Introduction

The National Institute of Standards and Technology (NIST) facilitated the development of this Firearms Process Map through a collaboration between the NIST Forensic Science Research Program and the NIST administered Organization of Scientific Area Committees (OSAC) for Forensic Sciences (specifically OSAC's Firearms and Toolmarks Subcommittee) in partnership with the Association of Firearm and Tool Mark Examiners (AFTE).

*This Firearms Process Map (Current Practices) captures details about the various procedures, methods and decision points most frequently encountered in the discipline of firearm examination from a national and international perspective and **is intended to reflect current practices**. The discipline of firearm examination requires examiners to make many decisions that can impact the quality and accuracy of results. The Firearms Process Map can benefit the firearm examination discipline by providing a behind-the-scenes perspective into the various components and decision points in the firearms analysis process.*

Process mapping is the visual representation of critical steps and decision points of a process. Components of the process are deconstructed, placed into specific shapes within a flowchart and connected by one-way arrows to indicate directionality regarding decisions as well as progression throughout the overall process. The shape of each box assists the reader by representing a specific type of activity.

*This process map captures the **diverse** practices of multiple laboratories, with the goal of allowing a firearm examiner to find their process represented in the map. To ensure this, the mapping team avoided creating a map of what **should** be done (e.g., best practices) and instead attempted to represent all reasonable variations of casework **currently performed** by firearm examiners. For this reason, it is important to state that neither the OSAC Firearms and Toolmarks Subcommittee nor AFTE necessarily support or endorse (as best practices) all of the different steps and paths depicted in this process map.*

This map is not intended to be a step-by-step instruction manual outlining minutia, nor is it intended to be so broad that it lacks utility. Rather, judgements were made by the process mapping group as to which steps should be combined and which steps should be divided further. Certain processes represented in the map have a required sequence while other components may vary by examiner or agency. Processes and decisions may also be dictated by agency policy or law.

Process Map Applications:

The Firearms Process Map is intended to be used to help improve efficiencies while reducing errors, highlight gaps where further research or standardization would be beneficial, and assist with training new examiners. It may also be used to develop specific laboratory policies and identify best practices.

Scope of the Firearms Process Map:

The scope of this Firearms Process map is limited to core processes within the discipline of firearm and toolmark examination such as the examination of firearms and the microscopic comparison of fired ammunition components. Several topics are omitted from this map to include individual characteristic databases, toolmark examination, fracture matching and distance determination. These topics may subsequently be addressed by the process mapping team, an individual laboratory or a standardization committee.

OSAC Organization of Scientific Area Committees for Forensic Science

ASSOCIATION OF FIREARM AND TOOL MARK EXAMINERS AFTE 1969 TM

1000 - Administrative Assessment

Inquiry Received

- Intake Criteria Assessment
- Capacity Assessment

2000 - Technical Assessment

- Examiner Evidence Intake
- Case Assessment

3000 – Unknown Analysis

- Item Determination
- Feature Assessment
- Grouping Based on Class Characteristics
- Suitability Determination

4000 – Functionality / Operability /Known Analysis

- Render Firearm Safe
- Functionality
- Trigger Pull Measurement
- Test Fire
- Ammunition Selection
- Known Analysis/Suitability Determination

5000 – Subclass Characteristics

- Subclass Characteristics

6000 – Individual Characteristic Database (ICD)*

- *Suitability Determination
- *Database Entry
- *Review of Results

*These processes are not represented in this document

7000 – Comparison/Evaluation

- Projectile to Projectile (P to P)
- Projectile to Firearm (P to F)
- Cartridge Case to Cartridge Case (C to C)
- Cartridge Case to Firearm (C to F)
- Ammunition to Projectile/Cartridge Case/Ammunition

8000 – Reporting and Verification

- Verification
- Technical/ Administrative Review
- Report

9000 - Other Examinations*

- Serial Number Restoration
- Barrel Length Measurement
- *Toolmark Examination
- *Fracture Match
- *Distance Determination
- *Miscellaneous Examinations

*These processes are not represented in this document

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Underlined Word
Word that will be defined in the glossary

Technology Assist
Technology that aids in the steps on this page

Input Box
Outlines the inputs at the beginning of each section

Output Box
Describes an output of the steps on the page

Discontinuation of Assessment or Examination

Legend	
	Process start/end
	Process
	Decision
	Subprocess
	Document

This process map provides a visual description and attempts to represent all reasonable variations of casework currently performed by firearm examiners. OSAC and AFTE do not necessarily support or endorse (as best practices) all of the different steps and paths depicted in this process map.

Return to Overview

1100 - Intake Criteria Assessment

1110
Request Received

1120
Evaluate the request for acceptance criteria?

YES

NO

1130
Case Acceptance Criteria Per Agency Policy (PAP)

- Approval required?
- Approval received?
- Analysis timeframe appropriate?
- Description of evidence packaging
- Sufficient case related information (i.e. police report)?
- Is the request appropriate?
- Resource Evaluation: Time and Expertise?

1140
Does it meet acceptance criteria?

YES

NO

1150
Can the issue be addressed immediately?

YES

NO

1160
Discontinue Evidence Receiving and proceed PAP

1200 - Capacity Assessment

1210
Initiate Evidence Receiving Process
Per Agency Policy (PAP)

- Unique Case Identifier
- Unique Item designation for evidence
- Ensure firearm is unloaded
- Receipt generated and provided to submitting agency
- Check/Ensure for proper packaging/sealing
- Initiate Laboratory chain of custody
- Generate appropriate documentation PAP

FROM 2160

1270
Create Appropriate Case Assignment(s)

1280
Were there multiple assignments for varying disciplines?

YES

1295
Process case PAP

NO

1290
Transfer Case to Assigned Examiner

GO TO 2000 Examiner Evidence Intake

Technology Assist

- LIMS

This process map provides a visual description and attempts to represent all reasonable variations of casework currently performed by firearm examiners. OSAC and AFTE do not necessarily support or endorse (as best practices) all of the different steps and paths depicted in this process map.

Return to Overview

2000 – Examiner Evidence Intake

FROM 1290/1295

2105
Input: Evidence item(s) forwarded to assigned examiner
- Firearms / Firearms Parts
- Projectile (Bullets and Shot)
- Shotshell Components
- Cartridge Case/Shotshell
- Live /Unfired Ammunition
- Other Items

2110
Is access to additional information such as autopsy reports, police reports, or crime scene reports, necessary for evaluating the case request?

YES → 2120
Evaluate or make request for the necessary information

NO

2130
Inventory of Evidence (mark package and describe evidence Per Agency Policy -PAP)

2140
All necessary items received?

YES → 2190
Review and Document Pre-Examination Information

-Additional examination prior to FATM examination
-Case Circumstances

NO → 2150
Communicate with customer
- Request Additional Evidence
- Clarification on Service requested

2160
Additional evidence requested?

YES → GO TO 1210 Capacity Assessment

NO → 2170
Proceed with existing evidence items?

YES

NO → 2180
Discontinue evidence receiving and proceed PAP

2195
Output:
Cataloged evidence items

2200 Case Assessment

2205
Input:
Cataloged evidence items

2220
Based on Case information/PAP, determine what samples to test and in which order (Testing Plan)

2230
Output:
Evidence Testing Plan (i.e. priority list)

GO TO 3100 Item Determination

Factors When Determining Testing Plan

(e.g. which items and how many will be processed and in which order?)

- Administratively chosen
- Customer driven
- Investigative driven
- Random order
- Perceived probative value based on examiners opinion
- Sequential order
- Processed based on grouping
- Crime Type

Use the following questions to determine next steps:

- Review unknowns before firearms?
- Were only unknowns submitted for examination?
- Analyze all unknowns?
- Will sampling plan be applied (such as ICD)?

Return to Overview

3100 Item Determination

FROM 2230/7085/ 7145/7290/ 7569/7590/ 7680

3105 **Input:** Evidence testing plan and evidence items

3110 Select Item per evidence testing plan

3120 Open packaging

3130 Document and/or Photograph Per Agency Policy (PAP)

3140 Do the contents match the item description?

YES

NO

3145 Communicate with customer and/or process contents PAP

3150 Can case continue?

YES

NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

3160 Is it a single item?

YES

NO

3170 Inventory and sub-itemize

3180 Label item as appropriate PAP

3190 Visual Examination to characterize sample type Document PAP

3200 Label PAP?

YES

NO

3210 Label items as appropriate

3220 Update Evidence Testing Plan based on case information PAP

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?

Y

Return to 3100 (Item Determination)

N

GO TO REPORTING

Technology Assist

- Camera
- LIMS
- Magnifier
- Flashlight
- Magnet
- Tool Kit
- Reference Material: Parts and Firearms
- Reference Material: Literature

Determine Sample Type

Feature Assessment

3300 Is it Live/Unfired Ammunition?

GO TO 3400 Live/Unfired Ammunition

3310 Is it shotshell components?

GO TO 3800 Projectile/Bullets

3320 Is it a projectile (Bullets/Shot)?

GO TO 3800 Projectile/Bullets

3330 Is this a cartridge case/shotshell?

GO TO 3600 Cartridge Case/Shot Shell

3340 Is this a firearm?

GO TO 4100 Render Firearm Safe

3350 Is this a firearm part(s)?

GO TO 4100 Render Firearm Safe or 4200 Functionality PAP

3360 Items not consistent with components of a firearm or ammunition (eg debris or other items)

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Return to Overview

3400 Feature Assessment: Live/Unfired Ammunition

FROM 3300

3405 **Input:** Live/Unfired Ammunition

3410 Document Per Agency Policy (PAP) (Descriptive and/or Detailed Toolmark Documentation)

3415 Mark evidence with identifiers PAP

3417 Will there be examinations of live/unfired ammunition? — YES / NO

3420 Multiple Items? — YES / NO

3425 Group by Class Characteristics and update testing plan

3430 Determine if live ammunition is similar in descriptive features to fired ammunition? — YES / NO

3435 Compare descriptive features and Document PAP

3440 Will there be a comparison of toolmarks? — YES / NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan? — Y: Return to 3100 (Item Determination) / N: GO TO REPORTING

3445 Evaluate and document suitability PAP

Technology Assist

- Camera
- LIMS
- Magnification Device (Magnifying Glass/Comparison Microscope/Stereoscope etc)
- Flashlight
- Magnet
- Casting Material
- Reference Material: Literature
- General Rifling Characteristics Database
- Ammunition Reference Collection
- Measuring tool (Caliper/ruler/micrometers etc)

Descriptive Documentation Through Direct Observation - Live/Unfired Ammunition

- Photograph Documentation (Agency Dependent)
- Visual Examination for Trace Evidence (Collect? Decontaminate?)
- Determine Cartridge Caliber
  - reference material
  - experience
  - measurement
- Determine cartridge/ shot shell Manufacturer / Marketer
- Determine projectile Type (HP, FMJ)
- Determine composition of: Primer, Case, Bullet, battery cup (Based on Color or MAGNET)
- Document Headstamp on Cartridge
- Document Cannelures
- Document Sealant
- Document Hull Marks (Shot Shells)
- Ignition System (Rimfire/Centerfire)
- Shotshell length

Detailed Toolmark Documentation (Comparable Features)- Live/Unfired Ammunition

- Reloading Marks
- Manufacturing Marks
- Light Strikes - primer
- Bunter Marks
- Feed Ramp Marks
- Magazine Marks
- Chamber Marks
- Ejection Port Marks
- Extractor Marks
- Ejector Marks
- Shell Stop Marks

3450 Evaluate for Subclass? — YES: GO TO 5100 Subclass / NO

3455 Suitable for comparison? — YES / NO

3460 Are there multiple cartridges? — YES / NO

3465 Select sample PAP

3470 Are the marks of interest on the projectile? — YES / NO*

3475 Is there a firearm? — YES / NO

3480 If multiple projectiles, will there be intercomparison prior to test fire comparison? — YES / NO

*It is implied/understood here that if the mark isn't on the projectile, it is on the cartridge case.

3490 Enhancement techniques and document/ photograph PAP

3495 Evaluate suitability for comparison

Enhancement Techniques

- Magnesium smoking
- Casting
- Sharpie

3485 Try enhancement techniques to aid in comparison? — YES / NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

3500 Is there a firearm? — YES / NO

3505 Output: Cartridges suitable for comparison, where the markings of interest are on the cartridge case, and there is no firearm present

3510 If multiple cartridges, will there be intercomparison prior to test fire comparison? — YES / NO

3512 Output: Cartridges suitable for comparison, where the markings of interest are on the cartridge case, there will not be an intercomparison, and there is a firearm present

3515 Output: Cartridges suitable for comparison, where the markings of interest are on the cartridge case, there will be an intercomparison, and there is a firearm present

3520 Output: Cartridges suitable for comparison, where the markings of interest are on the projectile, there will not be an intercomparison, and there is a firearm present

3525 Output: Cartridges suitable for comparison, where the markings of interest are on the projectile, there will be an intercomparison, and there is a firearm present

3530 Output: Cartridges suitable for comparison, where the markings of interest are on the projectile, and there is no firearm present

GO TO 7800 Comparison C to F

GO TO 7500 Comparison C to C

GO TO 7300 Comparison P to F

GO TO 7100 Comparison P to P

Return to Overview

3600 Feature Assessment: Cartridge Cases/Shotshells

FROM 3330

3605 **Input:** Fired Cartridge Cases/Shotshells

3610 Document Per Agency Policy (PAP) (Descriptive and/or Detailed Toolmark Documentation)

3620 Mark evidence with identifiers PAP

3630 Multiple FCC/SHOT SHELL? YES / NO

3632 Group by Class Characteristics and update testing plan

3635 Evaluate item for suitability? Individual Characteristic Database (ICD), or comparison? YES / NO

3640 Evaluate and document suitability PAP

3645 Will there be a comparison made? YES / NO

3650 Enter into ICD? YES / NO

3655 Will there be entry into ICD prior to comparison? (PAP) YES / NO

3660 Select items for entry

3665 ENTER INTO ICD PAP

3670 Determine if live ammunition is similar in descriptive features to fired ammunition? YES / NO

3675 Compare descriptive features and Document PAP

3680 Will there be a comparison of toolmarks? YES / NO

3715 Suitable for comparison? YES / NO

3720 Evaluate for Subclass? YES / NO

GO TO 5100 Subclass

3725 Are there test fires with the same class characteristics available? YES / NO

3730 If multiple, will there be intercomparison prior to test fire comparison? YES / NO

3735 Try enhancement techniques to aid in comparison? YES / NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

3740 Enhancement techniques and document/photograph PAP

3745 Evaluate suitability for comparison

3685 Enter information into General Rifling Characteristics (GRC) database? YES / NO

3690 Launch Search

3695 Report results? YES / NO

3700 Document/Report GRC results PAP

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

3750 Output: Fired cartridge cases or shotshells suitable for comparison, where there are not test fires with the same class characteristics available

3760 Output: Fired cartridge cases or shotshells suitable for comparison, where there are test fires with the same class characteristics available, and there will not be intercomparison

3755 Output: Fired cartridge cases or shotshells suitable for comparison, where there are test fires with the same class characteristics available, and there will be intercomparison

GO TO 7500 Comparison C to C

GO TO 7800 Comparison C to F

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan? Y / N

Return to 3100 (Item Determination)

GO TO REPORTING

Descriptive Documentation Through Direct Observation– Cartridge Case/Shotshell

- Photograph Documentation (Agency Dependent)
- Visual Exam for Trace Evidence (Collect? Decontaminate?)
- Cartridge Caliber/Gauge
- Cartridge Manufacturer / Marketer
- Composition (Primer, Case, Battery Cup)
- Design / Type (high brass, low brass…)
- Cannelures
- Sealant
- Condition (Is it mutilated? Does it require manipulation?)
- Info on Hull
- Manufacturer or Marketer
- Ignition System (Rimfire/Centerfire)
- Shotshell length
- Nominal Caliber
- Visual Examination: reference material (direct comparison), experienced analyst

Note Type:

- Headstamp
- Straight, rim, rimless, rebated,
- Measurement (cartridges of the world - book)
- Diameter: Mouth, Shoulder, rim, neck,
- Rim thickness
- Length

Detailed Toolmark Documentation- Cartridge Case/Shotshell

- **Document general class characteristics, location, and shape:**
  - Firing Pin Impression
  - Breech Face Marks
  - Firing Pin Aperture
  - Anvil (rim fire)
  - Extractor
  - Ejector
  - Chamber Marks
  - Ejection Port Marks
  - Reloading Marks
  - Cycling Marks
  - Chambering Marks
  - Magazine Lip Marks
  - Manufacturing Marks / Features
  - Light Strikes
  - Bunter Marks

Enhancement Techniques

- Magnesium smoking
- Casting
- Sharpie

Technology Assist

- Camera
- LIMS
- Magnification Device (Magnifying Glass/Comparison Microscope/Stereoscope etc)
- Flashlight
- Magnet
- Casting Material
- Reference Material: Literature
- General Rifling Characteristics Database
- Ammunition Reference Collection
- Measuring tool (Caliper/ruler/micrometers etc)

Return to Overview

3800 Feature Assessment: Projectiles/Bullets

FROM 3310/3320

3805 **Input:** Fired Projectiles/Bullets/ Shotshell Components

3810 Document Per Agency Policy (PAP) (Descriptive and/or Detailed Toolmark Documentation)

3815 Mark evidence with identifiers PAP

3820 Multiple Items? YES / NO

3825 Group by Class Characteristics and update testing plan

3830 Evaluate item for suitability? Individual Characteristic Database (ICD), or comparison? YES / NO

3840 Evaluate and document suitability PAP

3845 Will there be a comparison made? NO / YES

3850 Enter into ICD? NO / YES

3835 Will there be entry into ICD prior to comparison? (PAP) YES / NO

3855 Select items for entry

3860 ENTER INTO ICD PAP

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan? Y / N

Return to Item Determination

GO TO REPORTING

Descriptive Documentation Through Direct Observation– Projectiles/Bullets/Shotshell Components

- Photograph Documentation (Agency Dependent)
- Visual Exam for Trace Evidence (Collect? Decontaminate?)
- Composition
- Design/Type (round nose, hollow point, etc.)
- Cannelures (number and type)
- Characteristics of Base
- Condition (Is it mutilated? Does it require manipulation?)
- Wad/shot cup or other internal portions of shotshell present (paper wad, shot buffer, etc.)-
- Jacket Manipulation (If needed)
- Manufacturer or Marketer
- Nominal Caliber/Gauge/Bore
- Weight
- Diameter
- Rifling Characteristics
- Visual Examination: reference material, experienced analysis

Detailed Toolmark Documentation – Projectiles/Bullets/Shotshell Components

- Cycling Marks
- Manufacturing Marks / Features
- Case Mouth Marks
- Number of Petals
- Mould Marks
- Shot Dimples
- Other Toolmarks
- Other Measurements

3865 Determine if live ammunition is similar in descriptive features to fired ammunition? YES / NO

3870 Compare descriptive features and Document PAP

3875 Will there be a comparison of toolmarks? YES / NO

3945 Evaluate suitability for comparison

3905 Suitable for comparison? YES / NO

3910 Evaluate for Subclass? YES / NO

GO TO 5100 Subclass

3915 Are there test fires with the same class characteristics available? YES / NO

3920 If multiple, will there be intercomparison prior to test fire comparison? YES / NO

3950 Output: Fired projectiles, bullets, or shotshell components suitable for comparison, where there are not test fires with the same class characteristics available

3960 Output: Fired projectiles, bullets, or shotshell components suitable for comparison, where there are test fires with the same class characteristics available, and there will not be intercomparison

GO TO 7300 Comparison P to F

3955 Output: Fired projectiles, bullets, or shotshell components suitable for comparison, where there are test fires with the same class characteristics available, and there will be intercomparison

3880 Enter information into General Rifling Characteristics (GRC) database? YES / NO

3885 Launch Search

3890 Report Results? YES / NO

3895 Document GRC results PAP

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

3940 Enhancement techniques and document/photograph PAP

3925 Try enhancement techniques to aid in comparison? YES / NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Enhancement Techniques

- Magnesium smoking
- Casting
- Sharpie

GO TO 7000 Comparison P to P

Technology Assist

- Camera
- LIMS
- Magnification Device (Magnifying Glass/Comparison Microscope/Stereoscope etc)
- Flashlight
- Magnet
- Casting Material
- Reference Material: Literature
- General Rifling Characteristics Database
- Ammunition Reference Collection
- Measuring tool (Caliper/ruler/micrometers etc)
- Balance/Scale

Return to Overview

4100 Render Firearm Safe

FROM 3340/3350

4105
Input: Firearm

4110
Examiner familiar with the firearm?
YES
NO

4115
Consult reference material or another examiner?
YES
NO

4120
Consult Reference Material or another Examiner and Document PAP

4125
Document/Photograph/ Collect Trace Evidence/Swab for DNA prior to rendering firearm safe?
YES
NO

4130
Photograph/Collect trace evidence/swab for DNA Per Agency Policy (PAP)

4135
Document PAP

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?
Y
Return to 3100 (Item Determination)
N
GO TO REPORTING

4140
Is the firearm Loaded?
YES
NO

4150
Can the firearm be unloaded through non-destructive means?
YES
NO

4155
Unload Firearm by least destructive means necessary PAP

4160
Can the process continue with undamaged parts?
YES
NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

4170
Unload Firearm

4180
Document and Photograph PAP

4165
Document PAP

4145
Output: Unloaded firearm or firearm parts

4185
Conduct/Document Initial Examination?
YES
NO

4187
Conduct Initial Examination

4190
Inspect General Condition of the Bore (obstructions or defects)

4191
Will functionality testing and/or test fire be conducted?
YES
GO TO 4200 Functionality
NO

4195
Will other examinations be conducted?
YES
GO TO 9000 Other Examintions
NO

STOP/RETURN EVIDENCE/ Document PAP or go to 2500 (Evidence Testing Plan)

Technology Assist

- Camera
- LIMS
- Bore Scope
- Magnification Device (Magnifying Glass/Comparison Microscope/Stereoscope etc
- Flashlight
- Tool Kit
- Reference Material: Parts and Firearms
- Reference Material: Literature

Initial Examination

Document any pertinent observations:

- Scratches
- Rust
- Defects
- Modifications
- Missing/broken parts
- Trace material
- Misc. (or otherwise noteworthy features)

QUALITATIVE EVALUATION:

- Manipulate Action
- Dry Fire
- Trigger Pull – (Qualitative)

Return to Overview

4200 Functionality

FROM 3350/4191

4205 **Input:** Firearm Rendered Safe

4210 Photograph condition as received/Collect Trace Evidence/Swab for DNA? — YES → 4230 Photograph/Collect trace evidence/swab for DNA Per Agency Policy (PAP)

NO → 4235 *Document (also see list Descriptive Documentation and/or Class Characteristics) PAP*

4215 Is this a complete firearm? — YES → 4240 Does the firearm appear to be operating?

NO → 4220 Are the necessary reference parts available for the firearm? — YES → 4275 Attempt to fix issue? — YES → 4280 Fix issue Document/Photograph PAP → 4240

4220 NO → 4225 Are test standards (TS) needed? — YES → 4290 Can standards be created through alternative means (cast, push a bullet, etc)? — YES → 4295 Create test standard through alternative methods → 4300 Output: Alternative Test Standard (TS) → 4310 Will these standards be used for examination? — YES → GO TO 6000 OR 7000 PAP

4225 NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

4290 NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

4310 NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

4240 NO → 4245 Continue? — YES → 4260 **TROUBLESHOOTING** STEPS PAP: -field strip -detailed strip -research → 4265 Has the issue been identified? — YES → Functionality and Safety Tests

4245 NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

4265 NO → 4270 Continue troubleshooting? — YES → Functionality and Safety Tests

4270 NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Functionality and Safety Tests

4320 Check Safety Recall? — YES → 4360 SAFETY RECALL: CHECK RELEVANT REFERENCE MATERIAL PAP

4321 Conduct Impact Test?

4322 Conduct Capacity Test?

4323 Measure Barrel/Overall length? — YES → GO TO 9600 Barrel/Overall Length

4324 Conduct Trigger Pull Measurement?

4325 Examine Safety Mechanism(s)?

4326 Assess Action Type?

NOTE: Multiple safety and functionality steps are interchangeable. Some are sequential, others are simultaneous, some order is agency specific.

4360 SAFETY RECALL: CHECK RELEVANT REFERENCE MATERIAL PAP → 4365 Is there any issue that will affect the examination that warrants troubleshooting? — YES → GO TO 4260 TROUBLESHOOT

4365 NO → 4330 DOCUMENT RESULTS OF ANY FUNCTIONALITY AND SAFETY TESTS PAP → 4340 Output: Firearm ready for test fire; Documented results for the relevant functionality test(s) performed → 4345 Is it operating as designed? — YES → 4347 Evaluate for subclass? — YES → GO TO 5100 Subclass

4345 NO → GO TO 4260 TROUBLESHOOT

4347 NO → 4350 Can the firearm be safely fired? — YES → GO TO 4500 Test Fire

4350 NO → GO TO 4225 Are test standards needed?

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan? — Y → Return to 3100 (Item Determination)

N → GO TO REPORTING

DOCUMENT ONE OR MORE OF THE FOLLOWING:

Descriptive Documentation:

- Serial Number
- Make
- Model
- Importer
- Manufacturer
- Caliber
- Modifications (Visual/External/Dimensional)
- Firearm Type (Shotgun, revolver, etc.)
- Accessories (Visual)
- Safety Mechanisms
- Condition (Rust, Scratches, Other Damage etc)

Class Characteristics:

- Breech or Bolt Face
- Firing Pin Aperture
- Firing Pin Detail
- Ejector / Extraction
- Rifling
- Caliber

Field Strip/Detailed Disassembly

- Damage
- Use/Wear
- Safety
- Chamber Modification
- Action Type (Modification)
- Other

Trigger Pull

- Spring Scale
- Digital Scale
- Weights

Technology Assist

- Camera
- LIMS
- Balance
- Bore Scope
- Magnification Device (Magnifying Glass/Comparison Microscope/Stereoscope etc
- Flashlight
- Magnet
- Casting Material
- Tool Kit
- Reference Material: Parts and Firearms
- Reference Material: Literature
- General Rifling Characteristics Database

Return to Overview

4500 Test Fire

FROM 4192/4350/5210/7390/7480/7860

4505 **Input:** Firearm that can be fired

4510 Can the gun be safely fired *by hand?* YES / NO

4515 Can a remote firing system be used? YES / NO

FROM 4825

4520 Are test standards (TS) needed? YES / NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

4525 Can TSs be created through alternative methods (cast, push a bullet, etc)? YES / NO

4527 Create Alternate TS

4530 **Output:** Test Standards

4535 Will these be used for examination purposes? YES / NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

GO TO 4650 Will there be a comparison?

GO TO 4800 Ammunition Selection

FROM 4880

4555 Label ammunition now? YES / NO

4560 Label ammunition and document Per Agency Policy (PAP)

4565 Will projectile be recovered? YES / NO

4570 Select Non-Recoverable or Recoverable System (no restrictions on system):
-Bullet Trap
-Open Range
-Other/Recoverable
-Rubber Media System (eg Forensic Buddy)

4580 Select Recovery System:
-Water
-Cotton Box
-Kevlar Tube

4590 Execute Test Fire Plan

4600 Document PAP

4610 Visually Inspect Test Fire

4615 Is a re-shoot necessary? YES / NO

4620 Are there any additional functionality/other examinations of firearm prior to proceeding? YES / NO

4630 Other examinations (e.g. Impact Test/Serial Number Restoration, other functionality testing etc.) document observations PAP

4625 Keep all test fires? YES / NO

4640 Determine which TF to Keep and document PAP

Label Ammunition

- Label Ammunition for indexing?
- Label Ammunition for identification?

Label Fired Components

- Label fired components for indexing?
- Label fired components for identification?

4645 Label fired components with identifiers? YES / NO

4670 Label ammunition and document PAP

4650 Will there be a comparison? YES / NO

4675 Conduct known analysis? YES / NO

4677 Evaluate for Subclass? YES / NO

GO TO 5100 Subclass

4720 Description and/or Comparison of TS and document observations PAP

4725 Are features repeatable? YES / NO

Output: Test standards deemed suitable for comparison

4690 Select sample for comparison and document PAP

4700 Is unknown projectile available for comparison? YES / NO

GO TO 7300 Comparison P to F

GO TO 7800 Comparison C to F

4652 Entry into ICD? YES / NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

4655 Conduct known analysis? YES / NO

4657 Select Sample(s)

4750 Description and/or Comparison of TS and document observations PAP

4760 Determine number of TSs to enter into the database

FROM 5210

4660 ICD ENTRY PAP

4730 Would additional test standards be helpful? YES / NO

GO TO 4800 Ammunition Selection or Back to 4527 Alternative Test Standards

4735 Continue with comparison? YES / NO

4740 Entry into ICD? YES / NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan? Y / N

Return to 3100 (Item Determination)

GO TO REPORTING

Technology Assist

- PPE
- Mallet
- Remote Firing device
- Scribe (i.e Dremel)
- Sharpie, label maker, laser engraver
- Magnification Device (Magnifying Glass/Comparison Microscope/Stereoscope etc)
- Reference Library
- Stock Ammunition

Return to Overview

4800 Ammunition Selection

FROM 4515/4510/4615/ 4730

4805
Input:
Firearm needing test standards (TS)

4810
Determine ammunition needs (see Considerations for Ammunition Selection)

4820
Is there any evidence ammunition available?

YES

4850
Can evidence ammunition be consumed Per Agency Policy (PAP)?

YES

4855
Will evidence ammuniton be consumed?

YES

4860
Select *evidence* ammunition and document PAP

YES

4870
Are additional cartridges needed specifically for ICD?

YES

NO

4880
Output:
Selected ammunition

GO TO 4555 Test Fire

NO

NO

NO

4825
Can stock ammunition be obtained?

YES

4830
Select *stock* ammunition and document PAP

NO

GO TO 4520 Test Fire

Considerations for Ammunition Selection

- Availability
- Comparison and/or ICD Purposes
- Similarity to questioned items
- Composition
- Bullet Design (likelihood of fragmentation)
- Familiarity (likelihood of reproducibility)
- ICD Guidelines/Parameters

Return to Overview

5100 Subclass Determination

5105
Input: Tool (firearm)/Projectile/Cartridge Case or Live/Unfired Ammunition

From 4347 (Functionality)/ 4677 (Test Fire)/7205 (P to P)/7405 (P to F)/7605 (C to C/ 7805 (C to F)

5110 Evaluate tool for subclass?

YES → 5160 Evaluate Tool (See considerations: Tools) → 5170 Document Per Agency Policy (PAP) → 5180 Can the most likely methods of manufacture be determined based on the tool design and toolmarks?

YES → 5185 Is further evaluation of subclass needed based on manufacturing techniques?

YES → 5190 Examination Evaluation for Subclass (e.g., visual and/or casting, which may include disassembly).

NO → 5185

NO → 5180

5180 NO → 5200 *Document Subclass Evaluation PAP*

5200 → 5210 Output: Tool evaluated and subclass features documented → GO TO 4500 (Test Fire)/GO BACK TO 4720/7410/ 7810

5110 NO → 5120 Evaluate toolmark (See considerations: Toolmark)

From 3450/3720/3910 (Feature Assessments) → 5120

5120 → 5125 Is the nature of the marks suggestive of subclass?

YES → 5130 Visual Examination Evaluation for Sub Class → 5140 *Document Subclass Evaluation PAP*

5140 → 5150 Output: Toolmarks evaluated and subclass features documented → GO BACK TO 3465/3780/3955/ 7210/7410/7607 /7810

5125 NO → 5140

Considerations for Subclass Determination: Toolmarks

- Coarse/Bold Detail
- Continuous markings (eg long continuous toolmarks)
- Gross uniform spacing
- Mold marks
- Similarity of Pattern in other areas
- Symmetry
- How the tool moves against substrate/object

Considerations for Subclass Determination: Tools

- Most likely manufacturing method based on tool design
- Location of tool surfaces
- Directionality of marks
- Part lines/Mold marks
- Manufacturer literature or reference materials
- How the tool moves against substrate/object

Technology Assist

- Camera
- LIMS
- Balance
- Bore Scope
- Magnification Device (Magnifying Glass/Comparison Microscope/Stereoscope etc)
- Measurement Projection Scope
- Flashlight
- Magnet
- Casting Material
- Tool Kit
- Reference Material: Parts and Firearms
- Reference Material: Literature
- General Rifling Characteristics Database

Return to Overview

7000 Comparison: Projectile to Projectile (P to P) 1 of 2

FROM 3525/3530/ 3950/3955/ 4310

7005
Input: Projectiles suitable for comparison

7010
Are one of the unknowns described as test fire (TF) at time of submission?
YES
NO

7012
Treat as knowns?
YES
NO

GO TO 7300 (P TO F)

7015
Set up Evidence Items for Comparison (e.g. comparison microscope, 3-D scanning software images etc)- See Considerations for Comparison; Optimize lighting, magnification, and focus

7020
Compare class characteristics of the two items

7025
Are the class characteristics in agreement?
YES
NO

Exclusion / Elimination

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7030
TM Selection
Determine which toolmark/area of interest to compare (markings that the firearm would reproduce)

- •rifling
- land, groove impression
- misalignment/slippage
- •feedramp marks
- •forcing cone/shave marks
- •Other

7040
Determine which of the two items to hold in fixed position

7050
Position fixed item using area of interest features

7060
Rotate other item to find corresponding area of interest

7065
Is there a corresponding area of interest (in phase)?
YES
NO

GO TO 7200 P TO P (2 of 2)

FROM 7210/7235 P TO P (2 of 2)

7070
Is there an additional area of interest?
YES
NO

7075
Is there disagreement among individual detail present?
YES
NO

7100
Able to eliminate based on individual detail Per Agency Policy (PAP)?
YES
NO

7130
Is the level of disagreement sufficient to exclude?
YES
NO

7135
Can exclusion be made without Firearm?
YES
NO

Exclusion / Elimination

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7080
Are one of the unknowns described as TF at time of submission?
YES
NO

7082
Request the Firearm?
YES
NO

7085
Request Firearm PAP

GO TO 3100 Item Determination

7120
Are one of the unknowns described as TF at time of submission?
YES
NO

7140
Request the Firearm?
YES
NO

7145
Request Firearm PAP

GO TO 3100 Item Determination

7087
Use three levels of inconclusive (PAP)?
YES
NO

Inconclusive - B

Inconclusive

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7125
Use three levels of inconclusive (PAP)?
YES
NO

Inconclusive - C

Inconclusive

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?
Y
N

Return to 3100 (Item Determination)

GO TO REPORTING

10000 GRC Database Search *

* GRC search may be approprite when the evidence item(s) are not identified to a firearm.

Enter information into GRC?
YES
NO

Launch Search

Report results?
YES
NO

Document/Report GRC results PAP

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Considerations for Comparison

Selecting which unknown or known to compare first/next:
Select the applicable criteria:

- Quality/complexity of toolmarks
- Administratively chosen
- Customer driven; investigative question
- Random order
- Perceived probative value based on examiner discretion

Technology Assist

- Computer aided comparison (3D Modeling)
- Computer aided documentation
- Computer aided selection of the known / unknown to compare (NIBIN)
- Comparison Microscope
- Imaging System

Conclusions

- Identification
- Inconclusive
- Inconclusive - A
- Inconclusive - B
- Inconclusive - C
- Exclusion / Elimination

Return to Overview

7200 Comparison: Projectile to Projectile (P to P) 2 of 2

FROM 7065 P TO P (1 of 2)

7200 Evaluate level of correspondence in area of interest and document observations Per Agency Policy (PAP)

7205 Is there potential subclass in the corresponding detail?
- YES → GO TO 5100 SUBCLASS
- NO

7210 Continue reviewing in phase?
- YES
- NO → RETURN TO 7030 (P TO P PAGE 1)

FROM 5150

7215 Mark/Index items?
- YES → 7220 Mark items and document PAP
- NO

7225 Are there additional areas of interest to examine?
- YES → 7230 Rotate in Phase position to visualize additional corresponding features until complete → 7235 Does the Phase position need to be re-evaluated?
  - YES → RETURN TO 7030 (P TO P PAGE 1)
  - NO → *7240 Photograph/Document PAP*
- NO

7245 Can identification be made without Firearm?
- YES → 7250 Will CMS be used as a criteria for identification?
  - YES → 7260 Evaluate and Document CMS → 7265 Does evaluated CMS meet threshold for identification?
    - YES
    - NO → 7270 Use three levels of inconclusive PAP?
      - YES → Inconclusive - A → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
      - NO → Inconclusive → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
  - NO → 7255 Is the agreement sufficient for ID? (Qualitative and Quantitative)
    - YES
    - NO
- NO

7275 Are one of the unknowns described as TF at time of submission?
- YES → 7280 Request the Firearm?
  - YES → 7290 Request Firearm PAP → GO TO 3100 Item Determination
  - NO
- NO → 7285 Use three levels of inconclusive (PAP)?
  - YES → Inconclusive - A → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
  - NO → Inconclusive → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7295 Is the mark being identified a result of the firing process?
- YES → Identification: Firing
- NO → Identification: Cycling/common tool or source → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?
- Y → Return to 3100 (Item Determination)
- N → GO TO REPORTING

10000 GRC Database Search * GRC search may be appropriate when the evidence item(s) are not identified to a firearm.

Enter information into GRC?
- YES → Launch Search → Report results?
  - YES → Document/Report GRC results PAP
  - NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)
- NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Conclusions

- Identification
- Inconclusive
- Inconclusive - A
- Inconclusive - B
- Inconclusive - C
- Exclusion / Elimination

Return to Overview

7300 Comparison: Projectile to Firearm (P to F) 1 of 2

FROM 3520/3960/ 4310/4700/ 7012

7305
Input: Projectile and Test Standard (TS) Suitable for Comparison

7310
Set up Evidence Items for Comparison (e.g. comparison microscope, 3-D scanning software images etc)- See Considerations for Comparison; Optimize lighting, magnification, and focus

7320
Optimize lighting, magnification, and focus

7325
Are the class characteristics in agreement?
YES
NO

Exclusion / Elimination

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7330
TM Selection
Determine which toolmark/area of interest to compare (markings that the firearm would reproduce)

•rifling
- land, groove impression
- misalignment/slippage
•feedramp marks
•forcing cone/shave marks
•Other

FROM 7410/7435/7475 P TO F (2 of 2)

7340
Determine which of the two items to hold in fixed position

7350
Position fixed item using area of interest features

7360
Rotate other item to find corresponding area of interest

7365
Is there a corresponding area of interest (in phase)
YES
NO

GO TO 7400 P TO F (2 of 2)

7370
Is there an additional area of interest?
YES
NO

7375
Is there disagreement among individual detail present?
YES
NO

7377
Able to eliminate based on individual detail Per Agency Policy (PAP)?
YES
NO

7380
Is the level of disagreement sufficient to exclude?
YES
NO

Exclusion / Elimination

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7387
Use different TS if multiple exist?
YES
NO

RETURN TO 7330 TM Selection

7390
Do new TSs need to be produced?
YES
NO

GO TO 4500 Test Fire

7395
Use three levels of inconclusive (PAP)?
YES
NO

Inconclusive - B

Inconclusive

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7385
Use three levels of inconclusive (PAP)?
YES
NO

Inconclusive - C

Inconclusive

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?
Y
N

Return to 3100 (Item Determination)

GO TO REPORTING

10000 GRC Database Search * GRC search may be appropriate when the evidence item(s) are not identified to a firearm.

Enter information into GRC?
YES
NO

Launch Search

Report results?
YES
NO

Document/Report GRC results PAP

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Considerations for Comparison

Selecting which unknown or known to compare first/next:
Select the applicable criteria:

- Quality/complexity of toolmarks
- Administratively chosen
- Customer driven; investigative question
- Random order
- Perceived probative value based on examiner discretion

Technology Assist

- Computer aided comparison (3D Modeling)
- Computer aided documentation
- Computer aided selection of the known / unknown to compare (NIBIN)
- Comparison Microscope
- Imaging Systems

Conclusions

- Identification
- Inconclusive
- Inconclusive - A
- Inconclusive - B
- Inconclusive - C
- Exclusion / Elimination

Return to Overview

7400 Comparison: Projectile to Firearm (P to F) 2 of 2

FROM 7365 P TO F (1 of 2)

7400 Evaluate level of correspondence in area of interest and document observations Per Agency Policy (PAP)

7405 Is there potential subclass in the corresponding detail?
- YES → GO TO 5100 SUBCLASS
- NO

7410 Continue reviewing in phase?
- YES
- NO → RETURN TO 7330 TM Selection (P TO F PAGE 1)

FROM 5150 OR 5210

7415 Mark/Index items?
- YES → 7420 Mark items and document PAP
- NO

7425 Are there additional areas of interest to examine?
- YES → 7430 Rotate in Phase position to visualize additional corresponding features until complete → 7435 Does the Phase position need to be re-evaluated?
  - YES → RETURN TO 7330 TM Selection (P TO F PAGE 1)
  - NO → *7440 Photograph/Document PAP*
- NO

7445 Will CMS be used as a criteria for identification?
- YES → 7450 Evaluate and Document CMS → 7455 Does evaluated CMS meet threshold for identification?
  - YES
  - NO → 7460 Use three levels of inconclusive PAP?
    - YES → Inconclusive - A → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
    - NO → Inconclusive → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
- NO

7465 Is the agreement sufficient for ID? (Qualitative and Quantitative)
- YES
- NO → 7475 Use different test standard (TS) if multiple TSs exist?
  - YES → RETURN TO 7330 TM Selection (P TO F PAGE 1)
  - NO → 7480 Do new TSs need to be produced?
    - YES → GO TO 4500 Test Fire
    - NO → 7485 Use three levels of inconclusive (PAP)?
      - YES → Inconclusive - A → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
      - NO → Inconclusive → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7470 Is the mark being identified a result of the firing process?
- YES → Identification: Firing → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
- NO → Identification: Cycling/common tool or source → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?
- Y → Return to 3100 (Item Determination)
- N → GO TO REPORTING

10000 GRC Database Search * GRC search may be appropriate when the evidence item(s) are not identified to a firearm.

Enter information into GRC?
- YES → Launch Search
- NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Report results?
- YES → Document/Report GRC results PAP
- NO

Conclusions

- Identification
- Inconclusive
- Inconclusive - A
- Inconclusive - B
- Inconclusive - C
- Exclusion / Elimination

This process map provides a visual description and attempts to represent all reasonable variations of casework currently performed by firearm examiners. OSAC and AFTE do not necessarily support or endorse (as best practices) all of the different steps and paths depicted in this process map.

Return to Overview

7500 Comparison: Cartridge Case to Cartridge Case (C to C) 1 of 2

FROM 3505/3515/3750/3755/4310

7500
Input: Cartridge Cases suitable for comparison

7505
Are one of the unknowns described as test fire (TF) at time of submission?
YES
NO

7507
Treat as knowns?
YES
NO

GO TO 7700 (C TO F)

7510
Set up Evidence Items for Comparison (e.g. comparison microscope, 3-D scanning software images etc)- See Considerations for Comparison; Optimize lighting, magnification, and focus

7515
Optimize lighting, magnification, and focus

7520
Are the class characteristics in agreement?
YES
NO

Exclusion / Elimination

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7525
TM Selection
Determine which toolmark/area of interest to compare

- Firing Pin Impression
- Breech Face Marks
- Firing Pin Aperture
- Anvil (rim fire)
- Ejector Marks
- Extraction Marks
- Ejection port marks
- Chamber Marks
magazine marks
Other

7530
Determine which of the two items to hold in fixed position

7535
Position fixed item using area of interest features

7540
Maneuver other item to find corresponding area of interest

7545
Is there a corresponding area of interest (in phase)
YES
NO

GO TO 7600 C TO C (2 of 2)

FROM 7605/7620 C TO C (2 of 2)

7550
Is there an additional area of interest?
YES
NO

7555
Is there disagreement among individual detail present?
YES
NO

7565
Able to eliminate based on individual detail Per Agency Policy (PAP)?
YES
NO

7575
Is the level of disagreement sufficient to exclude?
YES
NO

7580
Can exclusion be made without Firearm?
YES
NO

Exclusion / Elimination

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7560
Are one of the unknowns described as TF at time of submission?
YES
NO

7567
Request the Firearm?
YES
NO

7569
Request Firearm PAP

GO TO 3100 Item Determination

7570
Use three levels of inconclusive (PAP)?
YES
NO

Inconclusive - B

Inconclusive

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7585
Are one of the unknowns described as TF at time of submission?
YES
NO

7587
Request the Firearm?
YES
NO

7590
Request Firearm PAP

GO TO 3100 Item Determination

7595
Use three levels of inconclusive (PAP)?
YES
NO

Inconclusive - C

Inconclusive

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?
Y
N

Return to 3100 (Item Determination)

GO TO REPORTING

10000 GRC Database Search

* GRC search may be appropriate when the evidence item(s) are not identified to a firearm.

Enter information into GRC?
YES
NO

Launch Search

Report results?
YES
NO

Document/Report GRC results PAP

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Considerations for Comparison

Selecting which unknown or known to compare first/next:
Select the applicable criteria:

- Quality/complexity of toolmarks
- Administratively chosen
- Customer driven; investigative question
- Random order
- Perceived probative value based on examiner discretion

Technology Assist

- Computer aided comparison (3D Modeling)
- Computer aided documentation
- Computer aided selection of the known / unknown to compare (NIBIN)
- Comparison Microscope
- Imaging Systems

Conclusions

- Identification
- Inconclusive
- Inconclusive - A
- Inconclusive - B
- Inconclusive - C
- Exclusion / Elimination

Return to Overview

7600 Comparison: Cartridge Case to Cartridge Case (C to C) 2 of 2

FROM 7545 C TO C (1 of 2)

7600 Evaluate level of correspondence in area of interest and document observations Per Agency Policy (PAP)

7605 Is there potential subclass in the corresponding detail?
- YES → GO TO 5100 SUBCLASS
- NO → 7607 Continue?
  - YES → 7610 Mark/Index items?
  - NO → RETURN TO 7525 TM Selection (C TO C PAGE 1)

FROM 5150

7610 Mark/Index items?
- YES → 7615 Mark items and document PAP
- NO → 7620 Are there additional areas of interest to examine?
  - YES → RETURN TO 7525 TM Selection (C TO C PAGE 1)
  - NO → 7625 Can identification be made without Firearm?
    - YES → 7630 Will CMS be used as a criteria for identification?
      - YES → 7635 Evaluate and Document CMS → 7640 Does evaluated CMS meet threshold for identification?
        - YES → 7655 Is the mark being identified a result of the firing process?
        - NO → 7645 Use three levels of inconclusive PAP?
          - YES → Inconclusive - A → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
          - NO → Inconclusive → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
      - NO → 7650 Is the agreement sufficient for ID? (Qualitative and Quantitative)
        - YES → 7655 Is the mark being identified a result of the firing process?
        - NO → 7670 Are one of the unknowns described as TF at time of submission?
          - YES → 7675 Request the Firearm?
            - YES → 7680 Request Firearm PAP → GO TO 3100 Item Determination
            - NO → 7685 Use three levels of inconclusive (PAP)?
              - YES → Inconclusive - A → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
              - NO → Inconclusive → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
          - NO → 7685 Use three levels of inconclusive (PAP)?

7655 Is the mark being identified a result of the firing process?
- YES → Identification: Firing → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
- NO → Identification: Cycling/common tool or source → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?
- Y → Return to 3100 (Item Determination)
- N → GO TO REPORTING

10000 GRC Database Search * GRC search may be appropriate when the evidence item(s) are not identified to a firearm.

Enter information into GRC?
- YES → Launch Search → Report results?
  - YES → Document/Report GRC results PAP
  - NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)
- NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Conclusions

- Identification
- Inconclusive
- Inconclusive - A
- Inconclusive - B
- Inconclusive - C
- Exclusion / Elimination

Return to Overview

7700 Comparison: Cartridge Case to Firearm (C to F) 1 of 2

FROM 3512/3760/4310/4710/7507

7705 **Input:** Cartridge Cases suitable for comparison

7710 Set up Evidence Items for Comparison (e.g. comparison microscope, 3-D scanning software images etc)- See Considerations for Comparison; Optimize lighting, magnification, and focus

7715 Optimize lighting, magnification, and focus

7720 Are the class characteristics in agreement?

YES

NO

Exclusion / Elimination

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7725 Determine which toolmark/area of interest to compare

- Firing Pin Impression
- Breech Face Marks
- Firing Pin Aperture
- Anvil (rim fire)
- Ejector Marks
- Extraction Marks
- Ejection port marks
- Chamber Marks
- magazine marks
- Other

FROM 7810/7825/7855 C TO F (2 of 2)

7730 Determine which of the two items to hold in fixed position

7740 Position fixed item using area of interest features

7750 Maneuver other item to find corresponding area of interest

7755 Is there a corresponding area of interest (in phase)

YES

GO TO 7800 C TO F (2 of 2)

NO

7760 Is there an additional area of interest?

YES

NO

7765 Is there disagreement among individual detail present?

YES

7770 Able to eliminate based on individual detail Per Agency Policy (PAP)?

YES

7775 Is the level of disagreement sufficient to exclude?

YES

Exclusion / Elimination

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

NO

NO

NO

7785 Use different test standard (TS) if multiple TSs exist?

YES

RETURN TO 7725 TM Selection

NO

7790 Do new TSs need to be produced?

YES

GO TO 4500 Test Fire

NO

7795 Use three levels of inconclusive (PAP)?

YES

Inconclusive - B

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

NO

Inconclusive

7780 Use three levels of inconclusive (PAP)?

YES

Inconclusive - C

GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

NO

Inconclusive

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?

Y

Return to 3100 (Item Determination)

N

GO TO REPORTING

10000 GRC Database Search * GRC search may be appropriate when the evidence item(s) are not identified to a firearm.

Enter information into GRC?

YES

Launch Search

NO

Report results?

YES

Document/Report GRC results PAP

NO

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Considerations for Comparison

Selecting which unknown or known to compare first/next:
Select the applicable criteria:

- Quality/complexity of toolmarks
- Administratively chosen
- Customer driven; investigative question
- Random order
- Perceived probative value based on examiner discretion

Technology Assist

- Computer aided comparison (3D Modeling)
- Computer aided documentation
- Computer aided selection of the known / unknown to compare (NIBIN)
- Comparison Microscope
- Imaging Systems

Conclusions

- Identification
- Inconclusive
- Inconclusive - A
- Inconclusive - B
- Inconclusive - C
- Exclusion / Elimination

Return to Overview

7800 Comparison: Cartridge Case to Firearm (C to F) 2 of 2

FROM 7755 C TO F (1 of 2)

7800 Evaluate level of correspondence in area of interest and document observations Per Agency Policy (PAP)

7805 Is there potential subclass in the corresponding detail?
- YES → GO TO 5100 SUBCLASS
- NO

7810 Continue reviewing in phase
- YES
- NO → RETURN TO 7725 TM Selection (C TO F PAGE 1)

FROM 5150 OR 5210

7815 Mark/Index items?
- YES → 7820 Mark items and document PAP
- NO

7825 Are there additional areas of interest to examine?
- YES → RETURN TO 7725 TM Selection (C TO F PAGE 1)
- NO

7830 Will CMS be used as a criteria for identification?
- YES → 7835 Evaluate and Document CMS
- NO

7850 Is the agreement sufficient for ID? (Qualitative and Quantitative)
- YES
- NO

7855 Use different test standard (TS) if multiple TSs exist?
- YES → RETURN TO 7725 TM Selection (C TO F PAGE 1)
- NO

7860 Do new TSs need to be produced?
- YES → GO TO 4500 Test Fire
- NO

7865 Use three levels of inconclusive (PAP)?
- YES → Inconclusive - A → GO TO 1500 (Evidence Testing Loop) OR 1600 (GRC) PAP
- NO → Inconclusive → GO TO 1500 (Evidence Testing Loop) OR 1600 (GRC) PAP

7840 Does evaluated CMS meet threshold for identification?
- YES
- NO

7845 Use three levels of inconclusive PAP?
- YES → Inconclusive - A → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
- NO → Inconclusive → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

7870 Is the mark being identified a result of the firing process?
- YES → Identification: Firing → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP
- NO → Identification: Cycling/common tool or source → GO TO 2500 (Evidence Testing Loop) OR 10000 (GRC) PAP

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?
- Y → Return to 3100 (Item Determination)
- N → GO TO REPORTING

10000 GRC Database Search * GRC search may be appropriate when the evidence item(s) are not identified to a firearm.

Enter information into GRC?
- YES → Launch Search
- NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Report results?
- YES → Document/Report GRC results PAP
- NO → STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

Conclusions

- Identification
- Inconclusive
- Inconclusive - A
- Inconclusive - B
- Inconclusive - C
- Exclusion / Elimination

Return to Overview

9100 Serial Number Restoration

FROM 4195

Input: Firearm with request for serial number restoration or observable obliteration

9105 Should the fiream have a serial number?

YES

9120 Determine and document method of obliteration

9125 Attempt to restore?

YES

9140 **Document Research** (i.e. structure, is it hidden: location, composition e.g. location, ferrous v non-ferrous metal)

YES

9150 Determine and document whether ferrous/non-ferrous

9155 Use non-destructive method?

YES

9160 Select and apply non-destructive technique based on experience or PAP

9170 Document Results and verify PAP

NO

9110 Document rationale and /or research Per Agency Policy (PAP)

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

NO

9130 Document/Report Per Agency Policy (PAP)

STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

NO

9180 Select and apply destructive technique based on experience or PAP

9190 Document Results and verify PAP

9195 Use another restoration method?

YES

NO

GO TO 8000 Reporting/ Verification

2500 Evidence Testing Plan

Is there more evidence to examine per testing plan?

Y

Return to 3100 (Item Determination)

N

GO TO REPORTING

Destructive Methods

- **Chemical**
- **Heat**
- **Electrochemical Etching**
- **Polishing**

Non- Destructive Methods

- **Magnaflux (Magnetic particle inspection)**
- **Infrared imaging/ALS**
- **Scanning Electron Microscope (SEM)**
- **Acetone/Cleaning**
- **Barcode/QR Deciphering**

Technology Assist

- Camera
- Magnification Device (Magnifying Glass/Comparison Microscope/Stereoscope etc)
- Flashlight/Light Source
- Magnet
- Electrochemical Power Source
- Dremel/Rotary Tool

Return to Overview

9600 Barrel Length/Overall Measurement

FROM 4323

9605
Input: Firearm Rendered Safe

9620
Use a tool with calculated measurement uncertainty?

YES

9640
Measure and document using tool with calculated measurement uncertainty

NO

9630
Measure and Document

Technology Assist

- Calibrated Measurement Device
- Measurement Device

9650
Report uncertainty?

YES

9660
Report/Document uncertainty Per Agency Policy (PAP)

NO

9670
Is examination complete?

YES

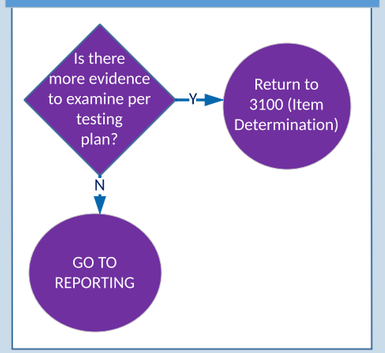
9680
Report Barrel Length

NO

RETURN TO 4240 Functionality

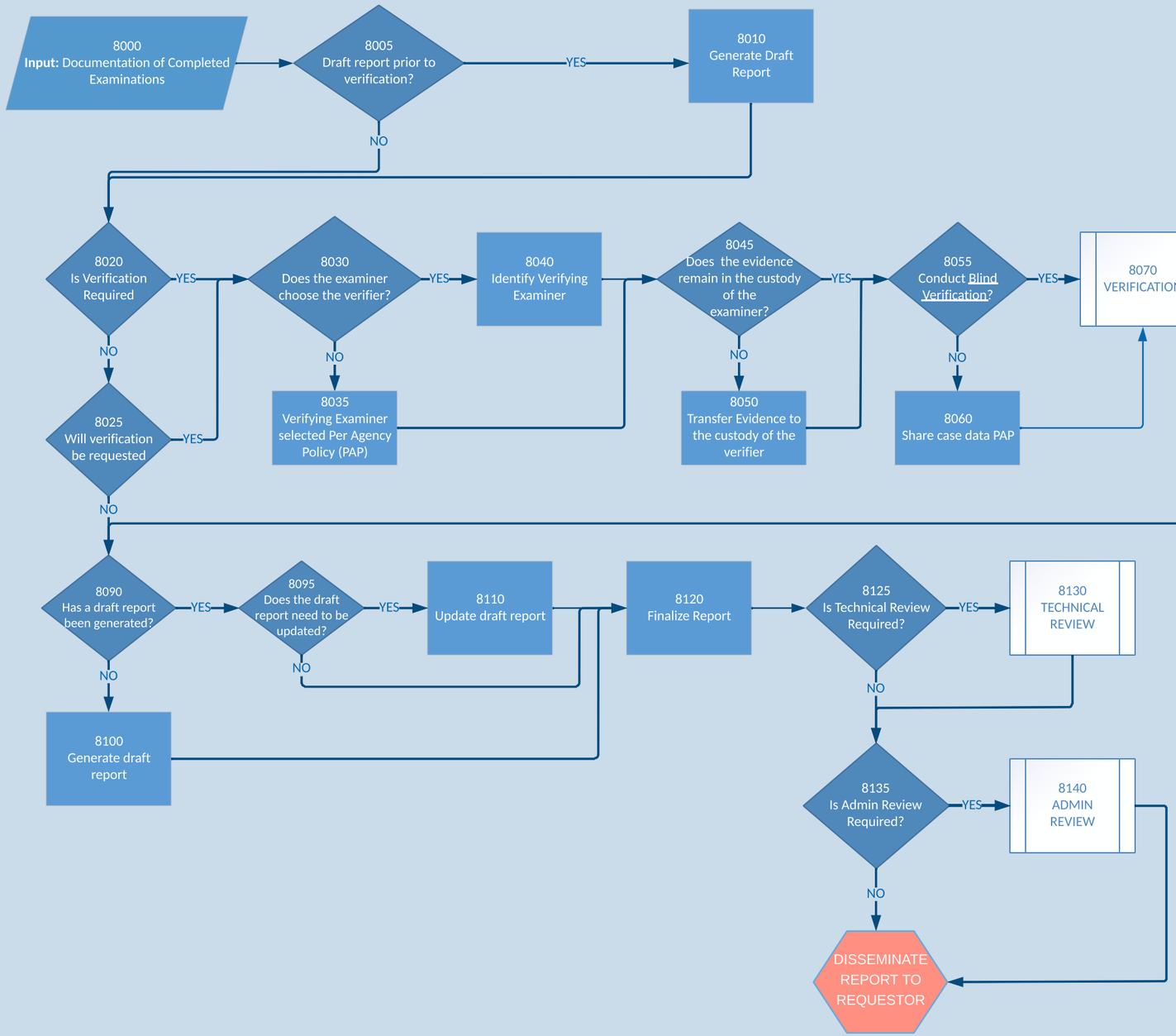
STOP/ Document PAP or go to 2500 (Evidence Testing Plan)

2500 Evidence Testing Plan

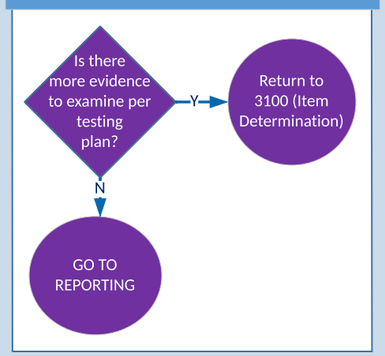


Return to Overview

8000 – Reporting and Verification



2500 Evidence Testing Plan



Considerations for Conflict Resolution

- Request new exam
- Request verification
- Bring in other examiners (eg. Supervisor, Q/A, Tech lead etc)
- Consultation
- Report no conclusion, multiple conclusions, report as concensus conclusion.

Considerations for Verification

- Does Examiner Mount Evidence for Verifying Examiner?
- Does Examiner provide examination documentation to Verifying examiner?
- Does Examiner provide conclusion of comparison to Verifying examiner?
- Will case be completely reworked by another examiner or via additional/different methods?

Glossary of Terms and Definitions*

*A brief summary of selected terminology. For the purposes of this document, the AFTE definitions[2] are used for any terms otherwise not listed here.

Assess Action Type (adopted from AFTE Terminology): Assessment of the working mechanism of a firearm. The combination of the receiver or frame, the breech bolt, and the other parts of the mechanism by which a firearm is loaded, fired, and unloaded. May be broken down into action such as automatic, semiautomatic, bolt action, single action etc.

Blind Verification: The confirmation of an examiner's conclusion by another competent examiner who has no expectation or knowledge of the prior conclusion[1]. In some instances, this may lead to an entire re-examination of the case.

Capacity Test: A test to determine the maximum number of cartridges of ammunition a magazine or a magazine and firearm are capable of holding.

Detailed Strip: To disassemble a firearm beyond Field Strip.

Evidence Testing Plan (2500 series): Series of steps placed on the appropriate pages where the user opts to either test additional evidence items in a case or, in the event the examinations are complete, to move on to reporting steps.

Exclusion / Elimination (AFTE Terminology): Significant disagreement of discernible class characteristics and/or individual characteristics.

Ferrous v Non-Ferrous (adopted from AFTE Terminology): Ferrous materials are alloys containing a significant amount of iron. Ferrous metals are magnetic; versus non-ferrous materials where the main component is not iron and is not magnetic.

Field Strip: To disassemble a firearm for cleaning, repair, or transportation.

General Class Characteristics (AFTE Terminology): Measurable features of a specimen which indicate a restricted group source. They result from design factors, and are therefore determined prior to manufacture.

GRC Database: General Rifling Characteristics Database. A database of firearms detailing their general rifling characteristics including, but not limited to; caliber, rifling type, land and groove dimensions, and direction of twist.

GRC Database Search (10000 series): General Rifling Characteristics Database path. Series of steps where the user opts to perform GRC database search during the course of the examination as appropriate, while allowing them to then return and do additional examinations.

Identification (AFTE Terminology): Agreement of all discernible class characteristics and sufficient agreement of a combination of individual characteristics where the extent of agreement exceeds that which can occur in the comparison of toolmarks made by different tools and is consistent with the agreement demonstrated by toolmarks known to have been produced by the same tool.

Impact Test: Testing of a firearm in a controlled setting to determine if discharge may occur as a result of being struck or striking a surface.

Inconclusive: Agreement of all discernible class characteristics. Insufficient agreement and/or disagreement of individual characteristics. Cannot identify or exclude.

Inconclusive – A (AFTE Terminology): Agreement of all discernible class characteristics and some agreement of individual characteristics, but insufficient for an identification.

Inconclusive – B (AFTE Terminology): Agreement of all discernible class characteristics without agreement or disagreement of individual characteristics due to an absence, insufficiency, or lack of reproducibility.

Inconclusive – C (AFTE Terminology): Agreement of all discernible class characteristics and disagreement of individual characteristics, but insufficient for an elimination.

Measurement: In some cases measurements may be taken by linear measurement device for length (e.g. Barrel Length), or may be assessed using a tool to meeasure weight (e.g. Trigger Pull).

Measurement Uncertainty: Parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand.[3]

Safety Mechanisms (AFTE Terminology): A device on a firearm intended to help provide protection against accidental discharge under normal usage when properly engaged.

Subclass Characteristics (AFTE Terminology): Features that may be produced during manufacture that are consistent among items fabricated by the same tool in the same approximate state of wear. These features are not determined prior to manufacture and are more restrictive than class characteristics.

Suitability for Comparison (Suitability Determination): Assessment of whether an item exhibits class and/or individual detail.

Test Standards (TS): Known standards produced by/from a tool/firearm/firearm parts. Can include test fired ammuniton components, casts, forced/pushed bullets.

Trigger Pull Measurement (AFTE Terminology): Measurement of the amount of force which must be applied to the trigger of a firearm to cause sear release. It is measured by hanging weights or an instrument touching the trigger at a point where the trigger finger would normally rest. The force applied during measurement is approximately parallel to the bore axis.

Trigger Puller : An instrument used to accurately measure the trigger pull of a firearm. Examples include standard weights, spring gauges, and mechanical/digital devices. Also known as a trigger tester.

Abbreviations:

PAP: Per Agency Policy
ICD: Individual Characteristic Database

[1]The **Fingerprint Sourcebook**. Washington, DC: U.S. Dept. of Justice, Office of Justice Programs, National Institute of Justice, 2011.
[2]AFTE Glossary: https://afte.org/resources/afte-glossary
[3] https://www.nist.gov/itl/sed/topic-areas/measurement-uncertainty