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 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.
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.
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9600  Barrel Length/Overall Measurement

FROM 4323

9605  Input: Firearm Rendered Safe

9620  Use a tool with calculated measurement uncertainty

9630  Measure and Document

9640  Measure and document using tool with calculated measurement uncertainty

9650  Report uncertainty?

9670  Is evaluation complete?

9680  Report Barrel Length

RETURN TO 4240  Functionality

STOP/ Document PAP or go to 2500  Evidence Testing Plan

Technology Assist
- Calibrated Measurement Device
- Measurement Device

9660  Report/Document uncertainty Per Agency Policy (PAP)

2500  Evidence Testing Plan

Is there more evidence to complete per testing plan?

Return to 2500 Item Determination

GO TO REPORTING

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.
**8000 - Reporting and Verification**

- **8000**: Input Documentation of Completed Examinations
  - **8005**: Draft report prior to verification? (YES)
  - **8010**: Generate Draft Report
  - **8015**: Is verification required? (YES)
    - **8020**: Does the examiner choose the verifier? (YES)
      - **8030**: Identify Verifying Examiner
    - **8020**: Will verification be requested? (NO)
    - **8035**: Verify Examiner selected for Agency Policy (PAP)
  - **8040**: Is the evidence still in the custody of the examiner? (NO)
  - **8050**: Transfer Evidence to the custody of the verifier
  - **8060**: Does the evidence remain in custody of the examiner? (NO)
  - **8070**: Confidence (Hold Document)
  - **8075**: Do the examiners have consensus agreement? (YES)
    - **8080**: Conflict Resolution (PAP)
  - **8085**: Examination Complete? (NO)
    - **8090**: Go to 2500 Evidence Testing Plan
  - **8095**: Does a draft report need to be updated? (NO)
    - **8100**: Generate Draft Report
  - **8105**: Has a draft report been generated? (YES)
    - **8110**: Update draft report
    - **8120**: Hostile Report
    - **8130**: Is Technical Review Required? (YES)
      - **8140**: Technical Review
    - **8150**: Is Admin Review Required? (YES)
      - **8160**: Admin Review
    - **8170**: Report to Requested

**Considerations for Conflict Resolution**
- Request new exam
- Request verification
- Bring in other examiners (eg. Supervisor, QA, Tech lead etc)
- Consultation
- Report or 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 can 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 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. 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 Riffing 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 Riffing 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 measure 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.

**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 ammunition 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 the 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

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2 AFTE Glossary: [https://afte.org/resources/afte-glossary](https://afte.org/resources/afte-glossary)
3 [https://www.nist.gov/itl/seed/topic-areas/measurement-uncertainty](https://www.nist.gov/itl/seed/topic-areas/measurement-uncertainty)