



Forensic Databases: Paint, Shoe Prints, and Beyond

by Robin Bowen and Jessica Schneider

About the Authors

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A detective working a missing persons case undoubtedly knows how to make the most of databases such as the Combined DNA Index System (CODIS) and the Integrated Automated Fingerprint Identification System (IAFIS), but does he or she know how to investigate a paint chip, a tire track, an ink sampling, or a piece of glass?

Many government and private forensic databases can help both law enforcement investigators and the scientists who support their work in the lab. To help spread the word about the existence of these tools, the National Institute of Justice (NIJ) funded West Virginia University to gather the following basic information.¹

Integrated Ballistic Identification System: IBIS

Maintained by the Bureau of Alcohol, Tobacco, Firearms and Explosives' National Integrated Ballistic Information Network, this forensic database contains bullet and cartridge casings that have been retrieved from crime scenes and test-fires of guns found at a crime scene or on a suspect. One limitation of this database is that there must be a suspected gun to make a comparison. Because the database contains information on bullets and casings—and not on specific guns—a test-fire bullet from a gun must be compared to a bullet found at a crime scene, for example, to determine whether a bullet came from a specific gun. Any image of a casing or bullets must be sufficiently clean—that is, be clear, show characteristics, and have little glare—for a comparison to be valid.

How does IBIS work? Technicians use forensic imaging technology to enter bullet and casing evidence into IBIS. New images are correlated against data, and technicians are alerted to possible matches. At that point, a firearms examiner uses a comparison microscope to perform a manual examination. For more information, see www.atf.gov.

Paint Data Query: PDQ

Maintained by the Royal Canadian Mounted Police (RCMP), PDQ contains the chemical compositions of paint from most domestic and foreign car manufacturers and the majority of vehicles marketed in North America after 1973. The PDQ software is free to agencies that supply a minimum of 60 paint samples per year. The database information comes from the street (more than 60 percent from body shops and junkyards) and from manufacturers. In 1998, RCMP entered into agreements with the German Forensic Institute and the Japanese National Police Agency, which resulted in 1,500 samples being added to the database each year. Not all manufacturers, however, are willing to divulge the chemical composition of paint used on their vehicles. If a particular sample has not been entered into the database from the street, it would not be possible to obtain a match.

How does PDQ work? Each paint layer—an automotive paint job usually consists of four—is examined to determine the spectra and chemical composition. The chemical components and proportions are coded into the database. These known samples are compared against a paint sample from a crime scene or a suspect's vehicle to search the make, model, and year of manufacture of a vehicle involved in a hit-and-run or other criminal activity. For more information, see www.rcmp-grc.gc.ca.

National Automotive Paint File

This Federal Bureau of Investigation (FBI) database contains more than 40,000 samples of automotive paint from manufacturers.

How does the database work? Paint chips from cars can be compared to samples in the database. Undercoats help to narrow down possible manufacturers. For more information, contact the FBI's Laboratory Division at 202-324-3000.

Glass Evidence Reference Database

This database contains more than 700 glass samples from manufacturers, distributors, and vehicle junkyards. It is housed by the Technical Support Working Group, an interagency group that includes the U.S. Department of State and the U.S. Department of Defense. Although it cannot determine the source of an unknown piece of glass, the database can assess the relative frequency that two glass samples from different sources would have the same elemental profile.

How does the database work? Two plasma mass spectrometers are used to perform an elemental analysis of glass. For more information, e-mail isfsubgroup@tswg.gov.

TreadMark™

The number of shoe prints at a crime scene can be so large that the process of impression recovery becomes very time-consuming. TreadMark™ is a commercial product that uses four parameters—pattern, size, damage, and wear—to identify individual outsole impressions. These are then compared with shoe print data from two sources: suspects in custody and crime scenes. A match could yield the name, date of birth, criminal record number, places of interest, and similar offenses for possible suspects.

How does TreadMark™ work?

Impressions from a crime scene are obtained using the current recovery methods of photograph, gel lift, dust lift, and adhesive lift. These are input directly into the analytical system by high-resolution digital imaging. The same procedure is used

with an impression of a suspect's shoe print: It is photographed using a high-resolution digital camera, and these impressions (along with the offender's details) are input into the analytical system, where the operator can measure, analyze, and compare crime-scene and suspect images. Both image sources can be searched within themselves and against each other, allowing such images to be transmitted to other users. For more information, see www.csiequipment.com/systems.aspx.

SoleMate

This commercial database contains information—manufacturer, date of market release, an image or offset print of the sole, and pictorial images of the uppers—for more than 12,000 sports, work, and casual shoes. Sold on DVD, the product is updated and distributed to subscribers every 3 months. One limitation is that different manufacturers often use the same sole unit. Therefore, it may be difficult to determine the exact make and model of a shoe. The software links such records, however, so that all footwear that might match a crime-scene print can be considered.

How does SoleMate work? The pattern of an unidentified shoe print is assigned a set of codes to isolate basic features, such as circles, diamonds, zigzags, curves, and blocks. Options, with variations, are presented pictorially, which allows an investigator to code features that best match the shoe print. These codes form the database search, with results presented in descending order of pattern correlation. For more information, contact Foster & Freeman USA Inc., at 888-445-5048 or usoffice@fosterfreeman.com.

TreadMate

Maintained by the same United Kingdom company that markets SoleMate, this database contains information on more

than 5,000 vehicle tires and tire tread patterns, including manufacturer, date of market release, pictorial image, and pattern features. Because manufacturers sometimes use the same tread, it may be difficult to find the exact make and model match of a tire. In these cases, records are linked so that all tires that might match a crime-scene tire mark may be considered.

How does TreadMate work? The pattern of an unidentified tire mark is assigned a set of codes for pattern features, such as waves, lines, diamonds, zigzags, curves, and blocks, which then form the basis of the database search. Results are presented in descending order of correlation. For more information, contact Foster & Freeman USA Inc., at 888-445-5048 or usoffice@fosterfreeman.com.

Forensic Information System for Handwriting: FISH

Maintained by the U.S. Secret Service, this database enables document examiners to scan and digitize text writings such as threatening correspondence.

How does FISH work? A document examiner scans and digitizes an extended body of handwriting, which is then plotted as arithmetic and geometric values. Searches are made on images in the database, producing a list of probable "hits." The questioned writings, along with the closest hits, are then submitted to the Document Examination Section for confirmation. For more information, see www.secretservice.gov/forensics.shtml.

International Ink Library

The collection—maintained jointly by the U.S. Secret Service and the Internal Revenue Service—includes more than 9,500 inks, dating from the 1920s. Every year, pen and ink manufacturers are asked to submit their new ink formulations, which are chemically tested and added to the reference collection.

Open-market purchases of pens and inks ensure that the library is as comprehensive as possible.

How does the library work? Samples are chemically analyzed and compared with library specimens. This may identify the type and brand of writing instrument, which can be used to determine the earliest possible date that a document could have been produced. If the sample matches an ink on file, a notation is made in the database. The U.S. Secret Service generally provides assistance to law enforcement on a case-by-case basis. For more information, contact 202-406-5708.

Ident-A-Drug

The Therapeutic Research Center, a private company, publishes a computer program and book to help identify drugs in tablet or capsule form. To make an identification, sufficient information about the unknown drug must be available.

How does Ident-A-Drug work? Data used for comparison purposes contain codes that are imprinted on tablets and capsules, information on color and shape, the national drug code (NDC #), and drug class. Schedule information is shown if the drug is a narcotic or in one of the U.S. Drug Enforcement Administration schedules. For more information, see www.therapeuticresearch.com.

PharmInfoNet

This free Internet database contains information on prescription drugs, including uses, marketing and availability, and common side effects.

How does PharmInfoNet work? To perform a search, the generic or brand name of the drug must be known, which may not be possible if only a portion of the drug exists or the drug is not marked with a name. For more information, see http://pharminfo.8media.org/drugpr/drugpr_mnu.html.

RxList

Another free Internet database of prescription drugs is RxList.com.

How does RxList work? As with PharmInfoNet, the name of the drug must be known. Information in the database may not be current because new drugs are created regularly and new side effects are discovered. Search results include patient summaries; side effects and interactions; and links to public health, policy, and economic information. For more information, see www.rxlist.com.

Ignitable Liquids Reference Collection: ILRC

Maintained by the National Center for Forensic Science, this database and associated liquid repository allows a laboratory to isolate an ignitable liquid of interest for inclusion in an inhouse reference collection. Designed for screening purposes only, it parallels—but does not replace—American Standard Testing Materials requirements for an inhouse reference collection. A laboratory does not need to adopt the ILRC classification system to use this database.

How does ILRC work? Users enter the name of the liquid into the searchable database. The database can also be organized by classification of the liquid for quick reference. Users can then purchase samples of the liquid. Commercial samples are obtained directly from manufacturers and distributors. The products are then repackaged for distribution using the product name and sent to forensic science laboratories. For more information, see www.ncfs.org.

ChemFinder

This free Internet-based database contains information from manufacturers on chemicals, including chemical structures, physical properties, and hyperlinks.

How does ChemFinder work? Searches are conducted using a chemical name, Chemical Abstract Service (CAS) registry number, molecular formula, or weight. For more information, call 800-315-7300 or see <http://chemfinder.cambridgesoft.com/reference/chemfinder.asp>.

Integrated Automated Fingerprint Identification System: IAFIS

This FBI-maintained database contains:

- Fingerprints acquired after arrest at the city, county, State, and Federal levels.
- Fingerprints acquired through background checks for employment, licensing, and other noncriminal justice purposes (if authorized by State or Federal law).
- Latent prints found at crime scenes.

Although IAFIS offers electronic search and storage capabilities, it has some limitations. The database contains the fingerprints of only a small percentage of the population. Moreover, to make a comparison, the latent print must be of sufficient quality to identify certain individual characteristics. For example, the cores and deltas must be present in the print to determine the orientation of the print.

How does IAFIS work? The database receives data electronically, in hard copy, or in machine readable data format. IAFIS accepts, stores, and distributes photographs, including the results of remote 10-print and latent searches. These are returned electronically to the requesting agencies with a list

of potential matching candidates and their corresponding fingerprints for comparison and identification. For more information, see www.fbi.gov/hq/cjisd/iafis.htm or contact the FBI's Criminal Justice Information Services Division at 304-625-2000.

Combined DNA Index System: CODIS

This FBI-run database blends forensic science and computer technology into a tool for solving violent crimes. CODIS enables Federal, State, and local crime labs to exchange and compare DNA profiles electronically, thereby linking crimes to each other and to convicted offenders. CODIS uses two indexes: (1) the Convicted Offender Index, which contains profiles of convicted offenders, and (2) the Forensic Index, which contains profiles from crime-scene evidence.

How does CODIS work? Searches are performed to find a match between a sample of biologic evidence and an offender profile. Matches made between the Forensic and Offender Indexes provide investigators with the identity of a suspect. DNA analysts in the laboratories share matching profiles, then contact each other to confirm the candidate match. For more information, see www.fbi.gov/hq/lab/codis/index1.htm.

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Note

1. The information in this article regarding manufacturers and products, including Internet databases, is presented for informational purposes only. The National Institute of Justice has not evaluated the utility, accuracy, or veracity of the data in these databases; no product approval or endorsement by the U.S. Department of Justice should be inferred.