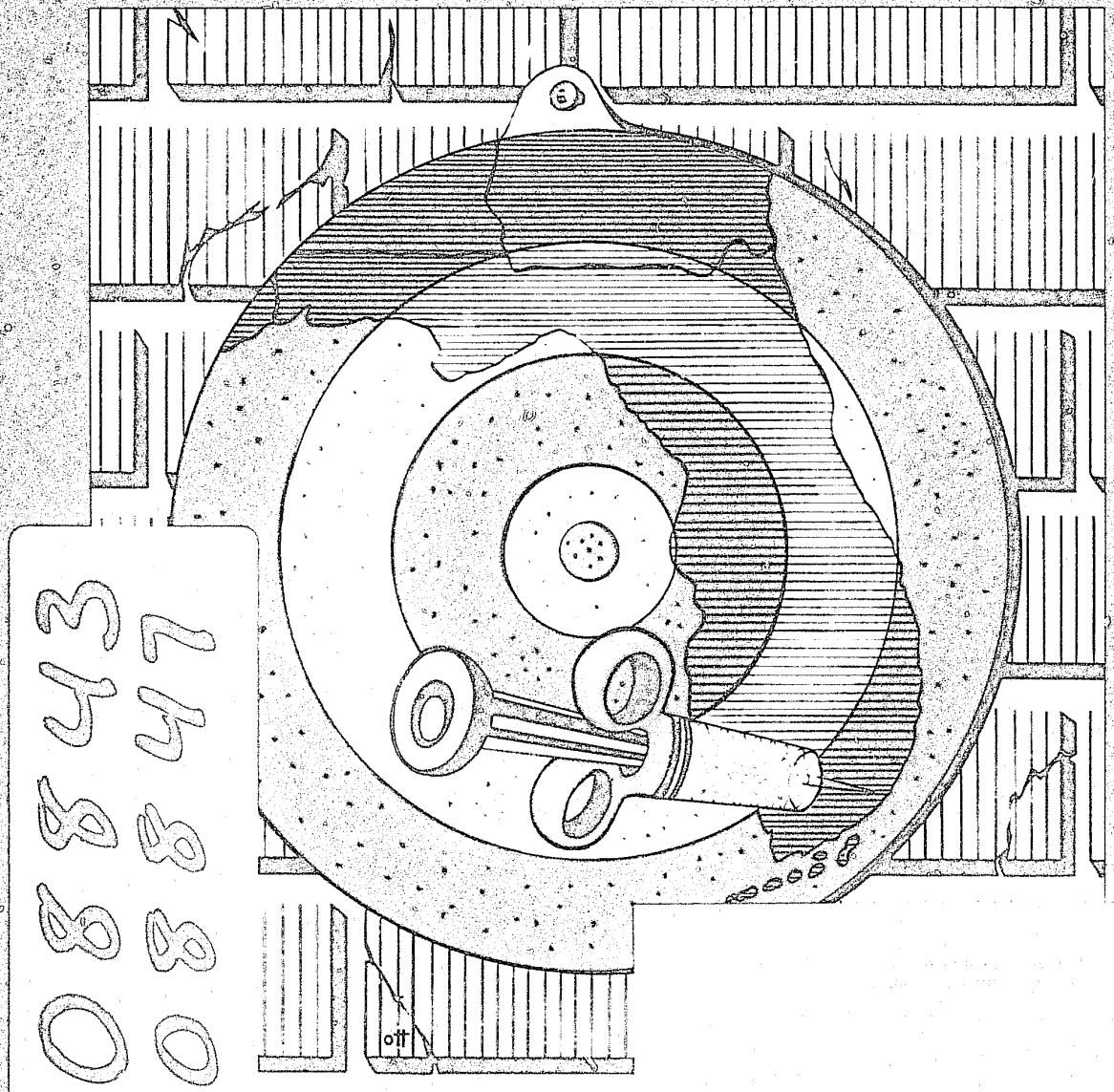
FBI
Law Enforcement Bulletin
January 1988



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January 1988, Volume 57, Number 1

FBI
Law Enforcement Bulletin

United States Department of Justice
Federal Bureau of Investigation
Washington, DC 20535

William S. Sessions, Director

The Attorney General has determined that the publication of this periodical is necessary in the transaction of the public business required by law of the Department of Justice. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 6, 1988.

Published by the Office of Public Affairs
Milt Ahlerich, *Assistant Director*

Editor—Thomas J. Deakin
Assistant Editor—Kathryn E. Sulewski
Art Director—John E. Ott
Production Manager/Reprints
—Mark A. Zettler

The Cover:
Miami's approach to the narcotics problem.
(See article p. 1).
Cover design by John E. Ott.

The FBI Law Enforcement Bulletin (ISSN-0014-5688) is published monthly by the Federal Bureau of Investigation, 10th and Pennsylvania Ave., N.W., Washington, DC 20535. Second-Class postage paid at Washington, DC. Postmaster: Send address changes to Federal Bureau of Investigation, FBI Law Enforcement Bulletin, Washington, DC 20535.

ISSN 0014-5688 USPS 383-310

Selecting An Automated Fingerprint Identification System

"A comprehensive benchmark test, coupled with in-depth documentation and scientific evaluation, will provide administrators with an objective basis to select an AFIS system for their agency."

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EDITOR'S NOTE:

This article reports on benchmark testing used by the Illinois Department of State Police to select an AFIS system for their agency. It should be noted that the National Bureau of Standards and the International Association for Identification are cosponsoring the development of a National AFIS Benchmark Test Standard which is near its final phase/stage of completion.

Automated fingerprint identification systems (AFIS) are replacing labor-intensive, manual fingerprint systems in many law enforcement agencies across the country. The speed and accuracy of AFIS in searching and identifying inked fingerprints and latent prints are little less than astounding. Agencies which are considering and/or are in the process of acquiring an AFIS system know that space-age technology does not come cheap. Although the per case cost of AFIS is a bargain, the purchase of an AFIS and related costs for facilities, personnel, communications, etc., represent a major expenditure of funds.

There are several AFIS vendors, each claiming their system is superior. Thus, administrators face a difficult task in selecting the system that will best satisfy their agency's needs.

One major element of the selection process is the benchmark testing of the systems that meet the requirements specified by the agency. The Illinois Department of State Police developed and used a unique latent print benchmark test as part of its selection process. The test outlined in this article is but one of several tests developed and used by law enforcement agencies. The recommendations are based on the experience of the Illinois AFIS Task Force.

Mr. Fitzpatrick

Jeremy D. Margolis
Director of State Police

Benchmark Test

According to Webster's dictionary, a benchmark test is a "point of reference from which measurements can be made." In preparing a benchmark test, decisions have to be made as to what will be measured and what points will be used as references for the measurements. In the field of fingerprint identification, benchmark tests can be subdivided into the two basic operational areas — 10-print identification and latent print identification.

The latent print segment of the benchmark test is more complex and demanding than the 10-print segment. This is due to crime scene latent prints being chance impressions, usually consisting of a low number of minutiae deposited by various digits of the hands and areas of the fingers and thumbs. In contrast, 10-print cards contain rolled inked impressions of known digits and will contain anywhere from 50 to 150 minutiae.

AFIS systems and benchmark tests are very technical in nature, so it would be wise for administrators to appoint technical personnel to an AFIS design and selection committee at the onset of the project. The persons selected to design and develop the latent print benchmark test should be senior latent print examiners (fingerprint experts), with basic knowledge of the AFIS systems currently on the market and in use by law enforcement agencies, an in-depth knowledge of the existing latent print operational procedures, and an understanding of the benefits and changes that will result from the acquisition of an AFIS system.

What Will Be Tested

The next step is identifying what will be measured and prioritizing the measurements from paramount to desirable. The accuracy of searching and identifying 10 prints and latent prints with the inked 10-print data base is the paramount measurement of an AFIS system. Obviously, if the system cannot find the matching print, then what value is it?

Other measurements include accuracy of the minutiae being captured and stored in the AFIS system in relation to the actual minutiae recorded on the 10-print card, accuracy of the minutiae recorded on the optic disc and displayed on the verification screen for comparison and identification purposes, and the resolution of the optic disc image displayed in the screen for comparison purposes. System features should also be tested, such as the latent print auto encoder feature, CAXI search feature; split screen image placement, movement, zoom, color reversal, position reversal, and image copy quality; facsimile subsystem; and equipment ergonomics features.

As AFIS systems evolve, additional features will surface for testing. The test should be designed to obtain data pertaining to the weak and strong points of each system tested, which will be of considerable value in finalizing the actual design and operation of the selected system and in training latent print examiners. The test design should

"The accuracy of searching and identifying 10 prints and latent prints with the inked 10-print data base is the paramount measurement of an AFIS system."

Latent print examiners reviewing a latent print prior to conducting a search.

be in layers so that if two or more vendor systems are equal in the primary areas, the measuring process will proceed through the layers until one system surfaces as the most acceptable.

Test Philosophy and Protocol

Benchmark test philosophy and protocol should be established. The test should be as scientific as practical, and each agency should control all aspects of the test with minimal vendor participation. Agency latent print examiners should select the latent prints for the test and the corresponding matching 10-print cards. The latent test print minutiae that will be encoded and used for the test should be predetermined and plotted. The plotted minutiae should consist of actual minutiae that would be used in the identification of latent prints.

Agency latent print examiners should encode and search all latent test prints. No vendor suggestions or directives relative to deviating from the preplotted test minutiae should be entertained during the test. The time spent at the test site should be minimal. Any special techniques or training (such as tracing) should be provided by the vendor prior to the test. Any unique latent test print preparation tasks, such as tracing, should be performed by the agency latent print examiners prior to traveling to the test site.

The computation of the test results should be objective, using scientific and mathematical data, and subjective results should be kept to a minimum. The benchmark test should test the system and not the skills of the operator. The test commences with the conversion of the 10-print cards by the vendor and concludes after the test results are analyzed. No test results need be given to the vendor during the test, but the vendor should be permitted to research the test prints after the test is completed. The agency should review the results of vendor-conducted searches and reserve the right to include or reject the vendor-search results as part of the benchmark test.

Size of Data Base and Number of Test Prints

The size of the 10-print background data base (number of 10-print cards recorded in the test data base) is open to the discretion of the agency. In keeping with the philosophy of the Illinois test, the vendor's data base was not used and the same background

"The type of latent prints to be used in the test should be representative of the case latent prints received and processed by the agency."

data base was used in the testing of all systems. The State of Illinois elected to use 4,600 10-print cards which were selected from its own master fingerprint file and were representative of the file composition, but did not allow for demographics, such as finger number or pattern type which, in effect, forced searches against a 46,000 finger file. The number of latent test prints must be identified and can range from 50 to 100. The State of Illinois placed the number at 70; 50 latent prints had matching impressions in the 10-print data base; 10 latent prints did not have matching 10 prints in the data base, and 10 (duplicate) latent prints had matching 10-print impressions in the data base and also matched 10 of the first 50 latent test prints.

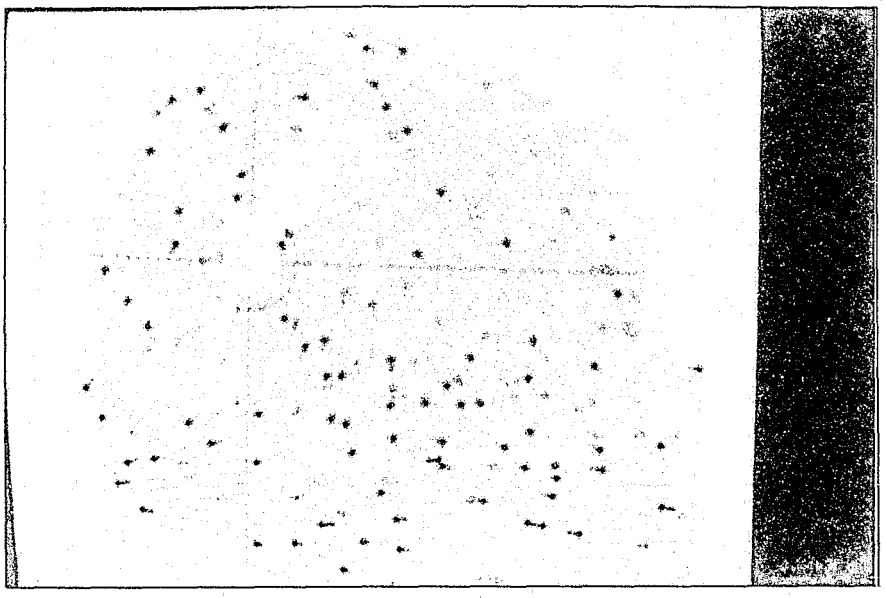
Type of Latent Test Prints

The type of latent prints to be used in the test should be representative of the case latent prints received and processed by the agency. The agency's latent print examiner(s) should prepare a specified number of latent benchmark test prints. Actual case latent prints do not have to be used for the test. There are several advantages in not using actual case latent prints. First, the location of the benchmark tests can be out of State or out of the country and the security of actual case latent prints should not be jeopardized. Also, control can be exercised in the type and minutiae number of each test print. In the event of the loss or destruction of a test print(s), a substitute can readily be developed, since latent prints developed in the laboratory are essentially the same as latent prints developed at the crime scene.

Plotting Minutiae

Minutiae are the ridge characteristics, sometimes referred to as points, that are used in the identification of latent and inked prints. The minutiae of the latent test prints and the corresponding minutiae on the 10-print card impression should be plotted, and only the plotted minutiae should be encoded and searched during the benchmark test.

The plotted test print minutiae should be documented. Each latent test print and each corresponding matching 10-print impression should be photographed and an 8" x 10" photograph (5x) made of each. The latent test print minutiae on the photograph and the corresponding minutiae on the 10-print photographic enlargement are plotted with a red felt tip pen. The documented test print minutiae photographs will be of critical value in conducting the test and evaluating the results. The photographs will be used for verifying the presence of the test minutiae in the inked and latent test prints, detecting any problem areas that the AFIS system tested may encounter in the searching of various quality impressions, and comparing the inked print minutiae captured and recorded during the conversion of the 10-print cards and the minutiae captured and stored on the optic disc image system with the actual



AFIS minutiae detection image of an inked print.