Firearm Examinations

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Firearm Examinations

1 INTRODUCTION

This procedure is for the evaluation, examination, and testing of a firearm and firearm components. It establishes the requirements for firearm examinations that include the safe handling, documentation, test firing, and recording of information as it pertains to the functionality of an item.

2 SCOPE

This procedure applies to Firearms/Toolmarks Discipline (FTD) personnel or authorized personnel when conducting firearms examinations in the FTD.

3 EQUIPMENT

- Personal protective equipment
- Various light sources suitable for the examination of a firearm
- General laboratory supplies
- Camera
- Microscope (stereozoom/comparison)
- Measurement equipment
- Dummy cartridges of various calibers/gauges
- Firing range and/or bullet recovery device(s)
- Trigger pull measuring device (e.g., Arsenal/static weights, IMADA DST-44A force gauge or similar)
- Firearm barrel and/or overall length measuring device
- Various tools necessary for disassembly of firearms (some of these may be specialty tools)
- Remote firing platform
- Rawhide mallet
- Bruel & Kjaer Model 2231 decibel meter (or equivalent decibel meter), including standard tone generator; the system must feature a rise time of 50 µsec or better, with a measuring range of 0 to 170 decibels.
- Computer with internet access
- Database account access (i.e., eTrace, NCIC, NIBIN, etc.)
- Alicona InfiniteFocus SL with rotational bullet mount, movable stage, and appropriate lighting and magnification lenses.
- Integrated Ballistic Identification Systems (IBIS®) TRAX-HD3D™ | BRASSTRAX™ and MATCHPOINT™
- Marking materials for floor grid (e.g., tape, chalk, string, etc.)
- Graph paper
- Casting material

4 STANDARDS AND CONTROLS

- National Institute of Standards and Technology (NIST) Standard Reference Material (SRM)

    - NIST SRM 2460 – Bullet
    - NIST SRM 2461-118 – Cartridge Case
- Alicona IF-Verification Tool G2
- Alicona 6mm Calibration Pin
- Known exemplars produced from evidentiary items during examination
- The tone generator is used as a control to determine if the sound meter is functioning properly

5 PROCEDURE

5.1 Test Preparations

A. Ensure every firearm is unloaded prior to examination and follow all appropriate measures for safe handling.
B. Perform mechanical function testing[1] of the firearm prior to test firing unless specifics of the case dictate otherwise.

5.1.1 Revolver

A. Open cylinder, check all chambers.
B. Remove any cartridges and/or cartridge cases remaining in chamber.
C. Visually inspect bore for obstructions.
D. Ensure proper timing and engagement of the cylinder bolt

5.1.2 Pistol

A. Engage safety and remove magazine if present.
B. Open action and inspect chamber areas.
C. Remove any cartridges and/or cartridge cases remaining in chamber.
D. Visually inspect bore for obstructions.
E. Inspect backplate and underside of slide for aftermarket fully automatic conversion modifications.

5.1.3 Shotgun

A. Engage manual safety, if available.
B. Remove detachable shotgun magazine if present.
C. Disengage safety.
D. Open action and lock open, if possible.
E. Visually inspect chamber area.
F. Engage manual safety if action is to be closed.
G. Press on magazine follower to ensure that no shotshells remain in magazine tube.
H. Visually inspect bore for obstructions.

[1] Mechanical function testing is the examination of a firearm concerning its mechanical condition and operation. It is usually performed to determine if all safety features are operable and/or if the firearm can fire a cartridge.

5.1.4 Rifle

A. Engage safety and remove magazine if present.
B. Open action and lock open, if possible.
C. Inspect chamber and magazine well area and remove any cartridges/cartridge cases remaining in chamber or in magazine tube.
D. Visually inspect bore for obstructions.
E. If present, engage manual safety if action is to be closed.

5.2 Documentation

Document the examination using the FTD Worksheet.

5.3 Initial Examination

A. Conduct a preliminary examination of the firearm and document the condition as received. Note any pertinent observations such as damage, modifications, improper assembly, accessories, missing parts, broken parts, or defects (paying particular attention to anything that may affect the structural integrity of the firearm).
B. Document the presence of any pertinent foreign or trace material adhering to the firearm as described in FTD-240.

5.4 Physical Examination

Describe the firearm to include the following, if known:

A. make/manufacturer;
B. firearm type (shotgun, rifle, pistol, revolver, etc.);
C. model;
D. caliber/gauge;
E. serial number.

Additional descriptions may include the following information:

A. serial number location(s), including any hidden location(s);
B. action type (semi-automatic, lever action, bolt action, etc.);
C. country of origin;
D. importer;
E. finish;
F. construction (polymer, metal type, etc.);
G. other markings on the firearm;
H. positions and class characteristics of marking surfaces (extractor, ejector, etc.);
I. safeties and location(s);
J. type of operation (recoil, blowback, etc.);
K. single action and/or double action;
L. Accessories received with the firearm, such as optics.

5.5 Barrel and/or Overall Length

Measure and record the barrel and/or overall length of the firearm. Generally, barrel and/or overall length is a descriptor of the firearm. In these instances, the estimation of uncertainty of measurement is not required. However, when measuring barrel and/or overall length for assessment of conformance with a statutory requirement, the examiner will follow section 5.5.1.

5.5.1 Reporting length measurements with uncertainty

5.5.1.1 Measuring

When measuring barrel or overall length the following should be considered before measuring ensure the firearm/barrel is free from movement and stable for measuring, measure in an area with proper lighting, and the proper calibration certificates are current. When a measurement is made where the uncertainty of that measurement will be reported, the calibration date and unique identifier for the equipment being used will be recorded in the FTD Worksheet.

5.5.1.2 Revolver Barrels

A. When measuring a revolver barrel, the distance parallel to the bore axis from the muzzle end to the end of the forcing cone represents the length of the barrel.
B. A steel ruler or measuring rod will be used to measure the length of a revolver barrel.
    1. When using a steel ruler, the ruler is placed on the exterior of the barrel parallel to the bore axis for measuring.
    2. A measuring rod can be used to measure barrel length; however, it may be difficult to determine the starting point for the measuring rod.
        i. Consideration must be taken to determine how the starting point can be accurately achieved.
        ii. A block at the muzzle or forcing cone end of the firearm, which is perpendicular to the axis of the bore can represent the starting point for the measuring rod to determine barrel length.

5.5.1.3 Integral Chamber Barrels

A. When measuring the barrel of a firearm that has an integral chamber, the distance parallel to the bore axis from the muzzle end to the breechface (with the action closed) represents the length of a barrel.
B. Before measuring an integral chamber barrel, ensure that the firing pin is not impeding the measuring rod from contacting the breechface. It may be necessary to cock the firearm to remove a protruding firing pin. In the case of a fixed firing pin, be certain it is not reducing the barrel length measurement. Ensure that the measuring rod, when inserted in the barrel, is parallel to the bore axis.
C. When using a measuring rod to determine the barrel length measurement, read the increments perpendicular to the bore axis at the furthest point of the barrel.
D. Barrel length will be measured to the nearest sixteenth of an inch.

E. When a barrel length measurement is being reported, the serial number of the measuring rod used will be recorded in the FTD Worksheet.

5.5.1.4 Overall Length Measurements

A. The overall firearm length is measured using the measuring platform.
B. When measuring the overall length of a firearm, the measurement is taken along a line which is parallel to the axis of the bore from a perpendicular tangential line which touches the rearmost point of the firearm to the muzzle.
C. With the firearm positioned in the measuring platform, a square is placed at a right angle to the measuring platform touching the muzzle to determine the overall length.
D. Overall lengths will be measured to the nearest sixteenth of an inch.
E. When an overall length measurement is being reported, the serial number of the ruler used will be recorded in the FTD Worksheet.

5.5.1.5 Measurement uncertainty and Confidence Level

A. Measurement uncertainty and confidence level will be included in a Laboratory Report, or as an enclosure, when it is relevant to the validity or application of the examination results or a customer's instructions require it.
    1. For example, a report may state the barrel length of the Item 13 shotgun was measured to be 16.56" ± 0.07" (k =3 for 99.7% confidence level).
B. The method used to determine the estimation of uncertainty can be found in the FTD-124-00.
C. The uncertainty budgets for barrel length and overall length measurements are retained in the FTU.

5.6 Mechanical Functional Testing

The testing of a firearm for mechanical function should confirm the operating condition of the firearm in all applicable modes of fire.

Certain tests below may require field stripping or more detailed disassembly of the firearm. Examiners and/or technicians should consider test firing prior to any disassembly, so as not to alter the as-received condition of the firearm.

Conduct an examination of the working mechanisms of the firearm. This may require the use of a firearm reference collection or consultation with manufacturer's product literature, armorer's manuals, disassembly/assembly guides, parts diagrams, recall and safety warning documents, or other reference materials.

A. Test the mechanical function in all applicable modes of fire (e.g., semiautomatic and fully automatic, single, and double action, etc.) Field test semiautomatic firearms to determine if they are capable of fully automatic fire.
    1. Observe trigger function, check for trigger reset following a pull of the trigger (semi-auto only)
    2. Consider the use of dummy cartridges when dry firing a rimfire firearm, or firearms known to be susceptible to firing pin breakage.
B. Individually check the operability of the safety mechanisms of the firearm.

1. Inspection and testing of internal working and safety mechanisms may require field stripping of the firearm. When it is necessary to disassemble the firearm beyond routine field stripping it will be recorded in the FTD Worksheet.
2. When preparing for test firing in the BRT, alternate live and dummy ammunition in magazines for firearms that may have been altered to fire fully automatic.

5.7 Non-Functional Firearms

A. If a firearm is non-functional as received in the laboratory, replacement parts from a variety of sources may be utilized to render the firearm functional and obtain test specimens. This may include installing the barrel, bolt, or other component of the submitted firearm into a reference firearm. Any replacement of parts will be recorded in the FTD Worksheet and removed after test-firing is complete.
B. For firearms that cannot be restored to operating condition, consider alternate methods for test specimen production.
    1. Examples may include casting, the use of soft lead media, etc.

5.8 Test Firing

A. Based on examinations listed above, determine if the firearm is suitable for test firing and if so, what test firing methods are appropriate. If there is any doubt as to whether the firearm can be safely fired by hand, consider the use of a remote firing device.
B. The firearm should be test fired on the FTU test range and/or bullet recovery tank using established safety rules to determine the functionality of a firearm.
C. Test firing should be done using the magazine provided with the firearm.
    1. If no magazine is provided, a Reference Firearms Collection (RFC) magazine should be substituted, if available.
D. Use appropriate ammunition for case circumstances.
    1. If reloaded ammunition or a potentially unsafe firearm-ammunition combination must be used, exercise special caution.
E. All chambers of firearms having multiple barrels, such as double-barreled shotguns, derringers, etc. should be loaded and test fired.
F. When producing test specimens for subsequent comparative analysis, select appropriate ammunition and recovery device(s) to facilitate the analysis. Mark or package the test specimens at the time of firing so that they are traceable to the firearm from which they were fired.

5.9 Silencer Test

A. Before conducting the sound reduction test, ensure that all other tests were completed, if possible. The examiner may confer with a latent examiner on the processing of the muzzle attachment. After completing all other exams, and at the discretion of the examiner, a patch can be passed through the inside of the device, which then can be examined/tested for the presence of gunpowder or lead.

B. Visually inspect the muzzle attachment to determine if it can be classified as a silencer by design.
    1. This would include looking for design features that are consistent with typical "homemade" silencers. Literature is available in the FTU to aid in this determination and the use of an X-ray machine may be warranted to allow an internal view of silencer construction.
C. The sound reduction test should be conducted in an area with as little interfering sound as possible. Outdoor testing over grass is ideal, but indoors on a firing range with sound absorbing walls is acceptable.
D. If possible, the microphone should be situated to the right of the firearm, 1 meter from, and at the same elevation as, the muzzle. A porous foam windshield should be used to cover the microphone if testing is conducted outdoors. The decibel meter should be set on the "A" weighting network, using the peak detector and peak hold circuit, if applicable.
E. A performance check of the decibel meter using the tone generator will be performed before each examination. If necessary, refer to manufacturer's operating manuals. Performance check results will be recorded in the FTD Worksheet.
F. For decibel (dB) readings exceeding 160db, and when using the Larson-Davis model 800B with the 160db option, calibrate the meter to read 10db low. This allows for readings up to 170db.
G. The submitted or reference firearm should be fired ten (10) times without the muzzle attachment, along the horizontal plane.
H. If no ammunition was submitted or no specific ammunition requested, then a major brand of ammunition should be used.
I. The readings of the decibel meter will be recorded for each of the ten shots.
J. The submitted or reference firearm will be fired using the same ammunition and procedures as were used in sections 5.9.F through 5.9.H, this time with the muzzle attachment.
K. The readings recorded from the decibel meter are in decibel units. Using the k correction factor for ten measurements, calculate three standard deviations from the mean for the first set of ten (10) measurements without muzzle attachment and repeat for the second set of ten (10) measurements with muzzle attachment in accordance with FTD-124.

5.10 Trigger Pull

Trigger pull testing is conducted using static weights or the IMADA DST-44A force gauge to determine the amount of force which must be applied to the trigger to release the hammer or firing pin of the firearm.

A. Trigger pull testing should not be conducted if parts that would directly affect the trigger pull, such as triggers, springs, etc., have been installed by the examiner to make the firearm operable for other exams.
B. Because trigger pull testing involves dry firing of the firearm and poses a threat of damage to firing pins and breech areas, such testing should not be conducted until

after the firearm has been test fired and sufficient specimen bullets and cartridge cases have been obtained.

C. The trigger pull weight for each mode possible for a firearm (single action, double action, semi-auto, full-auto) should be determined.
    1. The static weights hanger shall touch the trigger at a point where the trigger finger would normally rest, and with the force applied approximately parallel to the bore axis.

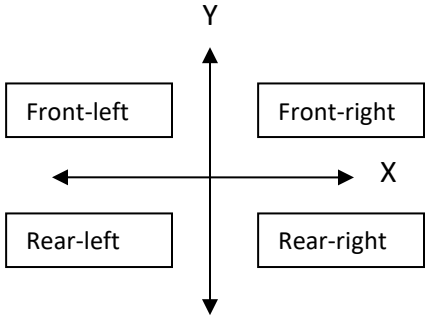
D. Trigger pull measurements will be recorded in the FTD Worksheet.

5.11 Ejection Pattern Test

Ejection pattern testing is designed to provide a basis for defining the approximate position of a shooter's firearm in the reconstruction of a shooting scene environment.

Before conducting this test, ensure that all other requested firearms examinations have been conducted. The ejection pattern test will be conducted on a firing range that is clear of any previously fired ammunition components.

A. The floor/ground will be marked in some manner with two intersecting lines to form a Cartesian coordinate plane. One line is from the shooting line traveling down the center of the shooting lane. The second line will cross this line at a right angle, and these lines may be extended as needed. The suggested grid divides the area into four quadrants (front-left, front-right, rear-right, rear-left).



B. This test requires two people; one person to be the shooter, and the other person to act as the spotter. The shooter will stand so that the intersecting lines on the floor are below the ejection-port of the firearm. The shooter will hold the firearm at a normal height and fire on a level trajectory.

C. The shooter will fire the suspect firearm a minimum of ten (10) shots.

D. It is the spotter's responsibility to mark where each ejected cartridge case first strikes the floor/ground. This may be done with tape or some other marking device. The spotter will also make notes as to the shooter's position and firearm height as well as any functional problems.

E. After all shots are fired and their respective strikes marked, measurements and notes will be made as to the location of the ejected cartridge cases. The ejected position will be determined using the Cartesian coordinate plane (i.e., 3 feet right and 4 feet rear).

F. Conclusions will be drawn based on the shots fired and the positioning of the ejected cartridge cases.

G. Using the k correction factor for ten measurements, calculate three standard deviations from the mean for determining ejection pattern in accordance with FTD-124.

5.12 Accidental Discharge Test

Accidental discharge testing will be conducted in the FTU test range when specifically requested by the contributor or when an examiner determines such a test is necessary.

A. The accidental discharge test will be conducted in all modes of fire for a particular firearm, utilizing a primed cartridge case.
B. A firearm being physically held, unless deemed unsafe, will be struck with a rawhide or similar styled mallet on its six planes:
    1. Front of muzzle
    2. Butt plate
    3. Top of breech and chamber
    4. Bottom of trigger guard and frame
    5. First side of the receiver/frame
    6. Second side of the receiver/frame
C. Any additional testing undertaken to attempt to duplicate the conditions under which the firearm discharged is left to the discretion of the examiner.

5.13 Firearm Drop Test

The firearm drop test will be conducted in the FTU test range when specifically requested by the contributor or whenever an examiner determines such a test is necessary.

A. Prior to a drop test being conducted, the examiner will inform the contributor of the potentially destructive nature of this test and of the risk of significant damage to the firearm and record the notification in the communication log.
    1. Firearm drop test should be conducted after all other examinations have been completed.
B. The drop test will be conducted utilizing a primed cartridge case.
C. Absent specific information provided by the contributor concerning the discharge of the firearm, the method of testing to be used is left to the discretion of the examiner.
    1. If known, the conditions surrounding the discharge of the firearm at a shooting scene, such as height or type of surface, should be duplicated as closely as possible.

5.14 Database Searches

5.14.1 eTrace and NCIC

This section applies to the query and submission of firearm serial numbers (referred to as SN throughout remaining document) into national databases that are a result of complete (non-transitory in nature) SN restorations. The term requestor refers to FTD personnel who maintain account access through the relevant databases.

5.14.1.1 Electronic Tracing System (eTrace)

A. The requestor will create a new trace submission by using the minimum case information required to generate an eTrace request:
    1. Firearm manufacturer
    2. Firearm caliber
    3. Firearm type
    4. Restored serial number
    5. Importer, if applicable
    6. Recovery date
    7. Recovery state
    8. Recovery city
    9. Name of contributor
    10. NCIC crime code
B. In situations where there are contrasting SN located on a single firearm (i.e., frame, barrel, slide), a trace request will be submitted for each SN.
C. The location of the SN may be indicated in the database field 'Identifying Marks'.
    1. Example: slide and barrel only.
D. Upon trace submission by the FTD, the trace number will be recorded in the FTD Worksheet. The trace number is a twelve-digit alpha-numeric number that starts with the letter T.
E. A copy of the completed trace report may be retained.
F. The examiner will include the trace number when providing results.
G. Incomplete SN will not be submitted into eTrace.

5.14.1.2 National Crime Information Center (NCIC)

A. A query of the NCIC gun records will be performed on complete (non-transitory in nature) SN restorations. Hyphens or spaces are not included as part of the query.
B. The NCIC query will be recorded in the FTD Worksheet.
C. If the query results in no records being found, no further action is required.
D. If the query results in gun record(s) being found, the requestor and/or examiner will proceed in reviewing the details of the record.
E. For a stolen gun record, an examiner will review and communicate the stolen gun record with the contributor. The examiner will include the stolen gun record, not previously acknowledged, as part of the Communication Log entry.

5.14.2 GRC

The General Rifling Characteristics (GRC) database is comprised of observed and measured class characteristics collected from known test-fired bullets and cartridge cases. Test-fired specimens used for the GRC database are received from forensic laboratories and law enforcement agencies. The purpose of the GRC database is to provide investigative information to law enforcement agencies on the make and model of a firearm that could have fired a questioned bullet or cartridge case based on observed and measured class characteristics.

Performance checks of the measurement equipment and Alicona will be performed and recorded as outlined in FTD-240.

5.14.2.1 GRC Measurements of Bullets and Observable Class Characteristics on Cartridge Case for Entry into the GRC Database

A. Each entry into the GRC database will be assigned a unique identifier.
B. For specimens generated internally for entry into the GRC database, the GRC Program Manager (PM) will record the observable class features and conduct the necessary measurements for specimen(s) being entered into the GRC database. At a minimum, the GRC unique identifier, number of lands and grooves (L/G), direction of twist, L/G widths, and observable class characteristics on the cartridge cases will be recorded on the container for the specimen being entered into the database.
C. For specimens submitted from forensic laboratories and cooperating law enforcement agencies, the GRC PM will determine if the necessary materials have been submitted: a minimum of two test-fired bullets and/or cartridge cases or suitable casting material from barrel and completed GRC Test-fire Entry Sheet (located on the GRC database CD).
D. Specimens for entry into the GRC database must be in suitable condition for accurate measurements - no fragments or interference from expansion and land and groove edges are acceptable.
E. The primary method for obtaining measurements will be analysis of three-dimensional (3D) scan data acquired from the 3D Toolmark Topographical Instrument, the Alicona G5. When using the Alicona, only one measurement is necessary for each specimen entered into the GRC database.
    1. If the Alicona instrument is not available or not functioning properly, measurements can be obtained using methods described in section 5.14.2.1.G and two sets of measurements are necessary if using these methods.
F. 3D Toolmark Topographical Instrument Measured GRCs
    1. The instrument instructions on how to obtain scans and perform measurements, using a 3D Toolmark Topographical Instrument, are located with the instrument.
    2. Appropriately trained personnel will use the AIicona to scan the surface of the test-fired bullet and save the scans for future measurements.
    3. The GRC PM will perform the measurements on the acquired scans. The high and low values of the range of measurements will be recorded on the specimen container.
G. Microscope Measured GRCs
    The GRC PM will use the appropriate FTD Technical Procedure to determine the GRC information for the specimen(s).
    1. The GRC PM will measure the chord (width) of each land impression (LIMP) and groove impression (GIMP) for all the submitted test-fired bullets. The high and low values of the range of measurements will be recorded on the specimen container.

2. The maximum and minimum measurement from both sets of measurements will be used to establish the LIMP/GIMP boundaries for the GRC database.

5.14.2.2 GRC Database Entry and Management

A. The data acquired from section 5.12.2.2 will be entered into the database by the GRC PM and saved for use by the FTU for future distribution.
B. After entries are made to the GRC database, a review may be performed by authorized personnel.
C. Records for entries made to the GRC database will be maintained by the GRC PM.
D. Records for specimen entry into the GRC database are maintained by the GRC PM.

5.14.2.3 Distribution of the FBI GRC Database

A. Approximately every two years, an updated version of FBI GRC database will be distributed to forensic laboratories and cooperating law enforcement agencies.
B. The GRC PM will facilitate the production and distribution of the GRC database.
C. Prior to distribution to forensic laboratories and cooperating law enforcement agencies, the GRC PM will conduct a performance check on the GRC database using FTD-008 GRC Form.
    1. This performance check will determine if the information contained in the database is present and retrievable.
    2. The total number of hits for each search field will be recorded; this record will be maintained by the GRC PM.
    3. If the performance check fails, a second attempt will be made. If the second performance check fails, the GRC PM will contact the FBI Laboratory Database Programmer for assistance.
    4. The updated GRC database will not be distributed until a successful performance check has been completed.
D. Each distributed updated version of the GRC database will include operating instructions, a GRC Test-fire Entry Sheet, a copy of the completed FTD-008 GRC Form, and instructions on performance check conducted by recipients.

5.14.2.4 GRC Database Search

A. Use the appropriate FTD Technical Procedure to determine the GRC information.
B. Conduct a search of the GRC database using a range of land and groove widths.
    1. At the discretion of the examiner or condition of the evidence, the range for the widths may be adjusted to expand or narrow the search results.
    2. Additional search criteria, such as cartridge case information, may be added to further narrow the search results.
C. The examiner will review the search results to ensure the GRC information is complete and that no obvious errors are present.

5.14.3 NIBIN

National Integrated Ballistic Information Network (NIBIN) technology compares images of submitted ballistic evidence from shooting scenes and recovered firearms and produces a list of possible similar results. Trained NIBIN users then conduct a correlation

review of these results, locating NIBIN leads or potential links or associations from the same firearm. A NIBIN lead is an unconfirmed, potential association between two or more pieces of firearm ballistic evidence and is based on a correlation review of the digital images in the NIBIN database.

A. Account Management
    1. The NIBIN Program Manager will maintain records for FTD personnel, who are trained NIBIN users.
    2. Refer to IBIS TRAX-HD3D BRASSTRAX and MATCHPOINT folders located on desktop of each IBIS system for additional guidance.
        i. BRASSTRAX Release Notes; BRASSTRAX User Guide
        ii. MATCHPOINT Release Notes; MATCHPOINT User Guide
B. Preventative Maintenance
    1. Perform a visual inspection periodically to ensure that none of the redundant components have failed.
    2. Refer to IBIS Products Administration Guide, located on each IBIS system for additional guidance.
C. Performance Check
    1. A monthly performance check of IBIS will be conducted prior to an item being entered into the system.
        i. If a performance check was completed within thirty days of previous acquisition, an additional performance check is not necessary.
    2. A performance check is conducted by acquiring and searching an image of the NIST SRM 2461-118 within Zone 1. Upon entry and synchronization, a default correlation will be generated and reviewed.
        i. If the NIST SRM 2461-118 is ranked among the top returned candidates, the performance check is acceptable. The correlation list for this performance check will be retained in the NIBIN Log binder.
        ii. If the NIST SRM 2461-118 does not appear among the top returned candidates, the performance check will be repeated. If the second performance check attempt fails, the issue will be recorded in the FTD-009 NIBIN Log, contact Global Customer Services, and the affected IBIS system will be labeled as out of service.
        iii. Record of communication with Global Customer Services, regarding failure of performance check, will be recorded in the FTD-009.
    3. Once a record of an acceptable performance check is complete, the images and correlation results from the search may be removed from the IBIS.

5.14.3.1 Requirements for Cartridge/Shotshell Case Entry

A. Submitted cartridge/shotshell cases and test fires from pistols, rifles, and shotguns will be entered and searched against the appropriate correlation sites. At a minimum, correlation sites are determined based on the submitting office.
B. Cartridge cases and test fires that are not typically entered in the IBIS include:
    1. revolvers
    2. single shot rifles
    3. firearms deemed unsafe, inoperable, or incomplete

5.14.3.2 Cartridge/Shotshell Case Data Entry

A. The appropriate case information will be recorded for each entry.
    1. FBI Case ID Number (or a derivative)
    2. FBI Laboratory Number
    3. Item Identifier
    4. Case Supervisor (assigned FTD Examiner)
B. The appropriate FTD Technical Procedure will be performed prior to acquiring an image in IBIS.
C. If source identification can be attributed to several cartridge cases, only the item containing the most suitable microscopic marks of value is entered into IBIS.
D. The BRASSTRAX User Guide and MATCHPOINT User Guide will be followed for acquiring images and reviewing correlation requests.
E. All cases entered into IBIS will be searched against the appropriate correlation sites.
    1. Correlation review results will be recorded in the FTD Worksheet or on the printed correlation results page.
    2. If a NIBIN lead, potential link, or association from the same firearm is located, NIBIN records will be retained that can include:
        i. Correlation Results
        ii. Cartridge Case Image Comparison Exhibit Information
        iii. Cartridge Case Image Comparison Primer
        iv. Cartridge Case Image Comparison Firing Pin
        v. Exhibit Information
        vi. Firearm Information
    3. NIBIN leads will be communicated to the submitting agency.
F. Correlations requests may be removed from the IBIS once the review is complete.

6 CALCULATIONS

6.1 Ejection Pattern and Silencer Tests

Mean = $x_m = (\sum_i x_i)/n$

Standard Deviation = S = $\sqrt{\sum_{i=1}^{n}(\frac{(xi-xm)2}{n-1})}$

6.2 GRC Database

To convert measurements of large lands and grooves from chord (L_c) length to arc (L_a) length the following equation can be used (D : bullet diameter):

$$L_a = \pi\, D \left(\frac{2 \sin^{-1}\left(\frac{L_C}{D}\right)}{360^\circ} \right)$$

7 MEASUREMENT UNCERTAINTY

7.1 Barrel and/or Overall Length

Measurement uncertainty and confidence level will be included in a Laboratory Report when measuring barrel and/or overall length for assessment of conformance with a statutory requirement.

7.2 Silencer Test

For the examination of a muzzle attachment in the FTU, the uncertainty of measurement is not applicable. However, if a quantitative numerical measurement result is requested to be included in an FBI Laboratory Report, the uncertainty of measurement must be reported. The method used to determine the estimation of uncertainty can be found in FTD-124.

7.3 Ejection Pattern Test

If a quantitative numerical measurement result is included in a Laboratory Report, the measurement uncertainty will be reported. The method used to determine the estimation of uncertainty can be found in FTD-124.

8 LIMITATIONS

Due to damage or other factors, some of or all the above examinations might not be possible. It is at the discretion of the examiner as to what examinations are necessary and if they should be conducted.

8.1 Barrel and/or Overall Length

Barrel length measurements are dependent on the straightness of the measuring device and the assessment of the muzzle end in relation to the measuring device. Overall length measurements are dependent on proper alignment of the firearm in the measuring platform.

8.2 Mechanical function testing and test firing

Due to damage or other factors, some of or all the above examinations might not be possible. It is at the discretion of the examiner as to what examinations are necessary and if they should be conducted.

8.3 Silencer Test

Sound attenuation tests are not intended to measure an absolute value for sound reduction, but rather the measured difference with and without a silencer installed.

Additionally, excessive wind velocity in outdoor tests could yield inaccurate results. Testing indoors on a small range with no sound absorbing material whatsoever on walls or ceiling could also yield inaccurate results.

8.4 Ejection Pattern Test

Several conditions (orientation of the firearm when fired, walls or intervening objects, floor or ground surface variability, inadvertent movement of cartridge cases by first responders) may affect the final location of fired cartridge cases at a shooting scene. The test results establish an approximate ejection pattern boundary and are only valid for the firearm tested along with the magazine and type of ammunition used.

8.5 Database Searches

8.5.1 eTrace and NCIC

Due to damage, time of manufacturer or other factors, some information may not be available.

8.5.2 GRC

The GRC database does not include every firearm produced by each manufacturer. Variations in manufacturing methods, use, neglect, and/or environmental effects may cause the GRCs to vary within a single firearm. The GRCs for a specific make/model of a firearm from a single manufacturer may vary slightly from one firearm to the next due to acceptable manufacturing tolerances. Different manufacturers may produce firearms of a specific caliber with similar GRCs, and a specific make/model of a firearm could be chambered in more than one caliber. The addition of aftermarket components to a firearm can have varying GRCs from the original manufacturer's design. Furthermore, some data entry errors may exist in the database.

8.5.3 NIBIN

IBIS is a multi-user system that has established guidelines. However, variables such as lighting, user experience, case material, and the reproducibility of microscopic marks can affect the appearance of images captured, thus impacting the correlation results within IBIS. Digital images viewed on the IBIS may not have the quality and clarity of those same items that are physically viewed using a comparison microscope and will not be used to make an identification conclusion. If the visual comparison of digital images on IBIS results in an association, the evidence will be physically examined, by a qualified Examiner, using light comparison microscopy and/or virtual comparison microscopy to determine if there is a source identification. Additionally, the IBIS algorithm merely provides a sorting capability for potentially associated toolmarks represented on cartridge cases and provides no statistical confidence in possible matching results.

9 SAFETY

FTD personnel will follow the established policies and guidance located in the FBI Laboratory Safety Manual as outlined by the FBI Laboratory's Health and Safety Group.

A. FTD personnel are not permitted to test fire alone in the firing range or bullet recovery tank room.

B. FTD personnel will adhere to the guidelines outlined in the FTD-QRG-Safe Handling of Firearms and Ammunition.
C. Additionally, new FTD personnel are required to complete a safety briefing and familiarization, including test firing, with a qualified firearms examiner.
D. A record of this briefing and familiarization will be maintained in the FTD personnel's training records.
E. If a request has been made for non-FTD personnel to perform test-firing within the FTU firing range or bullet recovery tank room, the FTU Chief will be notified, and the request will be evaluated.
    1. If the FTU Chief approves, a qualified firearms examiner will be present.

10 REFERENCES

ANSI/ASB Best Practice Recommendation 068, Safe Handling of Firearms and Ammunition, First Edition, 2020, Sections 4.3 and 4.4.

ANSI/ASB Standard 093, Standard Test Method for the Examination and Testing of Firearms, First Edition, 2020, Section 4.11.

Glossary of the Association of Firearm and Tool Mark Examiners, AFTE Standardization and Training Committee, 6th Edition, Version 6.030317.1.

SWGGUN, SWGGUN Admissibility Resource Kit (ARK), Scientific Working Group for Firearms and Toolmarks. https://afte.org/resources/swggun-ark. Web 2022.

Federal Firearms Regulations Reference Guide – 2014 Edition (ATF P 5300.4). Retrieved from the ATF website: https://www.atf.gov/firearms/docs/guide/federal-firearms-regulations-reference-guide-2014-edition-atf-p-53004. Web. 2022.

Sporting Arms and Ammunition Manufacturers' Institute Inc. Glossary of Industry terms. Retrieved from SAAMI website: https://saami.org/saami-glossary/. Web. 2022.

eTrace User Guide Manual

NCIC Gun File Training Manual

NIBIN Training Outline and Guidelines. Retrieved from the ATF website: https://www.atf.gov/firearms/nibin-training-outline-and-guidelines. Web. 2022.

William J. Lewinski, Ph.D., William B. Hudson, Ph. D., David Karwoski, Christa J. Redmann, "Fired Cartridge Case Ejection Patterns From Semi-Automatic Firearms," Investigative Science Journal, Volume 2, Number 2, November 2010.

Garrison, D.H., "Reconstructing Drive-By Shootings from Ejected Cartridge Case Location," AFTE Journal, 1993;25(1):15.

Stephen Bell, Measurement Good Practice Guide No. 11 (Issue 2), A Beginner's Guide to Uncertainty of Measurement, Crown Publication, 1999, Issue 2 – 2001.

Alan C. Paulson, Silencer: History and Performance, vol. 1. Paladin Press, 1996.

Phillip H. Dater, "Sound Measurement Techniques," Small Arms Review, vol. 3, No. 11, August 2000.

11 REVISION HISTORY

Revision	Issued	Changes
10	10/17/2022	Updated to meet template requirements and include the Organization of Scientific Area Committees for Forensic Science (OSAC) include published standards. Incorporated Ejection Pattern Testing (FTD-209-02), Individual Characteristic Database Searches (FTD-217-08), Silencer Testing (FTD-218-04), Barrel and Overall Length Measurements (FTD-221-05), Class Characteristic Database Entries and Searches (FTD-226-02), National Database Searches (FTD-231-01) into FTD-211.