Knife Identification Project (KIP)

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ABSTRACT

Toolmark identification has long been grounded in the fact that no two tools can leave toolmarks that are alike. Whether they are the three-dimensional toolmarks transferred from the barrel of a gun to the surface of a bullet, or the toolmarks transferred from consecutively made knife blades onto a receptive medium these marks should be unique from tool to tool. It is the thrust of this three year study to further develop the science of Firearm and Toolmark Identification and to help examiners meet the Frye and Daubert challenges in the coming years.

Introduction

This research project is modeled after the Hamby/Brundage Consecutively Made Barrel Test (also known as the Ruger ten barrel test) sent out by AFTE member David Brundage, then of the Illinois State Crime Laboratory system, and currently employed at the Indianapolis Crime Laboratory. Our thanks to him for laying the ground work that provided a basis for this project.

Just as the ten-barrel test helped to establish the individual characteristics for consecutively made barrels, this project will help to demonstrate the unique individual characteristics in striated toolmarks, and satisfy Daubert criteria. Daubert criteria are based on practices that can be scientifically tested, subjected to peer review, possess known error rates and be generally accepted as science.

Previously published articles on consecutively made knives had been published in the AFTE Journal and include the following:

AFTE: Vol. 10 No. 3, 1978
AFTE: Vol. 12 No. 3, 1980
AFTE: Vol. 14 No. 1, 1982
AFTE: Vol. 21 No. 2, 1989

The Birth of KIP

The Knife Identification Project (KIP) started out with 140 Chinese made, folding knives (photograph #1). On each of the knives there were combinations of smooth and smooth/serrated blades (photograph #2).

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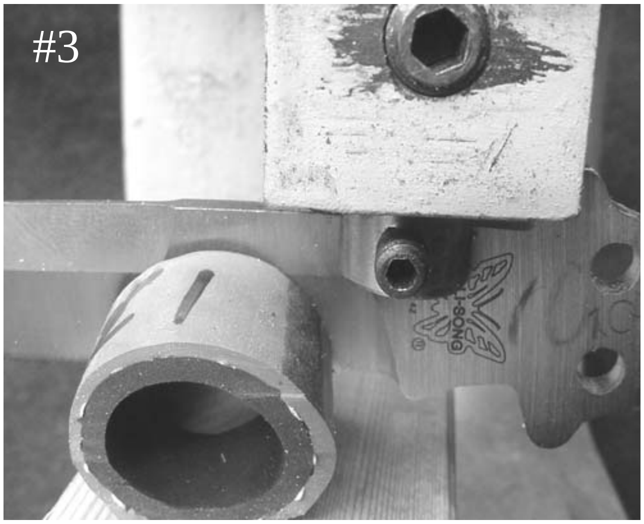
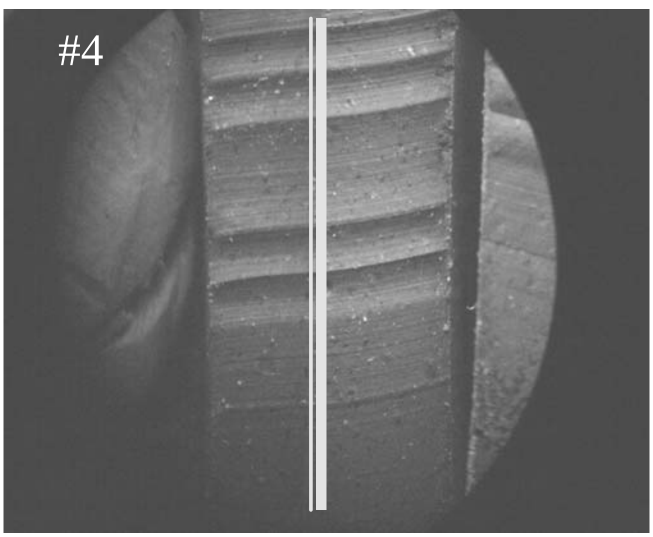
Each of the knives was used to cut two samples of rubber radiator hose (photograph #3). These samples were then microscopically compared (photograph #4).





The individual characteristics from each of the knives were compared to one another and, as expected, individual markings were vastly different between all of the knives.

These sets of comparisons inspired the idea to compare consecutively made knives.

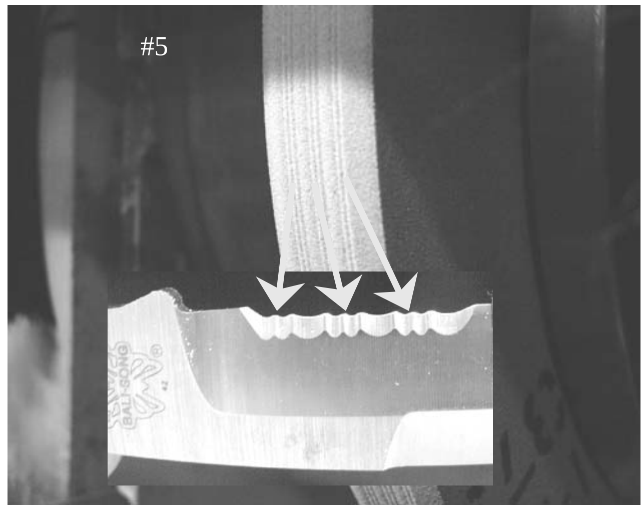
Obtaining Knife Blades

Benchmade Knife Corporation, located in Oregon City, Oregon, agreed to furnish ten consecutively made knives and allowed us to observe the manufacture of the blades.

Each Benchmade blade is cut from a sheet of high grade steel by a tracing laser machine. The blades are ground and polished, after which liners and handles are added. The final step is the sharpening process (photograph #5) where the serrated edges were ground using a 24 inch diameter wheel.

Benchmade sequences the sharpening task last to assure that safety within the plant is maintained and that each knife is optimally sharp when shipped.

Each consecutive test knife was individually numbered during production for future reference by the authors.



Obtaining a Test Medium

After receiving the blades, a suitable test material was needed which would:

- Not damage the blades;
- Be Small enough to ship nationally;
- Take marks consistently (reproducibility);
- Mark sufficiently;
- Be easily obtained;
- and be cheap and reusable

The test medium used for this project is commonly called Dippac®, suggested by Rob Caunt, of the Vancouver, British Columbia Police Department. This material is commonly used to coat the cutting ends of drill bits and end mills. It is a soft plastic material that will melt quickly at 350°F. One source for the Dippac is:

Dip Seal Plastics Inc,
2311 23rd Ave, Rockford, IL 61104
(phone: 800-634-7821).

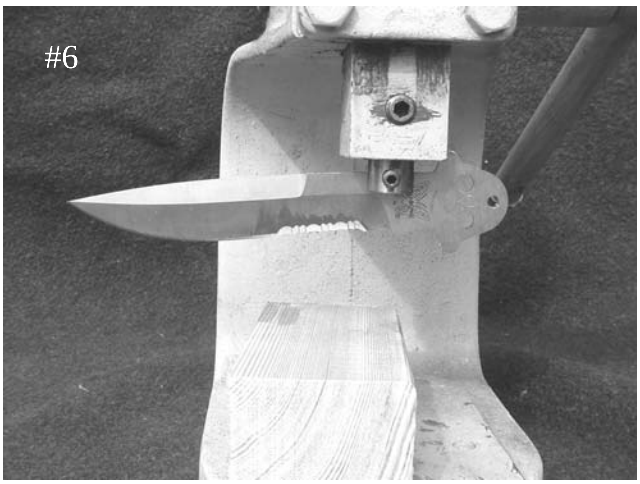
Dippac's best quality was its ability to retain reproducible microscopic individual characteristics without damaging the knife blade. It was tested in our laboratory and found to be a saturated polymeric material.

Sample Set Production

The Dippac was cut from rough blocks, melted, and poured into ½ inch deep pans. It was then allowed to cool, and cut into approximately one-inch wide strips.

The strips were separated into 20 groups, and hand stamped with numbers (0-9) for knowns, and letters (A-J) for unknowns.

A fixture was developed to securely hold each knife (photograph #6). Each of the numbered strips was cut using the corresponding blade reference number. The lettered strips were randomly selected to generate unknowns.



The cutting process was done with one knife and two groups of strips (numbers and letters) one set at a time to eliminate the possibility of co-mingling samples. Cuts were not made through the entire block to allow easier orientation to one another and to prevent drying.

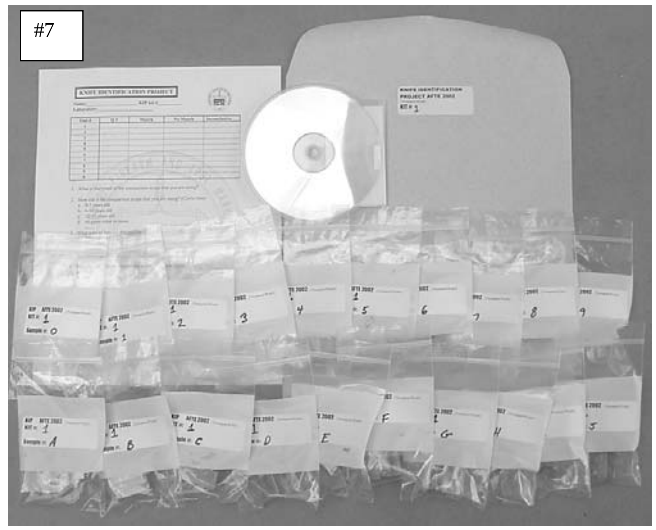
KIP kit generation

The following list outlines some of the key production elements of the project:

- 75 pounds of Dippac material used
- 200 strips cut from the molds
- 30 blocks cut per strip
- 6000 knife cuts made and stamped
- 40 blocks per kit (20 Knowns, 20 Unknowns)
- 150 Kits
- 5 pulled randomly for verification
- 145 kits available for distribution

The "Beta" Test

Prior to mass production, five kits were distributed and verified by eight separate examiners. Each kit (photograph #7) was assigned a number, with 20 "Knowns" in sets of 2 (0-9) and 20 "Unknowns" in sets of two (A-J). Also included with each test kit was a CD containing the KIP PowerPoint presentation and a Word file with the answer sheet to be printed and filled out by the examiner. All eight test subjects determined the test to be valid and worthy of distribution to the membership.



Test #	Q #	Match	No Match	Inconclusive
1				
2				
3				
4				
5				
6				
7				
8				
9				
0				

Distribution and Results

The goal of KIP was to associate numbered, known knife blade test marks with corresponding unknown lettered blocks. The KIP tests were distributed free of charge to members with 140 of the 145 kits signed out at the AFTE 2002 Conference. One hundred three (103) examiners submitted test results from around the world.

Results from every participant were submitted to the authors via the worksheet provided with every kit. As a quality assurance measure, the kit number was pre-printed on each worksheet.

The worksheet consisted of an answer chart followed by seven informational questions. Summation of all of the responses from the worksheets revealed the following:

Of 1,030 possible answers (103 kits sent X 10 possible answers) 1,022 were correct. The error rate was calculated to be 0.776%:

$$\frac{8 \text{ incorrect}}{1030 \text{ possible}} \text{ X } 100 = 0.776\%$$

NOTE: Inconclusive results were not considered incorrect for examiners who used this option.

There seemed to be no obvious correlation between those individuals who incorrectly reported the results, indicating no errors in the kit making process. Summation of the results for each question are presented below:

1. What is the brand of the comparison scope that you are using?

2. How old is the comparison scope that you are using? (Circle One)
   0-5 years old
   6-11 years old
   12-17 years old
   18 years older or more

The average age of the microscope used was approximately 6-11 years.

3. What type of lighting did you use to make the comparison? (Circle One)
   Fiber optics
   Florescent
   Day light
   Other (specify)

Florescent lighting was preferred by most participants.

4. Did you use a direct comparison method? (Circle One)
   Yes
   No

Direct comparison was preferred by most participants.

5. If no, what method(s) did you use?

Mikrosil casts were the most popular.

6. How long have you been doing toolmark examinations? (Circle One)
   0-5 years
   6-11 years
   12-17 years
   d. 18 years or more

The range of experience reported by examiners was between a few hours to over 18 years. The average experience reported was approximately 10 years.

7. How long did it take you to complete the examination?

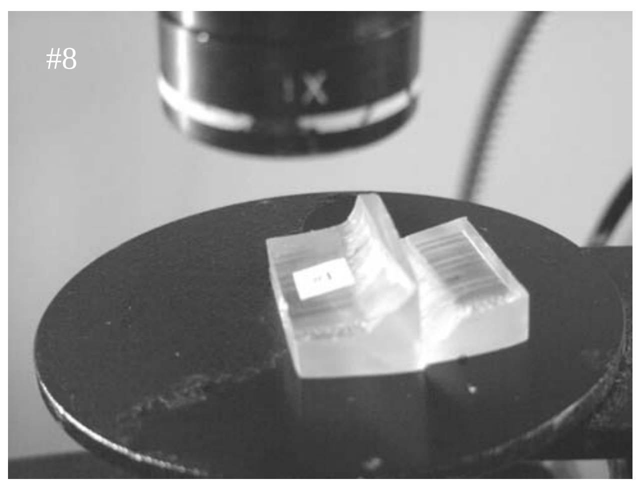
The time required to complete the KIP tests varied from 1/2 hour to two working days. The average was approximately 5.6 hours to complete all comparisons.

Additional Feedback

The authors' own experience as well as feedback from examiners who participated in the test was that lighting and proper alignment was vital to success. A black background aided in the examination of the blocks (photograph #8).

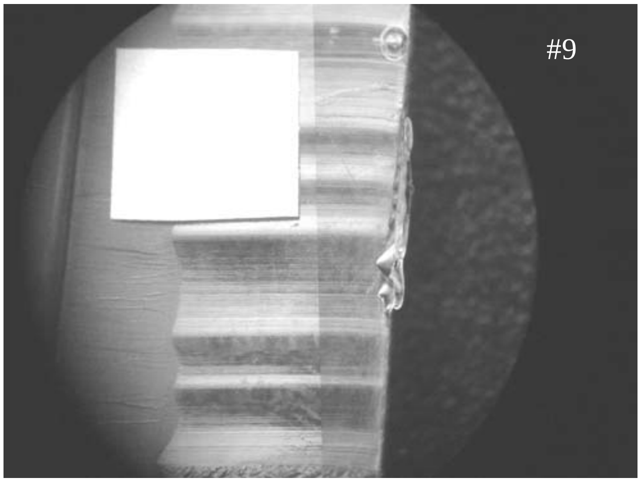
It was the authors' preference to use fluorescent lighting instead of fiber optics (Photograph #9).

Examiner Loren Sugarman (Orange County Sheriff's Office) suggested using Mikrosil to make the comparisons easier and increase longevity of samples. Examiner Gaylan Warren (Columbia International Forensics Laboratory)



suggested the placement of a paper backer on each of the Mikrosil casts before they harden to assist labeling the casts.

In summary, the authors would like to personally thank



all of you who took the time to participate in this world-wide test. We hope that the results of this test will bolster future court testimony, help to validate the science of tool-mark identification, and help to address future Daubert challenges.

Special thanks to our two WSP interns, Nathan Krieger and Katie Leslie, for helping make this project a success.