

## Scope

This document describes procedures used in the examination of fabric, fabric impression and cordage characterization, identification, and comparison in the Trace Evidence Unit. The nature and extent of the evidence will determine the techniques used.

## Safety Precautions

- While working with physical evidence, laboratory personnel will wear appropriate protective attire (at a minimum, laboratory coat and gloves).
- Universal precautions will be followed.
- No specific hazards are associated with the examination techniques performed.

## Materials Required

- Sterobinocular microscope, magnification range from 0.5x to at least 40x
- Comparison microscope, magnification range from 40x to 600x
- Forceps
- Spatula
- Scissors
- Probes
- Camera: digital or film
- Lux-o-lamp

## Standards and Controls

Not applicable.

## Procedure

### 1 Fabric Examinations

- 1.1 Prior to a fabric analysis, specimens are typically processed utilizing the procedures outlined in the Evidence Handling Procedures.
- 1.2 After being processed, analyze and document the general appearance, stains, size, shape, color and condition of the pieces of fabric, paying special attention to cut, torn, crushed or burned edges.
- 1.3 Document the type of fabric *i.e.* woven, knit, or non-woven.
- 1.4 Document if there are any identifying characteristics which may help identify the possible end use of the textile (trousers, jacket, etc.)

- 1.5** Look for obvious gross characteristics that may serve to quickly eliminate the pieces of fabric as having come from a common source. These characteristics may include repeats or manufacturer's "flaws", a missing portion of a printed design, a thicker yarn, stains, etc.
- 1.6** Determine the size and shape of missing portion(s) from each of the fabrics, if possible. The size of the area missing from one piece of fabric should be equal to or greater than that of the other fabric.
- 1.7** Determine the correct "side" or "face" of the fabric, if possible, and orient the warp and fill yarns (or courses and wales) in the same direction for comparison.
- 1.8** Using gross characteristics such as irregular contours, different types, sizes and colors of yarns, design patterns and stain patterns, attempt to orient the pieces of fabric to one another.
- 1.9** Determine if two pieces of fabric can be physically matched to one another.
  - 1.9.1** Once the pieces of fabric are oriented using gross characteristics, begin to compare individual yarns to one another, ensuring that the "long" yarns in one fabric coincide with a "short" yarn in the other piece of fabric. Continue comparing each yarn along the entire cut or torn edges.
  - 1.9.2** If all of the gross characteristics and all of the "long and short" yarns along the entire cut or torn edge of one piece of fabric can be associated to the second piece of fabric, it can be concluded that the two pieces of fabric physically match one another.
  - 1.9.3** Diagrams and/or photographs of the two pieces of fabric together will be made and retained in the notes.
  - 1.9.4** If the two pieces of fabric physically fit together, they must also be alike in color, construction and composition. Therefore, it can be concluded that the two pieces of fabric were once joined along their cut and/or torn edges, and no additional examinations are necessary.
- 1.10** If two pieces of fabric cannot be physically matched to one another, determine if the two pieces of fabric exhibit the same color, construction and composition.
  - 1.10.1** Document the number, size, color and construction of yarns in each direction for each piece of fabric.
  - 1.10.2** Document direction of twist (S or Z) of the yarns (warp and fill) in both pieces of fabric.

- 1.10.3 Analyze and identify the fibers present in each yarn utilizing the procedures outlined in the Forensic Fiber Examination Protocol.
- 1.10.4 If no differences are found between the pieces of fabric (including the composition of the fibers), it can be concluded that the pieces of fabric exhibit the same color, construction and composition as one another, and, therefore, could have come from the same source.

## 2 Fabric Imprint/Impression Examinations

- 2.1 Examination may be of the questioned item bearing a “pattern” of the actual imprint/impression, a “lift” of an imprint, a “cast” of an impression (from various types of surfaces, e.g. mud, glass, fender) or a photograph of an imprint/impression. If the actual item bearing the pattern is submitted, first examine the item for the presence of trace evidence utilizing the procedures outlined in Evidence Handling Procedures.
- 2.2 Study the general shape of the pattern, looking for identifying features that may help in the identification of the fabric type (*i.e.* twill, plain weave, knit, etc.) of the potential donor.
- 2.3 Look for damaged areas on the fabric item (cuts, tears, snags) that may aid in orientation of the fabric and may add significance to the association.
- 2.4 Make multiple impressions of the potential fabric donor on a suitable substrate such as ink or modeling clay, using different amounts of force or pressure.
- 2.5 Compare the number of yarns or loops per inch in each direction for both the fabric specimen and the imprint/impression specimen. Document the results in the case notes.
- 2.6 If no differences can be found between the known fabric and the questioned imprint/impression pattern, it can be concluded that the fabric could have made the imprint/impression. The presence of individualizing or unusual characteristics such as cuts, tears, snags, etc., may allow for a positive identification be made.

## 3 Fabric Tape Examinations

- 3.1 Prior to a fabric tape analysis, specimens are typically processed utilizing the procedures outlined in the Evidence Handling Procedures.
- 3.2 Fabric tapes possess a backing material, adhesive and a fabric portion. The fabric portion of the tape is subjected to fabric and fiber analysis. It is usually necessary to submit the tape for compositional analyses of the backing and adhesive materials.

- 3.3 Document the number, size, color and construction of yarns in each direction for each piece of fabric.
- 3.4 Document direction of twist (S or Z) of the yarns (warp and fill) in both pieces of fabric.
- 3.5 Analyze and identify the fibers present in each yarn utilizing the procedures outlined in the Forensic Fiber Examination Protocol.
- 3.6 If the portion received for analysis encompasses the entire width of the tape and at least 1 inch of the length of the tape, and if no differences are found between the pieces of fabric (including the composition of the fibers), it can be concluded that the fabric comprising the pieces of tape exhibit the same color, construction and composition as one another, and, therefore, could have come from the same source.
  - 3.6.1 If the portion received for analysis does not encompass the entire width of the tape and at least 1 inch of the length of the tape, and if no differences are found between the pieces of fabric (including the composition of the fibers), it can be concluded that the fabric comprising the pieces of tape exhibit the same color, construction and composition as one another, and, therefore, could have come from the same source. However, a statement should be added to the results identifying that the piece of tape received for analysis was not sufficient to fully characterize the tape.

#### 4 Cordage Examinations

- 4.1 Prior to a cordage analysis, specimens are typically processed utilizing the procedures outlined in the Evidence Handling Procedures.
- 4.2 After being processed, analyze and document the general appearance, stains, size, shape, color and condition of the pieces of cordage, paying special attention to cut, torn, crushed or burned edges.
- 4.3 Examine the ends of the pieces of cordage to determine how the cordage was severed (e.g. cut, burned, torn).
- 4.4 Document the diameter (and length, if pertinent), type of cordage (twisted or braided) and note any knots that are present, if pertinent.
- 4.5 Document the number of crowns or turns per inch, the number of plies and braids, and the direction of twist (“S” or “Z”) for the entire piece of cordage and for each ply or braid.
- 4.6 Determine if two pieces of cordage can be physically matched to one another.

- 4.6.1** Look for individualizing characteristics on the ends of the cordage such as a paper core or jagged plastic edges.
- 4.6.2** If the cordage has a paper or fabric core, open the core so that it lays flat on the workspace.
- 4.6.3** Using gross characteristics such as irregular contours, different types, sizes and colors of yarns, design patterns and stain patterns, attempt to orient the pieces of fabric to one another.
- 4.6.4** Once the cores are oriented using gross characteristics, begin to compare individual cores to one another. If the core is fabric, ensure that the “long” yarns in one fabric coincide with a “short” yarn in the other piece of fabric. Continue comparing each yarn along the entire cut or torn edges. If the core is paper, compare the cut and/or torn edges to one another along the entire length of the core.
- 4.6.5** If no differences can be found between the two pieces of the core, then it can be concluded that the two pieces of core, and, therefore, the pieces of cordage, physically match one another.
- 4.6.6** Diagrams and/or photographs of the two pieces of cordage together will be made and retained in the notes.
- 4.6.7** If two pieces of cordage physically match one another, then they must also be alike with respect to color, construction and composition. Therefore, it can be concluded that the two pieces of cordage were once joined along their severed ends, and no additional examinations are necessary. If a physical match cannot be affected, continue with the examination.
- 4.7** If two pieces of cordage cannot be physically matched to one another, determine if the two pieces of cordage exhibit the same color, construction and composition.
  - 4.7.1** Remove a measured section (e.g. one inch) from a logical area (not near the end, a knot, etc.), and tape the remaining cut ends together and mark them appropriately. Use this “section” for determination of construction and composition.
  - 4.7.2** Document if the piece of cordage has a core or a tracer. If so, describe the construction of the core or tracer and document this in the case notes.
  - 4.7.3** Analyze and identify the fibers present in each piece of cordage utilizing the procedures in the Forensic Fiber Examination Protocol.

4.7.4 Repeat these steps for each piece of cordage.

4.7.5 If no differences can be found between the pieces of cordage (including the composition of the fibers), it can be concluded that the pieces of cordage exhibit the same color, construction and composition as one another, and, therefore, could have come from the same source.

## 5 Fabric, Fabric Tape, and Cordage Confirmations

Fabric, fabric tape and cordage associations are confirmed by a second qualified examiner. These confirmations are documented by the signature of the confirming examiner and the date of the confirmation on the Confirmation Form (see Case Assignment and Review Procedures).

### Limitations

Not applicable.

### Comments

Not applicable.

### Documentation

The following worksheet(s) shall be generated and managed:

Casework Documentation
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Fiber Confirmation Form
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### References

- Hatch, Kathryn L., Textile Science, West Publishing Company, Minneapolis/Saint Paul, New York, Los Angeles, San Francisco, 1993.
- Reader's Digest Complete Guide to Sewing, The Reader's Digest Association, Inc. Pleasantville, New York, 1976.
- Cordage Directory, Published by the Cordage Institute, Hingham, Massachusetts, 1989.
- Registered Numbers & Wool Profabrics Label Encyclopedia, The Salesman's

Guide, A Unit of the Cahners Business Information, New Providence, New Jersey, 1998.