11. 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.

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Training Examiner Date

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Lab Manager Date

12. 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.

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Training Examiner Date

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Lab Manager Date



13. 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.

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

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Lab Manager Date

15. 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.

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Training Examiner Date

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Lab Manager Date

16. 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.

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Training Examiner Date

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Lab Manager Date

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

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Training Examiner Date

_____

Lab Manager Date

Basic References:

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

"Machinery's Handbook Revised 21st Edition" OBERG, JONES & HORTON

"Handbook of Forensic Science" FBI

## M. SERIAL NUMBER RESTORATION

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

_____
Training Examiner Date

_____
Lab Manager Date

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.

_____
Training Examiner Date

_____
Lab Manager Date

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, embossing, debossing, coining, vibratory pencil, laser and electrical discharge machining.

(a) Discuss with the Training Examiner the effect each of these marking techniques has on the subsurface of the marked area.

(b) Discuss with the Training Examiner how the marking methods used can directly affect the ability of the examiner to restore any obliterated markings and why.

_____

Training Examiner Date

_____

Lab Manager Date

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

_____

Training Examiner Date

_____

Lab Manager Date

5. Briefly discuss in your notebook and the Training Examiner the difference between cold rolled steel and cast iron metal.

_____

Training Examiner Date

_____

Lab Manager Date

6. Discuss with the Training Examiner 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) healing
(f) puddling
(g) welding
(h) removal
(i) combinations of the above

_____
Training Examiner Date

_____
Lab Manager Date

7. Determine the tell-tale signs that can be left by the various alteration methods. Discuss how these signs will determine your specific approach to the restoration attempt.

_____
Training Examiner Date

_____
Lab Manager Date

8. Discuss with the Training Examiner the different types of lighting (e.g., incandescent, infrared, UV, 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.

_____
Training Examiner Date

_____
Lab Manager Date

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

_____
Training Examiner Date

_____
Lab Manager Date

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.

_____
Training Examiner Date

_____
Lab Manager Date

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.

_____
Training Examiner Date

_____
Lab Manager Date

12. Determine the specialized equipment that might be used in number restoration and discuss these with the Training Examiner.

Training Examiner Date

Lab Manager Date

13. Discuss with the Training Examiner the La Rock-Buchanan technique of photography on freshly etched numbers.

Training Examiner Date

Lab Manager Date

14. Determine the various types of film utilized for number restoration photography. Be prepared to discuss with the Training Examiner under what circumstances each would be used.

Training Examiner Date

Lab Manager Date

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

Training Examiner Date

Lab Manager Date

16. 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) H2O2
(l) Tartaric acid
(m) Ammonium Persulfate

_____

Training Examiner Date

_____

Lab Manager Date

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

_____

Training Examiner Date

_____

Lab Manager Date

18. 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

_____

Training Examiner Date

_____

Lab Manager Date

19. 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.

_____

Training Examiner Date

Lab Manager Date

20. Determine 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 autoloading pistol
(f) shotgun alloy receiver
(g) shotgun case hardened receiver
(h) Winchester rifle

Training Examiner Date

Lab Manager Date

21. Obtain several firearms from the Training Examiner, alter the serial numbers using different methods and then attempt to restore them. Prepare notes and photographs to substantiate your conclusions and results.

Training Examiner Date

Lab Manager Date

22. Be prepared to discuss with the Training Examiner the methods used and lessons learned during the restoration process.

_____
Training Examiner Date

_____
Lab Manager Date

23. 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.

_____
Training Examiner Date

_____
Lab Manager Date

24. Discuss with the Training Examiner how the combination of brief application of CuNH4C12 followed by normal NaOH application can shorten the processing time on aluminum.

_____
Training Examiner Date

_____
Lab Manager Date

25. Discuss with the Training Examiner why alternating HNO3 and HCl can work so well on chrome or nickel plated firearms.

_____
Training Examiner Date

_____
Lab Manager Date

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

Training Examiner Date

Lab Manager Date

Basic References:

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

"Firearms Identification" MATHEWS

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

# Idaho State Police Forensic Services

# FIREARMS & TOOL MARK EXAMINER TRAINING Manual

Table of Contents

## 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 Technical Protocol Manual, 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 month 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 Discuss with your Lab Manager the laboratory Quality Assurance Program and the Proficiency Testing Program.

_____ _____

Lab Manager Date:

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

_____ _____

Lab Manager Date

1.3 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

1.4 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

1.5 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

1.6 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

1.7 Be briefed by the Lab Manager in regard to her 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

1.8 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.

_____ _____

Discipline Leader/on-site trainer 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



_____ _____
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 | (aa) bullet |
| (b) cartridge case | (bb) round-nosed bullet |
| (c) primer | (cc) "hollow-point" bullet |
| (d) shotshell | (dd) jacketed bullet |
| (e) shotshell casing | (ee) bullet sizing |
| (f) bottleneck cartridge | (ff) wadcutter bullet |
| (g) rebated-rim cartridge | (gg) semi-wadcutter bullet |
| (h) rimless cartridge | (hh) soft point bullet |
| (i) rimmed cartridge | (ii) spitzer bullet |
| (j) semi-rimmed cartridge | (jj) swaging |
| (k) shoulder | (kk) cast lead bullet |
| (l) neck | (ll) mold marks |
| (m) mouth | (mm) truncated cone bullet |
| (n) head | (nn) cannelure |
| (o) headstamp | (oo) ogive |
| (p) proof cartridge | (pp) brass-coated lead bullet |
| (q) tapered cartridge | (qq) copper-coated lead bullet |
| (r) extractor groove | (rr) nylon-coated lead bullet |
| (s) gauge | (ss) "silvertip" bullet |
| (t) battery cup | (tt) antimony |
| (u) brass | (uu) arsenic |
| (v) "Rule of 17" | (vv) chilled shot |
| (w) wadding | (ww) high brass, low brass |
| (x) shot collar | (xx) lubaloy |
| (y) crimp | (yy) dram equivalent |
| (z) bunter | (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) obscuration
(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 competnacy 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 co-signed cases**

12.1 Complete cosigned cases (if the analyst is only being certified in one area the cosigned cases will be in that area, if the analyst is being certified in all areas the cosigned cases will be comprehensive of all areas). The on site trainer will determine when this is completed based on analysts ability to work independently and the types of cases completed.

_____ _____
Discipline Leader/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

**Firearms, Toolmarks and Serial Number Training Manual**

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