Technical Memorandum No. 8
March 1974

REPORT ON
LATENT FINGERPRINT
IDENTIFICATION SYSTEMS

Final report on work performed under Law Enforcement Assistance Administration Grant No. 73-NI-99-0035-G, awarded to the California Crime Technological Research Foundation for Project SEARCH by the National Institute of Law Enforcement and Criminal Justice.

Submitted by the
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EXECUTIVE SUMMARY

BACKGROUND

This document reports on research and development activities conducted by the Project SEARCH Committee on State Identification Bureaus and its Latent Fingerprint Subcommittee.

Project SEARCH is a cooperative effort of the criminal justice systems of the 50 states, banded together to apply technology to the criminal justice system of the United States. The work reported in this document, as well as other efforts of Project SEARCH, were funded by grants from the Law Enforcement Assistance Administration of the U. S. Department of Justice. Special appreciation is extended to Mr. Richard Velde, LEAA Deputy Administrator, for his support of the project and his personal attention to LEAA/SEARCH liaison activities.

The objective of the study reported here was to survey, document, and evaluate the existing latent fingerprint systems in use throughout the United States.

Members of the Project Committee are shown in Exhibit 0-1 and those of the Latent Fingerprint Subcommittee are shown in Exhibit 0-2. Gary D. McAlvey served as chairman of the Project Committee and Vincent Peterson served as chairman of the Subcommittee.

Administrative services were provided by the California Crime Technological Research Foundation under the direction of Douglas E. Roudabush, Executive Director. Mr. David G. Yamada served as the administrative and technical coordinator of the project and prepared Part Two of the report.

Technical staff services for the project were provided by Public Systems, inc., under the direction of Paul K. Wormeli, SEARCH Project Coordinator. Mr. Gregory Campbell acted as principal investigator for PSi on the project. Mr. John P. McGuire

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Exhibit 0-1: State Identification Bureau Project Committee

Exhibit 0-1

Project SEARCH

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Exhibit 0-2.

provided technical and analytical support and prepared Parts One and Three of the report.

This effort was conducted in parallel with a study of developing technology in areas possibly applicable to the latent fingerprint problem but not currently implemented. Examples of such areas include the development of means for automatically scanning fingerprint patterns and for classifying the scanning data into a code suitable for storage, retrieval and identification. A separate report documents the results of that effort.

This report is intended to provide police administrators, heads of crime laboratories and heads of identification bureaus with information on existing latent fingerprint systems and guidance in selecting from available single fingerprint search systems.

TASKS

In conducting the study, the following tasks were performed using the methods described.

- Existing latent fingerprint systems were identified by means of a letter and telephone survey.
- Data were collected on identified existing systems through a survey questionnaire mailed to 109 agencies.
- After a review of the 71 questionnaire responses, the subcommittee and staff selected typical latent fingerprint systems for additional study.
- Subcommittee and staff members conducted on-site reviews and documentation of nine selected systems.
- The staff evaluated the existing latent fingerprint systems using the collected data and site visit documentation.

ORGANIZATION

Following the Executive Summary, the report is organized as follows:

PART ONE: APPROACH AND FINDINGS

This part of the report presents a detailed description of each of the tasks conducted during the study and reports on their outcome. It begins on page 15.

PART TWO: OPERATIONAL SYSTEMS DESCRIPTION

This part of the report documents the information obtained concerning those latent fingerprint systems selected for intensive review and on-site visits. It begins on page 68.

Appendix A: Questionnaire Responses

This Appendix includes a sample of the questionnaire used to survey the various agencies and presents, in tabular form, the responses received to the questionnaire. It begins on page A-1.

Appendix B: Classification System Description

This Appendix presents a detailed description of each of the distinct single fingerprint classification systems reported in the questionnaire survey. It begins on page B-1.

Appendix C: Hood-Taylor Palm Print Coding System

This appendix describes a palm print coding system reported by the Shreveport, Louisiana Police Department. It begins on page C-1.

QUESTIONNAIRE RESPONSES

Of 109 questionnaires mailed, 71 responses were received from:

39* agencies with currently operational latent fingerprint identification systems;

17* agencies with latent fingerprint identification systems that are about to be operational or in the planning stage;

5 agencies with currently inactive latent fingerprint identification systems; and

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*One agency responded twice, concerning both the current system and a planned update.

11 agencies having no such system.

Of the 39 operational systems, 23 use the Miracode search and retrieval equipment. This equipment uses a fingerprint image data base and coding information which is maintained on reels of film. The film coding is searched in response to an inquiry concerning latent fingerprints.

Three operational systems used completely automated search and retrieval equipment, including computer capability and either microfilm, microfiche, or videotape image storage capability.

Thirteen operational systems employed manual search and retrieval of files of fingerprint cards.

Twenty distinct classification systems were reported as used in connection with latent fingerprint identification systems.

An analysis of the questionnaire responses is presented in Section 1-3, beginning on page 26. The actual questionnaire responses for each agency are presented in Appendix A. The classification systems are described in Appendix B.

ON-SITE VISITS OF SELECTED SYSTEMS

Based on a review of the questionnaire responses, nine agencies with operational systems were selected for intensive review and on-site visits. These agencies were selected as typical agencies having one each of:

- one of six fingerprint classification schemes,
- one of three image storage media, and
- one of three search and retrieval methods

in combinations which were representative of all the systems reported.

Exhibit 0-3 lists the nine agencies visited along with descriptive information concerning each system. A narrative of the site selection procedure is given in Section 1-2. An evaluation of the data collected from these agencies is presented in Section 1-4. Detailed descriptions of each system are presented in the Sections of Part Two listed in the last column of Exhibit 0-3.

SYSTEM SELECTION CONSIDERATIONS

Within Section 1-4, following the evaluation of the visited operational systems, the information which follows is presented to provide a range of options which a law enforcement agency administrator may consider prior to establishing a latent fingerprint system.

From all of the systems reported, four system configurations were selected as representing the basic options available. These were:

- The Miracode search and retrieval equipment employing microfilm images as the data base;
- A microfiche/microfilm image file with the capability of a computerized data base search;
- A videofile system employing a videotape image and data base file and having a computer search capacity; and
- A manual system utilizing fingerprint cards.

The system listed second is probably the most general in that it describes a configuration which, in its various forms, is available from several manufacturers.

A listing of a number of parameters that can be associated with these systems is presented in Exhibit 0-4. These parameters were developed from the collected system data.

AGENCY	STORAGE MEDIUM	SEARCH TECHNIQUE (Hardware)	CLASSIFICATION SCHEME	FILE ORGANIZATION	EQUIPMENT COST $(000s)	ANNUAL OPERATING COST	DATA BASE FILE SIZE	SYSTEM DESCRIPTION REFERENCES Section	Page
Oakland, CA P.D.	Microfilm	Computer	3 digit/finger	Microfiche (stored in order of filming.	$100	$18,000	14,000	2-1	68
Dade Co., FL P.S.D.	Fingerprint cards	Manual	5 finger (separate hands) 1-2 characters/finger	Right and left hand filed by thumb and index finger pattern and geographic area.	N/A	$10,000	7,500	2-9	197
Miami, FL P.D.	Fingerprint cards	Computer listing Manual lookup	8 character/finger (Russak)	Cards stored by ID number. Computer sort cross referenced.	N/A	$29,000	1,600	2-6	159
Atlanta, GA P.D.	Microfilm	Miracode Equipment	3 digit/finger (Miracode system)	Reels of film (stored in order of filming).	$17	$3,600	31,000	2-4	126
New Orleans, LA P.D.	Fingerprint cards (one per finger)	Manual	7 character/finger (Battley)	Each finger filed separately and according to pattern.	N/A	N/A	10,000	2-7	180
Shreveport, LA P.D.	Microfilm	Miracode Equipment	6 or 9 digits/finger (Hood-Taylor)	Cassettes of film (stored in order of filming).	$35	$34,000	5,000	2-2	86
Boston, MA P.D.	Fingerprint cards	Manual	5 finger (separate hands) 1-2 characters/finger	Right and left hand cards stored by pattern classification system order 00001, 00002,... 88888.	N/A	$18,000	35,000	2-8	190
Nassau Co., NY P.D.	Microfilm	Computer	4 digits/finger	Cassettes of film.	$72	$28,000	6,000	2-3	106
HQ, R.C.M.P.	Videotape	Computer	8 characters/finger (Battley)	Sets of fingerprints (accessible by any or all fingers) stored by geographic region on videotape in order of filming.	$1,500*	$100,000	19,000	2-5	137

*Cost of entire Videofile system

Exhibit 0-3. SUMMARY OF DESCRIPTORS FOR SYSTEMS REVIEWED

STORAGE MEDIUM	SEARCH TECHNIQUE	CLASSIFICATION SCHEME	OBSERVED DATA BASE RANGE	RECOMMENDED* DATA BASE RANGE	COST OF EQUIPMENT	APPROXIMATE NUMBER OF EQUIVALENT FULL TIME EMPLOYEES	TYPICAL ANNUAL OPERATING COST	AVERAGE MONTHLY LATENT SEARCH VOLUME	AVERAGE MONTHLY HITS	VISITED AGENCIES HAVING COMPARABLE SYSTEMS
Microfilm	Miracode	3 digit	1-31K	2-10K	$40K	0.5-1.5	$15K	30	3	Atlanta (Shreveport)
Microfiche/ Microfilm	Computer	3 digit	6-14K	8-20K	$100K**	1.5-2	$20K	50	5	Oakland (Nassau)
Videofile	Computer	Battley	19K	15-50K	$1.0M**	6-10	$100K	200	20	RCMP
Fingerprint Cards	Manual	5 finger	2-74K	2-6K	N/A	1-3	$25K	20	2	Boston Dade Co. (New Orleans)

*Based on efficiency of search and data base maintenance considerations.

**Since these equipments would not be dedicated to latent activities, the cost borne by those activities should be an appropriate percentage of the figure shown

Exhibit 0-4. LATENT SYSTEM SELECTION PARAMETERS

The classification schemes suggested for each system are not meant to be rigid. Other schemes can be employed as well. Coding schemes more complex than a three-digit one, require additional data base encoding effort. The complex Battley system is suggested for the Videofile because it has been tested operationally. A modified version of the simple NCIC system is planned for use on the Videofile system being implemented by the Illinois Bureau of Identification.

It should be noted that the recommended data base range is generally smaller than that observed in operating systems during the study. While the recommendations are intended to be flexible, they were selected as the range of file size which could be handled efficiently by the system. Manual and Miracode systems are limited to the smaller ranges of data base because of the inefficiency of manual search itself and the time involved in searching a large (many reel) film data base with the Miracode equipment.

The equipment costs, estimated number of full time equivalent employees and typical annual operating costs were developed from the survey and on-site visit data for each type of system. They are intended to indicate the various cost brackets available.

The average monthly latent search volume, while not rigid, is intended to be typical for each system having operating personnel commitments in the range listed. The expected "hit" rate, while basically unpredictable, is chosen as ten per cent of the search volume for each system.

SUMMARY OF FINDINGS

The following is a summary of the principal findings of the study:

- A variety of single fingerprint classification schemes are in use throughout the United States. The range of such schemes runs from simple systems classifying one or two parameters per finger to complex systems classifying as many as eight to ten parameters per finger.
- The classification scheme used by an agency is not necessarily a function of the filing or search procedures employed, but some classification schemes tend to be used in conjunction with certain search and retrieval equipment.
- The amount of detail included in a classification scheme affects the selectivity of the search procedure. In general, the more complex (detailed) the classification scheme, the smaller the number of candidates returned in response to a search argument.
- The storage media used for fingerprint images were in most cases fingerprint cards stored in file drawers or microfilm images stored on reels of film or in microfiche equipment. Two agencies reported use of video tape for storage of fingerprint images. The search and retrieval methods used included: manual search of fingerprint card files; electro-mechanical equipment for searching reels of film using a light scanning device to read coding on the film; and computer equipment to allow programmed search of data base parameters maintained on computer storage devices, e.g., discs, and tied to fingerprint image files.

- Because of the increased selectivity of classification systems employed with automated search equipment, the actual time (reviewing candidates' cards) used in automated search is much less than that for a manual system. Even with the limited data available, this tends to justify the cost of automatic search equipment. The drawback to this conclusion is the cost of reclassifying a manual file data base to a new system suitable for use with automatic search equipment.
- A large percentage of the questionnaire respondents had placed their latent fingerprint systems in operation only a short time ago or were about to do so. Consequently, some of the responses are only estimates based on limited operation.
- All latent print systems have various minimum ridge detail requirements. It should be understood that no latent print system known today will handle all latent fingerprints.

RECOMMENDATIONS

Recommendations are made for law enforcement agency administrators to consider when establishing latent fingerprint systems.

- The cost effectiveness of a latent system should be considered in relation to that of other investigative processes.
- The labor savings provided by automated systems justifies their initial cost.
- Available computer capability that can be used in conjunction with search and display equipment to establish a latent system should be considered.

Recommendations for further research are:

- More accurate measurement should be made of system performance parameters, including selectivity and reliability.
- A review of the operation and productivity of latent systems, particularly those that have recently become operational is recommended for approximately two years in the future.
- Operational testing of automatic fingerprint classification equipment should be undertaken. This is recommended because of the large amount of effort expended by agencies in manual classification of fingerprints.

PART ONE

APPROACH AND FINDINGS

Section 1-1

INTRODUCTION

This report documents the technical activities in support of the Project SEARCH Latent Fingerprint Study. Project direction was provided by the Latent Fingerprint Subcommittee of the Project SEARCH State Identification Bureau Project Committee. The purpose of the study was to survey, document, and evaluate the existing latent fingerprint systems throughout the United States and the system at the Royal Canadian Mounted Police Headquarters. This report is intended to provide police administrators, heads of crime laboratories, and heads of identification bureaus with information on existing latent fingerprint systems and guidance in selecting from available single fingerprint search systems.

The six tasks performed in conducting this study were:

1. the identification of existent latent fingerprint systems;
2. the collection of data on existing systems;
3. selection of typical latent fingerprint systems for review;
4. on-site review and documentation of selected systems;
5. existing system evaluation; and
6. project documentation.

Each of these tasks is described in detail in the remainder of the report.

The responses obtained to a survey questionnaire mailed to 109 agencies are presented in Appendix A. The details of all manual single fingerprint classification schemes reported are given in Appendix B. The description of a palm print

classification system reported is contained in Appendix C. It should be noted that this document does not report on the Subcommittee and staff efforts to investigate the state-of-the-art and newly emerging technology in the area of automatic scanning and classification of fingerprint patterns. A report to be published separately will document that activity.

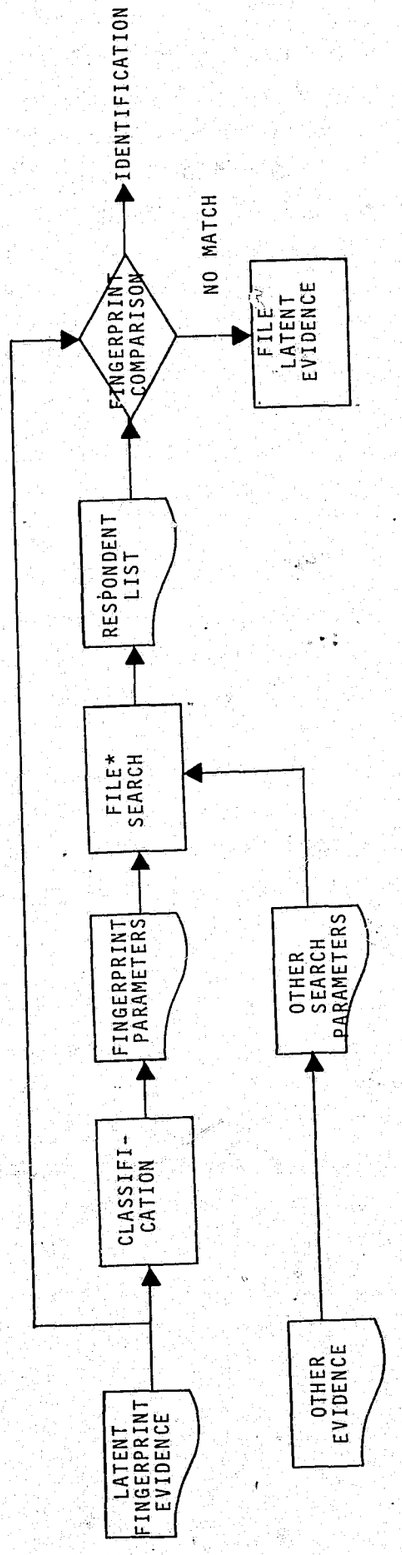
THE LATENT FINGERPRINT EVIDENCE IDENTIFICATION PROCESS

To provide a framework for the discussion of the various tasks undertaken in the study and the subsequent material presented in the report, a brief description is given here of the processes involved in attempting to identify suspects from latent fingerprint evidence. Two basic processes will be described: the first is the search of latent fingerprint evidence against the files of fingerprints of individuals known to have committed the types of crimes that generally result in latent fingerprint evidence; the second is the search of the fingerprints of individuals, charged with certain kinds of crimes, against latent fingerprint evidence of previously unsolved cases accumulated in the files.

Latent fingerprint evidence is presented to fingerprint examiners to effect identification by comparing the latents with existing inked fingerprints. Procedures involved in searching latent fingerprint evidence against a file of offenders can be described with reference to Exhibit 1-1-1. The latent fingerprint evidence is studied and classified according to some system devised for cataloging the parameters of the fingerprint pattern and detail. There are quite a number of such classification schemes, which are described later in the report. All of them result in fingerprint parameters which enable the technicians to perform a search against the file of fingerprints of known offenders. The files are

organized according to the parameters used in the classification scheme of the agency under consideration. Frequently other evidence, such as a witness report, enables the technician to employ other search parameters--a suspect description for instance--in the file search, as indicated in Exhibit 1-1-1. After the search has been completed a respondent list, that is, a list of possible candidates whose fingerprint parameters agree with those on which the search was based, is available to the technician. In the case of a manual system, the actual fingerprint cards constitute the list to be searched. A comparison of the latent fingerprint evidence and the fingerprints of the respondent is usually made visually and if a sufficient number of identification points occur, then an identification for this particular case results. If no identification occurs, then the latent evidence is filed with the other open cases involving latent fingerprint evidence. The process just described is the one most commonly used by law enforcement agencies in attempting to solve crimes using latent fingerprint evidence. As a consequence, most of the descriptions of classification schemes, search techniques, file organization and image storage media given in the remainder of the report are related to fingerprint systems which employ this process.

The second process, that is, searching the fingerprints of new arrestees against the files of open cases involving latent fingerprint evidence, is used in many places. It is less formal in that it usually involves a manual search procedure and does not involve investment in a great deal of equipment. A number of agencies responding to the questionnaire indicated that they do not employ this procedure.

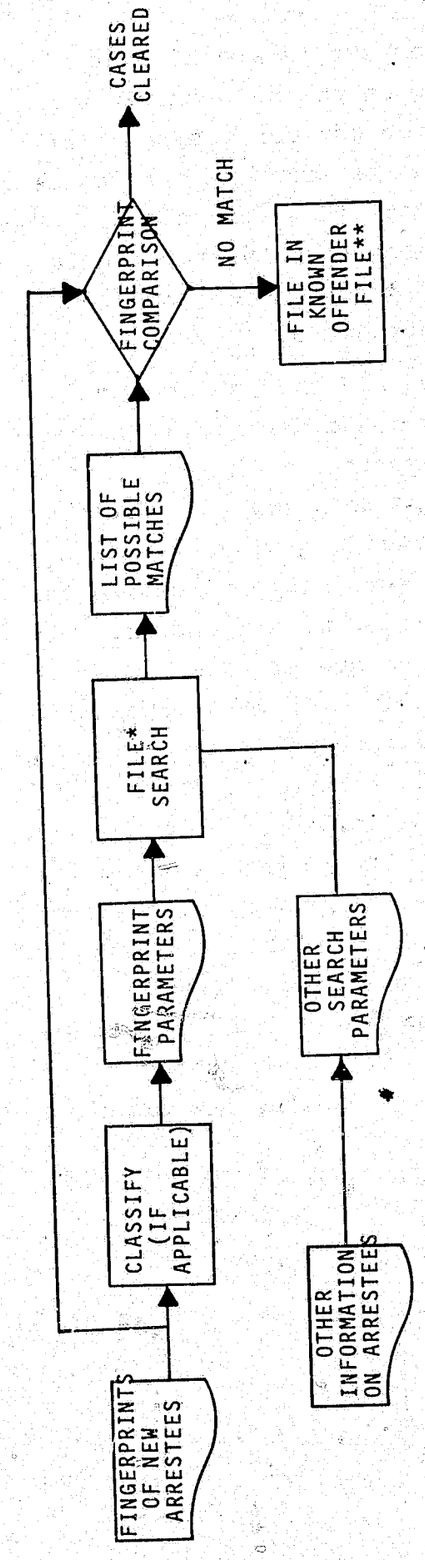


*FILE OF KNOWN OFFENDERS (APPLICABLE OFFENSES)

Exhibit 1-1-1. PROCESS OF SEARCHING LATENT FINGERPRINT EVIDENCE AGAINST FILED FINGERPRINTS

The fingerprints of certain new arrestees are of interest. For example, narcotics arrestees might be the suspects in some burglary cases because of the connection between the need for funds to support a narcotics habit and the frequent burglarizing of property to obtain merchandise or materials for sale for ready cash. Some agencies have indicated that this particular search process has a high payoff among juveniles who may tend to operate repeatedly in the same geographic area.

The fingerprint cards are examined and the pattern type of the various fingers noted. This enables the technician to perform the search. Classifying the fingerprints with anything more than some rudimentary scheme, such as pattern type, is probably not fruitful because the file is generally organized by crime type and then by individual case, with notations indicating the pattern types of latent evidence associated with the crime. In any case, having the pattern types of the new arrestee, a search is made against the open cases (see Exhibit 1-1-2) to determine whether any open cases contain the same pattern type that might be examined in more detail. Occasionally, there is other information on the arrestees, such as modus operandi (MO) or the geographic area in which he was arrested or suspected of having operated. These parameters can help to narrow down the search, by limiting the area of the file to be searched. After cursory search, a list of possible cases in which a match could take place results. Comparison of the fingerprints with the latent either results in cases that are cleared or not matched. In the case of no match, the fingerprint cards of the new arrestee may be filed in the known offenders file.



*FILE OF OPEN CRIMINAL CASES INVOLVING LATENT FINGERPRINT EVIDENCE

**IF APPROPRIATE

Exhibit 1-1-2. PROCESS OF SEARCHING FINGERPRINTS OF NEW ARRESTEES AGAINST FILE OF OPEN CRIMINAL CASES INVOLVING LATENT FINGERPRINT EVIDENCE

Section 1-2

SYSTEM IDENTIFICATION, DATA COLLECTION, AND SITE SELECTION

This section of the report describes the first three tasks of the study.

SYSTEM IDENTIFICATION

The initial activity of the project was to identify, as far as possible, all significant latent fingerprint storage and retrieval systems within the United States. This was accomplished by sending letters of inquiry to the managers of all state identification bureaus with a telephone follow-up where warranted and by making inquiries of the members of the Project SEARCH State Identification Bureau Project Committee concerning existing latent fingerprint systems which had come to their attention. In addition, a list of agencies that had purchased the Kodak Miracode microfilm search equipment for use with fingerprint information was obtained.

The names of agencies obtained in these ways were used to compile a mailing list for a questionnaire concerning latent fingerprint storage and retrieval systems. It was realized that many but not all of the agencies with latent systems could be identified in this way. Nevertheless, the list was large enough for selection of typical systems of various types.

DATA COLLECTION

Having established a list of agencies thought to have latent fingerprint systems, a survey questionnaire was designed to be self-administered by representatives of the agencies. The questionnaire contents was based on a list of substantive data elements

developed during conduct of the task. These included: classification scheme; filing scheme; geographical area served, population served; implementation date; minimum fingerprint detail for search; search parameters (other than fingerprint information); data base size; criteria for inclusion in data base; purge criteria; search and identification rates; classification and search times; use of palm prints; staffing, source of latent evidence; elimination print submission procedure; and desirable improvements to the latent system.

A reproduction of the questionnaire format is presented in Appendix A.

After an initial mailing to 109 agencies, 54 responses were received. A follow-up letter to initial non-respondents resulted in 17 additional responses for a total of 71 responses.

The returned questionnaires were analyzed for similarities and differences and to provide information for the next task: the selection of a number of systems for intensive review. The responses to the questionnaire are presented in Appendix A and the results of the questionnaire analysis are presented in Section 1-3. In general, there were four respondent groups: those with operational systems; those planning or installing new systems; those with deactivated (no longer operational) systems; and those with no systems.

SITE SELECTION

The initial analysis of the questionnaire responses served to divide the various respondents into natural categories. The basis for such a division was the variety of classification schemes the types of storage media for fingerprint cards and the search techniques employed.

There were, among the respondents, six classification schemes with a number of variations. The six schemes were:

- A 3-digit (basic Miracode) system
- A 4-digit extension of the 3 digit system
- The Russak system (Miami, Florida Police Department)
- The Battley system
- The five finger (separated hand) system
- The Hood-Taylor (6 and 9 digit) systems.

A description of all the classification systems reported by the questionnaire respondents is presented in Appendix B.

Three storage media were reported for fingerprint images: fingerprint cards, microfilm and videotape. Three search techniques were also reported: manual search, computer aided search and the Miracode (light scan/coded film) search system.

In selecting latent fingerprint systems for intensive review, a cross section of respondents with operational systems was selected in order to include each of the listed classification schemes, storage media, and search techniques. Exhibit 1-2-1 shows the agencies selected by the Latent Fingerprint Study Subcommittee in accordance with the above criteria and indicates which of the selection parameters the agency's system satisfies. The Dade County Public Safety Department's Latent System had characteristics found among the other sites. However, because the questionnaire response indicated a relatively large number of identifications and because it was located in the same city as the Miami Police Department, it was added to the list.

To conduct the intensive review of these agencies' latent systems, one member of the technical staff and at least one member of the Subcommittee visited the agency and were briefed on the operations of the system. (In the case of the Royal Canadian

Exhibit 1-2-1

LATENT FINGERPRINT SYSTEMS SELECTED FOR INTENSIVE REVIEW AND SYSTEM PARAMETERS

STATE/AGENCY	CLASSIFICATION SCHEME							STORAGE MEDIUM			SEARCH TECHNIQUE		
	3 DIGIT	4 DIGIT	RUSSAK	BATTLEY	5 FINGER	HOOD - TAYLOR		CARDS	MICROFILM	VIDEOTAPE	MANUAL	COMPUTER	MIRACODE
CALIFORNIA													
Oakland P.D.	X								X			X	
FLORIDA													
Dade Co. P.S.D.					X			X			X		
Miami P.D.			X					X				X	
GEORGIA													
Atlanta P.D.	X								X				X
LOUISIANA													
New Orleans P.D.				X				X			X		
Shreveport P.D.						X			X				X
MASSACHUSETTS													
Boston P.D.					X			X			X		
NEW YORK													
Nassau Co. P.D.		X							X			X	
CANADA													
HQ, R.C.M.P.				X						X		X	

Mounted Police, only a member of the technical staff reviewed the system.) The documentation resulting from the site visits is presented in Part Two of this report.

Section 1-3

QUESTIONNAIRE ANALYSIS

In this section of the report, the questionnaires received in response to the survey of agencies that were assumed to have latent fingerprint identification systems are analyzed. A total of 109 questionnaires were initially distributed through the mail. Within three weeks, 54 responses had been obtained. A follow-up letter was used to encourage a response from those who had not returned the questionnaire. Subsequently, 17 questionnaires were received resulting in a total of 71 responses.

A review of the preliminary questions on the questionnaire resulted in a sorting of the responses into four groups:

- Agencies with currently operational latent fingerprint identification systems.
- Agencies with latent fingerprint identification systems that are about to be operational or in the planning stage.
- Agencies with latent fingerprint identification systems that are currently inactive.
- Agencies with no latent fingerprint identification system.

Exhibit 1-3-1 lists the responding agencies sorted according to these groupings. The questionnaire analysis in this section is based principally on the responses in Group 1 concerning operational systems. Some brief description is given concerning the implementation plans of the respondents in Group 2. The responses of those in Group 3 can be found in Appendix A. It should be

Exhibit 1-3-1

Agencies Responding to Survey Questionnaires

Group 1: Operational Latent Fingerprint Identification Systems

ALASKA
Anchorage Police Department

CALIFORNIA
Berkeley Police Department
Los Angeles County Sheriff
Los Angeles Police Department
Oakland Police Department
Orange County Sheriff's Department
Sacramento Police Department

FLORIDA
Dade County Public Safety Department
Miami Police Department
Palm Beach County Sheriff's Department
West Palm Beach Police Department

GEORGIA
Atlanta Police Department

HAWAII
Honolulu Police Department

ILLINOIS
DuPage County Sheriff's Office

KANSAS
Kansas City Police Department

LOUISIANA
New Orleans Police Department
Shreveport Police Department

MASSACHUSETTS
Boston Police Department

MINNESOTA
Minneapolis Police Department

MISSISSIPPI
Jackson Police Department

MISSOURI
Kansas City Police Department

NEW JERSEY
Atlantic County Sheriff's Department
East Orange Police Department

NEW YORK
Nassau County Police Department
New York Division of Criminal Justice Services
Rochester Police Department

NORTH CAROLINA
Charlotte Police Department

OHIO
Cincinnati Police Department
Cleveland Department of Public Safety

OREGON
Wasington County Sheriff's Office

TEXAS
Austin Police Department
Brownsville Police Department
Galveston Police Department
Harlingen Police Department
McAllen Police Department
Texas Department of Public Safety

VERMONT
Vermont Department of Public Safety

WEST VIRGINIA
Charleston Police Department

CANADA
Headquarters, Royal Canadian Mounted Police, Ottawa, Ontario

Group 2: Planned Latent Fingerprint Identification Systems

CALIFORNIA
Los Angeles County Sheriff

COLORADO
Denver Police Department
Lakewood Department of Public Safety

FLORIDA
Pensacola Police Department

GEORGIA
Savannah Police Department

ILLINOIS
Illinois Bureau of Identification

MARYLAND
Baltimore Police Department
Montgomery County Department of Police

NEW JERSEY
Elizabeth Police Department
Jersey City Police Department
Newark Police Department
Paterson Police Department
Trenton Department of Public Safety

OHIO
Columbus Police Department
Toledo Police Department

OKLAHOMA
Tulsa Police Department

OREGON
Portland Bureau of Police

Group 3: Currently Inactive Latent Fingerprint Identification Systems

CALIFORNIA
California Department of Justice
Richmond Police Department

KANSAS
Kansas Bureau of Identification

PENNSYLVANIA
Pittsburgh Bureau of Police

VIRGINIA
Norfolk Police Department

Group 4: No Latent Fingerprint Identification Systems

ALABAMA
Huntsville Police Department
Montgomery Police Department

CALIFORNIA
San Diego Sheriff's Department

DELAWARE
Delaware State Police

DISTRICT OF COLUMBIA
Washington I.D. Bureau

ILLINOIS
Chicago Police Department

MARYLAND
Baltimore County Police Departme

NEVADA
Division of Identification and Communications

NEW JERSEY
Vineland Police Department

OKLAHOMA
Ardmore Police Department

PENNSYLVANIA
Philadelphia Police Department

noted that most of the agencies responding that their system was currently inactive, indicated that the reason for this was either a lack of funds or a lack of sufficient manpower to operate the system effectively. Some of the agencies are anxious to return the system to an operational status.

Analysis of Questionnaires Received from Operational Systems

The initial analysis of the questionnaire responses from operational systems was performed by grouping them according to population and comparing the responses to questions in the survey concerning data base, size, the volume of searches, identifications, etc. The respondents were then further subdivided according to the age of the system, the times required to classify a set of fingerprints for the files, search times, etc. The second sorting initially divided the respondents into those having a Miracode search and retrieval system, those having automated search and retrieval equipment of other manufacturers, and those having manual systems. This initial sorting was further divided according to the single fingerprint classification system employed by the agency.

An initial sorting of the questionnaire responses was made according to the population served by the agency responding. For several population groupings, a chart was prepared listing the jurisdiction of the agency, the population, the date of implementation, the size of the data base, the number of searches and hits per month, indication of whether the system was automatic or manual, the times required to classify sets of prints, to classify latent prints, to enter data into the search and retrieval system, the average search time, the classification system, and the number of full-time equivalent employees operating the system (e.g., 2 employees spending 50 per cent of time = 1 full-time equivalent employee).

Examination of the responses within the various population groups indicated no particular unifying thread that would tend to lead to a conclusion regarding any of the described parameters on the basis of population. There was, for instance, no correlation between the size of the latent fingerprint data base and the population served. When consideration was given to the age of the system, that is, how long it had been in operational status, it was observed some of the older systems did have larger data bases than those systems recently in operation. This is certainly a reasonable situation because of the time and cost involved in converting and implementing a data base and the relatively short time allowed for this in new systems. Certainly the very large systems, such as the Los Angeles Police Department and the Los Angeles County Sheriff's Office, which have been in operation for several years, had quite large data bases. Thus, in isolated cases, if one compared a small number of respondents one could conclude that larger cities and older cities had larger data bases, but when all the respondents were included together such generalizations tended to break down. Because of the nonproductiveness of this initial sorting of the respondents, a second sorting procedure was initiated as described below.

Of the forty respondents indicating they had a currently operational latent fingerprint identification system, twenty-three of them indicated that the Kodak-Miracode search and retrieval equipment was employed in their system. Because of this predominance, it was decided to sort the respondents into those using the Miracode equipment and those not using it, and to further sort the group that did not use the Miracode equipment into those having automated search and retrieval facilities and those using manual search techniques.

Miracode Search and Retrieval Equipment Systems

The questionnaire responses from the twenty-three agencies with currently operational Miracode search and retrieval

equipment were grouped together for comparison purposes. Becauses this was a large group and all members of the group are using equipment with essentially the same capabilities, the group was further subdivided. The next more reasonable grouping is according to the fingerprint classification scheme employed by the agency. This grouping is not only convenient, but natural, because the comparison to be made among some of the parameters, such as the time required to classify a set of prints or a latent print and the time required to enter the data into the system, is related to the detail of the classification system. Six respondents from the State of Texas employ a six-digit classification system developed by the Texas Department of Public Safety. Ten of the agencies responding use a three-digit classification scheme which was developed in conjunction with the Miracode equipment. Two of the respondents use the Hood-Taylor classification scheme and the five other agencies with Miracode equipment use different classification schemes.

Six-Digit Texas DPS System

The six-digit classification scheme developed for the Miracode system by the Identification and Criminal Records Division of the Texas Department of Public Safety is used by five of the municipal police forces responding to the quesionnaire survey as well as by the Texas Department of Public Safety itself. The DPS provides latent fingerprint identification services for a section of central Texas. A summary of comparative information from these agencies is presented in the top portion of Exhibit 1-3-2. A brief review of the exhibit for the six-digit Texas Department of Public Safety classification scheme systems reveals the following: with the exception of Galveston, all the systems require from fifteen to twenty minutes to classify a set of ten prints and require from twenty

AGENCY	JURISDICTION	POPULATION (1,000s)	DATE OF IMPLEMENTATION	DATA BASE	SEARCHES/HITS	AUTO/ MANUAL	CLASS. TIME FOR 10 PRINTS (min.)	TIME TO ENTER DATA (min.)	LATENT CLASS TIME (min.)	AVG. SEARCH TIME (min.)	FULL TIME EQUIVALENT MANPOWER	CLASS. SYSTEM
Austin, Texas PD	City	300	1/73	1,000	20-25/1-2	A(MC)*	20	40	2	20	1.35	TX DPS
Brownsville, TX PD	City Cameron Co.	67/140	12/71	3K	30/Unk.	A(MC)	20	30	15	3	.6	TX DPS
Galveston, TX PD	City	70	71-2	600	10-20/none	A(MC)	90	varies	5	1-2	1.9	TX DPS
Harlingen, TX PD	2 counties	400	71	1,500/ 18,000 cards	?/0	A(MC)	15	20	10	Unk.	.6	TX DPS
McAllen, TX PD	Region	...	71	500	25/0	A(MC)	15	30	5	Unk.	0.15	TX DPS
Texas D.P.S.	Central State	...	8/71	8.1K	16/0	A(MC)	20	25	10	180	3.0	TX DPS
Sacramento, CA PD	County	690	3/71	11.3K	23/2.7	A(MC)	5	10-15	1	30	2.3	3 digit
Palm Beach, FL SO	County	320	71	11K	0/0	A(MC)	5	Unk.	3	Unk.	0.6	3 digit
Atlanta, GA PD	City & Co.	1,450	68	31K	30/21	A(MC)	3-5	7-8	.5	Unk.	1.0	3 digit
DuPage Co., IL SO	County	500	71	8K	100/?	A(MC)	7	Unk.	1-4	Unk.	1.2	3 digit
Kansas City, MO PD	Metro area	1,500	9/70	16K	300-400/8-10	A(MC)	5-8	8-10	5	180	4.0	3 digit
Rochester, NY PD	City	300	70	10.2K	20/1	A(MC)	15	22	0.5	60	0.5	3 digit
Charlotte, NC PD	County	400	11/70	6,000	100/very minute	A(MC)	3	10	1	30	2.2	3 digit
Cleveland, OH DPS	City	750	10/71	6K	10-15/0	A(MC)	Unk.	Unk.	1-2	10(est)	0.45	3 digit
Washington Co., OR Sheriff's Office	County	180	5/72	7K	?/?	A(MC)	5	Unk.	5	3	1.0	3 digit
Charleston, WV PD	Metro area	270	1/73	700	5/1 in 10 mo.	A(MC)	20	45	2	15	2.2	3 digit
Shreveport, LA PD	Metro area	385	71	15K	250/20	A(MC)	5	20	10	Unk.	3	6&9 dig. H-T
Jackson, MS PD	Metro area	288	1/73	1,300	?/?	A(MC)	20	Unk.	4-5	Varies	1.5	9 digit H-T
Berkeley, CA PD	City	116	1/73	5K	50/0	A(MC)	12	30	3	30	0.05	3 digit spec.
Honolulu, HI PD	State	801	71	1.2K	40/0	A(MC)	4	10	1	45	2.5	3 digit spec.
Orange Co, CA SO	County	1,750	2/72	2.4K	NA/NA	A(MC)	10	35	1	Unk.	0.5	6 digit spec.
Cincinnati, OH PD	Metro area	500	9/71	10K	20-30/0	A(MC)	5-10	20	1	30-45	6.0	6 digit spec.
Anchorage, AK PD	City	78	1/73	12K	20/1 in 10 mo.	A(MC)	3	15	0.5	45	0.75	NCF

*Miracode

Exhibit 1-3-2. MIRACODE CLASSIFICATION SYSTEMS

to forty minutes to enter the data into the system. With the exception of Brownsville, all the systems require from two to ten minutes to classify a latent fingerprint. If the search can be confined to one reel of film, then the average search time is relatively short. As the search requires use of additional reels of film, the search time increases appropriately. As indicated, a search through the files of the Texas Department of Public Safety can take as long as three hours. The age of all of these systems is between one-half and two years old. There appears to be some variation among the agencies as to the number of searches conducted in a month. There have been a very small number of identifications made using the respective systems. There also appear to be variations from one agency to the next concerning the number of full-time equivalent employees in the latent fingerprint identification section. The manpower employment reads from a low of 0.15 man-months per month to a high of 3. The latter system has a fairly large data base compared to most of the others. However, there was no direct relationship between the size of the data base, the number of searches conducted a month, and the number of full-time equivalent employees.

Three-Digit (Miracode) Systems

The responses from ten agencies using the Miracode retrieval and storage equipment indicated that a three-digit fingerprint pattern classification scheme was employed. This particular three-digit system has been developed by the Atlanta Police Department for use with the Miracode equipment. A tabular presentation of the pertinent responses from these agencies is shown in the center section of Exhibit 1-3-2. A review of the entries in this exhibit indicates the following common information: for most respondents the time required

to classify a set of ten fingerprints varied from three to eight minutes. However, one indicated that it took fifteen minutes and another twenty minutes. Similarly, the time required to enter the information into the Miracode system ranged from seven to twenty-two minutes with one exception at forty-five minutes. The time required to classify a latent fingerprint ranged from one-half to five minutes. In general, the search times varied with the size of the file, a reasonable expectation. One agency data base was contained on one reel of film and thus a search of the data base was extremely fast. However, in most cases the data base was spread out over several reels of film. Some searches require use of more than one reel of film which adds to the search time. The number of searches conducted by the agencies in a month varied among the agencies with no correlation among the other parameters. The number of identifications also varied slightly, but was almost uniformly small. The age of most of the systems ranged from one-half to three years, with the exception of the Atlanta Police Department's equipment which has been in operation for five years. The number of full-time equivalent employees working on the latent area for these system ranged from approximately one-half man month per month to almost 2.5 man months per month.

Other Classification Systems

The remaining seven respondents employing Miracode equipment had among them four different classification systems. Exhibit 1-3-2 (bottom) indicates the relevant parameters obtained from the questionnaire responses from these agencies. Two of the respondents listed employ the Hood-Taylor six or nine digit classification scheme developed by the Shreveport (Louisiana) Police Department. The next two employ a three-digit special classification scheme and the last one the

three-digit NCF classification scheme. Because of the small number of agencies using each of these classification schemes, no particular comparative conclusions can be drawn from the data other than merely examining it for its content.

Other Operational Latent Fingerprint Identification Systems

In this section, the survey questionnaire responses received from agencies having operational latent fingerprint identification systems which did not employ the Kodak-Miracode automatic search and retrieval equipment are analyzed. Of the sixteen responding agencies, only four employed automatic means for search or data retrieval. The remainder had entirely manual systems. As in the case of Miracode systems, a suitable basis for comparison is found by first dividing the respondents according to the fingerprint pattern classification scheme. The two principle groupings are the five-finger classification system employed by nine respondents, and the Battley & Russak classification systems employed by five respondents. Two other respondents had distinct and individual classification schemes.

Five-Finger Classification Systems

In the five-finger classification scheme, the rolled fingerprints of the left and right hand are recorded on separate cards, classified independently according to the patterns and stored separately in two files (for more information on the classification systems refer to Appendix B). All eight of the respondents with operational systems employing the five-finger classification scheme used a manual search procedure in the separate right and left hand files. A listing of the comparable responses by the agencies employing these systems is presented in Exhibit 1-3-3. The time required to classify a set of ten

AGENCY	JURISDICTION	POPULATION (1,000s)	DATE OF IMPLEMENTATION	DATA BASE	SEARCHES/HITS	AUTO/ MANUAL	CLASS. TIME FOR 10 PRINTS (min.)	TIME TO ENTER DATA (min.)	LATENT CLASS TIME (min.)	AVG. SEARCH TIME (min.)	FULL TIME EQUIVALENT MANPOWER	CLASS. SYSTEM
Los Angeles, CA PD	City	2,800	1957	74K	Varies/2	M	3	5	Varies	?	0.1	5 finger (FBI)
Los Angeles CO SO	County	7,000	1965	50K	15-20/4-5	M	1	3		10	2.0	5 finger
Dade Co.,FL PSD	County	1,400	1965	7.5K	75-100/10-15	M	5	10	10	60	7.2	5 finger
Boston, MA PD	City	700	1950	35K	100/20	M	3	5-7	Unk.	Unk.	0.9	5 finger
Minneapolis, MN PD	City	435	Before 1960	5K	?/?	M	2	10	Unk.	60	Unk.	5 finger
E. Orange, NJ PD	City	79	1960	3K	NA/NA	M	3	5	Unk.	Unk.	0.1	5 finger
New York (DCJS)	State (except NYC)	8,000	1960	40K	NA	M	0.75	10	Unk.	days	3.5	5 finger
Vermont DPS	State	450	1969	2500	Var/0	M	2.5	5	1	5-30	.8	5 finger (del core)
Miami, FL PD	City	352	1962	2200	?/?	Semi A	15-20	Week	3-5	20	1.5	Russak
Kansas City, KS PD	City	175	1969	300	10/0	M	30	55	Unk.	Unk.	0.15	Battley
New Orleans, LA PD	Metro area	1,000	1930	10K	100/20	M	5	10	Unk.	1.0	1.0	Battley
Atlantic Co., NJ SO	County	175	1962	900	?/1	M	15	20	5	20	.7	Battley (1 fgr.)
Canada (R.C.M.P.)	National	22,000	10/73	19K	200/8	A	20	3	5-10	15	9.0	Battley
Oakland, CA PD	City	360	9/72	13.5K	25/1	A	6	Unk.	3	20	1.75	3 digit (spec.)
W. Palm Beach, FL PD	City	60	?	125	100/1	M	N/A	Unk.	N/A	60	0.1	5 finger
Nassau Co., NY PD	County	1,500	10/73	6K		A	10	15	1	2	1.55	4 digit (spec.)

Exhibit 1-3-3. OTHER CLASSIFICATION SYSTEMS

prints among these respondents varied from one to five minutes, with one exception, in which the respondent indicated it required ten minutes. The time required to enter data into the system was listed as varying from three to ten minutes. The time required to classify a latent fingerprint was generally unknown. However, two respondents indicated it required one minute to make such a classification and one respondent indicated it took ten minutes. For manual systems with data base sizes ranging from 3,000 cards to 74,000 cards it is not surprising that the variation in search time, indicated by the respondents should be quite large. In fact, they range from five minutes to a number of days (in the case of the New York State DCJS with a data base of 40,000 cards). The number of searches per month and the number of identifications made varied among the respondents. This variation is accounted for not only by the size of the data base but also by the level of effort employed by the various agencies. The full-time equivalent level of effort ranged from .01 of a man month per month to 7.2 man months per month. The number of identifications per month was listed as between ten and fifteen by the Dade County, Florida, Public Safety Department. As discussed in Part Two, a good number of these identifications are made by searching the fingerprint cards of newly arrested individuals against the file of open cases containing latent fingerprint evidence. The age of the systems employing the five-finger classification scheme varied from those that were fairly recently installed (three years or less) to one that had been in operation for twenty-three years. In general, although the variation in population served among these agencies ranged from 79,000 to 8,000,000, it can be stated that the data base size tended to grow with the population served, with one or two exceptions. The fact that a number of these systems have been in existence for quite a while indicates that their operation had reached a stable condition and that their data base size was reflective of the number of potential offenders in the area that were known.

Battley and Russak Systems

Four of the respondents employ the Battley single fingerprint classification scheme. In the Battley manual system all the prints from a given finger are filed together. Each finger is classified separately. (More information on this system can be found in Appendix B.)

The Russak system employed by the Miami Police Department has certain similarities to the Battley system. Therefore, it is described here also. Of the five respondents in this category, all had manual systems except the Royal Canadian Mounted Police. This agency has a Videofile system which stores the fingerprint images on video tape along with a digital track containing classification and identification information. Computer software and hardware are used for file search and storage and for display on television-type (CRT) screens. (For more information on this particular system refer to description in Part Two.) The search equipment employed by the Miami (Florida) Police Department can be termed a semi-automatic system, in that the classification information associated with all the fingerprint cards in the file is put on computer cards and read into a computer. Standard sort routines are employed to print out the entire file according to the classification parameters of the contents. Thus, when a latent fingerprint is classified, the file printout can be checked to determine whether any of the cards in the file have the same classification parameters as that of the latent evidence. If there are such candidates, then the listing indicates the locations in the manual file where fingerprint cards of the candidates can be

found. The search list can be updated as often as new information is available and the computer can be accessed for using that sort program. A listing of the pertinent parameters for the respondent systems employing the Battley and Russak classification schemes are also presented in Exhibit 1-3-3. The time required to classify a set of ten prints in this system varied from five to thirty minutes, while that required to enter data into the system varied from ten to fifty-five minutes. The time required to classify a latent print varied from one-half to fifteen minutes. The average search time for two of these systems was listed as unknown, while that for the others was between fifteen and twenty minutes. The number of searches per month ranged from ten to 200, although two of the respondents indicated that they did not know the answer to that question. The number of identifications ranged from one to eight per month. The systems employed ranged in age from three months to forty-three years and the data base size ranged from 300 in the case of a small city of 175,000 population to 19,000 for the RCMP serving a population of 22 million. Similarly, the number of full-time equivalent employees ranged from 0.15 man months per month for a small city of 175,000 to 9 man months per month in the case of the RCMP, providing services as requested throughout Canada.

Other Systems

The pertinent factors associated with the two other respondents in this category who had distinct single fingerprint classification schemes are also shown in Exhibit 1-3-3. Because of the different classification schemes and the small number of entries in the exhibit, a visual comparison and review of these parameters can be made by the reader.

Analysis of Questionnaires from Nearly Operational and Planned Latent Fingerprint Identification Systems

While the complete questionnaire response from those agencies indicating that a latent fingerprint identification system was

about to be implemented or in the planning stages is contained in Appendix A, some comments are made here concerning the overall responses in this category. Four of the respondents indicated that they were installing Miracode search and retrieval equipment and one other has indicated that it had not decided what search and retrieval equipment it would employ. The remaining 12 did indicate the equipment that would be used in their new system.

Seven large cities in New Jersey will be participating in the New Jersey State Datum Latent Fingerprint Microfilm Retrieval System which was being installed by the State Law Enforcement Planning Agency. Five of the respondents to the questionnaire will be employing the system. Project Datum will equip each of the police departments with an autonomous, fully automated system which automatically stores, retrieves, and displays selected images. The equipment employed is the Ragen MRS90 microfilm retrieval system which is described in Part Two for the Nassau County (New York) Police Department intensive review analysis.

Exhibit 1-3-4 lists five agencies that are planning latent fingerprint identification systems that will employ computer equipment to aid in the storage and retrieval operations. The exhibit lists the planned equipment and the proposed implementation date for those systems.

The response from the Baltimore (Maryland) Police Department indicates that they are planning to implement a manual file in one section of the city to assist in updating their latent fingerprint capabilities. The questionnaire response from the Portland (Oregon) Police Department indicated that they are planning to install a computer-based retrieval system which could be used in the latent fingerprint problem area; however, at this time the exact equipment to be employed in the system has not been determined.

Exhibit 1-3-4

Selected Planned Latent Fingerprint Identification Systems

Agency	Equipment Planned	Operational Date
Los Angeles, CA Sheriff's Office	computer search	1974
Denver, CO Police Department	computer/microfilm	1974
Illinois, Bureau of Identification	Videofile	1976
Columbus, OH Police Department	computer/microfilm	5/74
Montgomery County, MD Police Department	3M Micro-Disc	FY1975

Conclusion

The questionnaire responses that have been summarized here are presented in complete form in Appendix A. The most uniform comment among the respondents was in the area of system improvement. With few exceptions, the answers indicate that those responding, i.e., those operating the systems, feel the need for additional personnel to operate the complete system effectively. Interestingly enough, this is also the reason given for the current inactivity of some systems.

Section 1-4

EVALUATION

In Section 1-2, a description was given of the selection of nine operational latent fingerprint identification systems for intensive review and site visits. The detailed description resulting from this review, the visits, and the questionnaire responses are presented in Part Two of the report which follows this section. However, in order to present the evaluation of these latent fingerprint systems, a brief summary of the system descriptions is included here.

The nine systems were chosen to represent the various fingerprint image storage media and search techniques and the basic classification schemes reported in the questionnaire responses. At each of the systems visited, the following system operations and equipment were reviewed, observed and discussed:

- Overall system description.
- System hardware, including computers where applicable.
- Data base, including file organization, and storage media.
- Operational procedures, including search, data entry, file update and purging procedures.
- Classification system, including classification parameters and coding scheme.
- Personnel, including percentage of time associated with the latent system and qualifications.
- System selectivity and potential system improvements.

Exhibit 1-4-1 presents a summary of the qualitative system descriptions observed in the system review.

AGENCY	STORAGE MEDIUM	SEARCH TECHNIQUE (Hardware)	CLASSIFICATION SCHEME	FILE ORGANIZATION
Oakland, CA P.D.	Microfilm	Computer	3 digit/finger	Microfiche (stored in order of filming.
Dade Co., FL P.S.D.	Fingerprint cards	Manual	5 finger (separate hands) 1-2 characters/finger	Right and left hand filed by thumb and index finger pattern and geographic area.
Miami, FL P.D.	Fingerprint cards	Computer listing Manual lookup	8 character/finger (Russak)	Cards stored by ID number. Computer sort cross referenced.
Atlanta, GA P.D.	Microfilm	Miracode Equipment	3 digit/finger (Miracode system)	Reels of film (stored in order of filming).
New Orleans, LA P.D.	Fingerprint cards (one per finger)	Manual	7 character/finger (Battley)	Each finger filed separately and according to pattern.
Shreveport, LA P.D.	Microfilm	Miracode Equipment	6 or 9 digits/finger (Hood-Taylor)	Cassettes of film (stored in order of filming).
Boston, MA P.D.	Fingerprint cards	Manual	5 finger (separate hands) 1-2 characters/finger	Right and left hand cards stored by pattern classification system order 00001, 00002,... 88888.
Nassau Co., NY P.D.	Microfilm	Computer	4 digits/finger	Cassettes of film.
HQ, R.C.M.P.	Videotape	Computer	8 characters/finger (Battley)	Sets of fingerprints (accessible by any or all fingers) stored by geographic region on videotape in order of filming.

Exhibit 1-4-1. SUMMARY OF QUALITATIVE DESCRIPTIONS OBSERVED IN SYSTEM REVIEW

SYSTEM	M/A ?	CLASS SYSTEM	FILE SIZE	POTENTIAL FILE SIZE (CAPACITY)	SEARCH TIME	CLASS TIME	LATENT CLASS TIME	CLASS SYST. PARAMETERS (PER FINGER)	MONTHLY SEARCHES/HITS
1. Oakland, CA Police Dept.	A Computer/MF	3 digit special	14K	25K	20 sec -2 min	6	3	3	25/1
2. Dade Co., FL Pub. S. Dept.	M	5 finger (thumb & index only)	7.5K	Unlimited except for manpower requirements for search.	60 min (15-480) (8 hr)	5	10	.2	75-100 / 10-15
3. Miami, FL Police Dept.	Semi A	Russak 8 char	1.6K	Unlimited	20 min	15-20	3-5	8	?/?
4. Atlanta, GA Police Dept.	A	3 digit (Miracode)	31K	Storage limits on films (?)	? 30-90	3-5	1/2	-3	30/2
5. New Orleans, LA P. D.	M	Battley	10K	Unlimited except for manpower required for search.	? (lengthy)	5	1/2	7	100/20
.6. Shreveport, LA P. D.	A (Miracode II)	Hood-Taylor	5K	# of films to be stored limitation	Unknown	5	1/6	-6 or 9	250/25
7. Boston, MA Police Dept.	M	5 finger	35K	Search manpower limitations	?	3	?	-2	100/20
8. Nassau Co., NY P. D.	A	4 digit special	6K	300K	2 min 7 sec-8 min	10	1	4	?/?
9. R.C.M.P.	A	Battley	19K	Unlimited	15 2-30	20	5-10	8	200/8

**A - Right slope loop
B - Plain whorl
C - Twin loop

***Cost of entire videofile system

Exhibit 1-4-2. COMPARISON PARAMETERS FROM VISITED SYSTEMS

SELECTIVITY (% OF FILE) A	B	C	HARDWARE COST	ANNUAL OPERATING COST MATERIALS	WAGES	MECHANICAL RELIABILITY	DISPLAY IMAGE	IMPROVEMENTS
3.28	0.043	0.69	$100K	$3,000	$15,000	O.K. after shakedown	Minutia had to be compared from original point	Optical scanner magnifying capability for images. Higher retrieval rate. Variable ridge count range as search parameter.
67	67	18	~~0~~	--	$10,000	N/A	N/A	Automated search & retrieval.
ø	ø	.125	N/A	--	$29,000	N/A	Viewer	Computer storage of punched card info. Auto display unit to operate in conjunction with computer file (more personnel).
.6	1	.4	$17K	--	$3,600	Adequate	Adequate	Update to Miracode II (more personnel).
			N/A	--	--	N/A	N/A	Automation (more personnel).
8.5	0	0	$35K	$1,200	$32,500	Quite Good	Adequate	None (more personnel).
65	15	15	N/A	--	$18,000	N/A	N/A	Reduce file size by removing individuals who are "too old".
0.22	0.77	0.12	$72K	--	$28,000	Minor jams initially	Magnification required	None (more personnel).
0.92	0.12	0.36	$1.5M***	$126,000	$100,000	OK	Adequate	None.

Exhibit 1-4-2 (Continued) COMPARISON PARAMETERS FROM VISITED SYSTEMS

Having presented a description of each system, it is desirable from the point of view of the objectives of the study to make comparisons among the systems with respect to certain qualitative and quantitative factors. The remainder of this section begins with an introductory discussion of the potential benefits to be obtained from latent fingerprint identification systems and what is involved in establishing a system. Following that, an evaluative comparison is made among the nine latent fingerprint identification systems that were investigated. Finally, a discussion is presented concerning the suitability of the various system configurations to the variety of operational situations encountered in law enforcement agencies.

Potential Benefit of Latent Fingerprint Identification Systems

A law enforcement administrator who is giving consideration to the potential benefits of a latent fingerprint system would want to know what was involved in establishing such a system and what potential payoff it could have for his agency. One can argue that the efforts involved in operating a latent fingerprint identification system are fairly inefficiently spent. For example, figures in Exhibit 1-4-2 indicate as much as $1,200 in labor cost per identification for some systems. This is not to say that those involved in such a system are not extremely effective in conducting their work, but merely to indicate that if one considers the number of identifications made with the cost involved that one could conclude that the productivity was not very high. Unfortunately, such a conclusion must also be made for many of the detection activities involved in solving crimes. For example, the many hours spent by detectives in searching out clues to a crime cannot be evaluated only on a cost-effectiveness basis. If the premise is accepted that crime solving can be costly, but that with no investment no crimes are solved, then the only reasonable approach to this

problem is to accept the fact that such activity may seem relatively unproductive from a cost point of view, but from the point of view of clearing cases, particularly cases that would not have been cleared otherwise, the establishment of the latent fingerprint identification system in crime solving is, for all practical purposes almost a necessity.

Lest one conclude that most current latent fingerprint search activity is relatively unproductive, it should be pointed out that certain approaches to latent fingerprint analysis can occasionally have very high payoff. For example, the Dade County Public Safety Department has made it a practice to search the fingerprints of all arrested juveniles against the file of unsolved cases involving latent fingerprint evidence. Once such comparisons are made in the geographical area of residence of juveniles, a relatively large number of identifications have been made and as a result a significant number of cases have been cleared. The principal reason for such successful activity is the fact that these particular criminals have a tendency to repeat the same crimes several times in the same area. The first few times they are arrested, they are usually released to the custody of their parents and to them this seems like only a minor inconvenience leading them to be encouraged to become recidivists in their criminal activity.

Another reason for the effectiveness of searching new arrest cards against latents of unsolved cases is the fact that approximately half of all new arrestees have no previous arrest record although they may have committed crimes and left latent prints. Searching latent evidence against arrest cards would not result in identifications in such cases whereas searching new arrest cards against latents of unsolved cases could result in a "hit".

To establish a latent fingerprint identification system, an operationally useful data base must be established and allowed to expand. The source of data for the data base is the fingerprint files of old and current arrestees for those types of crimes which are likely to result in latent fingerprint evidence at the crime scene. Determination of the size of the data base and its contents is necessarily a compromise between the desire to have as much potentially useful information in the file as possible and the necessary requirement to search the file in a reasonable amount of time during the routine processing. This is particularly true in manual systems wherein the search effort is necessarily slow and increases directly with the file size.

This suggests that an agency administrator considering the establishment of a latent fingerprint identification system would want to consider an automated search and retrieval procedure (as will be discussed later). The cost of some of this automated equipment is not prohibitive and it does result in a significant saving in the labor involved in searching files.

In addition to the equipment costs, the administrator would want to consider the trade-offs to be obtained by choosing one classification system over another. The various classification systems have been discussed in the report and in detail in Appendix B. A brief evaluative discussion of them is presented here. The trade-offs involved in selecting a classification system are between a simple one, requiring relatively little time for classification of fingerprints and a complex classification scheme which requires additional time for classification of prints and entry into the data base. The simple system, however, results in considerable time involved in searching the data base while the complex system results in a much smaller number of search respondents (and search time), particularly when

significant detail is available from the latent fingerprint evidence. An administrator should consider the capability of his agency to gather sufficient fingerprint evidence from the scenes of crimes being conducted in the community to make his data base useful. Clearly, a community which has no crime problem in the sense that the criminal activity resulting in latent evidence very seldom occurs, is not a likely candidate for establishing a latent fingerprint identification system and investing the funds involved in establishing the necessary data base. On the other hand, an administrator of an established latent fingerprint identification system should want to consider the criteria to be used for purging the data base on a regular basis. In manual systems in particular, the need to keep the data base to a manageable size conflicts with the requirement that as many potential candidates as possible remain in the data base.

Summary

It is recommended that the administrators of law enforcement agencies considering latent fingerprint identification systems objectively compare the productivity of such a system with other criminal detection activity, such as the criminalistics laboratory, the detective effort, and even the productivity of routine patrol which, like so many other activities in this area, cannot be evaluated on a cost-effectiveness basis alone because of the difficulty of establishing an objective function to be optimized.

EVALUATIVE COMPARISON OF LATENT FINGERPRINT IDENTIFICATION SYSTEMS

To determine the effectiveness and efficiency of the typical latent fingerprint system examined in detail during this study, the data collected during the intense examination of these systems is reviewed. The summary of a number of the qualitative and quantitative parameters determined for each of the nine systems examined is presented in Exhibit 1-4-2. This exhibit presents

a number of significant system descriptors culled from the narrative description of each system presented in Part Two. In order that a reader may readily examine the data and follow the discussion concerning the systems evaluations, the effectiveness of the latent fingerprint identification systems examined is perhaps best described in terms of the number of identifications made by the agencies. These identifications, or "hits," vary among the agencies. However, in comparing the agencies examined in detail with the other agencies responding to the questionnaire, it is noted that the agencies examined in detail (whose latent fingerprint identification systems have been fairly well established) have a great many more identifications on a monthly basis than those agencies whose latent system has only recently become operational. The comparison of the number of "hits" to the number of searches for these agencies results in a rather narrow range for this ratio, varying between one in five to one in twenty-five. These figures give testimony to the effectiveness of the systems. But because, in most cases, they are estimates rather than calculated numbers, an actual comparison among them to determine which system is most effective would not result in a valid conclusion.

The ability of the latent fingerprint systems to handle the quality of fingerprint impressions commonly found at crime scenes was examined. In many cases, the latent fingerprints obtained at scenes of crimes and used as a basis for searching the data base may have many undesirable characteristics, such as smudges or smears, or may be difficult to completely classify. Naturally, the more detail available in the latent fingerprint, the better able the system and its operating technicians are to properly classify the print and searching the data base for it. If the print quality is marginal, then the amount of detail available for classification is limited. In the classification schemes requiring considerable detail to completely fill out the classification coding, a marginal fingerprint will result in a

number of uncoded search parameters. In other words, a marginal fingerprint will call for a search of a greater portion of the file than would have been necessary had the parameters been known. With relatively simple classification schemes (for example, the five-finger system which has at most only two parameters per finger), the poorer quality prints can be completely classified much more readily than with the classification schemes which require more detail. Both result in a large number of respondents in return for search. The former case occurs because of the nature of the classification system and the latter case occurs because of uncertainties in the coding. It is concluded that all of the systems examined are capable of handling the quality of fingerprint impressions commonly found at crime scenes.

In those systems employing display equipment, the quality of the images displayed and the adequacy of the display equipment itself was considered. The observation made on-site concerning the display adequacy and the image clarity was that all of the systems having such equipment provided sufficiently clear image quality and an adequate display for the requirements of operation. The operators of the equipment at the Oakland (California) Police Department indicated that to compare minutia points, it was necessary to refer to the original fingerprint card and use a magnifying glass. As a result, one of their desired improvements was a magnification for the display images.

Quantitative Capability and Growth Ability

The capability of the various systems to handle the quantity of crime scene data potentially available and the ability to grow as the workload increases was examined. The parameters which affect the ability of the system to handle

the quantity of available data are the file size, the search and retrieval times of the file, and the times involved in classifying both the latent fingerprints and the data base. It is clear from examination of Exhibit 1-4-2, particularly with respect to the search times (when they were provided by the respondents), that a great deal of time and man-hours are expended in the search activity in manual file systems. The ability to expand such systems as the quantity of the latent prints increases will be limited by the ability of the available personnel to conduct searches of the file in reasonable periods of time.

Without question, for manual systems, the larger the file size gets the more time is involved in conducting a search and this can be characterized as quite unproductive time. The solution employed by some of the systems has been to purge the file at an inordinate rate so that the search time is reduced. The wisdom of such a purging procedure can be challenged in that the reason the fingerprint cards are in the file is the possibility that the individual will be a recidivist and will leave latent fingerprints at crime scenes. Unfortunately, the cost of converting a manual system with an extensive file over to some automated system involving a new classification scheme is considerable. The automated search and retrieval equipment also increases search time with the number of searches. However, because of the relative efficiency of the automated search equipment compared to the manual systems, the comparison is not so drastic. The Miracode equipment in general tends to be midway in search time between the more sophisticated automated equipment which has the entire data base to search in one location and the manual system which is inherently time consuming. The reason the Miracode is in between is the fact that the data base is usually contained on several reels of film which have to be loaded manually by the operator in order to search more than one role of film.

The growth ability of the systems all appear to be unlimited. From a storage point of view, however, the searching ability associated with unlimited growth in a manual system, is considerably deteriorated. For the Miracode systems, increasing the data base results in additional reels of film to be searched. For the more sophisticated automated systems, such as the Nassau County system where the search parameters are maintained on a computer disk, increasing the data base is constrained only by the storage capability of disk which, with adequate initial planning, can be made sufficient for a substantial amount of time.

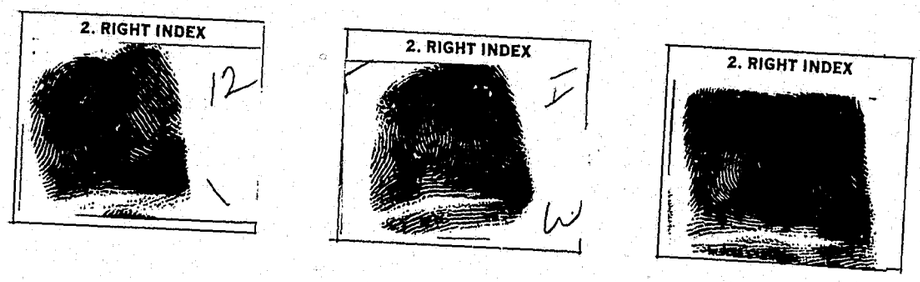
The classification times for the systems examined depend on the detail required in the classification scheme. Naturally, those classification schemes such as the Battley System that result in a number of parameters being examined, result in more time being required to classify a set of fingerprints than is required in a fairly simple system. The five finger system, for example, requires only two parameters per finger. The classification time has more effect on the time involved in maintaining and expanding the data base than it does on handling the quantity of latent fingerprints obtained from crime scenes.

SELECTIVITY

To examine the selectivity of the systems visited, three cards containing a single fingerprint pattern of a right index finger were presented to the personnel operating the system for classification, coding and search against the file. For manual systems, a rough estimate was given of the number of cards, or percentage of the file, to be searched and compared. For automated systems, a search against the file was made for each print to determine the number of respondents. Exhibit 1-4-3 shows the three fingerprint patterns; a right slant loop with a ridge

Exhibit 1-4-3

FINGERPRINT PATTERNS USED IN SELECTIVITY EXPERIMENT



count of 12, a plain whorl with an outer trace and a twin loop wi an inner trace. Exhibit 1-4-4 indicates the data collected in the selectivity experiment. From a comparative evaluation of the results of the selectivity experiment it can be stated that as a function of classification system, the more detailed classification systems appear to be much more selective than those in which a limited amount of information is contained in the classification coding. The gap in selectivity between the five finger and the other systems is quite substantial. The differences in selectivity among the other systems are comparatively small. The five finger classification systems, of course, are used with the manual files and, as is evidenced here, a great deal of searching through the manual files is required even when a very good latent print is used. It is only fair to say that were the search being made with real latent fingerprint evidence, in which some or possibly several of the parameters of the detailed classification schemes could not be interpreted from the print, then the spread in the selectivity among the systems would, probably, not have been as great. The reason for this is that, given actual latent fingerprints, some of the classification parameters could not be coded into the search procedure and so a search would have to be made over a larger portion of the file and would result in more candidates. Hence, the classification scheme could not be considered as selective as it had been in the case of "perfect" latents.

RELIABILITY

The reliability of the latent fingerprint search and retrieval system is defined as the probability that a correct match, if present, will be returned with the search candidates. The principal factor affecting the reliability of this system is the classification system. When a technician is classifying the latent fingerprint evidence, each time he makes a decision concerning a classification parameter, he does so with a certain reliability; that is, there is a certain percentage of a chance he makes an error. In general, the more decisions made in

AGENCY	FILE SIZE SEARCHED	RIGHT SLANT LOOP RESPONDENTS & (%)	PLAIN WHORL RESPONDENTS & (%)	TWIN LOOP RESPONDENTS & (%)
Oakland, CA P.D.	14,000	458 (3.28)	6 (0.043)	97 (0.69)
			1,000 (67)	1,000 (67)
Dade Co., FL P.S.D.	1,500	275 (18)	0 (0)	2 (0.125)
Miami, FL P.D.	1,600	0 (0)	5 (1)	2 (0.4)
Atlanta, GA P.D.	500	3 (0.6)		
Shreveport, LA P.D.			0 (0)	0 (0)
6-digit code	5,753	49 (8.5)	-	0 (0)
9-digit code	3,248*	0 (0)		
	*all fingers		(15)	(15)
Boston, MA P.D.	35,000	(65)	17 (.77)	3 (.13)
Nassau Co., NY P.D.	2,200	5 (.22)	3 (.12)	9 (.36)
HQ, R.C.M.P.	2,517	23 (.92)		

Exhibit 1-4-4: Selectivity Experiment Data

classification, the greater the chance of making an error. Thus, a classification system that results in a two character code for a search, can be deemed more reliable than one that results in a ten character code, because of the possibility that more errors may be made in deciding on the ten characters to code than in the two.

The review of the selected latent fingerprint identification systems, did not allow for conducting a reliability experiment. However, some additional discussion of the factors affecting reliability can be presented. The principal classification errors occur in the tedious portions of the classification such as making ridge counts and conducting pattern tracings. To overcome errors in these parameters, the best procedure is to conduct a search with a tolerance allowed. For instance, if a fingerprint pattern has a ridge count of 9, then the search could be conducted with the ridge count varying from perhaps 7 to 11. Allowing the tolerance would increase the likelihood of making a "hit" if a matching card is in the file. The effect of allowing this tolerance is that additional search time is required. In manual systems, with their already large search times, the additional searchs required to improve reliability become almost prohibitive. With automatic search and retrieval equipment, the tolerance spread for parameters such as ridge count can be built into the software or specified by the searcher. Because of the relatively faster searching performed by the automated equipment, the search time would not appear to be as greatly increased by allowing tolerances in the automated equipment as in the manual equipment.

COSTS

The cost data for the hardware, where applicable, and for the ongoing operation of the systems examined is presented in Exhibit 1-4-2. As far as hardware is concerned, the costs for the automated equipment range from $17,000 in the case of Miracode I system through $35,000 for a Miracode II system

through $72,000 for the Ragen equipment at Nassau County Police Department to $100,000 for the Oakland Police Department system. The Royal Canadian Mounted Police equipment is considerably more expensive than the other systems described. However, it is so unique that comparison of it with the others is not justified. First of all, the RCMP's system is not dedicated to the latent problem, but is time shared with the basic identification function performed by RCMP. The operating costs, which are principally the personnel costs of the various United States systems, ranged from $4,000 to $32,000 per year. However, the $10,000 cost given for the Dade County Public Safety Department reflects an estimate of the labor involved in searching the manual five finger system file. The personnel costs for the entire latent group is just under $128,000. This includes efforts spent in evaluating the latent data collected in the field and searching incoming arrestees against the file of open latent cases, which is a principal activity of the group.

Because the range of personnel costs for the United States is not very great and because in the questionnaire response nearly all the agencies indicated the desire for additional personnel, it is concluded that additional expenditures for personnel would probably be productive in the department so desiring it and a comparison of costs reflected here would be a comparison of systems not necessarily operating at the same productivity level. From the hardware cost point of view, it is fair to say that the hardware costs are reflective of the capability purchased. Clearly the more money invested in hardware, the more sophisticated the response. The suitability of the investment would have to vary with the desire and the needs of the agency.

In response to inquiries during the site visits, most of the automated systems were said to be generally mechanically reliable in the estimate of the operators. Naturally, all of them had shakedown problems after the intial installation, but

currently, all appear to be operating smoothly. None of the automated systems observed appear to present any special operator or maintenance training requirements on the personnel available to the latent fingerprint groups. On the contrary, it appeared that the trained fingerprint technicians are eager to learn the requirements of the new automated equipment and expand their capabilities.

SYSTEM SELECTION CONSIDERATIONS

The previous discussion has attempted to describe the potential benefits to be derived from a latent fingerprint identification system and to make evaluative comparisons among those systems analyzed during the study. In this section an effort is made to present, in a concise form, a range of options which a law enforcement agency administrator may consider prior to establishing a latent system.

From all of the systems reported, four system configurations were selected as representing the basic options available. These are:

- The Miracode search and retrieval equipment employing microfilm images as the data base;
- A microfiche/microfilm image file with the capability of a computerized data base search;
- A videofile system employing a videotape image and data base file and having a computer search capacity; and
- A manual system utilizing fingerprint cards.

The system listed second is probably the most general in that it describes a configuration which, in its various forms, is available from several manufacturers.

A listing of a number of parameters that can be associated with these systems is presented in Exhibit 1-4-5. These parameters were developed from the collected system data.

STORAGE MEDIUM	SEARCH TECHNIQUE	CLASSIFICATION SCHEME	OBSERVED DATA BASE RANGE	RECOMMENDED* DATA BASE RANGE	COST OF EQUIPMENT	APPROXIMATE NUMBER OF EQUIVALENT FULL TIME EMPLOYEES	TYPICAL ANNUAL OPERATING COST	AVERAGE MONTHLY LATENT SEARCH VOLUME	AVERAGE MONTHLY HITS
Microfilm	Miracode	3 digit	1-31K	2-10K	$40K	0.5-1.5	$15K	30	3
Microfiche/ Microfilm	Computer	3 digit	6-14K	8-20K	$100K**	1.5-2	$20K	50	5
Videofile	Computer	Battley	19K	15-50K	$1.0M**	6-10	$100K	200	20
Fingerprint Cards	Manual	5 finger	2-74K	2-6K	N/A	1-3	$25K	20	2

* Based on efficiency of search and data base maintenance considerations.

** Since these equipments would not be dedicated to latent activities, the cost borne by those activities should be an appropriate percentage of the figure shown.

Exhibit 1-4-5. LATENT SYSTEM SELECTION PARAMETERS

The classification schemes suggested for each system are not meant to be rigid. Other schemes can be employed as well. As indicated before, more complex coding schemes than a three digit one, require additional data base encoding effort. The complex Battley system is suggested for the Videofile because it has been tested operationally. A modified version of the simple NCIC system is planned for use on the Videofile system being implemented by the Illinois Bureau of Identification.

It should be noted that the recommended data base range is generally smaller than that observed in operating systems during the study. While the recommendations are intended to be flexible, they were selected as the range of file size which could be handled efficiently by the system. Manual and Miracode systems are limited to the smaller ranges of data base because of the inefficiency of manual search itself and the time involved in searching a large (many reel) film data base with the Miracode equipment.

The equipment costs, estimated number of full-time equivalent employees and typical annual operating costs were developed from the survey and on-site visit data for each type system. They are intended to indicate the various cost brackets available.

The average monthly latent search volume, while not rigid, is intended to be typical for each system having operating personnel commitments in the range listed. The expected "hit" rate, while basically unpredictable, is chosen as ten per cent of the search volume for each system.

Conclusions

Listed below are the principal conclusions that can be drawn as a result of the evaluation.

1. All latent systems involving manual encoding of prints are highly labor intensive and require a substantial manpower commitment to be effective.

2. The data base for established latent systems varied between 10,000 and 35,000. These relatively small files (compared to those of state identification bureaus) are required to make the systems manageable.

3. The time required to classify arrest fingerprint cards (generally 5-10 minutes) is the greatest labor expense in all systems requiring manual encoding.

4. Automated search systems (such as Miracode and computer/microfilm systems) provide greater flexibility and search speeds than manual search systems.

5. The labor savings provided by automated systems justifies their initial cost.

6. The amount of detail included in the fingerprint classification scheme affects the selectivity of the search procedure. In general the more complex (detailed) the classification scheme, the smaller the number of candidates returned in response to a search argument.

7. A large percentage of the respondents have placed their latent fingerprint systems in operation only a short time ago or are about to do so. Consequently, some of the responses are only estimates based on limited operation.

8. All latent print systems have various minimum ridge detail requirements, it should be understood that no latent print system known today will handle all latent fingerprints.

Recommendations

A law enforcement agency administrator should consider the following points in deciding whether or not to develop a latent fingerprint searching capability:

1. The cost-effectiveness of a latent system, as indicated in Exhibit 1-4-2, should be considered in relation to that of other investigative processes.

2. To establish a latent fingerprint capability, the initial investment in a modest automated search and retrieval capability is justified by the saving in labor cost over that of a manual system.

3. The additional features available in a computer/microfiche system as compared to a Miracode system should be closely reviewed from a difference in cost standpoint. The availability of a computer capability that can be used in conjunction with a microfiche system for establishing a latent system is probably more cost effective than a Miracode system.

4. For a large data base system, the Ragen system of automated cassette mounting provides a convenience and search time advantage over Miracode. The cost comparison should be made in consideration of data base size and search time saving.

5. An agency with a Videofile system should consider using it on a time-shared basis for the latent fingerprint application.

The following research in the latent fingerprint area is recommended:

1. An experiment should be performed to accurately measure system performance parameters, including selectivity and reliability for a selected number of latent fingerprint systems.

2. A review of the operation and productivity of latent systems, particularly those that have recently become operational is recommended. Agencies should be encouraged to collect accurate data on productivity. The recommended time frame for such a review is approximately two years hence.

3. Operational testing of automatic fingerprint classification equipments should be undertaken. This is recommended because of the large amount of effort expended by agencies in manual classification of fingerprints.

PART TWO

LATENT FINGERPRINT

OPERATIONAL SYSTEMS DESCRIPTION

Section 2-1

OAKLAND POLICE DEPARTMENT
CRIME FILE SYSTEM

INTRODUCTION

The Oakland Police Department began operating its unique CRIME file system (Computer Retrieval of Identifiers and Modus Operandi Elements) in September of 1972. With the use of the CRIME file system, officers are able to obtain information on vehicles and to retrieve mugshots and fingerprints of suspects. This study is centered on the use of the CRIME file system to search latent fingerprints against fingerprints of known offenders.

GENERAL SYSTEM DESCRIPTION

Hardware

The hardware for the CRIME file system consists of a main computer site and two remote terminals as illustrated in Exhibit 2-1-1. The main computer site contains a Hewlett-Packard 2100A mini-computer, a tape reader, two disk files and a system console teletype printer as shown in Exhibit 2-1-2. Each remote terminal consists of a teleprinter, a microfiche viewer (display unit), and a display keyboard for automatically advancing microfiche images in the display unit. The microfiche viewer is manufactured by Image Systems, Inc. (see Exhibit 2-1-3).

Equipment Operation

System control is handled at the main computer site. Here, information is added, modified or deleted from the system. Information is keypunched on computer punch cards from information supplied on standard input forms and then entered into computer memory.

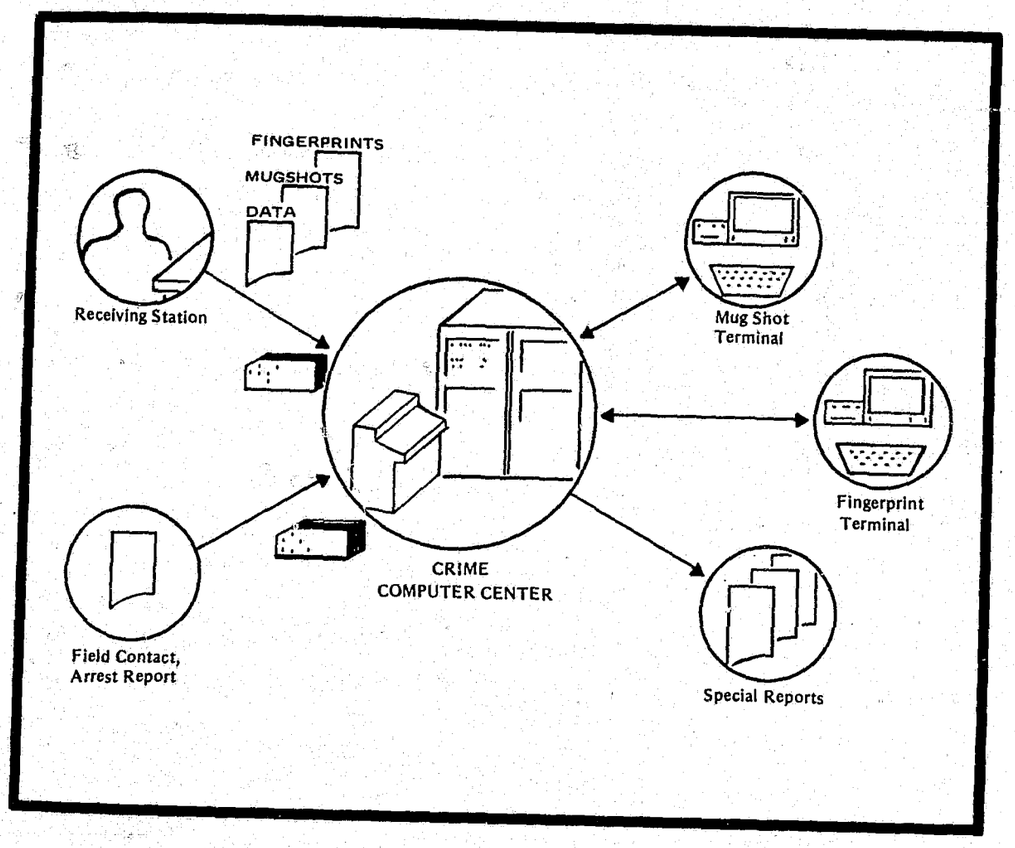


Exhibit 2-1-1. Components of the CRIME Computer System

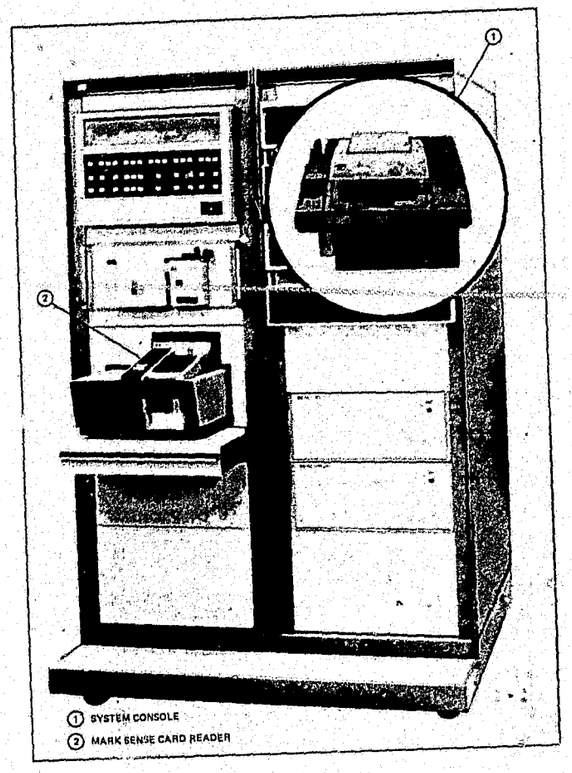


Exhibit 2-1-2

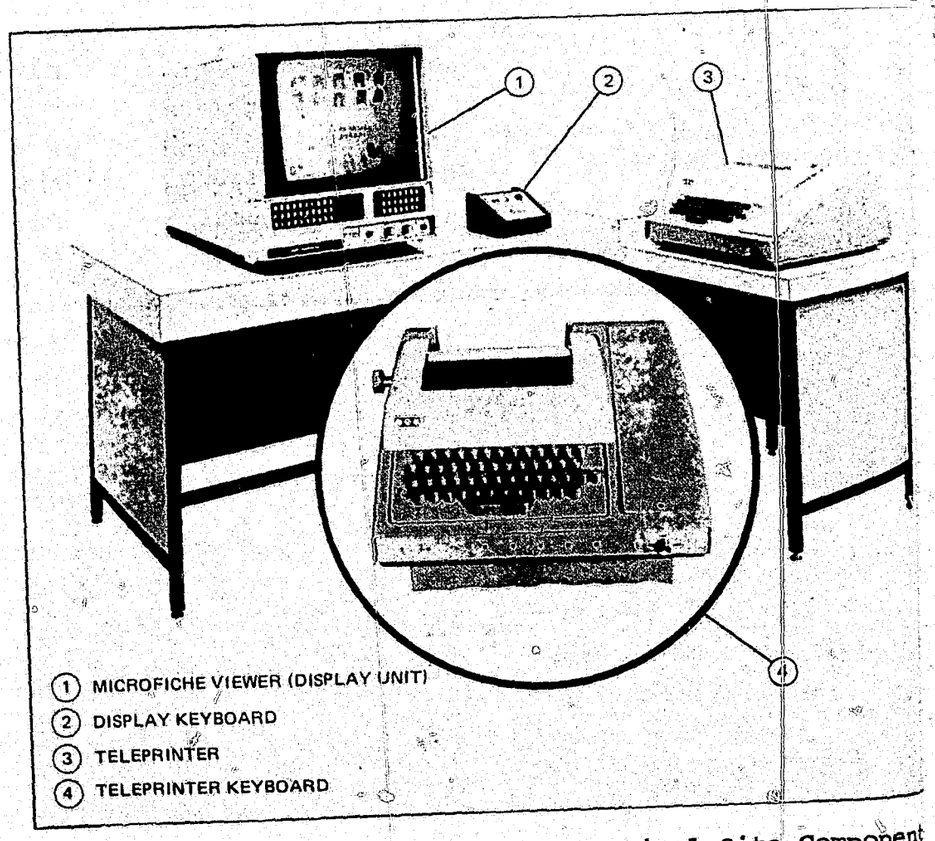


Exhibit 2-1-3. Terminal Site Component

The system is accessed from the two remote terminals. Officers key-in information on suspects, vehicles or fingerprints. The computer prints a listing of possible makes based upon the information keyed into the computer. From this listing, the officer may then call up a visual display of mugshots or fingerprint cards by using the computer address given on the printed listing. In the case of fingerprint cards, the computer will automatically load the microfiche display unit. Fingerprints are called up for matching on the display unit by the fingerprint technician.

File Organization

The CRIME file system contains two major files: a vehicle file and a subject file. The vehicle file contains intelligence data on vehicles, collected from officers in the field, and includes a description of the vehicle and individuals in the vehicle. The subject file contains personal descriptive information and modus operandi information, as well as the fingerprint classification of individuals. The subject file can be accessed by the two previously described remote terminals. Because the file contains both descriptive information and fingerprint classifications, descriptive information can be used in the search of a latent fingerprint.

The CRIME file system has the capacity to hold over 25,000 individuals. At the present time, 14,000 individuals have been entered into the system. Three subject types are put into the system: (1) parolees released by the California Department of Corrections, (2) persons arrested for felonies and selected misdemeanors, and (3) persons selected by police officers as likely suspects.

Unidentified latents are stored in a separate manual file and are divided into crime type and the year the crime was committed.

COST AND PERFORMANCE DATA

Equipment Cost

The CRIME file system costs approximately $100,000 for the hardware, software and development.

The ongoing cost of operation of the system includes a monthly maintenance contract, filming of fingerprint and mug-shot images and other materials costs. It was estimated that the total ongoing cost was approximately $250 per month. This includes microfiche filming, which costs approximately $9 per microfiche. This is twice the normal amount because the fingerprint cards are filmed twice.

Mechanical Reliability

Since its installation, the CRIME file system has encountered numerous minor mechanical problems. There were some problems with the mark sense card reader and from time to time, microfiche became jammed in the viewer. These problems involve adjustments which have been made and for the most part are not causing any major difficulties. The mini-computer in the system, to this point, has been highly reliable.

Display Adequacy and Image Clarity

The display of the microfiche image device was judged to be adequate for the rapid comparison of fingerprint cards in the system with the latent images. However, it was found to be very difficult to pick out minutiae points for positive identification, and therefore, the original fingerprint card was pulled from the manual files to make such identification.

The clarity of the images in the retrieval device, of course, depends on the quality of the input fingerprint cards. As a rule of thumb, when comparing the quality of the hardcopy fingerprint

card with that on the screen, an excellent quality card will display as good quality, good quality as fair, fair as poor, and poor as unreadable.

Personnel

Currently, five technicians work with the CRIME file system. Each technician spends the following percentage of time working with the system:

Number of Technicians	% of Time
1	90%
1	50%
2	15%
1	5%

Performance Data

Approximately 25 latent fingerprint searches are made on the CRIME file each month. The CRIME file system has been averaging one identification per month.

POTENTIAL IMPROVEMENTS

The users of the CRIME file system had several suggestions for improvements. One suggestion was to eliminate the viewer entirely and just use the computer for search of the data base. The computer could print identification numbers of possible candidates whose fingerprint cards could be retrieved from a manual file in identification number order.

Another suggestion was to add a palm print classification system to the computer data base. At the present time, palm prints are taken on the reverse side of the fingerprint cards but there is no breakdown in the files other than type of crime, sex, and year that the individual was arrested.

A third suggestion, which is not possible with the present equipment, would be to have an image display device with the capability of magnifying a single fingerprint to the entire size of the screen. This would greatly improve the ease with which comparisons and identification could be made.

The fourth suggestion was to obtain a display device capable of greatly increased speed of retrieval. It now takes an average of four seconds to retrieve an image. It was felt that since the comparisons for rejecting possible matches can be made rapidly, it would be appropriate to have the retrieval time of two or three cards per second.

OPERATIONAL PROCEDURES

Search Procedures

Identifiable latent fingerprints are coded using a special three digit code devised by the department. (The classification system is described later in this section).

Codes for up to three fingers, as well as descriptive data, can be keyed into the computer for a search (see Exhibit 2-1-4). When all the information is keyed into the computer, a search command is initiated by the fingerprint technician. The search time required varies from 20 seconds to 2 minutes. At the completion of the search, a counter on the terminal indicates the number of potential candidates which match the search argument. At this point, it is possible to add more parameters to eliminate some candidates. This process may be repeated until the operator is satisfied that all search arguments have been exhausted. The search time required for subsequent searches is considerably shorter because the search arguments are used only against those candidates which satisfied the initial search argument(s).

TF-5368 (4/73) OAKLAND POLICE DEPARTMENT

CII _____
OPD _____
NAME _____ LAST, FIRST MIDDLE

SEX
[CIRCLE ONE]
A1 Male
A2 Female

RACE
[CIRCLE ONE OR TWO]
B1 White
B2 Black
B3 Brown
B4 Yellow
B5 Undetermined

AGE
[ENTER MINIMUM & MAXIMUM AGE LIMITS]
C1
[#__-__ YEARS OF AGE]

RESIDENCE CODE
[ENTER UP TO 3 ONE-DIGIT DISTRICT NOS.]
D1
[#-#-#]

TYPE OF CRIME
[CIRCLE ONE OR TWO]
E1 Commercial burglary
E2 Residential burglary
E3 Locked auto burglary
E4 Possession of stolen property
E5 * E1, E2, E3, or E4
E6 Armed robbery
E7 Strongarm and purse snatch
E8 * E6 or E7
E9 Auto theft
E10 Grand theft
E11 Check and credit card
E12 Felony assault
E13 Murder
E14 * E12 or E13
E15 Rape
E16 Indecent exposure
E17 Child molesting
E18 Other-sex
E19 *E15, E16, E17, or E18
E20 Narcotics and drugs
E21 Fraud and bunco
E22 Arson
E23 Multiple felonies
E24 Operates in teams (major crimes only, such as robbery and burglary)
E25 Associated with shoplifting ring
E26 Associated with check/credit card ring
E27 Associated with group advocating or practicing violence
E28 Associated with extortion/loan shark ring
E29 Associated with consumer fraud/bunco ring
E30 Associated with organized prostitution
E31 Associated with organized narcotics
E32 Associated with organized gambling
E33 Associated with auto stripping ring

HEIGHT
[ENTER MINIMUM AND MAXIMUM HEIGHT LIMITS]
F1
[#__-__ INCHES]

WEIGHT
[ENTER MINIMUM AND MAXIMUM WEIGHT LIMITS]
G1
[#___-___ POUNDS]

HAIR COLOR Δ
[CIRCLE ONE OR TWO]
H1 Blond
H2 Brown
H3 Black
H4 Red
H5 White or grey

HAIR STYLE Δ
[CIRCLE ONE, TWO, OR THREE]
J1 Bald
J2 Partly bald or thinning
J3 Close cut or short
J4 Medium length
J5 Long (below ears)
J6 Afro american-natural style
J7 Afro american-processed style
J8 Curly, wavy, or kinky
J9 Straight

EYE COLOR Δ
[CIRCLE ONE]
K1 Brown or black
K2 Blue, grey, green, or hazel

EYE DEFECTS Δ
[CIRCLE ONE]
L1 Either eye blind, missing, or artificial
L2 Wears glasses (prescription)
L3 L1 or L2

EARS Δ
[CIRCLE ONE]
M1 Cauliflower
M2 Partial or missing
M3 Excessively protruding
M4 Male with earring(s)

LIPS Δ
[CIRCLE ONE]
N1 Hairlip
N2 Unusually large
N3 Other permanent deformity

COMPLEXION Δ
[CIRCLE ONE OR TWO]
P1 Light, fair
P2 Dark, black
P3 Freckled or splotchy
P4 Pockmarked

TATTOO MARKS Δ
[CIRCLE ONE]
Q1 Arms
Q2 Hands or fingers
Q3 Face and neck
Q4 Other location or combinations of the above

FACIAL HAIR Δ
[CIRCLE]
R1 Yes

TEETH Δ
[CIRCLE ONE OR TWO]
S1 Irregular or protruding
S2 Metal fillings visible
S3 Visible decay or stains
S4 False, chipped, or missing teeth

AMPUTATIONS & DEFORMITIES Δ
[CIRCLE ONE]
T1 Arms
T2 Hands or fingers
T3 Legs or feet
T4 Other or combinations of the above

VISIBLE SCARS, MOLES, BIRTHMARKS, OR NEEDLE TRACKS Δ
[CIRCLE ONE]
U1 Arms
U2 Hands or fingers
U3 Face, head, or neck
U4 Other location or combinations of the above

SPEECH Δ
[CIRCLE ONE OR TWO]
V1 Foriegn accent
V2 Noticeable regional accent
V3 Lisp
V4 Stutter

PECULIARITIES Δ
[CIRCLE ONE]
W1 Limp
W2 Effeminate male or masculine female
W3 Wears clothing of opposite sex (impersonator)
W4 Twitch of eye(s), face, or other

NICKNAME
[ENTER UP TO 10 CHARACTERS, IF NONE, ENTER FIRST NAME]
X1
=_____

MUG SHOT ADDRESSES

_____ _____ _____ _____

FINGERPRINT FICHE ADDRESS

FINGERPRINT CODES
[ENTER FINGER NUMBER AND THREE-DIGIT CODE, UP TO THREE TIMES; USE "?" FOR UNKNOWN CHARACTERS]
Y1
[#-___:___:___:___]

CRIME SYSTEM

Exhibit 2-1-4

When the operator is satisfied that all search arguments have been exhausted, he may call upon the computer to make a printed listing of the potential candidates or to automatically load the microfiche retrieval system. The computer terminal and the microfiche device are connected by an interface unit which has a buffer capable of storing 100 image addresses. If more than 100 candidates are present in a search, successive groups of candidates can be loaded into the buffer once the original candidates have been viewed. This process can be repeated to a limit of 256 candidates.

Only one terminal may operate at any given moment. Once the buffer is loaded, the terminal can be released allowing other users to operate their terminals.

Successive fingerprint cards are viewed on the display unit until a match is made. The display image is magnified 1.5 times normal size. The display keyboard has a counter which allows the operator to call back images which have already been viewed.

The fingerprint examiner can usually advance rapidly through the fingerprints displayed rejecting those that are obvious non-matches. A magnifying glass can be placed on the display unit to allow for closer viewing of the fingerprints displayed.

Oakland Police Department technicians have found it necessary to go to the original fingerprint card stored in the manual file to make a final verification of a possible match. Apparently, fingerprint minutiae is difficult to pick out from the image display.

UPDATING PROCEDURES

Data is keypunched on computer punch cards from information

given on the file input form (Exhibit 2-1-5), which is completed at the time of booking. The Criminalistics Section selects the persons who will be entered into the system. Approximately 350 persons are added to the subject data base each month. Data for entry in the Vehicle file is coded on a separate form (Exhibit 2-1-6).

Fingerprint cards and mugshots to be entered into the system are sent to the manufacturer of the image retrieval device for filming. To assure the quality of the fingerprint images, the fingerprint cards are shot at two exposures--one slightly underexposed and one slightly overexposed. The higher quality microfiche produced is stored in the display unit. The other copy is stored for emergencies. The film processing takes approximately four days.

Purging of the microfiche files has not yet become a problem. The display unit has a maximum capacity for 73,000 frames. Only 28,000 frames are currently being used. It is evident, however, that the Oakland Police Department will have to develop a purge methodology in the future.

Purging the computer files presents no major problems because of the ease in which information may be added, modified, and erased on the computer. Purging the microfiche file will probably require refilming of active subjects on new microfiche.

CLASSIFICATION SYSTEM *

The Oakland Single Fingerprint Classification Scheme Manual was designed by Oakland Police Department staff specifically for the CRIME file system. The fingerprint classification code is

NOTE: Edited material on the coding system taken from material provided in the Oakland Police Department's coding manual.

SUBJECT FILE INPUT (SFI) FORM

TF-536A (4/73) OAKLAND POLICE DEPARTMENT

DATE _____
(NEW) _____ CHECK ONE
(UPDATE) _____

ID NUMBER (ENTER C11 OR OPD NUMBER)
C11 _ _ _ _ _ _ _
OPD _ _ _ _ _ _

NAME (ENTER UP TO 24 CHARACTERS): _
LAST, FIRST MIDDLE

CARD #1

SEX
(CIRCLE ONE)
1 Male
2 Female

RACE
(CIRCLE ONE)
1 White
2 Black
3 Brown
4 Yellow
5 Undetermined

AGE
(ENTER YEAR OF BIRTH)
19 _ _

RESIDENCE CODE
(ENTER TWO-DIGIT "BEAT" NUMBER)
(_ _)

TYPE OF CRIME
(CIRCLE ONE OR TWO)
1 Commercial burglary
2 Residential burglary
3 Locked auto burglary
4 Possession of stolen property
NOT USED FOR UPDATING
6 Armed robbery
7 Strongarm and purse snatch
NOT USED FOR UPDATING
9 Auto theft
10 Grand theft
11 Check and credit card
12 Felony assault
13 Murder
NOT USED FOR UPDATING
15 Rape
16 Indecent exposure
17 Child molesting
18 Other sex
NOT USED FOR UPDATING
20 Narcotics and drugs
21 Fraud and bunco
22 Arson
23 Multiple felonies
24 Operates in teams (major crimes only, such as robbery and burglary)
25 Associated with shoplifting ring
26 Associated with check/credit card ring
27 Associated with group advocating or practicing violence
28 Associated with extortion/loan shark ring
29 Associated with consumer fraud/bunco ring
30 Associated with organized prostitution
31 Associated with organized narcotics
32 Associated with organized gambling
33 Associated with auto stripping ring

HEIGHT
(ENTER HEIGHT)
(_ _ INCHES)

WEIGHT
(ENTER WEIGHT)
(_ _ _ POUNDS)

HAIR COLOR Δ
(CIRCLE ONE)
1 Blond
2 Brown
3 Black
4 Red
5 White or grey

HAIR STYLE Δ
(CIRCLE ONE, TWO, OR THREE)
1 Bald
2 Partly bald or thinning
3 Close cut or short
4 Medium length
5 Long (below ears)
6 Afro american-natural style
7 Afro american-processed style
8 Curly, wavy, or kinky
9 Straight

EYE COLOR Δ
(CIRCLE ONE)
1 Brown or black
2 Blue, grey, green, or hazel

EYE DEFECTS Δ
(CIRCLE ONE)
1 Either eye blind, missing, or artificial
2 Wears glasses (prescription)
3 1 or 2

EARS Δ
(CIRCLE ONE)
1 Cauliflower
2 Partial or missing
3 Excessively protruding
4 Male with earring(s)

LIPS Δ
(CIRCLE ONE)
1 Hairlip
2 Unusually large
3 Other permanent deformity

COMPLEXION Δ
(CIRCLE ONE)
1 Light, fair
2 Dark, black
3 Freckled or splotchy
4 Pockmarked

TATTOO MARKS Δ
(CIRCLE ONE)
1 Arms
2 Hands or fingers
3 Face and neck
4 Other location or combinations of the above

FACIAL HAIR Δ
(CIRCLE)
1 Yes

TEETH Δ
(CIRCLE ONE)
1 Irregular or protruding
2 Metal fillings visible
3 Visible decay or stains
4 False, chipped, or missing teeth

CARD #2

AMPUTATIONS & DEFORMITIES Δ
(CIRCLE ONE)
1 Arms
2 Hands or fingers
3 Legs or feet
4 Other or combinations of the above

VISIBLE SCARS, MOLES, BIRTHMARKS, OR NEEDLE TRACKS Δ
(CIRCLE ONE)
1 Arms
2 Hands or fingers
3 Face, head, or neck
4 Other location or combinations of the above

SPEECH Δ
(CIRCLE ONE)
1 Foreign accent
2 Noticeable regional accent
3 Lisp
4 Stutter

PECULIARITIES Δ
(CIRCLE ONE)
1 Limp
2 Effeminate male or masculine female
3 Wears clothing of opposite sex (impersonator)
4 Twitch of eye(s), face, or other

NICKNAME
(ENTER UP TO 10 CHARACTERS, IF NONE, ENTER FIRST NAME)
_ _ _ _ _ _ _ _ _ _

Δ NOTE: (FOR CATEGORIES H THRU W RESPOND WHERE THE APPROPRIATE CONDITION EXISTS; ALL OTHER CATEGORIES REQUIRE A RESPONSE.)

CARD #3 MUG SHOT ADDRESSES
_ _ _ _ _ _ _ _ _ _ _ _

CARD #4 FICHE ADDRESS
_ _ _ _ _ _ _ _ _ _ _ _

FINGERPRINT CODES
(ENTER 10 THREE-DIGIT CODES)
(_ _ _ _ _ _ _ _ _ _)

CRIME SYSTEM

Exhibit 2-1-5

VEHICLE FILE INPUT (VFI) FORM
[QUERY ONLY]

DATE _____

FIELD CONTACT
CIRCLE ONE
A1 Yes
A2 No

DATE OF CITATION
ENTER CITATION PERIOD AS "DAY, MONTH, & YEAR", 1 OR 2 SIX-DIGIT DATES
B1
_ _ _ _ _ _ _ _ _ _ _ _
D D M M Y Y D D M M Y Y

YEAR OF VEHICLE
ENTER TWO-DIGIT YEAR NUMBER
C1
#19 _ _

MAKE/MODEL
CIRCLE ONE MAKE AND A MODEL IF APPLICABLE
D1 Alpha Romeo
D2 Alpine
D3 American Motors
#0 No specific model
#1 Ambassador
#2 AMX
#3 Gremlin
#4 Hornet
#5 Javelin
#6 Rambler American (See D38-#2/D46-#1)
D4 Aston-Martin
D5 Audi
D6 Austin
D7 Austin Healey
D8 Bentley
D9 BMC
D10 BMW
D11 Borgward
D12 Buick
#0 No specific model
#1 Riviera
#2 Skylark
D13 Cadillac
#0 No specific model
#1 El Dorado (FLE)
D14 Capri (import)
D15 Chevrolet
#0 No specific model
#1 Camero
#2 Caprice
#3 Chevelle
#4 Chevy II
#5 Corvair
#6 Corvette
#7 El Camino
#8 Impala
#9 Malibu (ELL)
#10 Monte Carlo
#11 Nova (CH2)
#12 Vega
D16 Chrysler
#0 No specific model
#1 Imperial
D17 Datsun
D18 Desoto
D19 Dodge
#0 No specific model
#1 Challenger
#2 Charger
#3 Coronet
#4 Dart
Dune Buggy (See D51-#1)

MAKE/MODEL -CONTINUED-
AUTOMOBILES -CONTINUED-
D20 Edsel
D21 English Ford (British)
D22 Ferrari
D23 Fiat
D24 Fiat-Abarth
D25 Ford
#0 No specific model
#1 Cobra
#2 Fairlane
#3 Falcon
#4 Galaxie
#5 LTD
#6 Maverick
#7 Mustang
#8 Pinto
#9 Ranchero
#10 Thunderbird
#11 Torino (FAI)
D26 Hillman
D27 Honda
D28 International (Harvester)
D29 Jaguar
D30 Jeep
D31 Karmann-Ghia
D32 Lincoln
#0 No specific model
#1 Capri
#2 Continental
D33 Lotus
D34 Mazda
D35 Mercedes-Benz
D36 Mercury
#0 No specific model
#1 Comet
#2 Couger
D37 MG
D38 Nash
#0 No specific model
#1 Metropolitan
#2 Rambler (See D3-#6/D46-#1)
D39 Oldsmobile
#0 No specific model
#1 Cutlass (F-85)
D40 Opel
D41 Packard
D42 Peugeot
D43 Plymouth
#0 No specific model
#1 Barracuda
#2 Belvedere
#3 Duster
#4 Fury
#5 GTX
#6 Road Runner
#7 Satellite
#8 Valiant
D44 Pontiac
#0 No specific model
#1 Bonneville
#2 Firebird
#3 Grand Prix
#4 GTO
#5 LeMans
#6 Tempest
D45 Porsche
D46 Rambler
#0 No specific model
#1 American (See D3-#6/D38-#2)
D47 Renault

MAKE/MODEL -CONTINUED-
AUTOMOBILES -CONTINUED-
D48 Rolls-Royce
D49 Saab
D50 Shelby American (See D25-#7)
D51 Special Vehicle
#0 No specific model
#1 Dune Buggy
D52 Studebaker
D53 Subaru
D54 Sunbeam
D55 Suzuki
D56 Toyota
D57 Triumph
D58 Volkswagon
D59 Volvo
D60 Willys-Overland
MOTORCYCLES
D61 BSA
D62 Harley-Davidson
D63 Honda
D64 Kawasaki
D65 Suzuki
D66 Triumph
D67 Yamaha

BODY TYPE
CIRCLE ONE
E1 2-door
E2 4-door
E3 Station Wagon
E4 Convertible
E5 Pickup
E6 Sportscar
E7 Van
E8 Panel
E9 Bus
E10 Hearse

COLOR
CIRCLE ONE (SINGLE COLOR) OR TWO (2-TONE)

T/S*	B*	
F1	F1	Black
F2	F2	Brown, Beige, Bronze, or Tan
F3	F3	Red, Pink, or maroon
F4	F4	Orange
F5	F5	Yellow or Gold
F6	F6	Green or Turquoise
F7	F7	Blue
F8	F8	Purple or Lavender
F9	F9	Silver or Gray
F10	F10	White or Cream

*NOTE:
T/S=TOP OR SINGLE COLOR
B=BOTTOM COLOR

STATE
CIRCLE ONE
G1 California
G2 Other

LICENSE NUMBER
ENTER UP TO 6 CHARACTERS LEFT JUSTIFIED WITH ALL BLANKS (SPACES) OMITTED AND INSERT "?" FOR UNKOWN CHARACTERS
H1
_ _ _ _ _ _

TF-537(3/72) OAKLAND POLICE DEPARTMENT

CRIME SYSTEM

Exhibit 2-1-6

intended to minimize subjective judgments and classifying difficulties. Furthermore, since the system will most frequently be used to compare classifiable prints rather than partial latents, it was decided to keep the search parameters reasonably broad. For these reasons, the "Battley" type details are not employed. This generalist approach, admittedly, creates overlapping basic and subpattern classifications, yet the tedious and time-consuming tasks of making these minute distinctions was felt to be unjustified in terms of the benefit derived.

Each individual fingerprint is classified according to the single three digit fingerprint code. The first digit represents the basic pattern (e.g., arch, loop, whorl); subclassification is done by use of the second digit and the tracing ridge count or slant (in the case of arches) is indicated by the third digit. In order to permit discussion of each classification in logical order, each will be divided according to its basic pattern.

1. Arches (Plain or Tented). All basic arch patterns are identified by a one (1) in the first digit. The subpattern (digit #2) will break the arch into a plain or tent class per FBI rules. The third digit identifies the characteristic of the arch as to a "slant" or "slope" in the sense that Ulnar or Radial Loops slant based on the ridge structure.

BASIC PATTERN		SUBPATTERN		SLANT	
1	ARCH Plain or tent.	1	Plain arch including plain arch reference any other pattern.	1	No apparent slant or not appreciable, definite, or obvious
		2	Tented arch including tent reference any other pattern.	2	Definite slant or tendency to slant down and to the right.
				3	Definite slant or tendency to slant down and to the left.

2. Loops. Loops have been identified according to two (2) basic patterns, right slope and left slope. The subpattern for each is broken down into four (4) classifications and the last digit identifies the ridge count made in the fashion described in the FBI rules.

BASIC PATTERN		SUBPATTERN		RIDGE COUNT	
2	Right Slope Loop	1	Normal plain loop without appreciable convergency of ridges in pattern area.	1	1-3
				2	4-6
3	Left Slope Loop	2	Loop pattern with fairly prominent to very noticeable convergencies of a type other than type 3 or 4 below.	3	7-9
				4	10-12
				5	13-15
		3	Loop having converging ridges giving pattern the form or appearance of a Central Pocket, or print should be reference to Central Pocket type as it may be one.	6	16-18
				7	19-21
				8	22-25
				9	26 and over
		4	Nutant loop - whether with or without convergencies. (All Nutants are classified as a number 4.)	0	Indeterminate

3. Central Pocket. Central pockets are divided into two (2) basic patterns, right slope and left slope. In a true central pocket, a delta-to-delta line must NOT touch or cross a valid recurve; it can touch such a line if there is an appendage between the recurve in front on the inner delta (or outer one) invalidating such a recurve according to the FBI rules. If the delta-to-delta line does touch a valid recurve, the print would become a plain whorl. Ridge counts are made in the same manner as counts for ordinary loops. The core will often be the center

of a whorling formation. In the absence of "rules" for whorl cores, it is best to treat the top of any circular or spiral formation as if it were a loop top and locate it accordingly.

BASIC PATTERN		SUBPATTERN		RIDGE COUNT	
4	Right Slope Central Pocket	1	"Classical" Central Pocket form--that is, mostly loop pattern but with small valid Central Pocket formation in core area. (Includes Central Pocket reference loop.)	1	1-3
				2	4-6
				3	7-9
5	Left Slope Central Pocket	2	Central Pocket more whorl-like in shape or form in which "loop" character of print may not be so obvious. (Includes Central Pocket reference whorl.)	4	10-12
				5	13-15
				6	16-18
				7	19-21
				8	22-25
				9	26 and over
				0	Indeterminate

4. Plain Whorl. Plain whorls are indicated by three (3) basic patterns and broken down into six (6) subpatterns. Counting of ridges in plain whorls will always be from core to right delta in all "inner" types, and from core to left delta in both "outer" and "meeting" types.

NOTE: On the following page, category six (6) for subpattern is used only if it appears essential to reference.

BASIC PATTERN		SUBPATTERN		RIDGE COUNT	
6	Plain Whorl Inner Tracing	1	Very ROUNDISH central pattern area or shape.	1	1-3
				2	4-6
7	Plain Whorl Meeting Tracing	2	Normal OVOID shape to pattern.	3	7-9
				4	10-12
8	Plain Whorl Outer Tracing	3	OVAL type (e.g., 3X to 4X high as wide, central circuit part).	5	13-15
		4	Very LARGE OVAL (e.g., 6X or more high as it is wide, central circuit).	6	16-18
				7	19-21
		5	ALMOND type of pattern or ridge structure. Overall effect is that pattern formed of almond shaped circuits.	8	22-25
				9	26 and over
		6	Whorl should be referenced to Dual Loop as it may be one, and this reference seems a better code than others for that reason.	0	Indeterminate

5. Dual Loop. The dual loop is indicated by a single pattern and broken down into three (3) subpatterns. Ridges are counted from the appropriate delta to a loop core associated with that delta, much as if they were radial or ulnar loops. Normally, the core will be of that loop commonly referred to as the "ascending loop," for usually one of the two loops would look like a typical plain loop if the other were removed. The other loop is frequently "upside down" or otherwise curved or oriented in a fashion different than a normal plain loop.

For those dual loops in which neither loop is obviously more like a plain loop than the other, a decision must be made

as to which core and delta to utilize. Normally, the loop to be used for the core would be that loop in which the shoulders formed an inverted U or horseshoe opening downward. Dual loop prints for which no reasonably consistent or valid decision can be made are classified as 0 (indeterminate) ridge count.

BASIC PATTERN		SUBPATTERN		RIDGE COUNT	
9	Dual Loop pattern (2 deltas, 2 separate shoulder to 2 looping formations, etc.)	1	INNER Tracing	1	1-3
		2	MEETING Tracing	2	4-6
		3	OUTER Tracing	3	7-9
				4	10-12
				5	13-15
				6	16-18
				7	19-21
				8	22-25
				9	26 and over
				0	Indeterminate

6. Accidental Type or Indeterminate, Mutilated, etc. The accidental or indeterminate pattern is identified by a zero (0). This digit is used even if the basic pattern type is apparent but the subpattern and ridge characteristics cannot be determined due to damage, scar, etc., in the inked print.

Also included as "accidentals" are those prints which might equally well be called one type (basic type) as another (e.g., where pattern is very ambiguous in character, such as tented arch having a whorl-like core but which whorl may be

defective, resulting in the print being Central Pocket or possibly even a loop or plain whorl).

BASIC PATTERN		SUBPATTERN		RIDGE COUNT	
0	Accidental type pattern OR indeterminate, mutilated, etc.	1	Accidental pattern type per FBI rules and exceptional prints.	1	Added to provide a full fingerprint code. (All Basic Pattern "0" will have a "1" in this column.)
		2	Pattern shows mutilation or damage by scar, cut, etc., which prevents interpretation of basic pattern type on coding adequately.		
		3	Ridges so reticulated or broken up that pattern type not clear. (Unable to assign pattern type on this basis or unable to adequately code.)		
		4	Finger missing or mostly missing or not printed due to injury, etc.		
		5	Indeterminate due to poor inking or other factors and unable to assign adequate coding formula otherwise.		

Section 2-2

SHREVEPORT POLICE DEPARTMENT
MIRACODE II SYSTEM

INTRODUCTION

In 1971, the Shreveport Police Department began operating its Miracode I Information Storage and Retrieval System, one purpose of which is to search latent fingerprints against those of known offenders. In December 1973, the Miracode I System was replaced by the more modern Miracode II Information and Retrieval System.

GENERAL SYSTEM DESCRIPTION

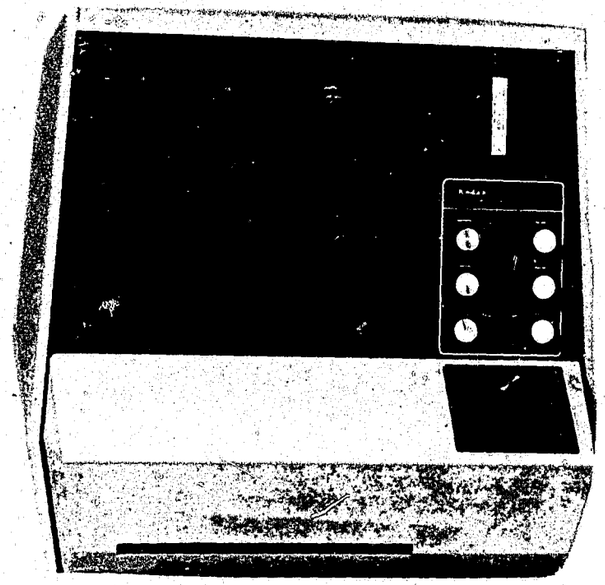
Hardware

The hardware for the Miracode II Information and Retrieval System consists of a Mod 18 Control Terminal, a retrieval terminal (display unit), and a filming and encoding device, all of which are manufactured by the Kodak Company. These devices are shown in Exhibits 2-2-1 and 2-2-2.

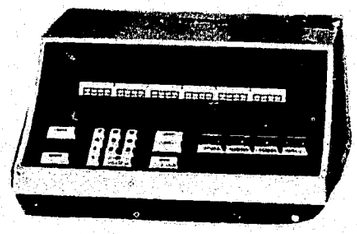
Equipment Operation

The Mod 18 Control Device is used in conjunction with the retrieval terminal (display unit) to search the data base for possible matches. Identification technicians key-in coded latent fingerprints on the Mod 18 Control Unit which initiates a search in the retrieval device. After a search is completed, possible matches may be viewed on the display screen mounted on the retrieval unit.

The encoding and filming devices are used to film the coded fingerprints and encode the film with the special latent fingerprint code devised by the Shreveport Police Department. Detailed

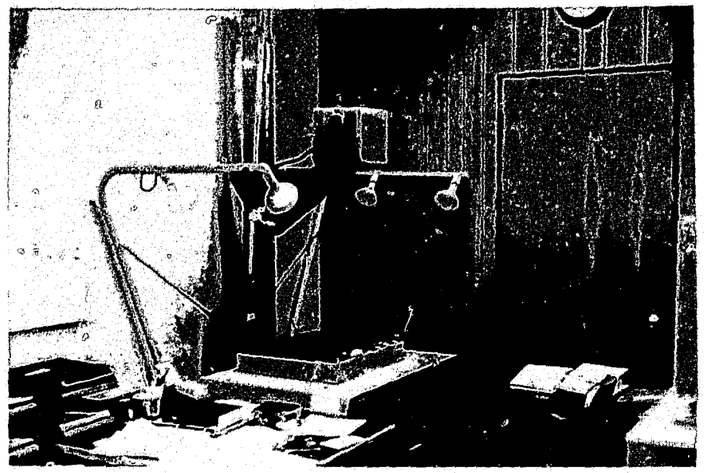


Retrieval Terminal

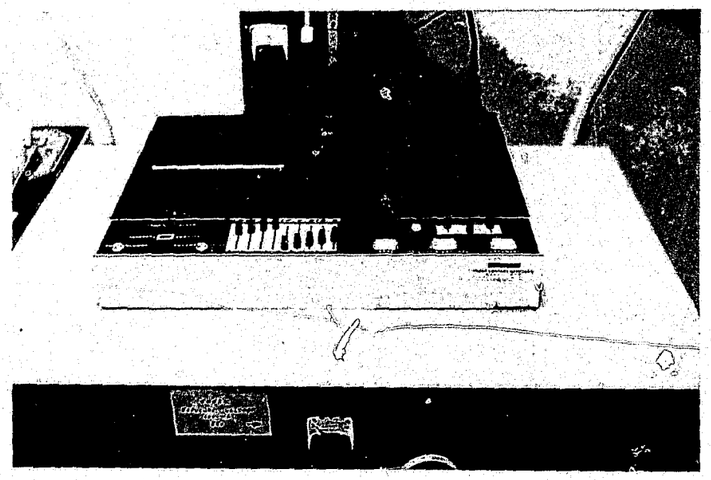


MOD 18 Control Unit

Exhibit 2-2-1



Filming Device

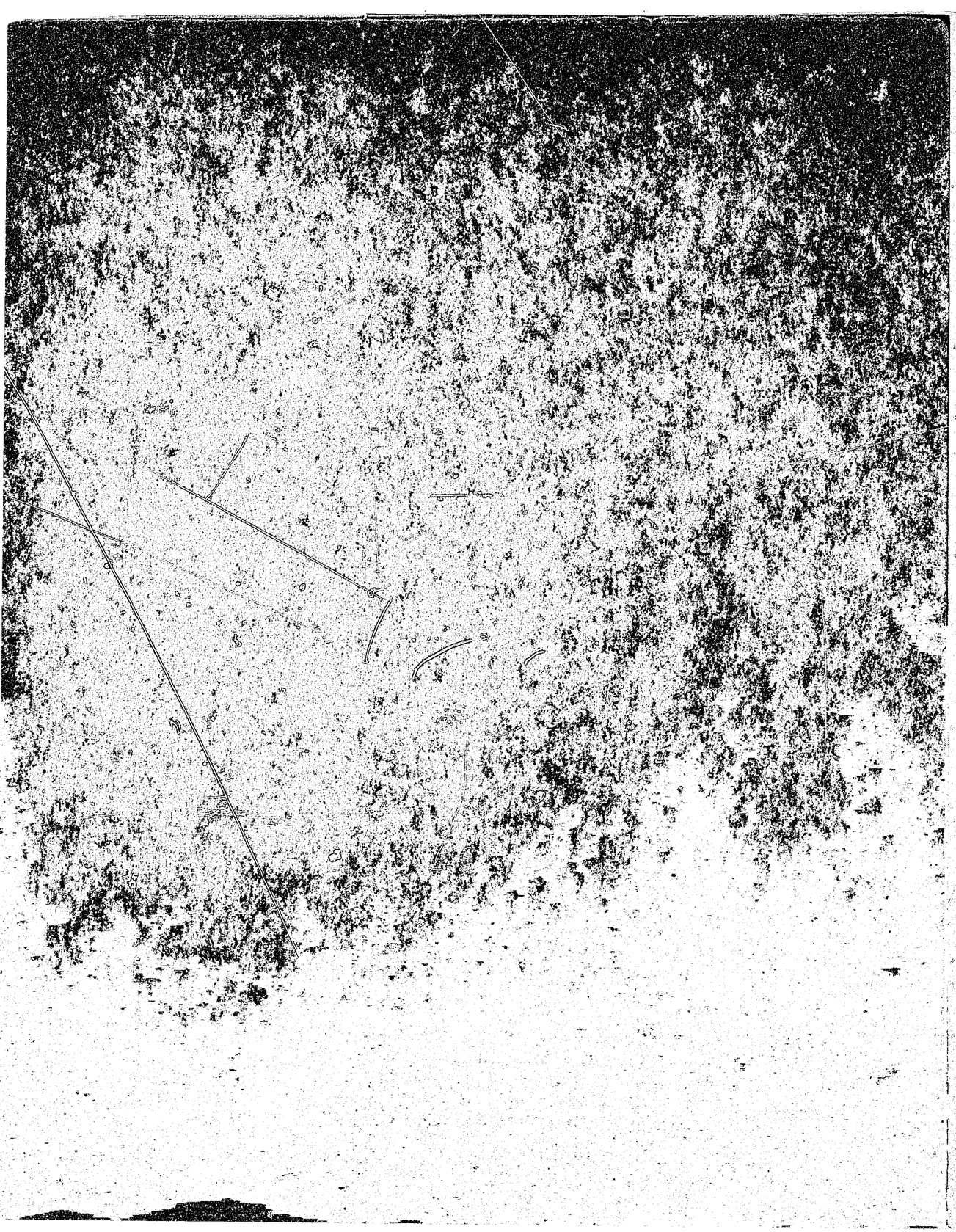


Encoding Device

Exhibit 2-2-2

CONTINUED

1 OF 4



descriptions of the coding, searching and updating processes are subsequently described.

File Organization

The Miracode file is retained on film cassettes which are coded with fingerprint information and descriptive information. Because the file contains both kinds of information, descriptive information can be used in a latent search along with fingerprint classification.

Each cassette holds film images of 400 to 500 fingerprint cards. At the present time, latents from crime scenes are run against a data base of approximately 10,000 individuals.

Prior to November 1973, only felony arrest fingerprint cards were entered into the system. Since that time, all arrest cards are being entered into the system.

COST AND PERFORMANCE DATA

Equipment Cost

The Miracode II system costs approximately $35,000. This includes the filmer, Mod 18 Control Unit, and display/retrieval unit.

The ongoing cost of operation was estimated to be $100-500 per month, for the Miracode II and included film and maintenance costs but did not include technician's time.

Mechanical Reliability

Since its installation in early December 1972, the Miracode II system has proven to be highly reliable. The Shreveport Police Department staff was confident that the Miracode II system would

be a marked improvement over the previously used Miracode I * system, which had an electro-mechanical control unit and was large and bulky in comparison with the more compact, solid-state Miracode II control unit.

Display Adequacy and Image Clarity

The display unit has been judged to be adequate for comparison purposes. The clarity, of course, is dependent upon the quality of the fingerprint cards input into the system; and, some degradation takes place as a result of filming.

Personnel

Currently, the Identification Section has a staff of 14 people, all with working knowledge of the Miracode II system. Approximately 20 percent of each technician's time is spent working with the Miracode system.

Performance Data

In 1973, the Shreveport Police Department handled 700 calls where searchable latent fingerprints were found. Twenty-four indentifications were made using the Miracode system.

POTENTIAL IMPROVEMENTS

Because the Miracode II system has just been installed, the staff has not had sufficient experience with the equipment to suggest possible improvements.

Captains Hood and Taylor, however, were considering a breakdown classification of the arches into three broad subclassifications: arches which were high on the left and sloped down to

*NOTE: The Kodak Company has indicated that the Miracode I system is no longer commercially available.

the right, arches that rose in the center of the fingerprint impression, and arches that rose from left to right, peaking on the right.

OPERATIONAL PROCEDURES

Search Procedures

To perform a search against a latent fingerprint lifted at a crime scene, the identification technician codes the fingerprint using the specially devised code developed by the personnel at the Shreveport Police Department. The code is keyed into the control device of the system. Individual cassettes are placed into the retrieval device and a search is initiated on each cassette. After a search is completed on an individual cassette, the identification technicians can view a counter located on the control unit which indicates the number of possible matches on that particular cassette. The identification technician may then view the possible matches on the display unit by calling the fingerprint images, using the control unit.

The fingerprint technician can enter a code and descriptive information for any given finger. It takes approximately 18 seconds to search one cassette of 4,000 fingerprints (400 fingerprint cards of individuals). The amount of time required for verification of a match depends upon the number of candidates. However, it takes approximately 2 to 10 seconds for the reader to locate a particular card. Verification takes another 10 to 15 seconds. Thus, on the average, it takes approximately 12 to 25 seconds per card. The display unit image was sufficiently clear to pick out fine minutiae points.

Updating Procedures

Data are entered into the system by the Identification

Section at the time of the booking. Currently, all arrestees are put into the system.

The fingerprints taken at the time of booking are coded by the Identification technicians. The coded fingerprints and the coded description form are encoded on film and a picture is taken of the fingerprint card by the filming device which is part of the system. From the information available, the time necessary to shoot a 100-foot roll of film is three weeks. The undeveloped film is then sent to a film processor for developing. It takes approximately three days to process the film. Thus, if an arrestee is put on the film at the beginning of the roll, it will take approximately one month to put him into the system.

Purging of the files has not yet become a problem. The data base is sufficiently small to allow for effective search of the existing data base. However, it is evident that some purging methodology will have to be developed. At present, court expunged persons and dead persons are purged from the system by erasing the coding information from the film strip.

Unidentified latents are filed by beat district. The city is divided into 16 districts. When a latent fingerprint is found at a crime scene within a certain district, it is placed in the file for that district.

In addition to latent fingerprint information, the semi-automated system contains a coded palm print file developed by the Shreveport Police Department.

CLASSIFICATION SYSTEM

The fingerprint codes developed by the Shreveport Police Department were the result of intensive research by Captains

Hood and Taylor. The philosophy behind the development of their six and nine digit systems is best described in an edited excerpt from their coding manual:

> It has been found after a long period of study and practical application that the previous method of using a three digit code which was a modification of the old Battley Classification was not satisfactory for our needs. The other method did not break down a print sufficiently enough to allow a rapid search when several thousands of prints had to be searched. In many cases, hundreds of prints with similarly coded classifications had to be observed and checked, causing many tedious hours of work on the part of the person making the search.
>
> Another great limitation was that a large majority of latent fingerprints were partials, with either the core or delta missing. In these cases it was difficult and somtimes impossible to code the latent. Thus, we decided that a method must be developed that would overcome the limitations of the previous code system. With this in mind, we devised a nine digit code, which we named and labeled the Hood-Taylor Nine Digit Fingerprint Code Method...
>
> Each single print is divided into three zones for coding purposes. Each zone receives three digits of the code. The zones are the Pattern type, Core area and the Delta area. The reason for this division is three fold: first, to aid in very rapid retrieval; second, to be able to locate a partial when only the core or delta is known; and third, the advantage of being able to criss-cross and obtain limited points of identification from a fragmented latent print. A disc

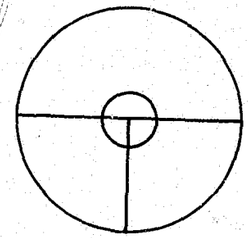
was designed using a 3/16 inch circle with a cross hair mounted in a regular fingerprint glass (as shown in Exhibit 2-2-3). The disc is placed on the core or delta and lined up with the innermost recurving ridge of a loop or whorl and the type lines of the delta zone. The first two identifying points above and within the top half of the 3/16 inch disc are considered as the first and second identification points above the core of loops and whorls. In the delta area, the 3/16 inch circle is placed on the delta and the first identification point is above the delta; the second and third are to the left and right of the delta and within the 3/16 inch circle. The identification points are determined by various ridge characteristics, e.g., ridge ending to right or left, bifurcation to right or left, short ridges, double bifurcations and islands. The three areas of the prints are broken down into zones for coding purposes which make it possible to make rapid identification when only a partial or fragmented latent print is available.

Coding

The chart shown in Exhibit 2-2-4 is used in the Hood-Taylor coding system. The chart is divided into the three zones. Three digits of information are derived from each zone. A single finger, therefore, will produce a nine digit code.

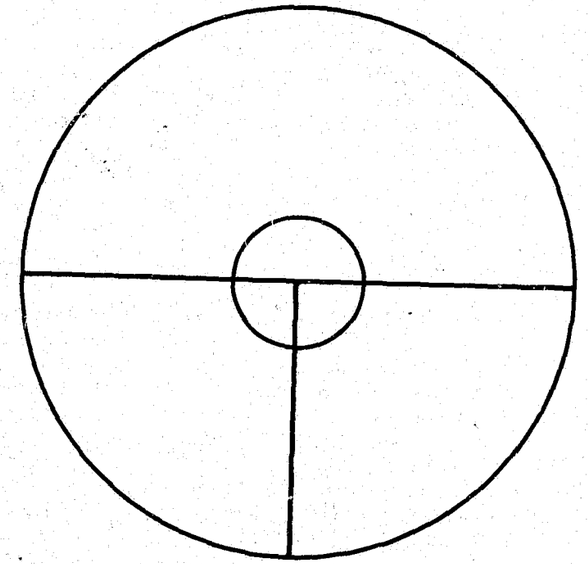
The following information was offered in the fingerprint manual provided by the Shreveport Police Department:

EXAMPLES OF CODE DISC



3/16 Code Reference Disc

The above disc is used for coding the Core Area of Fingerprints. This disc can be made of plastic.



Code Disc Enlarged

Exhibit 2-2-3

HOOD-TAYLOR
NINE DIGIT CODE SYSTEM CHART

COLUMN I

PATTERN TYPE	RIDGE COUNT OR TRACE	CORE TYPE
0= Ampt	0= No count or trace	0= Plain recurve
1= Arch	1= 1-5 ridges	1= Recurve with one rod
2= Tented Arch	2= 6-10 ridges	2= Recurve with Mult. rods
3= Right Slope Loop	3= 11-15 ridges	3= Any spoiled recurve
4= Left Slope Loop	4= 16-20 ridges	4= Clockwise twist
5= Plain Whorl	5= 21-out	5= Counterclockwise twist
6= Central Pocket Whorl	6= Inner	6= Complete enclosure
7= Double Loop Whorl	7= Meeting	7= Almond shaped whorl
8= Accidental Whorl	8= Outer	8= Upthrust - T. arch
9= Mutilated (cannot read)	9= Scar	9= Loop type - T. arch

COLUMN II

CORE TYPE	FIRST ID POINT ABOVE CORE	SECOND ID POINT ABOVE CORE
0= Plain Recurve	0= No ID Points	0= No ID points
1= Recurve w/one rod	1= Ending ridge right	1= Ending ridge right
2= Recurve w/mult. rods	2= Ending ridge left	2= Ending ridge left
3= Spoiled recurve	3= Bifurcation right	3= Bifurcation right
4= Clockwise twist	4= Bifurcation left	4= Bifurcation left
5= Counterclockwise twist	5= Short ridge or dot	5= Short ridge or dot
6= Complete enclosure	6= Island or enclosure	6= Island or enclosure
7= Almond shape	7= Bifurcation & short rdg	7= Bifurcation & short rdg
8= Upthrust T. arch	8= Double bifurcation	8= Double bifurcation
9= Loop type T. arch	9= Scar	9= Scar

COLUMN III

First ID Point Front of Delta	First ID Point at Right of Delta	First ID Point at Left of Delta
0= No ID Point	0= No ID Point	0= No ID Point
1= Ending ridge right	1= Ascending ridge	1= Ascending ridge
2= Ending ridge left	2= Descending ridge	2= Descending ridge
3= Bifurcation right	3= Ascending bifurcation	3= Ascending bifurcation
4= Bifurcation left	4= Descending bifurcation	4= Descending bifurcation
5= Short ridge or dot	5= Short ridge or dot	5= Short ridge or dot
6= Island or Enclosure	6= Island or enclosure	6= Island or enclosure
7= Bifurcation & short rdg	7= Bifurcation & short rdg	7= Bifurcation & short rdg
8= Double bifurcation	8= Double bifurcation	8= Double bifurcation
9= Scar	9= Scar	9= Scar

Exhibit 2-2-4

PATTERN TYPE

COLUMN I

PLAIN ARCH - The arch pattern has ridges that enter on one side of the pattern and flow toward the other side, with a rise in the center. It will have no more than one of the four requisites of a loop. Since, in most cases, this pattern does not contain the reference points, such as the Core and Delta, it makes it very difficult to devise a system of coding. In many arches, there is a billowing of ridges with a gentle curvature at the center. In some of these patterns, the billowing of ridges has a tendency to begin at the upper right or left side of the print and to flow downward toward the opposite side. In other prints, this crest of billowing ridges may tend to flow from top center to the bottom. It was thought that these peculiarities may play some part in breaking down this pattern in the future. For instance, the print could be broken down into three areas of code, such as Left Flow, Center Flow and Right Flow. The above breakdown may be considered at a later date, but as of now, the pattern will receive only three digits of code.

Example:	ARCH	RIDGE COUNT	CORE
Code #	1	0	0

The arch will always receive three digits of code and it will be coded with the number 100 unless scarred. Then it will receive the code number 109 (see Code Chart).

TENTED ARCH - The tented arches are a variety of the arch family but they differ from the ridge formation of plain arch. These patterns are divided into Upthrust and Loop Type in the code. Although the tented arch lacks at

least one of the four requirements of a loop, it can be separated and broken down further than the Plain arch for code purposes. The first three digits of the code for these pattern types will be as follows:

	T-ARCH	RIDGE COUNT	CORE
Code	2	0	8 Upthrust
	2	0	9 Loop type

The three digit code will remain constant for both type T-arches, but vary with identification characteristic code in the Core or Delta Zones. The tented arch is given a code of three to nine digits, depending on its type and the occurrence of a Core and Delta.

LOOPS-ULNAR AND RADIAL

1. The pattern will be broken down into Right and Left Slope loops, disregarding the hand on which it is located.

2. A ridge count will be made between the Core and Delta and will receive a code number (see Code Chart).

3. The Core type will be designated according to type and given proper code number (see Code Chart).

Example:

Right Slope Loop = Code #3
15 Ridge Counts = Code #3
Core is Spoiled = Code #3

WHORLS

Whorls will be broken down for coding purposes into four types: PLAIN, CENTRAL POCKET LOOP, DOUBLE LOOP, AND ACCIDENTAL.

PLAIN WHORL

1. Plain Whorl - first digit of code.

2. Inner, meeting, outer - second digit of code.

3. Core type--will be clockwise, counter-clockwise, almond shape, and enclosure.

CENTRAL POCKET LOOP WHORL

The above whorl is treated in same manner as a Plain whorl, but has its own code designation.

DOUBLE LOOP WHORL

1. This pattern is given three digits of code in the same manner as for other type whorls.

2. The ascending loop of this pattern will be considered in selection of the Core type, regardless of whether it is left or right in the pattern or not.

3. The Delta will be treated the same as in all other patterns.

ACCIDENTAL WHORLS

1. This is the same as for all other whorls, with the exception that the first ascending loop or recurve from the left Delta will be coded as the core.

2. The extreme left Delta will be considered for code purposes only.

Example Whorls:

	Plain Whorl	Inner Ridge Trace	Clockwise
Code #	5	6	4

MUTILATED PATTERNS

This type of pattern will be given a code number of 9 whenever it is impossible to tell what the pattern is. This applies to the first digit of code, Pattern type, only, but in many cases, it will be possible to know what the Core or Delta is. In this case, the correct code will be given to these areas.

CORE AREA

COLUMN II

The Core area of the Loop, Whorl and T-arch will be considered in this section. The arch is not considered. This section of the code is separated into three parts: Core Type, First and Second Identification Points, which will be explained in more detail below.

1. Core Type - This is the ridge details that compose the core; it is the innermost staple of the envelope.

2. Identification Points - These are the ridge characteristics that fall within the 3/16 inch circle when the center of the reference disc is placed on the core of the innermost recurving ridge. If the innermost recurving ridge is a plain recurve, place the center of the disc on the apex of the recurve. If a whorl is involved, such as a Plain Whorl, place the disc on the innermost recurving ridge if clockwise or counter-clockwise. If the Core is an enclosure, place the disc in the center of the enclosure.

3. First Identification Point - This is the first ridge characteristic that is above and nearest the core, such as Ridge Ending, Bifurcation, Islands, etc. Notice

the Island will always be considered the First I. D. point, regardless of its location within the top half of the 3/16 inch reference code disc.

4. Second Identification Point - This is the ridge characteristic that is located above by ridge count of the First Identification Point and within the 3/16 inch reference disc.

Example:

CORE AREA

1. Single Rod in Core = Code No. 1
2. First Identification Point = Code No. 3
3. Second Identification Point = Code No. 5

DELTA AREA

COLUMN III

Within the pattern area of the Whorls and Loop type fingerprints are fixed points known as Deltas. The Delta plays an important role in the classification of prints and also in this code. The Delta can be coded as a Delta plus identification characteristic or it can be used as a fixed reference point to obtain the points of Identification that appear to the front, right, and left of the Delta (see both charts). The Delta area will receive three digits of code.

1. First Identification Point - These are the ridge characteristics that are located in front of the Delta as it opens into the Pattern Area.

2. Second Identification Point - The same as the first, but it is located to the right of the Delta.

3. Third Identification Point - Same as the above, but it is located to the left of the Delta.

In addition to the 9-digit code, Captains Hood and Taylor have developed a 6-digit code and an alternate 9-digit code. These codes will not be covered in detail in this report because the regular 9-digit code is used most often.

The six digit code eliminates the use of the delta as a source of information. The first digit represents the basic pattern type; the second digit represents a ridge count or trace; the third digit represents the core type. The last three digits represent a more exact ridge count in the case of loops. In the case of whorls and tented arches, the last three digits represent (1) the core type, (2) the first identification point above the core, and (3) the second identification point above the core (see Coding Chart in Exhibit 2-2-5).

The alternate code is basically the same as the other Nine Digit System with some exceptions which are listed below.

COLUMN I

The Pattern type remains the same.

COLUMN II

CORE AREA

1. Core Type - remains the same.

2. Identification Points - Only the first ridge characteristics above the Core will be considered. There will be no second identification point in this area.

HOOD-TAYLOR
SIX DIGIT CODE SYSTEM CHART

COLUMN I

PATTERN	RIDGE COUNT OR TRACE	CORE TYPE
0= Ampt	0= No count or trace	0= Plain recurve
1= Arch	1= 1-5 ridges	1= Recurve with one rod
2= Tented Arch	2= 6-10 ridges	2= Recurve with mut. rods
3= Right slope loop	3= 11-15 ridges	3= Spoiled recurve
4= Left slope loop	4= 16-20 ridges	4= Clockwise twist
5= Plain Whorl	5= 21-out	5= Counterclockwise twist
6= Central Pocket Whorl	6= Inner	6= Complete enclosure
7= Double Loop Whorl	7= Meeting	7= Almond shaped whorl
8= Accidental Whorl	8= Outer	8= Upthrust - T. arch
9= Mutilated (cannot read)	9= Scar	9= Loop type - T. arch

COLUMN II

FOR WHORLS AND TENTED ARCHES ONLY:

CORE TYPE	FIRST ID POINT ABOVE CORE	SECOND ID POINT ABOVE CORE
0= Plain recurve	0= No ID points	0= No ID points
1= Recurve with one rod	1= Ending ridge right	1= Ending ridge right
2= Recurve w/mult rods	2= Ending ridge left	2= Ending ridge left
3= Spoiled recurve	3= Bifurcation right	3= Bifurcation right
4= Clockwise twist	4= Bifurcation left	4= Bifurcation left
5= Counterclockwise twist	5= Short ridge or dot	5= Short ridge or dot
6= Complete enclosure	6= Island or enclosure	6= Island or enclosure
7= Almond shape	7= Bifurcation-short rdg	7= Bifurcation-short ridge
8= Upthrust T. Arch	8= Double bifurcation	8= Double bifurcation
9= Loop type T. Arch	9= Scar	9= Scar

COLUMN II

FOR LOOPS ONLY:

CODE NUMBER	RIDGE COUNT	CODE NUMBER	RIDGE COUNT
002	1-2	018	17-18
004	3-4	020	19-20
006	5-6	022	21-22
008	7-8	024	23-24
010	9-10	026	25-26
012	11-12	028	27-28
014	13-14	030	29-30
016	15-16	032	31-32

Exhibit 2-2-5

COLUMN III

DELTA AREA

1. Delta type will be considered in lieu of the first identification point.

2. Identification Points - The first identification point above and in front of the Delta. The Delta area will have only two digits of code. The Whorl patterns will have both deltas coded and will receive two digits of code each.

This code is only a modification and rearrangement of the basic system that is in this publication. The 3/16 inch reference disc and the identification characteristic code remains as part of this modified method. (see Alternate Code Chart in Exhibit 2-2-6).

Hood and Taylor have also developed a palm print classification system. The codes are put into the Miracode system. The coding system has been included in Appendix C.

HOOD-TAYLOR
NINE DIGIT CODE SYSTEM CHART
COLUMN I

Alternate Code

PATTERN TYPE	RIDGE COUNT OR TRACE	CORE TYPE
0= Ampt	0= No count or trace	0= Plain recurve
1= Arch	1= 1-5 ridges	1= Recurve w/one rod
2= Tented Arch	2= 6-10 ridges	2= Recurve w/multiple rods
3= Right slope loop	3= 11-15 ridges	3= Any recurve spoiled
4= Left slope loop	4= 16-20 ridges	4= Clockwise twist
5= Plain whorl	5= 21-out	5= Counterclockwise twist
6= Central pocket whorl	6= Inner	6= Complete enclosure
7= Double loop whorl	7= Meeting	7= Almond shaped whorl
8= Accidental	8= Outer	8= Upthrust
9= Mutilated (can't read)	9= Scar	9= Loop type

COLUMN II

CORE TYPE	FIRST OF ID POINTS	DELTA TYPE RIGHT
0= Plain recurve	0= No ID points	0= Ridge dot
1= Recurve w/one rod	1= Ending ridge right	1= Bifurcation
2= Recurve w/mult rods	2= Ending ridge left	2= Ending rdg in front
3= Any spoiled recurve	3= Bifurcation right	3= Ridge
4= Clockwise twist	4= Bifurcation left	4= Ending rdg parallel
5= Counterclockwise twst	5= Short ridge or dot*	5= Ending rdg connected
6= Complete enclosure	6= Island	6= Enclosure
7= Almond Shaped whorl	7= Bifurcation & short rdg	7= Angle at ending rdg
8= Upthrust	8= Double bifurcation	8= Ending rdg that starts type line
9= Loop type	9= Scar	9= No Delta

COLUMN III

FIRST OF ID POINTS	DELTA TYPE LEFT	FIRST OF ID POINTS
0= No ID Points	0= Ridge dot	0= No ID Points
1= Ending ridge right	1= Bifurcation	1= Ending rdg right
2= Ending ridge left	2= Ending rdg in front	2= Ending rdg left
3= Bifurcation right	3= Ridge	3= Bifurcation right
4= Bifurcation left	4= Ending rdg parallel	4= Bidurcation left
5= Short rdg or dot*	5= Ending rdg connected	5= Short rdg or dot*
6= Island	6= Enclosure	6= Island
7= Bifurcation & short rdg	7= Angle at ending rdg	7= Bifurcation & short rdg
8= Double bifurcation	8= Ending rdg that starts type lines	8= Double bifurcation
9= Scar	9= No Delta	9= Scar

* The short ridge and ridge dot will be considered as the same ID point. The ridge dot should be as large as the ridges in the pattern.

Exhibit 2-2-6

Section 2-3

NASSAU COUNTY, NEW YORK POLICE DEPARTMENT
RAGEN RETRIEVAL SYSTEM

INTRODUCTION

In October 1973, the Ragen Retrieval System was installed in the Nassau County Police Department. The Ragen Retrieval System will provide the Nassau County Police Department with its first automated records and fingerprint retrieval system.

GENERAL SYSTEM DESCRIPTION

Hardware

The hardware for the Ragen Retrieval System consists of a Ragen MRS-90 Mini Computer (12,000 eight bit words), an on-line disc file (29,000,000 bytes expandable to 116 megabytes), two remote MRS-90 terminals attached to display units, and a filming unit. The remote terminal/display unit is capable of providing a hard copy of any given record of fingerprint cards on file. Each terminal has a capacity of 900,000 images on 16mm rolled film. (See illustration in Exhibit 2-3-1).

Equipment Operation

Data control is maintained in the main terminal (memory unit) shown in Exhibit 2-3-1. Information is input by means of computer punch cards. Detailed information on system procedures is described below.

The system is accessed by either of two remote terminals, each containing 300 rolls of film. Three thousand documents may be filmed on each roll giving a total retention capacity of 900,000 separate documents. A display unit is mounted on the remote terminals to enable viewing of the film images stored within the unit.

Each terminal is equipped with a terminal keyboard which is used by the terminal operator to access the computer. In addition, the remote terminals are equipped to produce hard copies of images viewed on the display unit.

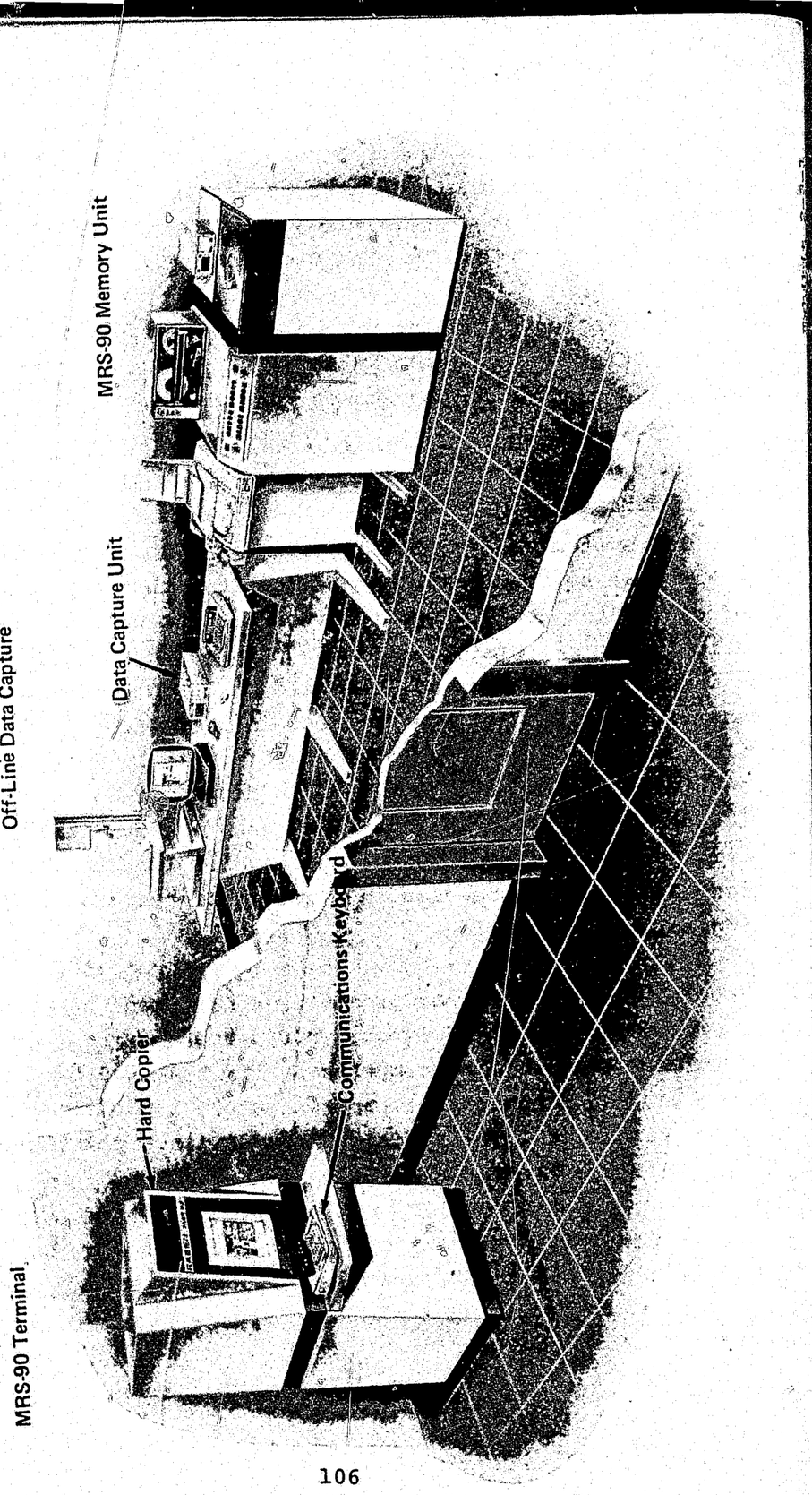
Information is filmed on the special off-line filming and data capture devices shown in Exhibit 2-3-1. The data capture device encodes the filmed images to enable computerized retrieval of images.

File Organization

The system will eventually contain a number of files. Currently, the police department anticipates that new arrest cards coded with the Henry classification and latent fingerprint information, criminal histories, and a physical description file will be input into the system. The file on latent fingerprints and descriptors is of primary interest in this study. The subject file can be accessed by two separate terminals. Each terminal is attached to a viewer equipped to display fingerprints and to provide hard copies. As the file contains both descriptive information and fingerprint codes, some available descriptive information can sometimes be used in a latent search along with the fingerprint information.

The display unit, as presently configured, has a subject file capacity of 300 reels at 3,000 frames per reel or 900,000 individual frames. The computer system has a 29 megabyte capacity. At the present time, approximately 2,200 fingerprint cards are on-line. An additional 2,800 fingerprint cards have been coded and are ready to go on-line.

Unidentified latent fingerprints are filed by case number, type of crime and the beat area where the crime was committed.



COST AND PERFORMANCE DATA

Equipment Cost

The cost of hardware was $72,000. Additionally, materials, labor to code fingerprints, and the effort involved in entering criminal history information and descriptions have been estimated to cost $183,000. The ongoing cost will include technicians to continue coding and searching as well as maintenance costs and materials. The ongoing cost of materials is mainly for filming. It is estimated that it would take approximately six months to fill one reel at 50 fingerprint cards per month.

Mechanical Reliability

Since the system had been installed, the police department has had some mechanical problems with the display unit jamming. The mini-computer, to this point, has been highly reliable.

Display Adequacy and Image Clarity

The display of the microfilm unit was judged to be adequate for rapid comparison of fingerprint cards. However, the ten fingerprint card image needed magnification for verification. Currently, a fingerprint glass is placed against the image screen. The department plans to attach a magnifier to the display unit to make verification easier.

Personnel Data

Latent Fingerprint Personnel
Nassau County Police Department Retrieval System

Position	Title	% Time Allocated to System
One Fingerprint Coder, Examiner	Detective	100%
Three Fingerprint Examiners	Detective	12%

One Fingerprint Examiner Supervisor	Detective Sgt.	25%
One Fingerprint Examiner Supervisor	Detective Sgt.	25%

Performance Data

The system was installed in October 1973. The department personnel are in the process of debugging the system. No statistics are currently available on the number of searches made or the number of hits.

POTENTIAL IMPROVEMENTS

Except for the possible addition of the magnification device to the display unit, no other improvements are planned.

OPERATIONAL PROCEDURES

Search Procedures

To perform a file search with an unknown latent fingerprint, the fingerprint technician enters the codes for the latent prints. From the remote terminal keyboard, the system can accept codes for at least two fingers in addition to codes for descriptive data elements contained in the file. When the entry of codes is complete, the technician enters a command which initiates a computer search requiring between 5 and 10 seconds (time based upon a data base of 2,200 individuals). At the completion of the search, the computer responds with the number of potential candidates which match the search parameters. The disc storage unit has a work area in which likely candidates are held until the search is completed. The size of this work area is only limited to the available space on the disc. By using the display unit, the technician may call up successive images for viewing and compare them with the latent fingerprint. The technician will typically advance rapidly through the candidates, rejecting fingerprints that are obvious non-matches. For matches requiring

close comparisons, the examiner may use a fingerprint glass directly against the display screen. Plans have been made to attach a magnifying unit to the display unit to avoid having to use the fingerprint glass.

Updating and Purging Procedures

Data is entered into the computer with the use of the subject file input forms which are completed by the identification section. The information from these forms is keypunched on computer punch cards for entry into the system. Approximately 50 individuals are added to the subject data base each month.

Fingerprint cards are presently being selected from the existing data base on the basis of age of the arrestee and type of crime. At the present time, subjects are entered into the fingerprint files only by meeting the following criteria:

1. Armed robbers
2. Burglars
3. Felony narcotic arrestees
4. All above under age of 30 years.

The manufacturer is filming and entering the data onto the data base. Newly coded fingerprints are batch processed into the computer. Film is currently being encoded and loaded in parts. A section is shot, encoded and loaded into the display unit. Later, if another section is shot and encoded, it is spliced into space on existing reels. The total reel is rephotographed to eliminate the splice.

Purging of the display file has not yet become a problem because the capacity of the display system has not yet been

reached. Codes can easily be erased from the computer memory. Clearly, some method of purging old reels must be considered in the future; however, the display unit has a capacity of 900,000 frames and currently only 2,200 are being used.

CLASSIFICATION SYSTEM

System Basis *

The basis of this system will be to assign descriptors to each finger impression, or portion thereof, to facilitate and accelerate search and retrieval of unknown and known fingerprints.

Four (4) descriptors will be assigned for each finger (see Exhibits 2-3-2 and 2-3-3). A final code for sex, race and the last two (2) digits of a person's year of birth completes the sequence.

The criteria for persons to be entered into the system are those arrested for Burglary, Robbery (and the attempt to commit these crimes), and felony Narcotics. The age grouping will include those persons thirty (30) years of age and younger. This was arrived at through statistics which show that only a small percentage of those persons over the age of thirty are arrested for these crimes or leave latent fingerprints.

Another group to be entered eventually will be the individual open latent prints, coded identically but divided by precinct and/or occurrence.

A two-way check can then be instituted. As a latent impression is discovered at the scene of a crime, it can

*NOTE: Edited material on coding system taken from the Nassau County Police Department Coding Manual.

be checked against the library of stored prints. In addition, each prisoner will be coded and checked against the open latent file, as he is booked.

FINGERPRINT CARD
SAMPLE

NAME	SURNAME	FIR T NAME	INITIAL	ID.B. NO.	
SEX	RACE	BIRTHDATE			

CHARGES	Law	Section No.	SubDiv.		Name of Offense	D.D. No.	ARREST NO.

POLICE DEPARTMENT
COUNTY OF NASSAU
MINEOLA, N.Y.

Signature of Person Fingerprinted ✓

CRIMINAL

Taken By: Sh No. Date Fingerprinted

1. RIGHT THUMB	2. RIGHT INDEX	3. RIGHT MIDDLE	4. RIGHT RING	5. RIGHT LITTLE
Code	Reference Code	Whorls Ulner Counts Loops Radial & Ulner	Whorls Radial Counts must be circled	Code check Coder init F/P Checker
6. LEFT THUMB	7. LEFT INDEX	8. LEFT MIDDLE	9. LEFT RING	10. LEFT LITTLE
	Code of Whorls Alternate Counts (Place below other code and circle)			

LEFT FOUR FINGERS TAKEN SIMULTANEOUSLY	LEFT THUMB	RIGHT THUMB	RIGHT FOUR FINGERS TAKEN SIMULTANEOUSLY
	Sex Race Birth Cartridge Number: Frame Number: Disc Number:		

Exhibit 2-3-2

1st Digit	2nd Digit	3rd Digit	4th Digit
0 AMP	0 Right hand 1 Left hand	0 Thumb, 1 Index, 2 Middle, 3 Ring, 4 Little	0 One, 1 Two, 2 Three, 3 Four, 4 All
1 ARCHES	0 PLAIN 1 TENTED	0 0, 1, 2, 3, 4, 5, 6, 7, 8 Others	0 0
2 LOOP \	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 Others	0, 1, 2	0 No count 1 1 to 3 2 4 to 5 3 6 to 7 4 8 to 9
3 LOOP /			
4 CPL \	0	3	5 10 to 11
5 CPL /	1	4	6 12 to 13 7 14 to 15 8 16 to 17
6 DL	2	5 Others	9 18 & over
7 PW	3		Counting Whorls: 1. Use common core. 2. Code ulner position count first. 3. Code radial position count next and circle. Counting Double Loops: 1. Use common core. 2. Use loop closest to center, in upward direction.
8 ACC	4 5 6 Others		
9 SCARRED	0 Right hand 1 Left hand	0 Thumb, 1 Index, 2 Middle, 3 Ring, 4 Little	0 One, 1 Two, 2 Three, 3 Four, 4 All

Exhibit 2-3-3

CODING SYSTEM

I

A. All AMPS will have a first descriptor of "0".

B. The second descriptor will be "0" for an AMP in the right hand or "1" when in the left hand.

C. The third descriptor:

Amp in Thumb	"0"
Amp in Index	"1"
Amp in Middle	"2"
Amp in Ring	"3"
Amp in Little	"4"

D. The fourth descriptor:

Amp in one finger same hand	"0"
Amp in two fingers same hand	"1"
Amp in three fingers same hand	"2"
Amp in four fingers same hand	"3"
Amp of all fingers same hand	"4"

II

ARCHES

A. All arches (plain and tented) will have first descriptor of "1".

B. PLAIN ARCHES:

Second descriptor will be "0"

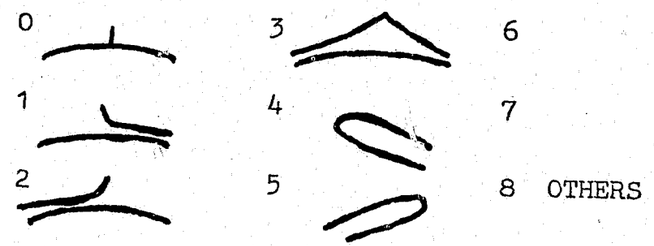
Third descriptor will be "0"

Fourth descriptor will be "0"

C. TENTED ARCHES:

Second descriptor will be "1"

Third descriptor will be "0" through "8"



Fourth descriptor will be "0".

III

LOOPS

A. \ slant Loops will have a first descriptor of "2"

B. / slant Loops will have a first descriptor of "3"

C. The second descriptor is determination of the core type of the Loop. They will be sub-divided "0" through "9".

0
1
2
3
4
5
6
7
8
9 OTHERS

D. The third descriptor is determination of the delta type of the Loop. They will be sub-divided "0" through "5"

0 Bifurcation

1 Ridge Ending beyond divergence

2 Ridge Ending through divergence

3 Fragment

4 First encountered ridge

5 OTHERS

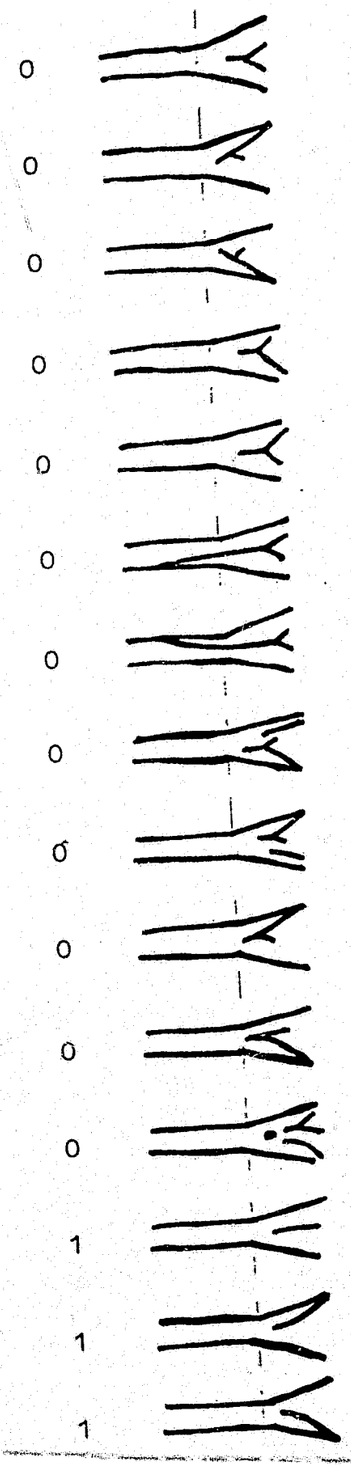
LOOP CORES

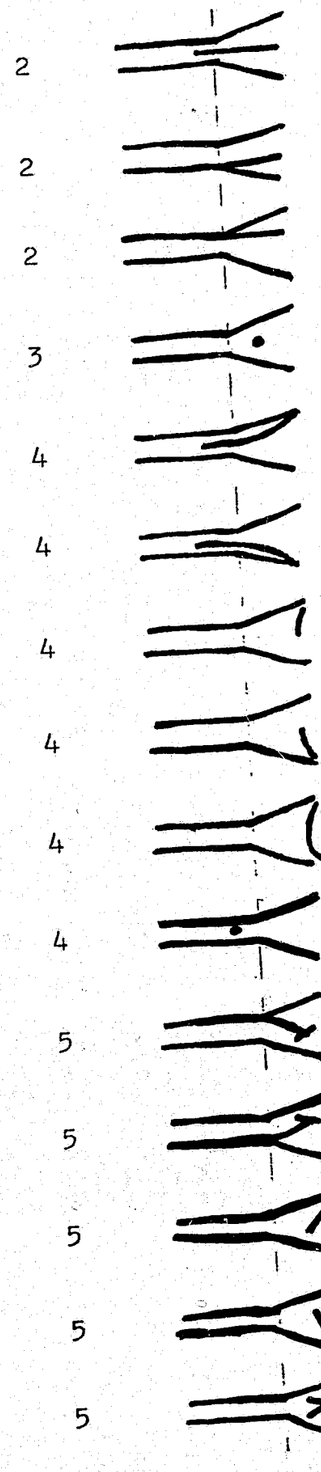
SECOND DIGIT

0
1
2
3
4
5
6
7
8
9 ALL OTHERS

DELTAS

THIRD DIGIT





E. The fourth descriptor is the ridge count of the Loop pattern. They are divided "0" through "9".

0 - No count

1 - 1 to 3

2 - 4 to 5

3 - 6 to 7

4 - 8 to 9

5 -10 to 11

6 -12 to 13

7 -14 to 15

8 -16 to 17

9 -18 and over

IV

WHORLS

A. CPL \ the first descriptor will be "4".

B. CPL / the first descriptor will be "5".

C. DL the first descriptor will be "6".

D. PW the first descriptor will be "7".

E. ACC the first descriptor will be "8".

F. The second descriptor is the determination of the core type of the Whorl. They will be sub-divided "0" through "6".

G. In determining the core type, the use of the general area at the center of the pattern shall be consideration.

0 — Any circle or incomplete circle void of anything inside.

1 — Any circle or incomplete circle with anything inside.

2 — Spiral CLOCKWISE

3 — Spiral COUNTERCLOCKWISE.

4 — DOUBLECORED

5 — TWO single cores.

6 — OTHERS

OTHERS

H. The third descriptor:

1. Is used in determining the sub-division in the ULNA position of the delta type.

2. Then the descriptor is used in further determining the sub-division in the RADIAL position of the delta type (as the alternate delta).

I. The fourth descriptor is the ridge count from the delta in the ULNA position, then the ridge count in the RADIAL position as the alternate.

J. In conclusion, the descriptors will result in a combination of four letters (or digits) with the alternates in a Whorl using a common core.

1. Example:

a. Type of whorl.
b. Core description.
c. Delta description in the ULNA position.
d. Ridge count using the ULNA position.

The alternate position (circled).

a. Type of whorl.
b. Core description.
c. Delta description in the RADIAL position.
d. Ridge count using the RADIAL position.

V

SCARRED

A. The first descriptor will be assigned "9".

1. This applies only if the pattern areas are missing or destroyed, or cannot be determined with accuracy.

B. The second descriptor will be "0" for scars in the right hand or "1" in the left hand.

C. The third descriptor:

Scar in Thumb	"0"
Scar in Index	"1"
Scar in Middle	"2"
Scar in Ring	"3"
Scar in Little	"4"

D. The fourth descriptor:

Scar in one finger same hand	"0"
Scar in two fingers same hand	"1"
Scar in three fingers same hand	"2"
Scar in four fingers same hand	"3"
Scars in all fingers same hand	"4"

VI

SUB-DIVIDING

A. Sex and Race are coded using "1" through "6".

1 - M-W

2 - M-B

3 - M-O

4 - F-W

5 - F-B

6 - F-O

B. Age is coded by using the last two digits of year of birth.

Example: Born in	1900	00
	1905	05
	1932	32
	1939	39
	1947	47

Section 2-4

ATLANTA POLICE DEPARTMENT
MIRACODE I SYSTEM

INTRODUCTION

The Atlanta Police Department was the first to use the Miracode I Microfilm Retrieval System for latent fingerprint work.

GENERAL SYSTEM DESCRIPTION

Hardware

The Miracode I system consists of an electro-mechanical keyboard control unit, a filming and data capture unit, and a retrieval/display unit. These devices are shown in Exhibits 2-4-1, 2-4-2, and 2-4-3.

Equipment Operation

The keyboard control unit is used to key-in coded information for a file search. The keyboard control is interfaced with the microfilm retrieval unit. Searches are made by inserting a film cassette into the retrieval unit. A photo cell in the retrieval unit scans the film to locate matches to the information keyed into the system.

The retrieval device is equipped with a display screen for viewing potential candidates selected during the search process.

The filming unit is used to photograph subjects to be included in the data base. The encoding device places the codes on the film which is scanned by a photo cell in the retrieval unit during a file search. After a roll of film is exposed, it is sent out for processing into film cassettes.

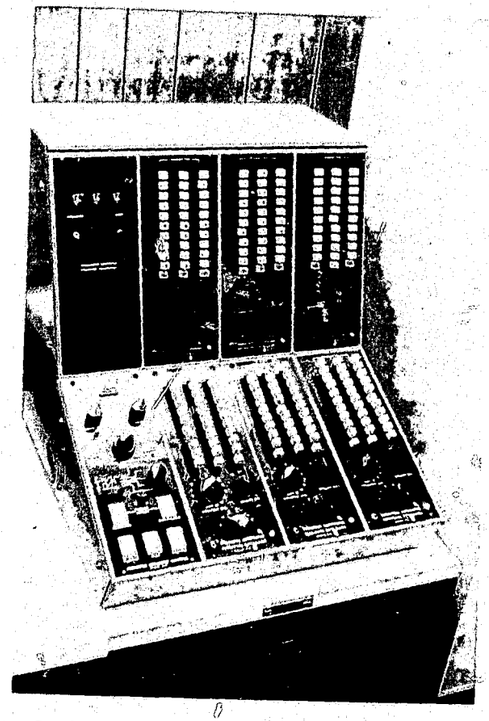


Exhibit 2-4-1. Keyboard Control Unit

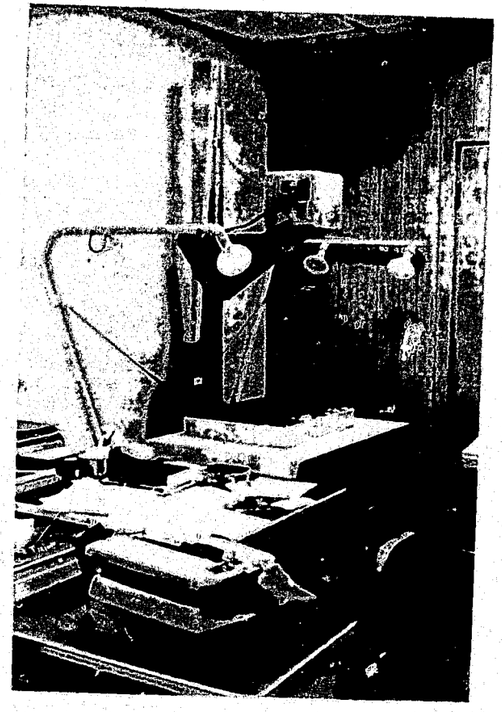
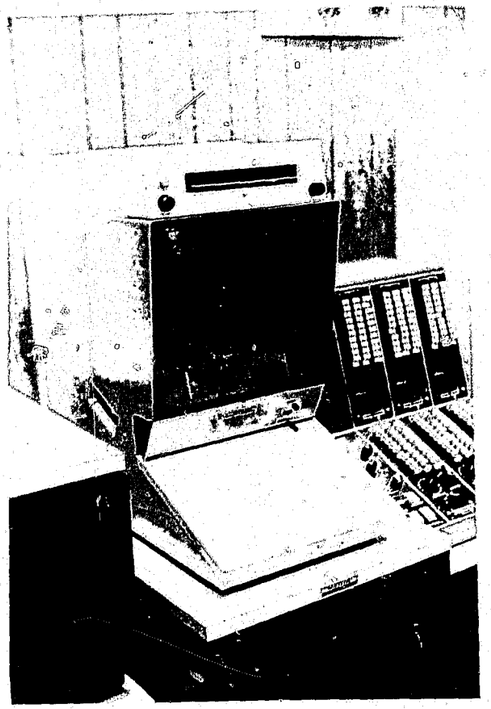
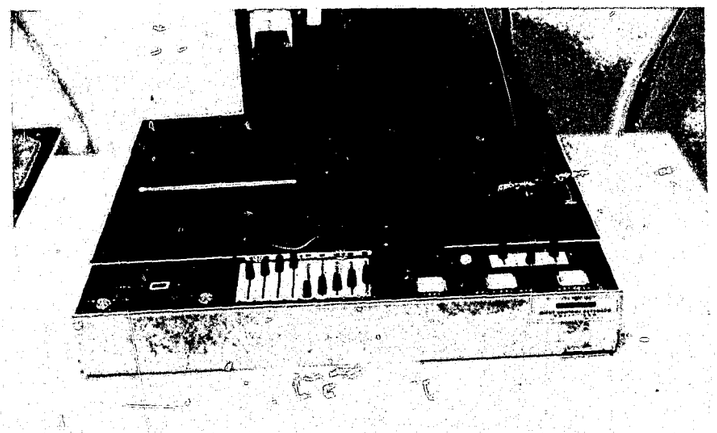


Exhibit 2-4-2. Typical Filming/Data Capture Unit



Typical Display/Retrieval Unit



Close-up View of a Typical Encoding Device

Exhibit 2-4-3

A more detailed account of the operation procedures is subsequently provided.

Files

At the Atlanta Police Department, the Miracode I system is dedicated to the searching of latent fingerprints. At last count, the cassette library contained the fingerprints of approximately 30,000 individuals. Persons arrested for burglary, robbery, larceny of automobiles, theft of automobiles and sex crimes are entered into the system. In addition, persons may be added to the file upon specific request of police officers and other police agencies.

Unidentified latent fingerprints are filed by case number. The form in Exhibit 2-4-4 is used by the department to log crime scenes where latent fingerprints are found.

COST AND PERFORMANCE DATA

Equipment Cost

In 1969, the time of purchase, the unit cost was $17,000. This included the keying-in unit, the display unit, and filming unit. The ongoing cost includes:

1. Maintenance: average over last three years, $238 per year
2. Cost of film
3. Cost of developing film

NOTE: The Kodak Company has indicated that the Miracode I System is no longer commercially available.

Mechanical Reliability

Since its installation, the equipment has suffered very little breakdown. The display unit jammed once and the control

IDENTIFICATION SECTION, POLICE DEPARTMENT, ATLANTA, GEORGIA
FINGERPRINT CALL REPORT

Case Number _____ Date _____

Name _____ Address _____

Location Checked _____

Number Prints _____ Number Cards _____ Powder Process ( ) _____

Chemical Process : ( ) Silver Nitrate ( ) Nin Hydrin ( ) Other _____

Call Answered By Det's _____ Uniform _____

Date of Call _____ Time Received _____ Arrived _____

Crime Involved _____ Date of Crime _____

Id Tech. Answering Call _____

Any Other Information Pertaining to Call _____

Have Victim's Prints been Eliminated Yes ( ) No ( ) _____

If Auto Involved: Year _____ Make of Car _____ Series _____ Color _____

Tag No. _____ Year of Tag _____ Serial No. _____

Comparison's Made

Name	Number	Compared By	Date	Disposition	Compared For

MIRACODE SEARCH:

#__-_____ #__-_____

#__-_____ #__-_____

#__-_____ #__-_____

By _____

Date _____

MASTER FILE SEARCH:

_____

_____

_____

By _____

Date _____

Prints Received From _____ By _____ Date _____

FORM 32-I-31 REV.

Exhibit 2-4-4

unit had to be repaired once. These problems have been called minor by department users.

Display Adequacy

The display unit magnifies the image approximately 2 1/2 times. The department has reported no problem in making matches directly from the display unit screen.

Filming Unit

The Atlanta Police Department personnel reported no problems with the filming unit which was purchased originally in 1969. Since that time, the police department has purchased a more modern solid-state device to encode the three-digit code onto the film.

Personnel

Currently, the Atlanta Police Department has 12 people who spend varying amounts of time operating the Miracode I system.

Personnel	Positions	% of Time on System
5	Identification Technician I	3%
6	Identification Technician II	10%
1	Identification Technician III	10%

Performance Data

Approximately 300 searches are made against the data base each month. "Hits" have been averaging two per month.

POTENTIAL IMPROVEMENTS

The only suggestion made for improvement was to update the present equipment to the new Miracode II system on the market. Otherwise, the department is satisfied with the system.

OPERATIONAL PROCEDURES

Search Procedures

To perform a file search of an unidentified latent fingerprint, the latent fingerprint is coded using a three-digit code which is described later. The codes are keyed into the keyboard control unit. Data is keyed into the control unit and a search is made by the retrieval/display unit. A photo cell in the unit scans the film, and when each card with information similar to the encoded material appears, the machine stops. Each of the fingerprints with similar codes can then be called up for visual display.

During the searching process, the reader determines the number of prints which must be seen. A counter indicates the number of possible matches. It takes up to 15 seconds to search a roll of film.

A 100-foot roll of film will hold approximately 550 fingerprint card images.

Matches are made directly against the display unit screen. The image on the screen is magnified to approximately 2 1/2 times normal size. Magnification of the image enhances its clarity for the purposes of identification.

Updating/Purging Procedures

Data is entered into the system at the time of booking. People arrested for burglary, robbery, larceny from autos, auto theft and sex crimes have been selected for input into the system. Approximately 150 individuals are input into the system monthly.

Each card is classified using the three-digit code developed by the Atlanta Police Department. The coded card is then filmed

and the code placed in the films with the use of the special filming device. The negative is developed by the department. The negative is sent out to obtain a positive film to be used in the system.

The file is not purged at this time. However, it is clear that purging will have to be considered if the data base grows without an increase in personnel and equipment. Department officials believe that prints might be purged on the basis of age or death of the person(s) whose prints appear in the data base.

CLASSIFICATION SYSTEM

The classification system used with the Miracode system in Atlanta is a three-digit code. The first digit represents the pattern type; the second digit represents a ridge count or tracing; and the third digit represents the core type. (See coding chart in Exhibit 2-4-5). In addition to the above, it is possible to further limit the search parameters by adding the age, race, or sex of the suspect (see Exhibit 2-4-6). If the finger is known, e.g. right thumb, this data may be input to limit the size of the search.

In coding fingerprints, the identification technician simply matches the pattern of the unidentified latent fingerprint against the pattern types shown on the coding chart. The number of the pattern on the coding chart which matches the pattern of the unknown latent fingerprint is used as the first digit of the three-digit code; e.g. if the pattern of the latent fingerprint is a left slant loop, the first digit of the three-digit code would be "4". This process is repeated for the second digit which represents the ridge count or trace. If the latent fingerprint had a ridge count of 7, the second digit of the three-digit code would be "3" (see coding chart for second digit). The last digit of the three-digit code represents the core type.

For the purposes of our example, we will let our left slanted loop, ridge count "7" have a core with a recurve with one rod which does not touch recurves. The third digit of the three-digit code will, therefore, be a "1". The entire three-digit code for our imaginary latent fingerprint is, therefore, "431". In addition to the three-digit code, the search may be further limited by inputting a code for the finger, i.e. right thumb, if known and inputting code numbers for race/sex, date of birth, and crime category, if known (see coding chart, Exhibit 2-4-6).

A slightly modified version of the three-digit code used by the Sacramento (California) Police Department has been included in Appendix B.

FINGERPRINT CHARACTERISTIC CHART
BY ATLANTA POLICE DEPARTMENT

First Digit	Second Digit	Third Digit		
PATTERN TYPE	RIDGE COUNT or TRACING	CORE TYPE	LOOP CORE TYPE	WHORL CORE TYPE
0 = AMPUTATION	No Secondary Code = 0	No Core Type Used = 0	Recurving Ridge Without Rods. or = 0	= ◯ ◡ = 0
1 = ARCH	No Secondary Code = 0	No Core Type Used = 0	Recurve with One Rod Which Does Not Touch Recurves. = 1	= ⊙ or ⊙ or ⊘ or ⊘ = 1
2 = TENTED ARCH	1 = Upthrust Type (Regular Tent) 2 = Loop Type Tent 3 = Angular Type Tent	No Core Type Used = 0	Recurve with Two Rods Which Do Not Touch Recurves. = 2	= 9 = 2
3 = RIGHT SLANT LOOP	Ridge Count by Parameters (1-3) = 1 (10-11) = 5 (4-5) = 2 (12-13) = 6 (6-7) = 3 (14-16) = 7 (8-9) = 4 (17-21) = 8 (22-Out) = 9	Use Loop Core Type refer to next column	Recurve with Three Rods Which Do Not Touch Recurve. = 3	= ℓ = 3
4 = LEFT SLANT LOOP		Use Loop Core Type refer to next column	Recurve with One Rod that Does or Touch Recurve. = 4	= 0 or 0 = 4
5 = PLAIN WHORL AND CENTRAL POCKET LOOP	By Tracing 1=Inner, 2=Meet, 3=Out	Use Whorl Core Type refer to far column	Recurve Which Attempts Unsuccessfully to or Make a Whorl. = 5	= 9 = 5
6 = DOUBLE WHORL-LOOP	By Tracing 1=Inner, 2=Meet, 3=Out	Use Loop Core Type - "Highest Rising Core - If Equal Rising, Core Nearest Left Delta"	Cores Which Have Scars Within or Battley Circle. = 6	= 0 = 6
7 = ACCIDENTAL	No Secondary Code = 0	No Core Type Used = 0	All Cores Which Do Not Conform to the Above. = 7	= ∿ (Oddities) = 7
8 = SCARRED OR MUTILATED PATTERN	By Pattern Type - As print appeared before Scar (1-8 at left)	No Core Type Used = 0	blank = 8	= Scarred = 8

To establish a 3-digit code for each finger:
(a) Determine pattern type . . . . . (1st digit)
(b) Determine ridge count or tracing depending on (a). (2nd digit)
(c) Determine core type depending on (a) . . . . . (3rd digit)

DESCRIPTIVE DATA AND CRIME SPECIALTY

(COLUMN #11)

KEYBOARD #1 -- RACE AND SEX

0 - WHITE - MALE
1 - NEGRO - MALE
2 - WHITE - FEMALE
3 - NEGRO - FEMALE
4 - OTHER - MALE
5 - OTHER - FEMALE

KEYBOARD #2 -- DATE OF BIRTH

0 - 1920 & UNDER
1 - 1921 - 1930
2 - 1931 - 1935
3 - 1936 - 1940
4 - 1941 - 1945
5 - 1946 - 1950
6 - 1951 - 1955
7 - 1956 - 1960
8 - 1961 - 1965
9 - 1966 - 1970

KEYBOARD #3 -- CRIME CATEGORIES

0 - OPEN
1 - BURGLARY
2 - ROBBERY
3 - LARCENY OF AUTO
4 - LARCENY FROM AUTO
5 - SEX CRIMES
6 - GENERAL

Section 2-5

ROYAL CANADIAN MOUNTED POLICE VIDEOFILE SYSTEM

INTRODUCTION

On October 15, 1973, the Royal Canadian Mounted Police (RCMP) Videofile system became fully operational after nearly a year of semi-operational testing with manual file backup. The Videofile system serves as a data bank with automated search capability against two files. These are the identification file, containing the fingerprints (and classification information) of 1,200,000 individuals with criminal records, and the latent file, containing the fingerprints (and classification information) of 19,000 individuals who constitute a list of likely suspects against whose fingerprints latent images can be searched.

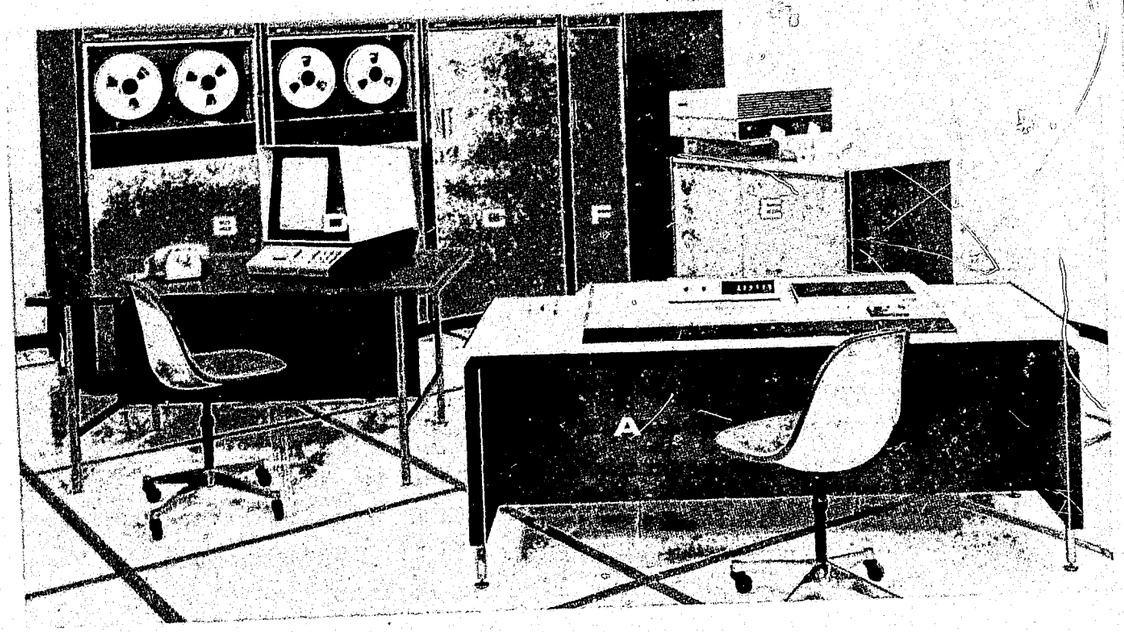
GENERAL SYSTEM DESCRIPTION

Hardware

The primary Videofile equipment includes recording cameras, card readers, a teletype terminal, a computer, videotape drives, storage buffers, a line printer and video displays. The working environment for the system is almost the same as a large computer installation. In one room are the input/output devices, e.g. card reader, recording camera, line printer and video displays. In an adjacent room are the cabinets containing the computer equipment, buffers and tape drives. (See Exhibit 2-5-1).

Equipment Operation

Although highly sophisticated, the system provides a storage and retrieval capability only. Technicians classify fingerprint impressions and convert the patterns, ridge counts and tracings



A. Input Console — This is a free standing, desk-type console which includes the video camera and optics, and a keyboard for data entry and control. A television monitor for viewing input and retrieved images is optional. The console has been designed for maximum ease of operation. It is estimated that an operator with normal clerical aptitude can be trained in its operation in less than 10 minutes.

B. Tape Sections — The tape sections are similar to those used on computers, except that video as well as digital recording capabilities are included. These tape sections search at the rate of 380 inches (or 1140 images) per second. Several tape sections may be searched simultaneously; for example, 4 tape sections containing a 75,000 card latent fingerprint file may be searched in less than three minutes.

C. Buffer Sections — Disk buffers are available as a temporary storage device for video images. As requested images are detected, or "matched," on a tape search, the image is copied to a disk buffer for viewing. Each disk has a storage capacity of 50 frames, or respondent images, and once the image is copied from tape to disk, the tape section is free to conduct further searches while the present set of respondents is being viewed.

D. Display Sections — Table top displays are available for entering requests and viewing images from remote locations. The display section consists of a keyboard for request entry and control and a television display monitor for viewing images.

E. Printer Section — For those applications requiring reproductions of recorded images, a facsimile printer is available. The print function is initiated by the actuation of a "print" button on any of the display sections and copies are generated at the rate of 18 per minute.

F. System Control Center — All sections of the system are logically controlled through a system control center consisting of a general purpose computer, in addition to the video and address switching and control elements. The request entry is through the input and display section keyboards. Program changes to the computer may be made through a paper tape reader.

*Materials contained in this exhibit were obtained from the Ampex Corporation

to specific numbers. The video images of the fingerprints are then recorded electronically on a two inch wide magnetic tape. On a digital track associated with the video images, the (single print) classification (address) is also recorded. Latent fingerprints are also classified and video images of the latents are recorded on a work tape along with the classifications. The system compares the classification of a latent with similar addresses in the (single print) file and any falling within a specified tolerance of the latent will be recognized, retrieved and copied onto a work tape. Fingerprint technicians then have the capability of displaying the candidate fingerprints against the latent on a split television screen. Visual comparisons are then made to determine whether an identification can be made.

File Organization

There are two distinct file systems in the Video file system, namely the ten-print (Henry) file and the single-print (latent) file.

The ten-print file contains the fingerprint records of 1,200,000 individuals stored on 44 reels of magnetic tape according to the primary Henry Classification. A certain number of tapes contain records of individuals with a 1/1 classification, another number contains the images of the next section of the file and so on until the last set of tapes which contain the 32/32 images. Because comparisons are generally made only against the images of the thumbs and index fingers, the actual working file has been concentrated onto 22 reels containing all the classification information but only the video images of the fingerprints from those four fingers.

The single-fingerprint (latent) system file is broken into five subfiles contained on six reels of video tape. Four of the subfiles (hereafter called "files") contain the fingerprint

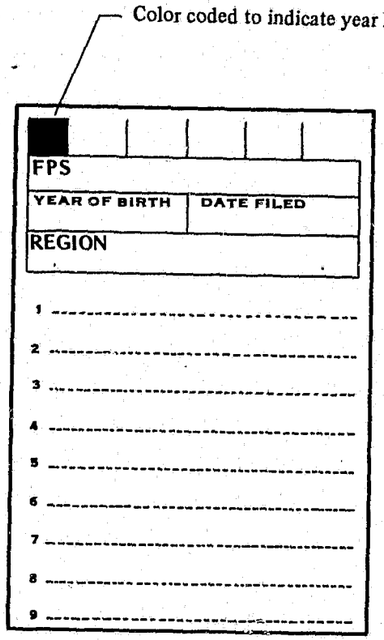
records of individuals who have been involved in selected crimes in one of four respective geographical areas of the country. These files are named the Maritime File (for the Maritime Provinces and Newfoundland), the Quebec File, the Ontario File and the Western File (for the Western Provinces, the Yukon and the Northwest Territories). A fifth file, called the Transient File, contains the fingerprint records of individuals involved in selected crimes in more than one of the geographical areas (hence, files) described above. Each file is contained on one reel of tape, with the exception of the Ontario File which, because of its size, is on two reels. There are currently 19,000 fingerprint records on these six reels of tape. A program of converting "still active" individuals from the manual file to the video file is still under way. Approximately 1,000 individuals are added to the data base every month.

A small manual file of 2" x 3" cards is also maintained (see Exhibit 2-5-2). Each individual in the video file has an associated card containing a reference number (called the FPS No.), his year of birth, the month the record was filed, the regional file containing the record, the classification of each of the eight fingers in the file and a colored square marking indicating the year in which the file was last updated (indicating the individual was "still criminally active"). This file allows easy update of records and rapid purging from the file of those individuals who have not been active for three years or more.

COST AND PERFORMANCE DATA

Equipment Cost

The RCMP Videofile system's initial cost was between $1.4 and $1.5 million. The ongoing costs include an annual maintenance contract costing $78,000 and a parts contract costing $48,000 per year, including taxes and duty. It should be noted



Sample of MANUAL FILE CARD

that the Videofile is used principally for the identification function; conservatively, in excess of 70% of its operation is devoted to this function. This is difficult to measure because of the parallel operation of both functions.

Mechanical Reliability

The RCMP interviewees indicated that performance of the Videofile system has been quite satisfactory. Down-time for the system has been averaging 4-5% per month. It appears that the one year operation in a test mode prior to going fully operational on October 15, 1973, may have been effective in reducing the number of operational reliability problems.

Display Adequacy/Image Clarity

The display of the Videofile image was judged to be quite satisfactory for rapid comparison between latent images and file images. The clarity of the images was dependent on the quality of the original source documents or evidence. Although,with good images an identification could be made with the viewer, a check of the identification is made by a fingerprint technician because of the necessity to go to the manual file in both the latent and identification areas for subsequent processing.

Training

Technicians working in the single fingerprint system are first trained in the Henry System and work in the identification area for 3 to 5 years. They are then trained in the Battley system and work under close supervision for 6 to 12 months. Subsequently, they are allowed to work alone on the various activities of the group.

Personnel

The group processing the latent fingerprint evidence (classifying, coding, searching) consists of one sergeant supervisor

and 8 technicians in three grades of "civilian member" classification, all working 100% on the latent problem.

POTENTIAL IMPROVEMENTS

The only recommendation for improvement offered by the interviewees was to improve the quality of the latent images submitted for search and (to a lesser extent) the quality of fingerprint impressions submitted for entry in the file.

OPERATIONAL PROCEDURES

Search Procedures

Crime scene fingerprints are classified for search against the files using a Battley seven-digit code. Reports accompanying the latents may contain the names of suspects. The initial search may be to compare suspect prints with the latents. These reports also state that elimination prints were taken and screened prior to submission. Generally, all latent prints are searched against the geographic regional file corresponding to the agency submitting the latent and against the transient file. If the location of the crime scene is near the border of two regions, both regional files as well as the transient file will be searched.

Two search modes are offered by the Videofile equipment. One is used when a small number of candidates is expected. In this case the search parameters are entered through punched cards. The appropriate file tape is mounted and the digital information on the tape is searched at 380 inches per second. Each time a candidate is found the tape drive stops, backs up, reads the digital and video images of the complete record, copies them to a work tape and begins the search again. After the search is complete, the work tape can be used for comparison with the latent fingerprint images on the split image video screen. In this mode, five searches of one tape can be conducted simultaneously.

If a large number of candidates is expected, the frequent winding/stopping/backing up, etc., of the tape can be quite time consuming. Thus, another search option has been provided. Search parameters and tolerances are entered via the teletype terminal and the tape is searched at 5 inches per second. In this case, when a candidate is found, the frame of interest (a pair of fingerprint images and their classifications) is copied onto the work tape without interruption in the search. There is thus no need to stop or rewind the tape in this search mode. Once the candidates have begun to be assembled on the working tape, the technician can make comparisons by displaying the candidates and a video image of the latent fingerprint on the split screen television monitor. The system contains three split screen video (television) display positions. These allow technicians to display a latent print on one half of the screen (e.g., the lower half) and to display candidate prints on the other half for comparison. The candidate prints are displayed from a working tape after the file search is complete and they can be advanced as quickly as the technician desires by depressing a button. Usually the first image is available within about 30 seconds of the search time. Subsequent images are generally available as fast as the technician can view them. The options of displaying a positive or negative of the image and of varying contrast and brightness are allowed in order that the technician can make comparisons under the most favorable circumstances.

Another option allows the technician to learn from teletype printout, the number of candidates found. If the number is too large or too small, he may adjust the tolerance in the search argument and search the tape again prior to viewing any images. In the teletype search modes, simultaneous searches cannot be conducted.

Once a search has been completed, the latent fingerprint evidence is returned to the contributing agency. If no identification has been made, the contributing agency may resubmit the evidence after six months and a search will be made against the records added to the appropriate files during the intervening six months.

Search times vary with file size. A search against the largest file (Ontario) takes about one hour in the teletype search mode. For the smallest file (Maritime) the corresponding time is 8 to 9 minutes. Once the search of one tape (i.e., a regional file) begins with a set of search arguments, the search of a second tape (e.g, the transient file) can be initiated and carried out simultaneously.

Latent prints submitted from a murder case are usually searched against all files and may be retained for subsequent searches against new records in the file.

Verification of an identification is made by comparison of the latent fingerprint with the hard copy fingerprint record maintained in the manual files. A file check is necessary whenever a "hit" is made because it is necessary to determine whether the subject is confined and whether the contributing agency already has his record.

A sample of the search request form is shown in Exhibit 2-5-3. The first sheet is a search request form for a teletype mode search against source tapes 303 and 305 (i.e., Ontario and Transient) for a right index finger with classification between the limits indicated by Hi and Lo address. (See Classification System, below). The second and third sheets are for searches against specific classifications of fingers on the right and left hand respectively (see Exhibits 2-5-4 and 2-5-5).

SFP TTY SEARCH

ALT MODE S4

ACT S

SRCE T10 303 = 305 =

OBJ T10 999

FNGR NUM 2 — 1-4 = ignore

HAND R — L = ignore

HI ADDR 03497175 0

LO ADDR 02373129 0

CASE NUM 1234 = 5678 =

STRT ADDR space bar.

REDY Y (yes) N (no)

FILED

NUM RESP.

IDENT. Yes – No

FPS

SINGLE FINGERPRINT SEARCH // VIDEOFILE

RIGHT HAND

Contributor

File #

WIP TID

CASE #

R 61 T 1

R 62 T 1

R 63 T 2

R 64 T 2

R 65 T 3

R 66 T 3

R 67 T 4

R 68 T 4

Other searches required? No Yes

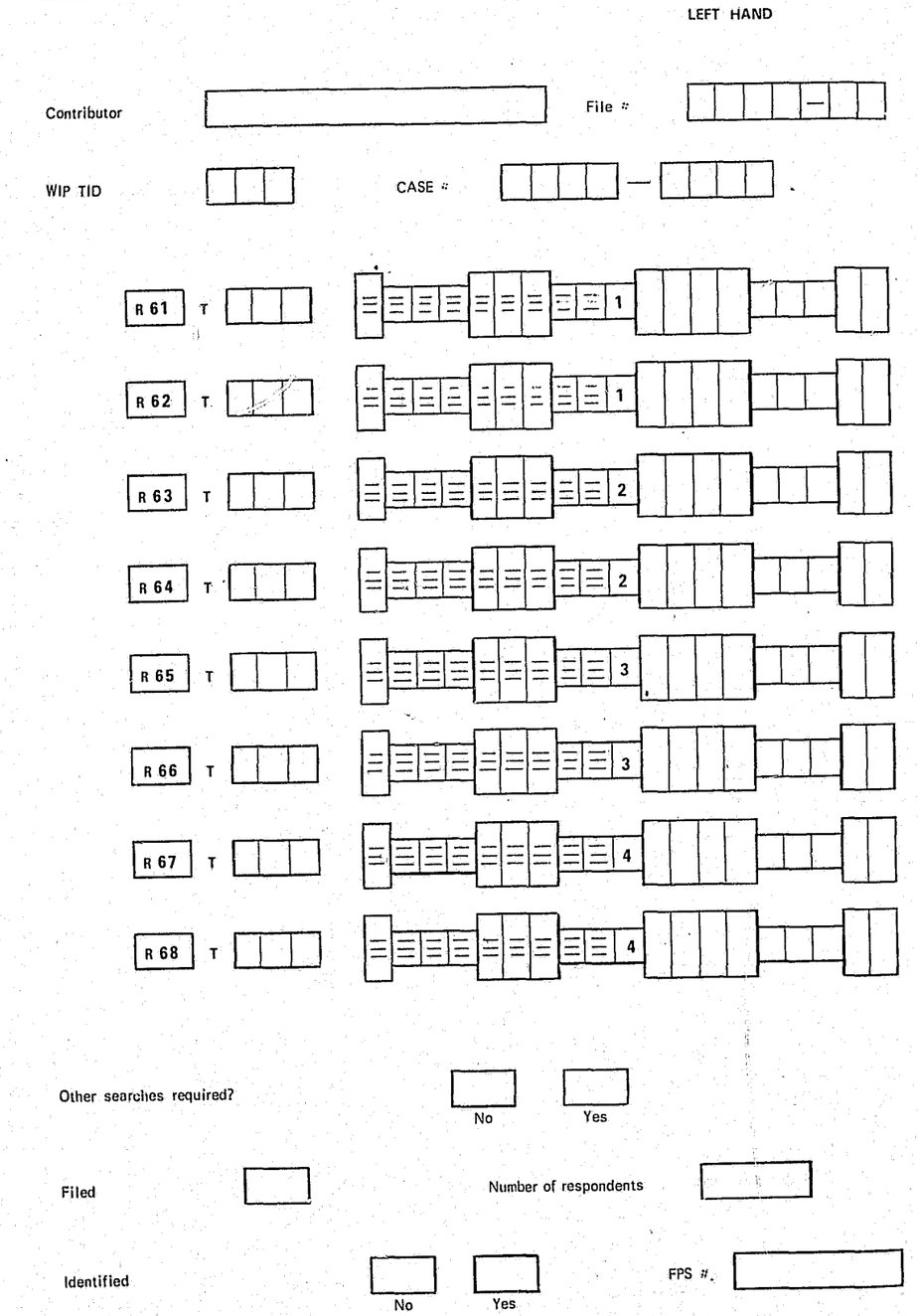
Filed

Number of respondents

Identified No Yes

FPS #

SINGLE FINGERPRINT SEARCH // VIDEOFILE



Updating/Purge Procedures

Fingerprint records for the single print files are generally completed by the contributing agency along with the regular (Henry) fingerprint record. The records are reviewed at the Crime Scenes Section to determine whether they should be retained. A search is made against the reference (FPS) number to determine if the individual is already in the file. If the record is already present and has been updated within the same calendar year (as evidenced by color coding the manual card file) no update takes place, except perhaps to transfer the record to the transient file if the subject record is not already there and the latest submission indicates suspected criminal activity in a geographic region other than that of the previous submission(s). If the record is present and has not been updated within the calendar year, the record is updated, the color coding is changed accordingly and, if warranted as described above, the record is transferred to transient file.

Annually, the manual file is reviewed and all cards that have not been updated within the last three years (indicating "no activity") are pulled. The corresponding records in the video file are erased. About 5,000 records are purged annually.

The latent (single fingerprint) files contain the fingerprints of males under 30 years of age involved in the following offenses or attempted offenses: arson, breaking and entering, possession of burglary tools and stolen property, robbery, auto theft, kidnapping and abduction, Excise Act violations, and Narcotic Control Act violations. Candidate prints for inclusion in the file are received on special forms from police departments, provincial police, the RCMP and penitentiaries throughout Canada. These candidates are reviewed by the Scenes of Crime Section and if retained they are screened for print quality, classified and entered in the file. Only the thumbs, index,

middle and ring fingers are recorded. The little fingers are not filed due to the infrequency of their lone occurrence at crime scenes.

Data and images are input to the system one frame at a time by means of a special camera with magnified optics. Fingerprint images are positioned for recording in a manner similar to the operation of a top-loading photo copying machine. A video display indicates to the operator the exact video image that will be recorded for the frame. A keyboard allows the operator to encode the digital information along with the video. A card reader on the console allows the option of encoding the digital information from prepunched cards instead of directly from the keyboard. There are two identical consoles from which data can be entered in the file. A standby teletype terminal can be used for entering search parameters and receiving responses, e.g., regarding the number of candidates returned.

The storage medium for the fingerprint files in the Video-file system consists of a number of reels of two inch wide video tape. In the Henry system, 60,000 fingerprint records can be filed on one 10-inch (in diameter) reel of tape. (See file description below). Computer hardware and software are employed to drive the tape drives during the recording, searching and copying operations. Buffers are used for temporary image storage.

The structure of an individual file on the magnetic tape consists of individual records written in sequence on the tape. An individual record consists of five frames, each containing digital information and four of which contain video information. (See Exhibit 2-5-6). The first frame (called No. 0) contains, in the digital track, 19 numeric characters identifying the record and the individual. (There is no video on this frame).

The second frame (called No. 1) contains, in the digital track, the classification of the right thumb print, converted to a 9 character numeric code, the frame number and the classification of the left thumb print converted to a 9 character numeric code. The video portion of this frame contains the fingerprint images of the right and left thumbs. (See below for description of classification system). The third, fourth and fifth frames (called frame No's. 2, 3 and 4) contain the digital coding and video images of the index, middle and ring fingers respectively in the same format as that described above for the thumbs.

The records are stored on the appropriate (regional or transient) file in the order of entry on the tape. As records are purged from the file, or are transferred from a regional file to the transient file, blank sections of the tape remain. When a large number of such blanks exist on a tape, it can be copied, closing the gaps to allow more efficient storage and search of the tape.

Occasionally, a fingerprint or part of a fingerprint (that might appear in a latent print) can be interpreted as another pattern. In such a situation, a second (modified) record is created for cross reference purposes. In the cross reference record, a modified reference (FPS) number, related to the original, is used and the cross reference finger is classifed appropriately. All non-cross referenced fingers (except index, middle and ring fingers of the same hand if the index, middle or ring finger is cross referenced) are classified with dummy variables (all 9 fill) so that searches against them will not be necessary. If two fingers, e.g., a middle finger and thumb, have to be cross referenced, three cross reference records in addition to the regular classification may be necessary to insure that the data base is complete.

SINGLE FINGERPRINT BUREAU ADDRESS FORMAT

FOLDER FORMAT

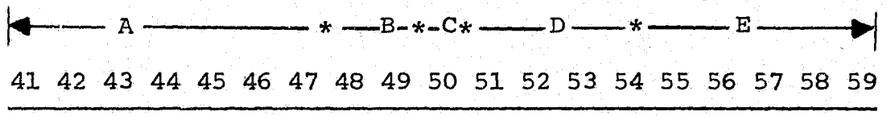
FRAME NO.

0	1	2	3	4
ADDRESS NO VIDEO	ADDRESS RT LT	ADDRESS RI LI	ADDRESS RM LM	ADDRESS RR LR

VIDEO CONTENT XY WHERE
X = HAND Y = FINGER

ADDRESS FORMAT

1. FRAME NO. 0



A. FPS NO. (7 CHARACTERS)

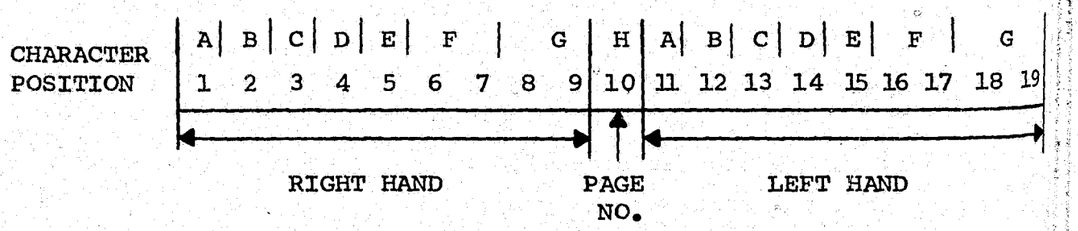
B. DATE OF BIRTH (2 CHARACTERS) - YEAR WITHIN THIS CENTURY

C. FRAME NO. (1 CHARACTER) - ENTER A ZERO

D. DATE FILED (4 CHARACTERS) - YEAR WITHIN THIS CENTURY FOLLOWED BY MONTH

E. NO USED (5 CHARACTERS) - ENTER ZEROS

2. FRAME NO. 1, 2, 3 and 4



A, B, C, D, E, -- 1 CHARACTER

F, G -- 2 CHARACTERS

Exhibit 2-5-6

The video file has no limitation on file size. As the number of records increases, additional tapes can be used for file storage.

CLASSIFICATION SYSTEM

The Battley Fingerprint System of classification is used to code fingerprints. In the Battley system, a seven-digit code is used to describe each coded finger. However, the fingerprint codes for the various types of patterns do not always have seven different characteristics which can be used for coding purposes. This point can be illustrated by referring to the conversion table used by the RCMP, entitled "Details of SFB Address" (Single Fingerprint Bureau) shown in Exhibit 2-5-7. For example, in a tented arch code, only three digits of code are utilized: the first digit represents the pattern type; the next digit represents the slope, i.e., radial, ulnar or plain; the last digit represents a circle reading of the delta utilizing the Battley fingerprint glass (described in detail in Section 2-6 on Miami Police Department). The remaining four digits are not used. A zero is placed in each of the last four slots. In the case of a whorl, however, all seven digits are used: the first digit represents the pattern type (see core chart shown in Exhibit 2-5-8); the second digit represents the core type; the third digit represents a circle reading of the left delta; the fourth digit represents a tracing; the fifth digit represents a circle reading of the right delta; the sixth digit represents a ridge count from the left delta; the last digit represents a ridge count from the right delta. Therefore, in the case of a whorl with:

1. A-1 core (see core chart)
2. Left delta in Circle "C"
3. Inner trace
4. Right delta in Circle "E"

DETAILS OF SFB ADDRESS

1. Arches

   A. Pattern Type
      0 = Arch

   B, C, D, E, F, G----Unused (zeros)

2. Tented Arches

   A. Pattern Type
      1 = Tented Arch

   B. Slope
      0 = Plain
      5 = Radial (R)
      6 = Ulnar (\)

   C. Circle Reading
      0 to 7 = A to H

   D, E, F, G----Unused (zeros)

3. Loops

   A. Pattern Type
      5 = Radial Loop (R)
      6 = Ulnar Loop (\)

   B. Core Type
      0 to 9 = A to K, where K also SCAR

   C. Circle Reading (Delta)
      0 to 7 = A to H

      # of Details (e.g. bifurcation)
      D. Delta side
      E. Other side

      of a vertical line parallel to the ridges.

   F.----Unused (zero)

   G. Ridge Count
      00 to 50

4. Whorls

   A. Pattern Type
      0 = Whorl (core A1 to A4)
      4 = Whorl (core B to H)

   B. Core Type
      1 to 4 (core A1 to A4)
      1 to 7 = B to H
      9 = SCAR

Exhibit 2-5-7

   C. Circle Reading - Left Delta
      0 to 7 = A to H

   D. Tracing
      7 = Inner (I)
      8 = Meet (M)
      9 = Outer (O)

   E. Circle Reading - Right Delta
      0 to 7 = A to H

   F. Ridge Count - Left Delta
      00 to 50

   G. Ridge Count - Right Delta
      00 to 50

5. Twin Loops

   A. Pattern Type
      3 = Twin Loop (D)

   B. Trend of Descending Loop
      5 = Radial (R)
      6 = Ulnar (\)

   C. Circle Reading Between Loops
      0 to 7 = A to H

   D. Circle Reading to Left Delta
      0 to 7 = A to H

   E. Unused (zero)

   F. Ridge Count Between Looping Formations
      00 to 50

   G. Ridge Count Descending Loop to Related Delta
      00 to 50

6. Lateral Pocket Loops

   A. Pattern Type
      3 = Lateral Pocket Loop (D)

   B. Trend of Ascending Loop
      5 = Radial (R)
      6 = Ulnar (\)

   C, D, E, F----Unused (zeros)

   G. Ridge Count Descending Loop to Inner Delta
      00 to 50

7. Composites and Accidentals

   A. Pattern Type
      2 = Composite (C)
      7 = Accidental (X)

B, C, D, E, F, G----Unused (zeros)

8. Scars

   A. Pattern Type
      9 = Scar

   B, C, D, E, F, G----Unused (zeros)

9. Amputations

   A. Pattern Type
      8 = Amputations

   B, C, D, E, F, G----Unused (zeros)

BATTLEY SINGLE FINGERPRINT SYSTEM
OF CORE PATTERNS - LOOPS & WHORLS

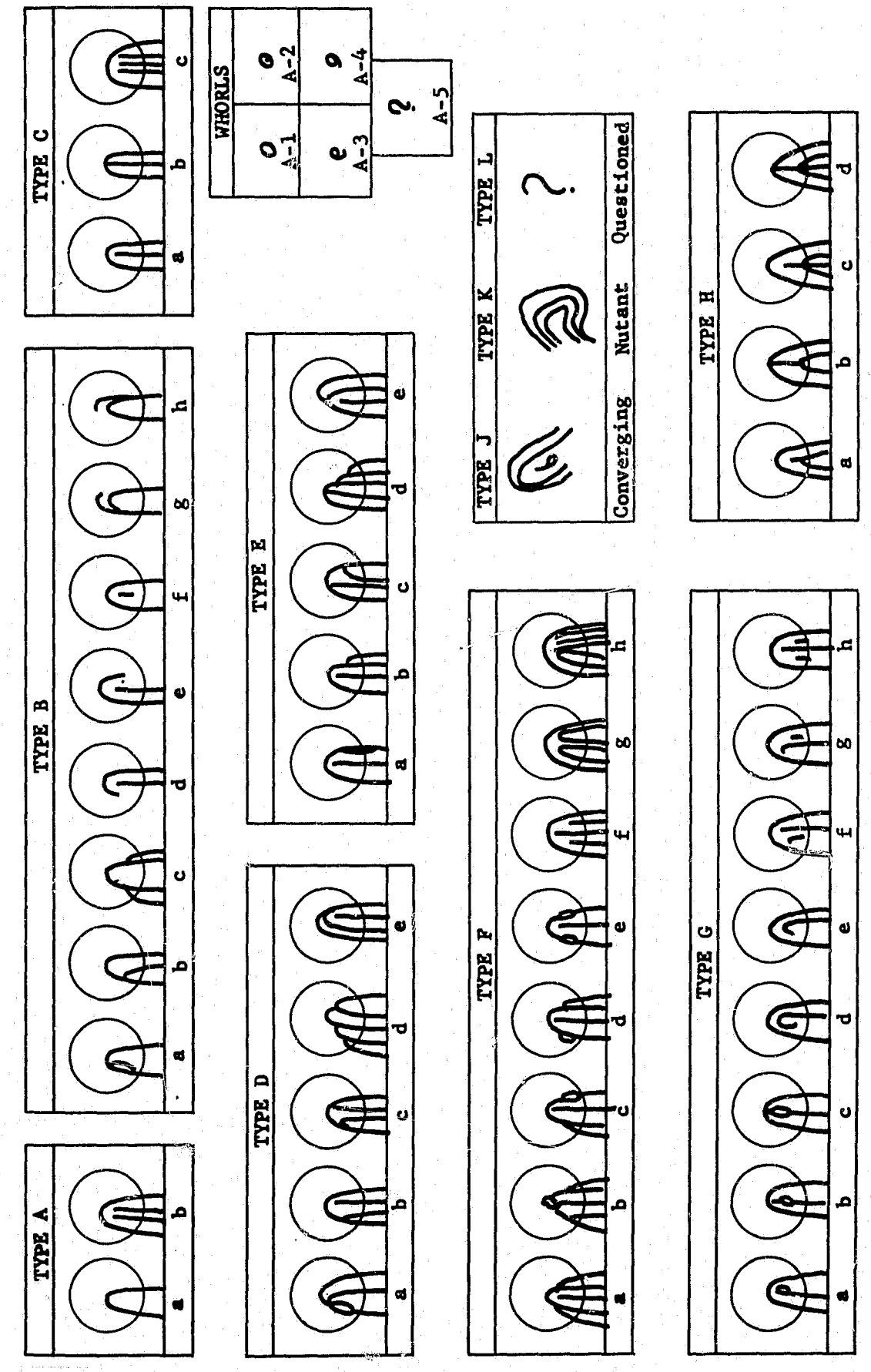


Exhibit 2-5-8

5. Ridge count from left delta, 6

6. Ridge count from right delta, 9

The seven-digit code would be "0127469". With the use of the conversion table and the core chart, a technician is able to code fingerprints for use in the Videofile system. By matching the fingerprint to be coded against the characteristics shown on the conversion table and core chart, each characteristic in the fingerprint to be coded is then converted into a numeral which represents each characteristic. Once the fingerprint characterisitics are reduced to a real number code, the technician may key-in the code for use in the computer.

Section 2-6

MIAMI POLICE DEPARTMENT
RUSSAK SYSTEM

INTRODUCTION

The Miami Police Department began developing their juvenile latent fingerprint file in 1969. In January 1973, the first listing of juvenile, coded fingerprints was produced.

GENERAL SYSTEM DESCRIPTION

Hardware

The hardware for the system is an NCR Century 100 Computer. The computer is programmed to sort fingerprint classifications into numerical order to be printed out in a computer listing. (See Exhibit 2-6-1 for a typed sample of a computer listing.)

Information to be put into the system is keypunched on computer punch cards.

File Organization

The juvenile file is maintained in file cabinets. A standard 10-finger fingerprint card is used. Currently, 1,600 juveniles are contained in the files. However, it was indicated that adults would be added to the system in the near future.

COST AND PERFORMANCE DATA

Equipment Cost

Since the computer was already purchased for other departmental uses, current costs are limited to that of maintaining the files, the cost of creating and modifying the computer program, and of the keypunch effort.

001026BRO	2	300	514	020
001048ELV	1	300	514	030
001583WAT	1	300	515	000
001820JOH	2	300	515	010
001458HAY	2	300	515	200
001239CAR	2	300	516	000
001602ACO	1	300	517	000
001627EVA	2	300	517	000
001766ALL	1	300	517	010
002104HIE	1	300	517	010
000939OCO	1	300	517	010

Exhibit 2-6-1. Sample of a portion of a computer listing of the juvenile file.

NOTE: Underlined numerical listing represents one individual on the listing. The first six digits represent an assigned computer number, indicating the location of the fingerprint cards in the manual file; the three letters represent the first three letters of the individual's last name; the last ten digits are the fingerprint code for the individual.

Personnel

Two latent fingerprint technicians are assigned to maintain and operate the system.

Performance Data

The first computer listing of the juvenile file was produced in early January 1974. The Miami Police Department has reported three makes for the month of January.

Potential Improvements

The staff suggested that the punched cards be eliminated by converting over to computer memory storage. This will enable easier handling of information for obtaining new listings and purging the file. The staff also indicated a desire to attach an automated display unit to the computer once the file is put on the computer memory. The fingerprints can then be microfilmed and placed into the display unit. This transition will, of course, involve a substantial amount of reprogramming and cost. No definite plans have been made for these improvements.

OPERATIONAL PROCEDURES

Search Procedures

To perform a search against individuals in the system, the unidentified latent fingerprint is coded using the Russak coding scheme. Once coded, the code for the latent fingerprint is matched against the computer listing of 1,600 juveniles. The printout identifies an individual's file location in the data base by the use of an assigned computer stored number, the first three letters of the last name and a full fingerprint code of the first four fingers of each hand. Only the pattern type of the little fingers is encoded. If the finger is known, one need only look at the codes for the particular finger (see Exhibit 2-6-2). If the particular finger being searched is unknown, similar codes

in all four fingers must be checked. However, using the ten-digit Russak code enables quick elimination of many candidates. The complete list can be checked in less than five minutes if the coded latent fingerprint had sufficient detail for coding.

After candidates are selected from the list, the technician then goes to the manual fingerprint file for verification. The records are currently filed according to the "juvenile number" which appears as the first six digits of the printout.

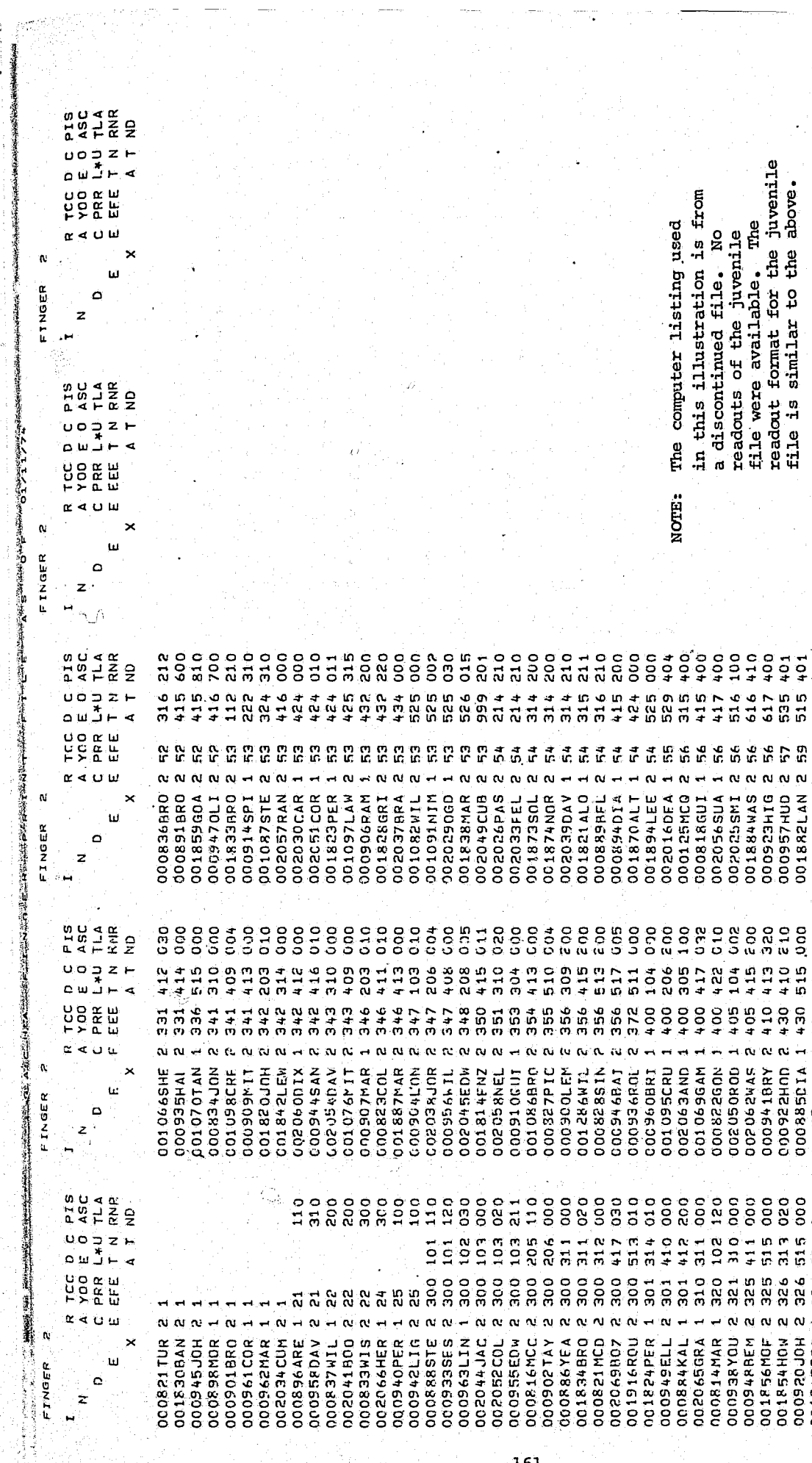
Updating/Purging Procedures

Currently, all juvenile arrest cards are being input into the system. At the time of booking, a duplicate fingerprint card is sent to the latent fingerprint section for coding. A name card is filled out and the fingerprints are coded onto a data capture sheet (see Exhibit 2-6-3). Once coded, the data capture sheets are to be held in suspense. It is estimated that the computer listing will be updated every three months. At three-month intervals, the newly coded arrest cards will be keypunched and entered into the computer for sorting and a new list will be made.

Purging of the file has not yet been considered. However, a purge can be done easily by pulling out the punched cards and eliminating the fingerprint cards from the file. If the file is ever put on computer memory, the entry for any person can easily be erased from computer memory.

CLASSIFICATION SYSTEM

The classification system was developed within the Miami Police Department by their latent fingerprint technician, Mr. Alex Russak. The Russak system utilizes a Battley-type classification system which has been modified by Mr. Russak. The Battley fingerprint glass used in coding fingerprints has a



NOTE: The computer listing used in this illustration is from a discontinued file. No readouts of the juvenile file were available. The readout format for the juvenile file is similar to the above.

Exhibit 2-6-2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
D.O.B.																																											
RACE		2																																								
# FINGER		2	1	2	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6	1	6
TYPE																																											
CORE																																											
DELTA AND COUNT																																											
PATTERN																																											
ISLANDS																																											
SCARS																																											
# FINGER																																											
TYPE																																											
CORE																																											
DELTA AND COUNT																																											
PATTERN																																											
ISLANDS																																											
SCARS																																											
# FINGER			1		8		3		8		3		8		3		8		3		8		3		8		3		8		3		8		3		8		3		8
TYPE																																											
CORE																																											
DELTA AND COUNT																																											
PATTERN																																											
ISLANDS																																											
SCARS																																											
# FINGER			4		9		4		9		4		9		4		9		4		9		4		9		4		9		4		9		4		9		4		9
TYPE																																											
CORE																																											
DELTA AND COUNT																																											
PATTERN																																											
ISLANDS																																											
SCARS																																											
TYPE OF #5 OR 10 FINGER																																											

Exhibit 2-6-3

CHART NO. V

glass reticule with a dot in the center and concentric circles at 3mm, 5mm, 7mm, 9mm, 11mm, 13mm and 15mm from the center. The dot is placed in the center of the first recurve, as indicated in Exhibit 2-6-4.

The first digit in the code indicates the finger, e.g., right thumb; the second digit represents the type of pattern (see Exhibit 2-6-5), e.g., whorl; the third and fourth digits represent the core type (see Exhibits 2-6-6 and 2-6-7); the fifth through seventh digits represent, in the case of loops, (1) the concentric circle in which the delta is located (2) a ridge count, or in the case of a whorl (1) the concentric circle in which the left delta is located (2) a trace from left delta to right delta (3) the concentric circle in which the right delta is located. The eighth digit represents the twist of the pattern, i.e., no twist, clockwise, counterclockwise, etc.; the ninth digit represents the number of islands within the first concentric circle; and the tenth or last digit indicates the presence of scars.

Plain arches are not classified except to note the finger position. Tented arches are classified by putting the dot in the reticule of the fingerprint glass over the core. A reading is taken of the concentric circle in which the platform ridge appears. In addition, the slant of the pattern is noted.

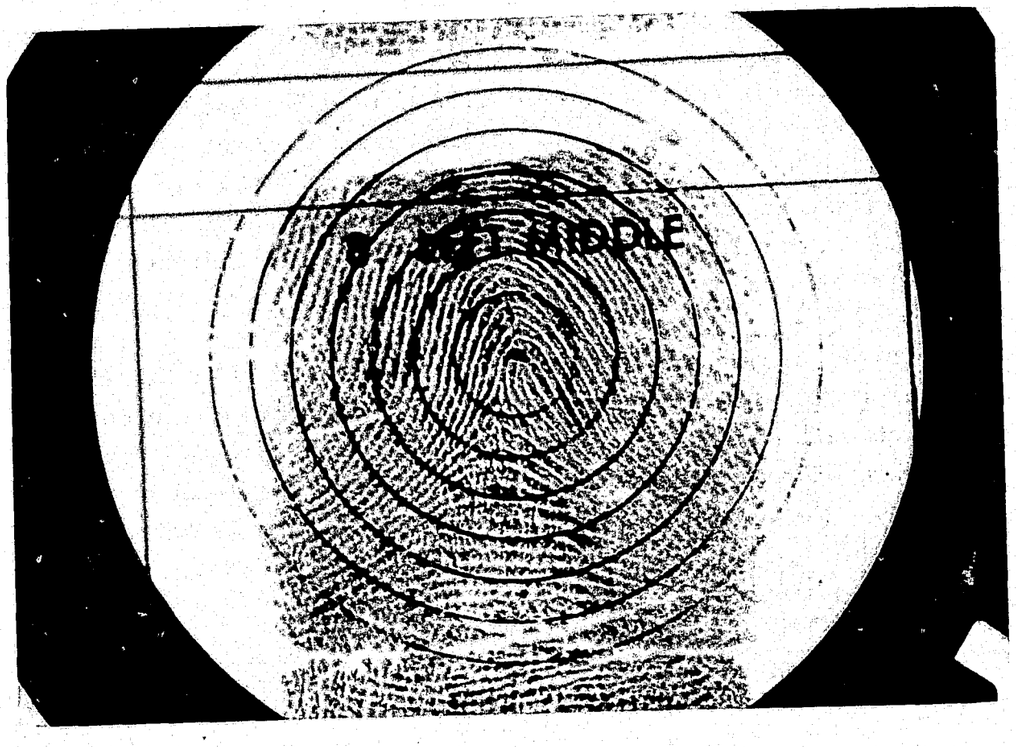


Exhibit 2-6-4

RUSSAK SYSTEM

SINGLE FINGERPRINT CLASSIFICATION

TYPE OF PRINT

0. Amputated Digit
1. Arch
2. Tented Arch
3. Right Slope Loop
4. Left Slope Loop
5. Whorl
6. Dual Loop
7. Accidental or Composite

9. Mutilated

1. ARCH: no breakdown

2. TENTED ARCH: core reading breakdown

   1. Platform ridge falls in first circle,
   2. Second circle,
   3. Third circle, etc.

   PATTERN

   1. No slope
   2. Left Slope
   3. Right Slope
   4. Unusual Pattern
   9. Mutilated

3-4. LOOP PATTERN BREAKDOWN: (refer to Chart III for Loop & Whorl Core reading)

   0. Plain type
   1. Tented type
   2. Converging loop
   3. Central pocket type
   4. Nutant loop
   5. Unusual

5. WHORL TRACING

   1. Inner
   2. Meeting
   3. Outer
   9. Unable to trace
   9. Damaged delta

5. WHORL PATTERN

   1. Looks like a dual
   2. Central pocket
   3. Spiral
   4. Elongated
   5. Eliptical
   6. No twist (1 & 2 core)
   7. Left twist (1 & 2 core)
   8. Right twist (1 & 2 core)
   9. Unusual
   0. No pattern

6. TWIN LOOP CORE READING (on ascending side, same as loop; tracing same as whorl.) PATTERN

   1. Right ascending loop
   2. Left ascending loop
   3. Horizontal

7. PATTERN READING

   1. Lateral
   2. Accidental
   3. Composite

ISLANDS in first circle

   0. No island
   1. One island
   2. Two islands
   3. Three or more islands

SCARS in first circle

   1. Scar in first circle
   2. Out of circle--above core
   3. Right of core
   4. Below core
   5. Left of core
   6. Outside back of delta

   Note: Register scar closest to circle.

   9. Damaged delta in loop
   0. No scar

CHART
NO. II

Exhibit 2-6-5

RUSSAK SYSTEM

INTERPRETATIONS OF CORES

0 - Characteristics attached to staple and characteristics inside staple but not touching circle.

1&2 - One ridge ending within staple.

3 - Two ridges ending within staple.

4 - Three ridges ending within staple.

5 - A staple enclosing a ridge not touching bifurcating in a downward direction.

6 - Three ridges converging at shoulder.

7 - Four ridges converging at shoulder.

8 - Five ridges converging at shoulder.

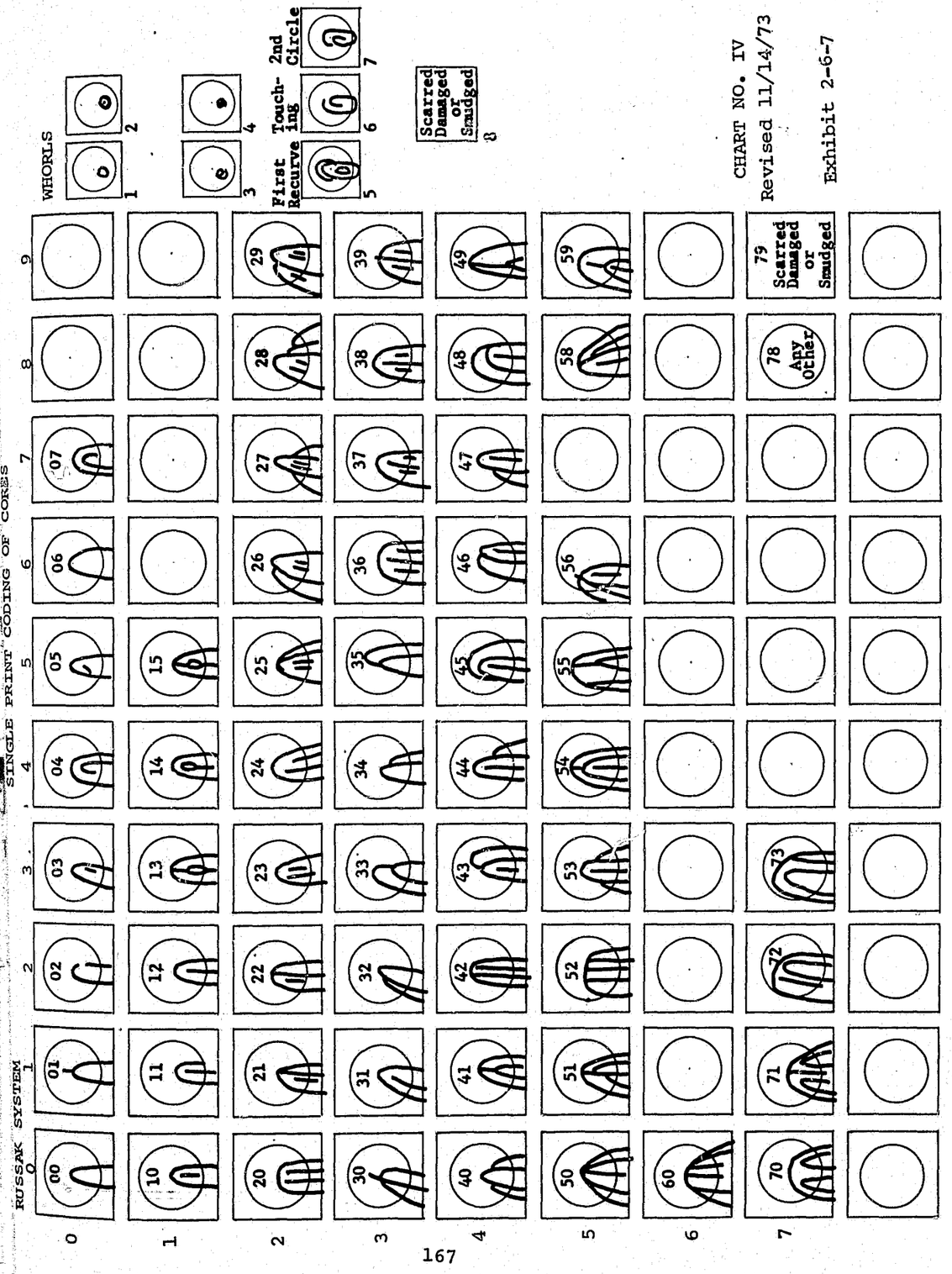
86 - Six or more ridges converging at shoulder.

9 - Two cores within staple.

Reading loop cores use "shoulder break" as guide.
Place dot in Battley reticule on first free recurve.

CHART
NO. III

Exhibit 2-6-6



Section 2-7

NEW ORLEANS POLICE DEPARTMENT
BATTLEY SYSTEM

INTRODUCTION

The New Orleans Police Department established their Battley Fingerprint System approximately 40 years ago. It is maintained strictly as a manual system.

GENERAL SYSTEM DESCRIPTION

Hardware

The only special equipment necessary is the Battley fingerprint glass which is equipped with a special reticule consisting of a glass disc with a dot in the center and a series of concentric circles around it at radii of 3mm, 5mm, 7mm, 9mm, 11mm, 13mm and 15 mm. The glass is placed over the fingerprint impression as indicated in Exhibit 2-7-1.

File Organization

The files consist of special 4" x 6" Battley fingerprint cards on which one rolled and one flat impression of individual fingers are taken and coded by utilizing the special Battley fingerprint glass. Each card is numbered according to its position on a standard ten-finger fingerprint card. As seen in Exhibit 2-7-2, the number "2" in the left-hand corner indicates the finger on the card is a right index finger. If the Battley fingerprint card had a number "6" in the left-hand corner, the finger on the card would be a left thumb.

A special file is kept for twin loops. The file, therefore, consists of eleven major breakdowns according to the finger position number and a special file for twin loops. The file is

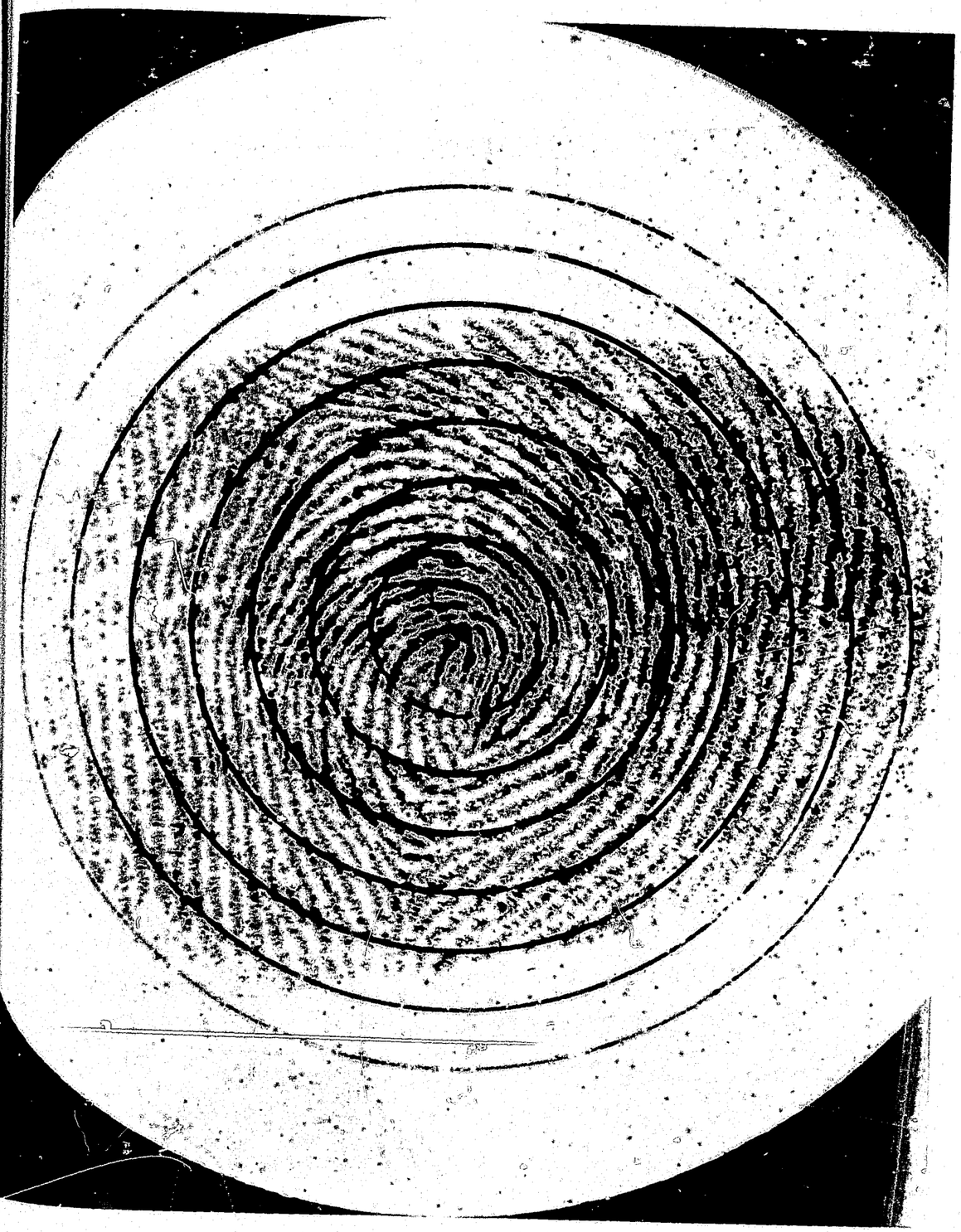


Exhibit 2-7-1

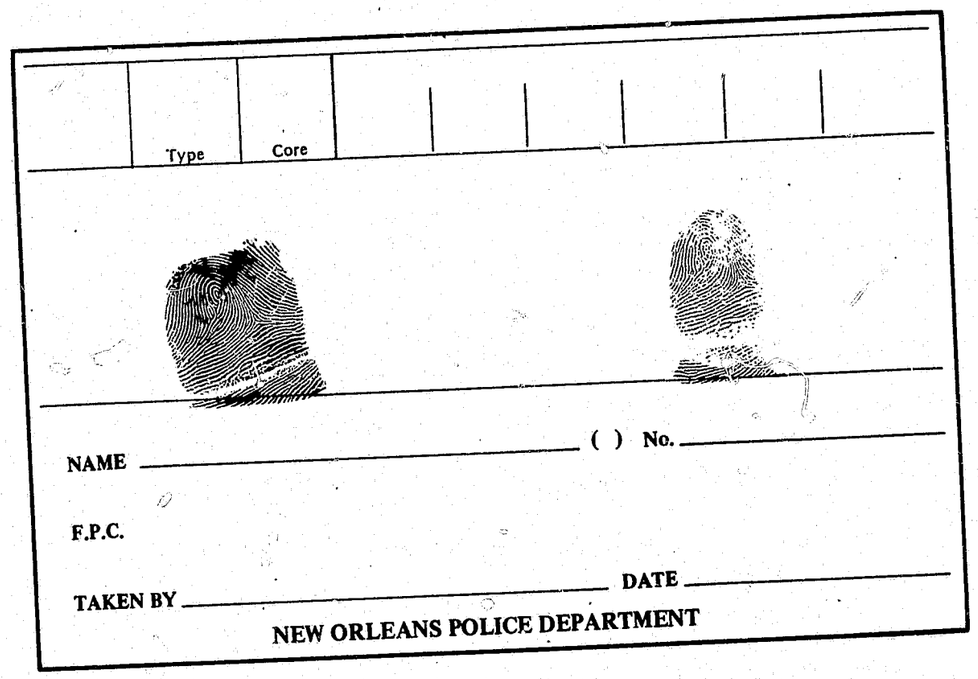


Exhibit 2-7-2

accessed by classifying the latent fingerprint and searching it against fingers with similar codes. Unless the latent fingerprint is known to be from a certain finger, e.g. right thumb, all the drawers must be searched.

As the system currently contains 10,000 individuals, the number of individual fingerprints in the file is 100,000.

Fifty to seventy-five individuals are added to the data base each month with the offense criteria limited to the following:

1. Armed robbers
2. Burglars
3. Auto Thieves
4. Rapists
5. Arsonists

The latent fingerprint file is divided by crime types. Unidentified latents are filed by the type of crime involved.

COST AND PERFORMANCE DATA

Equipment Cost

The system costs no more than the burden incurred by the cost of space, personnel and materials.

Personnel

Two men are assigned full time to maintaining the Battley latent fingerprint file. Each man spends approximately 50 percent of his time working with the system.

Performance Data

The fingerprinting staff reported approximately one to

two "makes" a month using the Battley latent fingerprint file.

POTENTIAL IMPROVEMENTS

The Battley system can be initiated at a relatively small cost. The most appreciable cost item in such a system is that associated with encoding the data base. As the rate of addition of new fingerprints to the data base increases, a proportionately greater amount of effort must be expended in encoding these data. In addition, because the fingers are filed separately, searching a latent from an unknown finger can also be time consuming. An automated search and retrieval system can reduce this cost considerably.

OPERATIONAL PROCEDURES

Search Procedures

A latent fingerprint is classified according to the Battley classification system. It takes approximately 30-40 seconds to classify the latent fingerprint. Several necessary elements are required to properly classify the latent fingerprint and make a search utilizing the Battley classification system. If the position of the finger being searched is not known, i.e., right thumb, all ten files must be searched. In the case of suspected twin loops, the latent fingerprint must be searched as loops and a whorl. The process can be extremely time consuming (days to weeks) if the fingerprint is found to be a fairly common classification, i.e., ulnar loop, or if some of the elements such as clear delta or core are missing. This results in a great deal of reference searching.

After the latent is classified, the fingerprint technician must first search the file in which he believes the finger belongs, e.g., right thumb file. If a match is not made, he may proceed to search pockets of cards with similar classifications.

Then, if no match is made, he must search through the cards of the other possible fingers. It is, therefore, of great benefit in using this system to know the finger position number of the latent fingerprint.

Updating/Purging Procedures

Dates are entered into the system from single print cards taken at the time of a booking. Suspected burglars, rapists, arsonists, armed robbers and auto thieves are input into the data base. These cards are classified and placed into the file according to the finger from which the print was taken. Monthly, 50 to 75 people are added to the data base.

Purging of the file is done on the basis of age. Persons over the age of 50 are taken out of the system. Purging is done on a low priority basis when time permits. The criteria is based on the belief that people over 50 are least active in the commission of crimes.

CLASSIFICATION SYSTEM

The Battley-type fingerprint classification systems have been previously described in Sections 2-5 and 2-6. Mr. Russak of the Miami Police Department has made modifications to the Battley system as described in Section 2-6. The Royal Canadian Mounted Police have used the classical Battley classification; however, the classification has been made all numeric to facilitate use in the computer. This section will concentrate on the Battley system used in a manual system.

At the time of booking, individual prints are taken of each finger on cards which are numbered according to the sequence on a standard fingerprint card, i.e., right thumb is No. 1, right index is No. 2, etc. Therefore, ten separate cards are taken, one for each finger. The card has one rolled and one flat

impression of a finger. Each of the cards is classified by utilizing the special Battley glass. The dot in the center of the reticule is placed in the center of the innermost recurving ridge (see Exhibit 2-7-1) in the case of loops and whorls. Arches and tented arches are not classifiable except to denote slant of pattern and the fact that it is an arch or a tented arch (see Exhibits 2-7-3 and 2-7-4).

The Battley code is designed to use a maximum of seven characteristics.

In the case of whorls (see Exhibit 2-7-5), the first space indicates that the pattern is a whorl; the second space indicates the core type as seen on the Battley core type differentiation chart; the third space is a reading of the concentric circles on which the left delta is located, A-G. The fourth space indicates a trace from the left delta to the right delta core; the fifth space indicates a reading of the concentric circle in which the right delta is located; the sixth space indicates a ridge count from the left delta to the core; and the seventh or last space is a ridge count from the right delta to the core.

In the case of loops (see Exhibit 2-7-2), the first space indicates the slant of the loop; the second space indicates the core type; the third space is the ridge count from core to delta; and the fourth or last space is to indicate in which concentric circle the delta is located.

Other types of patterns, e.g., twin loops (see Exhibit 2-7-6) are handled slightly differently. However, the system, as described above, is fairly easy to learn and use.

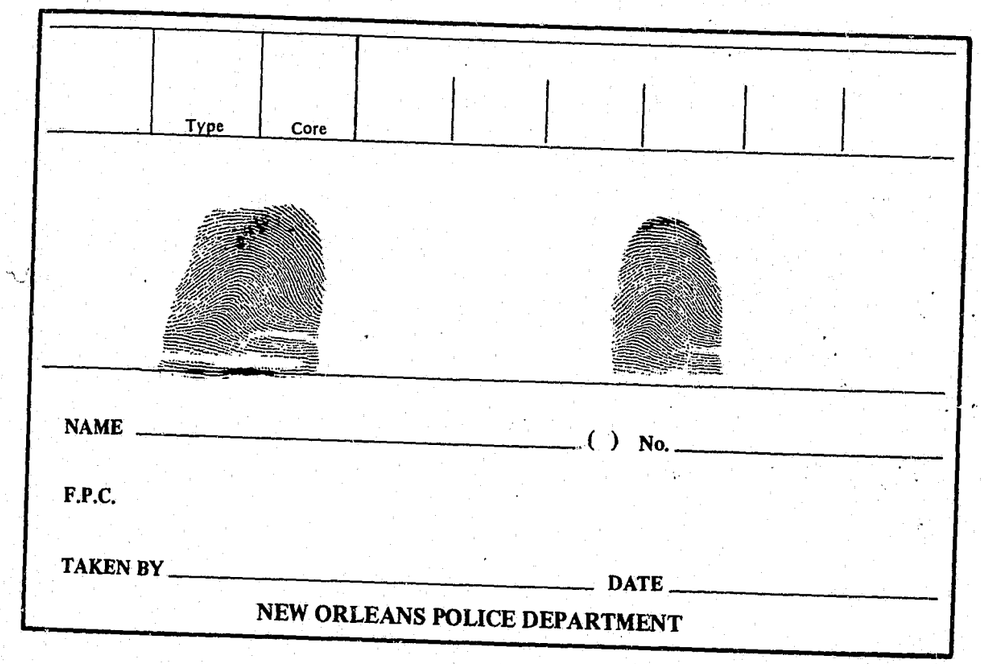


Exhibit 2-7-3

	Type	Core						

NAME _____ ( ) No. _____

F.P.C. [redacted]

TAKEN BY _____ DATE _____

NEW ORLEANS POLICE DEPARTMENT

Exhibit 2-7-4

	Type	Core						

NAME _____ ( ) No. _____

F.P.C.

TAKEN BY _____ DATE _____

NEW ORLEANS POLICE DEPARTMENT

Exhibit 2-7-5

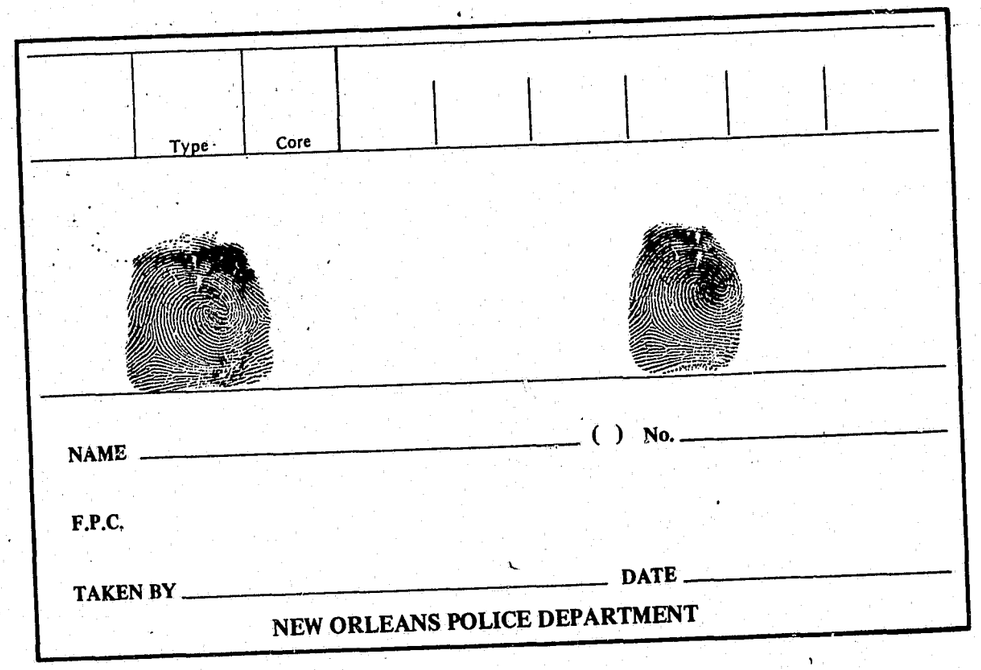


Exhibit 2-7-6

Section 2-8

BOSTON POLICE DEPARTMENT

FIVE-FINGER SYSTEM

INTRODUCTION

The Five-Finger System was instituted at the Boston Police Department approximately 20 years ago. This manual latent fingerprint system was designed for use in the identification of latent fingerprints found at crime scenes.

GENERAL SYSTEM DESCRIPTION

Equipment

The equipment consists of a special fingerprint card, filing cabinets and a fingerprint glass. The fingerprint card used consists of ten blocks in which the fingerprint impressions are rolled. The fingerprints are rolled in the same sequence as on a standard ten-finger card, starting with the right thumb. After the fingers are rolled, the card is cut in half and the fingerprints are coded. The right and left hand cards are filed separately. Each half is placed in the appropriate place in the filing cabinet according to the fingerprint.

File Organization

The fingerprint cards which make up the data base are filed in drawers according to coded sequence. At present, there are approximately 35,000 individuals in the data base. All felony and some misdemeanor fingerprints are presently being added to the card file.

The unidentified latent fingerprints are filed in enveloped in the form of negatives. These envelopes are filed by districts and by a color code if the crime involved was a rape, robbery or purse snatch.

COST AND PERFORMANCE DATA

Equipment Cost

The cost of maintaining and operating the system is limited to the cost of materials and personnel.

Personnel

The department utilizes the services of three technicians to work the latent fingerprint system. Approximately 25% of each man's time is used to maintain the system. The technicians also process crime scenes and fingerprint and process new arrestees.

Performance

It was estimated that the system produced approximately two to four identifications per month.

POTENTIAL IMPROVEMENTS

The Boston Police Department hopes to automate the system in the future. No mention was made of when the system would be automated or what equipment might be used if automation took place.

OPERATIONAL PROCEDURES

Search Procedures

Latent fingerprints are photographed at the crime scene. The negatives are printed and are searched against the file. Before the search begins, the latent fingerprints are coded with the five-finger coding system described below. After the latent fingerprint is coded, the fingerprint technician must search the file and compare the latent fingerprint against cards with the same or similar code. In common pattern types, the technician may have to search for many hours or days in attempting

to match the latent fingerprint against the file. For example, in common loop and whorl classifications, the technician may have to look at a minimum of 5,000 fingerprint cards.

Updating Procedures

Data is input into the file by using the subject file input form (see Exhibit 2-8-1) which is completed by the technician at the time of booking. After completing the information form, a set of fingerprints is rolled on the previously described fingerprint card. Approximately 300 individuals are added to the file monthly.

The files are purged annually on the basis of age. All people over the age of 65 are purged.

CLASSIFICATION SYSTEM

The classification in the five-finger system uses three major divisions of identification. First, the pattern type of each finger is identified (see Exhibit 2-8-2), and a number sequence is created to signify the types of patterns. Thus, if all five fingers have loop patterns flowing to the right, the classification would be 3-3-3-3-3. The next division of the coding identifies the ridge count in the thumb, a ridge count or a whorl trace of the middle three fingers on one hand, and a ridge count of the little finger (see Exhibit 2-8-2). The values listed in Exhibit 2-8-2 are used to determine the classification in the second division of identification. Lastly, the middle three fingers are used by determining the ridge count.

Although the five-finger system of classification is simple and straightforward, it utilizes only two characteristics for classification: ridge count and pattern type. Therefore, unless the data base is small, large pockets of cards accumulate in sections where pattern types and ridge counts occur most frequently.

Color _____ BOSTON POLICE DEPARTMENT B.R.# _____

Sex _____ IDENTIFICATION SECTION Photo # _____

S.S.# _____ Booking # _____

Name _____
Last Name First Name Middle Name

Address _____

Alias _____ Offence _____

Arrested by _____ Date of Arrest _____

District _____D.O.B. _____ Where Born _____

Height _____ Weight _____ Build _____ Eyes __ Nose__ Hair__

Complexion _____ Occupation _____ Descent _____MSD____

Father's Name _____
Last Name First Name Middle Name

Mother's Maiden Name_____
Last Name First Name Middle Name

Husband or Wife's Name_____
Last Name First Name Middle Name

Amps, Scars, Deformities, etc. _____

Date of Booking _____Time of Booking _____

Photo taken by _____Sig. of Booking Off. _____

FORM 1051R

Exhibit 2-8-1

CONTINUED

2 OF 4

FIVE FINGER CLASSIFICATION SYSTEM

First Division (Pattern Type)

1. - Arch
2. - Tented Arch or any Loop with less than a three ridge count.
3. - Loop flowing to the right.
4. - Loop flowing to the left.
5. - Whorl (Bullseye).
6. - Whorl (Oval, Double Loop or Accidental).
7. - Whorl - tight right delta (Central Pocket).
8. - Whorl - tight left delta (Central Pocket).
9. - Amputations or scars that obliterate the pattern area.

Where we have all loops flowing to the right on the right hand, the classification would be 3-333-3 and since this is a large category we use our own extension to reduce our search area. That extension is determined by the following tables:

Index Finger Ridge Count	Middle Finger Ridge Count	Ring Finger Ridge Count
1 to 5 S	1 to 8 S	1 to 10 S
6 to 12 M	9 to 14 M	11 to 18 M
13 or over L	15 or more L	19 or more L

Example: Right Thumb 14 - Right Index 7 - Right Middle 4 - Right Ring 22 - Right Little 8, all ulnars would be classified thusly:

MSL - Third Division
14 II0 9 - Second Division
3-333-3 - First Division

Also, if only one latent fingerprint or a partial latent fingerprint is found, the referencing of the various possibilities could require long, tedious hours of searching in large sections of the file.

Section 2-9

DADE COUNTY DEPARTMENT OF PUBLIC SAFETY FIVE-FINGER SYSTEM

INTRODUCTION

The on-site visit to Dade County revealed that the Dade County Latent Fingerprint System was similar to the system used by the Boston Police Department (see Section 2-8). For this reason, it was decided to limit the description of the Dade County Latent Fingerprint System to noting the differences between the two systems.

GENERAL SYSTEM DESCRIPTION

Dade County utilizes a standard ten-finger fingerprint card in the latent fingerprint file. The file is divided into geographic areas, is sorted into left and right hand and then according to the common fingerprint patterns observed in the thumb. In the Dade County Strip File System, only the thumb and index fingers are used to further subdivide the file. Currently, the file contains approximately 1,500 individuals in each of the three geographic files.

Files of unidentified latent fingerprints are stored according to the same geographic areas in which the strip file is broken down. Within each geographic area file, the file is further broken down by crime type and case number.

COST AND PERFORMANCE DATA

Cost

The only cost attached to the system is the cost of materials and personnel costs.

Personnel

Approximately 5% of Dade County's eight latent fingerprint technician's time is used to maintain and operate the strip file latent fingerprint system.

Performance Data

The following shows the number of identifications made using the strip file from 1969 to 1973:

1969 - 12 identifications
1970 - 29 identifications
1971 - 16 identifications
1972 - 22 identifications
1973 - 8 identifications

OPERATIONAL PROCEDURES

For the most part, searches are confined to fingerprints of new arrestees against the unidentified latent fingerprint file. Approximately 5% of each technician's time is spent searching against the department's strip file.

When a search is to be made against the strip file, the latent fingerprint(s) to be searched is coded and searched against the geographic file which corresponds to the area in which the latent fingerprint was lifted. An evaluation/comparison report is used to record the results of the search (see Exhibit 2-9-1).

The strip file is apparently used on a "when time allows" basis because of the other activities of the group and the higher productivity obtained from other searches.

CLASSIFICATION SYSTEM

The classification system used in Dade County is the same as described in Section 2-8 on the Boston Police Department. However,

in Dade County, only the classifications of the thumb and index finger are used and ridges are not counted. The result is a two-digit code for each hand which makes the system highly non-selective. Searching in this file can be very time consuming. However, very little time is needed to maintain the file. Coding is done rapidly because the system requires only the pattern types on four fingers.

PUBLIC SAFETY DEPARTMENT
DADE COUNTY, FLORIDA

IDENTIFICATION SECTION REPORT

LATENT FINGERPRINT EVALUATION/COMPARISON REPORT

Case No.

A.O.A. _____

Department _____

Date _____

CASE NAME _____ OFFENSE _____ ADDRESS _____

ANSWER TO _____

COPY TO _____

☐ Latent Comparison Report

☐ Latent Evaluation Report

EVIDENCE RECEIVED _____

Latents Received	Latents from Evidence Submitted	Latents of Value: Fingerprints / Palmprints	Elimination Prints Submitted: Yes ☐ No ☐
Evidence Delivered By	Evidence Received By	Evidence Processed By	Disposition of Evidence
	Date & Time		Date & Time

SUBJECTS COMPARED _____

COMMENTS: _____

Latent Examiner	Badge No.	Area Code

188

PART THREE

APPENDICES

Appendix A: Questionnaire Responses

Appendix B: Classification System Descriptions

Appendix C: Hood-Taylor PaLmprint Coding System

Appendix A

QUESTIONNAIRE RESPONSES

This appendix presents all of the responses received to the questionnaire survey in tabular form. The respondents to the questionnaire survey can be divided into four groups according to the information contained in the responses. These groupings are presented in the following exhibits. Exhibit A-1 lists, in alphabetical order according to the states, those agencies whose response indicated that they currently have an operational latent fingerprint identification system. Exhibit A-2 lists, in the same order, those agencies who responded that they had planned or were about to implement a latent fingerprint identification system. Exhibit A-3 lists the agencies whose response indicated that their latent fingerprint identification system is currently inactive. Exhibit A-4 lists those agencies whose response indicated that they do not currently have and are not currently planning a latent fingerprint identification system.

Sample Questionnaire

Exhibit A-5 presents a sample of the survey questionnaire mailed to the various agencies that were understood to have a latent fingerprint identification system.

Exhibit A-1

AGENCIES WITH OPERATIONAL LATENT FINGERPRINT IDENTIFICATION SYSTEMS

ALASKA
(A-6,7) Anchorage P.D.*

CALIFORNIA
(A-10,11) Los Angeles P.D.
(A-10,11) Los Angeles Co. Sheriff
(A-6,7) Berkeley P.D.
(A-8,9) Oakland P.D.
(A-6,7) Sacramento P.D.
(A-6,7) Orange Co. Sheriff

FLORIDA
(A-10,11) Dade Co. Public Safety
(A-10,11) Miami P.D.
(A-10,11) West Palm Beach P.D.
(A-6,7) Palm Beach Co. Sheriff

GEORGIA
(A-6,7) Atlanta P.D.

HAWAII
(A-6,7) Honolulu P.D.

ILLINOIS
(A-6,7) DuPage Co. Sheriff

KANSAS
(A-10,11) Kansas City P.D.

LOUISIANA
(A-10,11) New Orleans P.D.
(A-6,7) Shreveport P.D.

MASSACHUSETTS
(A-10,11) Boston P.D.

MINNESOTA
(A-10,11) Minneapolis P.D.

MISSISSIPPI
(A-6,7) Jackson P.D.

MISSOURI
(A-6,7) Kansas City P.D.

NEW JERSEY
(A-10,11) Atlantic Co. Sheriff
(A-10,11) East Orange P.D.

NEW YORK
(A-8,9) Nassau Co. Police
(A-10,11) New York DCJS
(A-6,7) Rochester P.D.

NORTH CAROLINA
(A-6,7) Charlotte P.D.

OHIO
(A-6,7) Cincinnati P.D.
(A-6,7) Cleveland D.P.S.

OREGON
(A-6,7) Washington Co. Sheriff

TEXAS
(A-6,7) Austin P.D.
(A-6,7) Brownsville P.D.
(A-6,7) Galveston P.D.
(A-6,7) McAllen P.D,
(A-6,7) Texas DPS
(A-6,7) Harlingen P.D.

VERMONT
(A-10,11) Vermont D.P.S.

WEST VIRGINIA
(A-6,7) Charleston P.D.

CANADA
(A-8,9) Hq. Royal Canadian Mounted Police, Ottawa, Ontario

* Numbers preceeding agency name indicate the numbers of the subsequent exhibits containing the responses of the agency.

Exhibit A-2

AGENCIES IMPLEMENTING OR PLANNING A LATENT FINGERPRINT IDENTIFICATION SYSTEM

CALIFORNIA
Los Angeles Co. Sheriff (update)*

COLORADO
Lakewood Department of Public Safety
Denver P.D.

FLORIDA
Pensacola P.D.

GEORGIA
Savannah P.D.

ILLINOIS
Illinois Bureau of Identification

MARYLAND
Montgomery Co. Department of Police
Baltimore P.D.

NEW JERSEY
Trenton D.P.S.
Newark P.D.
Elizabeth P.D.
Jersey City P.D.
Paterson P.D.

OHIO
Columbus P.D.
Toledo P.D.

OKLAHOMA
Tulsa P.D.

OREGON
Portland Bureau of Police

*Questionnaire responses for agencies listed in this exhibit are found in Exhibits A-12 and A-13.

Exhibit A-3

AGENCIES WITH CURRENTLY INACTIVE LATENT FINGERPRINT IDENTIFICATION SYSTEMS

CALIFORNIA
Richmond P.D. *
California Department of Justice

KANSAS
Kansas Bureau of Identification

PENNSYLVANIA
Pittsburgh Bureau of Police

VIRGINIA
Norfolk P.D.

* Questionnaire responses from agencies listed in this exhibit can be found in Exhibits A-14 and A-15.

Exhibit A-4

AGENCIES RESPONDING THAT HAVE NO LATENT FINGERPRINT IDENTIFICATION SYSTEMS

ALABAMA
Huntsville P.D.
Montgomery P.D.

CALIFORNIA
San Diego Sheriff

DELAWARE
Delaware State Police

DISTRICT OF COLUMBIA
Washington ID Bureau

ILLINOIS
Chicago Police

MARYLAND
Baltimore Co. Police

NEVADA
Division of Identification & Communications

NEW JERSEY
Vineland Police Department

OKLAHOMA
Ardmore P.D.

PENNSYLVANIA
Philadelphia P.D.

Exhibit A-5. Sample Questionnaire

RESPONDENT INFORMATION

A. Name and address of agency operating the latent print system. (i.e., police department, sheriff's office, state identification bureau):

_____

_____

_____

B. Name and title of agency head:

_____

C. Name and title of person(s) completing the survey:

_____

Telephone Number:_____

D. Name of section or division of agency in which the latent system is located i.e., identification section, crime lab, etc.

_____

QUESTIONNAIRE

1. Does your department use or plan to implement a classification and retrieval system (either manual or automated) for searching and comparing latent (crime scene) prints against a master file?

   Yes ( ) No ( )

2. If Yes, please describe briefly the system that is used. For example, Battley, One-Hand, Miracode, etc. If documentation can be provided, please attach.

   _____

   _____

   _____

3. What geographical area is served by your latent system?

   _____

   What is the approximate population of this area?

   _____

4. When was the system implemented (or will be implemented) in your agency?_____

   If the system is no longer operational, why was it discontinued and when did this occur?_____

   _____

   _____

5. When implemented, was the system patterned after one already in existence in another agency?

   Yes ( ) No ( )

   If Yes, which agency?_____

6. Is your system available commercially?

   Yes ( ) No ( )

7. Please describe the fingerprint classification scheme in detail or enclose documentation sufficient to fully describe it. Also, please enclose a sample fingerprint card which has been encoded using your system.

   _____

   _____

   _____

   _____

8. What is the minimum detail in the latent print required to initiate a search (i.e., single print with core and delta, two prints both with cores and deltas, etc.)?

9. What data in addition to fingerprint classification are utilized as search criteria [i.e., age, sex, offense, geographical location, M.O., etc.]?

10. Is the latent print system tied in with any other systems, such as Modus Operandi, Physical Descriptive File, etc.?

    Yes ( ) No ( )

11. If Yes, please explain briefly:

12. Approximately how many individuals are included in the data base against which latent prints are searched?

13. What guidelines are followed in selecting individuals for inclusion in the data base? For example, burglars and car thieves only; convicted criminals only; persons between ages 16 and 25 only, etc.

14. Approximately how many individuals are added to the data base per month?_____

15. What criteria are followed for purging the data base?

16. How often is the file purged?_____

    On the average, how many are purged each time?_____

17. On the average how many latent prints are searched against the data base per month?_____

18. On the average how many identifications result from latent print searches on the data base per month?_____

19. What is the average amount of time required to classify a set of 10 prints to be included in the data base?_____

20. What is the average amount of time required to enter a record into the data base (including classifying, filing, indexing, etc.)?_____

21. What is the average time required to classify a latent print?

22. What is the average amount of time required per search of the data base?_____

    What is the minimum time?_____

    What is the maximum time?_____

23. Are any incoming arrest prints searched against unidentified latent prints that have previously been received?

    Yes ( ) No ( )

    If Yes, what guidelines are followed?

24. If Yes, approximately how many searches are made per month in this manner?_____ How many identifications?_____

25. Does your agency utilize palm prints for comparison with latents?

    Yes ( ) No ( )

26. Is there a classification system for the palm prints?

    Yes ( ) No ( )

If Yes, please describe or enclose documentation.

_____

_____

_____

_____

_____

_____

27. How many persons are engaged in your department in the maintenance and operation of the latent print system? (If available please enclose job descriptions and qualifications of these persons.) _____

28. For each person counted above, what is the percentage of time spent in operating and maintaining the latent system? (For example: #1-100%, #2-50%, #3-30%, etc.)

_____

_____

29. Who processes crime scenes for latent prints in your agency?

_____

_____

30. What are the procedures for submission of elimination prints?

_____

_____

_____

_____

31. What improvements do you feel could be made in your latent print system, assuming that necessary funds were available?

_____

_____

_____

_____

_____

QUESTIONNAIRE RESPONSES

The responses to the questionnaire are presented below. For convenience and comparison, the responses are grouped according to the groupings described above in Exhibit A-1 through A-4. The majority of the questions are presented in tabular form, but those few questions requiring a lengthy answer on the part of the respondent are grouped separately. Only an indication of the type of fingerprint classification system employed is presented in these responses. A complete, detailed description of all classification systems reported is given in Appendix B. For the first grouping, which exhibits the responses from agencies having a currently operational system, the responses are grouped for convenience according to the search and retrieval techniques employed by the agencies. The first sub-group will be those agencies employing the Miracode search and retrieval equipment in alphabetical order, according to the states. The second grouping will be those agencies employing other automatic or semi-automatic search and retrieval techniques and the third sub-grouping will be those employing a manual search and storage procedure.

- Exhibit A-6 presents, in tabular form and alphabetically according to the states, the short responses received from those agencies currently having operational latent fingerprint identification systems employing the Miracode search and retrieval equipment.
- Exhibit A-7 presents the lengthy responses for those agencies employing the Miracode equipment.
- Exhibit A-8 presents, in tabular form, the short responses obtained from those agencies having automatic or semi-automatic search and retrieval equipment other than the Miracode.

Question #	LOCATION AGENCY	Anchorage AK Police Department	Berkeley, CA Police Department	Orange County CA Sheriff
2	Type of system	Miracode	Miracode	Miracode
7	Classification	NCF	3 digit special	6 digit special
3	Area served	city	city	county
3	Population	78,000	116,000	1,700,000
4	Implementation date	January 1973	January 1973	February 1972
5	System first implemented elsewhere?	yes	yes	yes
5	What agency(ies)?	L.A. P.D. and Sheriff	other Miracodes	Orange County & San Diego PD
6	System available?	yes	yes	yes
12	Size of data base	12,000	5,000	2,400
14	Added per month	100	none	500-goal
15	Is file purged?	no	yes	yes
17	Searches per month	20	50 to date	n/a not fully operational
18	ID's per month	1 since started	none to date	n/a
19	Class. time (10 prints)	3 minutes	12 minutes	10 minutes
20	Time to enter record	15 minutes	30 minutes	35 minutes
21	Class. time (latent)	.5 minutes	3 minutes	1 minute
22	Avg. search time	45 minutes	30 minutes	unknown
22	Maximum time	20 minutes	20 minutes	unknown
22	Minimum time	120 minutes	120 minutes	unknown
23	Unidentified latents searched against incoming arrest prints?	no	no	yes
24	Searches per month	n/a	n/a	unknown
24	ID's per month	n/a	n/a	unknown
25	Use palm prints?	yes	yes	yes
25	Classification?	no	no	yes
27	Persons run system	1	1	5
28	Full-time equivalent	.75	.05	.5

Exhibit A-6: SUMMARY OF LATENT PRINT QUESTIONNAIRE RESPONSES

(Operational Systems with Miracode Equipment)

- Exhibit A-9 presents the lengthy responses for these agencies.
- Exhibit A-10 presents the short responses obtained from those agencies employing the manual search and storage techniques.
- Exhibit A-11 presents the lengthy responses from those agencies.

The short and long responses from those agencies about to implement or planning an operational latent fingerprint identification system are presented in Exhibits A-12 and A-13, respectively. The short and long questionnaire responses received from those agencies whose latent fingerprint identification system is currently inactive are presented in Exhibits A-14 and A-15, respectively. For ease of reference, the numbers of the exhibits listing the responses from each agency are presented next to the agencies listed in Exhibits A-1 through A-4.

Question #	LOCATION AGENCY	Sacramento CA Police Department	Palm Beach FL County Sheriff	Atlanta GA Police Department
2	Type of system	Miracode	Miracode	Miracode
7	Classification	3 digit Miracode	3 digit Miracode	3 digit Miracode
3	Area served	county	county	city & county
3	Population	690,000	350,000	1,450,000
4	Implementation date	March 1971	1971	April 1968
5	System first implemented elsewhere?	yes	yes	no
5	What agency(ies)?	Atlanta	Atlanta	n/a
6	System available?	yes	yes	yes
12	Size of data base	11,303	11,000	31,350
14	Added per month	375	200	150
15	Is file purged?	yes	no	no
17	Searches per month	23	0	30
18	ID's per month	2.?	0	2
19	Class. time (10 prints)	5 minutes	5 minutes	3-5 minutes
20	Time to enter record	10-15 minutes	unknown	7-8 minutes
21	Class. time (latent)	1 minute	3 minutes	.5 minute
22	Avg. search time	30 minutes	unknown	unknown
22	Maximum time	960 minutes	960 minutes	90 minutes
22	Minimum time	20 minutes	15 minutes	30 minutes
23	Unidentified latents searched against incoming arrest prints?	yes	no	yes
24	Searches per month	minimal	n/a	unknown
24	ID's per month	none yet	n/a	2
25	Use palm prints?	yes	yes	yes
25	Classification?	no	no	no
27	Persons run system	3	3	8
28	Full-time equivalent	2.3	.6	1.0

Exhibit A-6 (Continued)

Question #	LOCATION AGENCY	Honolulu HI Police Department	DuPage IL County Sheriff	Shreveport LA Police Department
2	Type of system	Miracode	Miracode	Miracode
7	Classification	3 digit special	3 digit Miracode	6 & 9 digit Hood-Taylor
3	Area served	state	county	metro area
3	Population	800,500	500,000	385,000
4	Implementation date	December 1971	1971	1971
5	System first implemented elsewhere?	yes	yes	yes
5	What agency(ies)?	Atlanta, etc.	Atlanta	Atlanta
6	System available?	yes	yes	no
12	Size of data base	1,200	8,000	15,000
14	Added per month	500	250	500
15	Is file purged?	no	yes	yes
17	Searches per month	40	100	250
18	ID's per month	none to date	unknown	25-50
19	Class. time (10 prints)	4 minutes	7 minutes	5 minutes
20	Time to enter record	10 minutes	unknown	20 minutes
21	Class. time (latent)	1 minute	1-4 minutes	10 seconds
22	Avg. search time	45 minutes	unknown	unknown
22	Maximum time	60 minutes	120 minutes	unknown
22	Minimum time	10 minutes	30 minutes	unknown
23	Unidentified latents searched against incoming arrest prints?	no	no	yes
24	Searches per month	n/a	n/a	5
24	ID's per month	n/a	n/a	unknown
25	Use palm prints?	no	yes	yes
25	Classification?	no	no	yes
27	Persons run system	4	3	15
28	Full-time equivalent	2.5	1.2	3

Exhibit A-6 (Continued)

Question #	LOCATION AGENCY	Jackson MS Police Department	Kansas City MO Police Department	Rochester NY Police Department
2	Type of system	Miracode	Miracode	Miracode
7	Classification	9 digit Hood-Taylor	3 digit Miracode	3 digit Miracode
3	Area served	city	metro area	city
3	Population	173,000/288,000 metro	1,500,000	300,000
4	Implementation date	1/73	September 1970	1970
5	System first implemented elsewhere?	yes	yes	yes
5	What agency(ies)?	Shreveport	Atlanta, GA	Atlanta
6	System available?	no	no	yes
12	Size of data base	1,275	15,900	10,200
14	Added per month	50	250-300	100
15	Is file purged?	n/a	no	no
17	Searches per month	unknown	300-400	20
18	ID's per month	unknown	8-10	1
19	Class. time (10 prints)	20 minutes	5-8 minutes	15 minutes
20	Time to enter record	unknown	8-10 minutes	22 minutes
21	Class. time (latent)	4-5 minutes	5 minutes	.5 minute
22	Avg. search time	varies with no. of magazines & no. of hits	180 minutes	60 minutes
22	Maximum time	unknown	480 plus minutes	120 minutes
22	Minimum time	unknown	90 minutes	30 minutes
23	Unidentified latents searched against incoming arrest prints?	yes when prints on film	yes	no
24	Searches per month	?	100-125	n/a
24	ID's per month	?	4	n/a
25	Use palm prints?	yes	yes	yes
25	Classification?	no	no	no
27	Persons run system	5	4	5
28	Full-time equivalent	1.55	4.0	.5

Exhibit A-6 (Continued)

Question #	LOCATION AGENCY	Charlotte NC Police Department	Cincinnati OH Police Department	Cleveland OH Department of Public Safety
2	Type of system	Miracode	Miracode	3M Microdisc
7	Classification	3 digit Miracode	6 digit Special	3 digit Miracode
3	Area served	county	metro area	city
3	Population	400,000	500,000	750,000
4	Implementation date	November 1970	September 1971	October 1971
5	System first implemented elsewhere?	yes	yes	no
5	What agency(ies)?	Atlanta	unknown	n/a
6	System available?	yes	yes	yes
12	Size of data base	6,000	10,000	6,000
14	Added per month	100	300-500	unknown
15	Is file purged?	no	no	yes
17	Searches per month	150	20-30	10-15
18	ID's per month	very minute	0 to date	none as yet
19	Class. time (10 prints)	3 minutes	5-10 minutes	unknown
20	Time to enter record	10 minutes	20 minutes	unknown
21	Class. time (latent)	1 minute	1 minute	1-2 minutes
22	Avg. search time	30 minutes	30-45 minutes	unknown
22	Maximum time	45 minutes	180 minutes	several seconds
22	Minimum time	10 minutes	10 minutes	5-20 minutes
23	Unidentified latents searched against incoming arrest prints?	yes	no	no
24	Searches per month	150	n/a	n/a
24	ID's per month	5	n/a	n/a
25	Use palm prints?	yes	yes	no
25	Classification?	no	no	no
27	Persons run system	3	10	2
28	Full-time equivalent	1.15	6.0	.45

Exhibit A-6 (Continued)

Question #	LOCATION AGENCY	Washington Co. OR Sheriff	Austin TX Police Department	Brownsville TX Police Department
2	Type of system	Miracode	Miracode	Miracode
7	Classification	3 digit Miracode	Texas DPS	Texas DPS
3	Area served	city	city	Cameron Co.
3	Population	180,000	300,000	67,000(city) Co. 140,000
4	Implementation date	May 1972	January 1973	1971-72
5	System first implemented elsewhere?	yes	yes	yes
5	What agency(ies)?	Atlanta	Texas DPS	Texas DPS
6	System available?	yes	yes	yes
12	Size of data base	7,000	1,000	3,000
14	Added per month	100	150	25-30
15	Is file purged?	no	no	not yet
17	Searches per month	unknown	20-25	unknown
18	ID's per month	unknown	1-2	unknown
19	Class. time (10 prints)	5 minutes	20 minutes	20 minutes
20	Time to enter record	unknown	40 minutes	30 minutes
21	Class. time (latent)	5 minutes	2 minutes	15 minutes
22	Avg. search time	3 minutes	20 minutes	7 sec./film of 400
22	Maximum time	unknown	unknown	7 minutes/roll
22	Minimum time	unknown	unknown	5 minutes/roll
23	Unidentified latents searched against incoming arrest prints?	no-plan to implement	no	yes all arrests
24	Searches per month	n/a	n/a	unknown
24	ID's per month	n/a	n/a	unknown
25	Use palm prints?	no-plan to implement	yes	no
25	Classification?	no	no	no
27	Persons run system	1	7	2
28	Full-time equivalent	1.0	1.35	.6

Exhibit A-6 (Continued)

Question #	LOCATION AGENCY	Galveston TX Police Department	Harlingen TX Police Department	McAllen TX Police Department
2	Type of system	Miracode	Miracode	Miracode
7	Classification	Texas DPS	Texas DPS	Texas DPS
3	Area served	city	2 county area	Lower Rio Grande Valley of Texas
3	Population	70,000	400,000	--
4	Implementation date	1971-72	1971	1971
5	System first implemented elsewhere?	yes	yes	yes
5	What agency(ies)?	Texas DPS	Texas DPS	Texas DPS
6	System available?	yes	yes	yes
12	Size of data base	600	unknown	500
14	Added per month	--	unknown	30-40
15	Is file purged?	death,prison & 10 years "clean"	yes	no
17	Searches per month	10-20	unknown	25
18	ID's per month	none	none yet	--
19	Class. time (10 prints)	90 minutes	15 minutes	15 minutes
20	Time to enter record	function of workload	20 minutes	30 minutes
21	Class. time (latent)	.5 minutes	10 minutes	5 minutes
22	Avg. search time	1-2 minutes	unknown	unknown
22	Maximum time	1-2 minutes	unknown	unknown
22	Minimum time	30 seconds	unknown	unknown
23	Unidentified latents searched against incoming arrest prints?	yes	yes	no
24	Searches per month	15-20	3	--
24	ID's per month	?	none	--
25	Use palm prints?	no	yes	yes
25	Classification?	no	no	no
27	Persons run system	6	2	1
28	Full-time equivalent	1.9	.6	.15

Exhibit A-6 (Continued)

Question #	LOCATION AGENCY	Texas DPS	Charleston WV Police Department
2	Type of system	Miracode	Miracode
7	Classification	Texas DPS	3 digit Miracode
3	Area served	Central Texas	metro area
3	Population	unknown	270,000
4	Implementation date	August 1971	January 1973
5	System first implemented elsewhere?	no	yes
5	What agency(ies)?	n/a	Atlanta
6	System available?	no	no
12	Size of data base	8,100	700
14	Added per month	40	25
15	Is file purged?	yes	yes
17	Searches per month	16	5
18	ID's per month	none	1 since started
19	Class. time (10 prints)	20 minutes	20 minutes
20	Time to enter record	25 minutes	45 minutes
21	Class. time (latent)	10 minutes	2 minutes
22	Avg. search time	180 minutes	15 minutes
22	Maximum time	480 minutes	unknown
22	Minimum time	15 minutes	unknown
23	Unidentified latents searched against incoming arrest prints?	no	no
24	Searches per month	n/a	n/a
24	ID's per month	n/a	n/a
25	Use palm prints?	no	no
25	Classification?	no	no
27	Persons run system	3	3
28	Full-time equivalent	3.0	2.2

Exhibit A-6 (Continued)

EXHIBIT A-7

Questionnaire Responses to Selected Questions (requiring a lengthy answer) From Agencies Currently Employing Miracode Search and Retrieval Equipment.

A. Anchorage, AK Police Department

#8 (Re: Minimum detail required for search)
Single print with core and delta.

#9 (Re: Additional Search Criteria)
Race, sex, year of birth.

#10/11 (Re: System tied with other systems)
No.

#13 (Re: Data Base Inclusion Criteria)
All arrestees born after 1930.

#31 (Re: Improvements)
More manpower to remove inactive individuals from files, thus reducing search times.

B. Berkeley, CA Police Department

#8 Single print with core and delta. More time consuming searches can be made with sufficient print to establish pattern type (e.g., loop, whorl).

#9 None.

#10 No.

#13 Individuals convicted of arson, auto theft, bombing, burglary, felonious assault, homicide, kidnapping, narcotics, robbery, sex offenses and weapons offenses.

#31 a. Including juvenile fingerprints into the system.

b. Expanding the data base to include persons convicted of "lesser included" offenses.

c. Using fingerprints of arrestees rather than only those convicted.

C. Orange County, CA Sheriff's Department

#8 Single print with core.

#9 Sex and race.

#10 No.

#13 Known local burglars, car thieves and robbers up to 40 years of age.

#31 Two or three permanent personnel to assist in making system fully operational.

D. Sacramento, CA Police Department

#8 Basic pattern type with core.

#9 Sex, race, age, height and type of offense.

#10 Yes. Mug shot retrieval system (Miracode).

#13 Robbery, burglary, car theft, hard narcotics, sex crimes, prowling, history of violent crimes.

#31 Additional Miracode - Retrieval unit to allow simultaneous search of mug shot and latent print data bases. More room.

E. Atlanta,GA Police Department

#8 Single print with one or all three of the codes used in the classification scheme.

#9 Color, sex, date of birth and offense.

#10 No.

#13 Arrestees for burglary, robbery, larceny of automobiles, sex crimes and others on specific requests from officers.

#31 Additional full time latent system personnel. Additional mobile crime scene units and personnel.

F. Honolulu, HI Police Department

#8 Single latent print with identifiable pattern and core, or multiple fingerprints (on same hand) in which at least two prints are present and pattern identifiable.

#9 None.

#10 No.

#13 All adults (18 years and older) arrested for murder, robbery, burglary, theft I, criminal trespass, narcotics, aggravated batteries, assault I, sex offenses and kidnapping.

#31 Additional personnel to allow full-time operation of the Miracode Project. Acquisition of the Miracode II System Equipment.

G. DuPage County, IL Sheriffs Department

#8 Pattern type.

#9 None.

#10 No.

#13 Felons.

#31 More, qualified technicians for latent print searches.

H. Shreveport, LA Police Department

#8 For nine-digit system, either the core or delta.

#9 Year of birth, sex and race.

#10 No.

#13 All felonies of all ages.

#31 Team of crime scene investigators with specialized duties, including latent examination and court presentation.

I. Jackson, MS Police Department

#8 Print with delta or core.

#9 Race, sex, year of birth and type of crime.

#10 No.

#13 Individuals charged with homicide, robbery, business burglary, auto theft, residence burglary, trespassing, narcotics, grand larceny, larceny by trick, receiving stolen goods, possession of stolen goods and sex offenses.

#31 Additional employees and additional funds for salaries.

J. Kansas City, MO Police Department

#8 Core, delta, ridge count or tracing.

#9 Age, sex and race.

#10 No.

#13 All known offenders and persons charged with a felony (on a daily basis).

#31 New equipment, e.g., Miracode II.

K. Rochester, NY Police Department

#8 One print with core and delta and ability to obtain ridge count or whorl tracing.

#9 Age, sex and offense.

#10 No.

#13 Burglary, robbery, auto theft and drug arrests. (misdemeanors and felonies).

#31 Additional personnel to make system workable and productive.

L. Charlotte, NC Police Department

#8 Single print, pattern type, ridge count on tracing and core or delta type.

#9 Sex, race, crime type and type of establishment entered.

#10 No.

#13 Arrestees for storebreaking and larceny (auto), larceny from auto, narcotics, forgery and sex crimes.

#31 The capability to code more information into the Miracode system other than pattern type, core/delta type and ridge count or tracing types, e.g., ridge endings, etc., in relation to core or delta.

M. Cincinnati, OH Police Department

#8 Single print with sufficient ridges to estimate pattern type.

#9 Sex and race (if known).

#10 No.

#13 Arrestees for felonies, narcotics and fraud (e.g., check passers).

#31 More personnel and additional viewing screens to allow multiple simultaneous searches.

N. Cleveland, OH Department of Public Safety

#8 Delta and core or in cases of Arches and Tented Arches, sufficient clarity.

#9 Color, sex, year of birth and M.O.

#10 No.

#13 Robbery, rape, burglary, assaults, fraud, auto theft and other felonies where latent evidence might be found.

#31 Additional personnel to increase data base and increase chances of identifications.

O. Washington County, OR Sheriffs Department

#8 A core, or a delta and combination of both with ridge count, single print or sequenced prints.

#9 _____.

#10 No.

#13 Not selective. Juveniles and persons over 60 years of age are not included.

#31 "Manpower and time enough to print every burglary and search every print on hand and every available latent through our system and gather prints from Portland, etc., to search."

P. Austin, TX Police Department

#8 One print with either core or delta.

#9 Race and sex.

#10 No.

#13 Repeated arrests or activity in burglary, forgery, car theft, narcotics and sex offenses.

#31 One or two "ident." technicians to work the system full time. Be able to have crime scene searched by "ident" technicians.

Q. Brownsville, TX Police Department

#8 Single print with a core and a delta or deltas.

#9 Age, sex.

#10 No.

#13 All individuals fingerprinted (for criminal reasons) except juveniles.

#31 None at the moment.

R. Galveston, TX Police Department

#8 _____.

#9 None.

#10 Yes. M.O. and physical description code-sheets aid search.

#13 Active criminals.

#31 Additional personnel.

S. Harlingen, TX Police Department

#8 Single print with either a core or delta areas.

#9 None.

#10 No. Plan to add M.O. and physical description file on separate reels of film.

#13 All criminal arrestees.

#31 Additional personnel.

T. McAllen, TX Police Department

#8 Single print with core or delta.

#9 Crime type.

#10 No.

#13 Category of crime with an age limit of 50 years unless deemed still active over that age.

#31 Additional personnel to make system current and convert to three digit coding scheme.

U. Texas Department of Public Safety

#8 Core or delta of latent of one print.

#9 None.

#10 No.

#13 Good quality prints. Most criminals active within the last ten years including sex crimes, fraud, armed robbery and burglary. Sex and fraud offenders are retained from the entire state. Armed robbery and burglary from central Texas area unless active in several areas of the state.

#31 None at this time.

V. Charleston, WV Police Department

#8 Single print with core.

#9 None.

#10 No. Designing an M.O. file using Miracode.

#13 Subjects from specific crime files, e.g., breaking and entering, robbery and sex crimes.

#31 Additional personnel to purge and print (card) files and a full-time print technician to classify (convert) the prints.

Exhibit A-8: Operational Systems with Automatic Search Equipment (other than Miracode)

Summary of Latent Print Questionnaire Responses

Question	LOCATION AGENCY	Oakland CA Police Department	Nassau Co. NY Police Department	Ottawa,Ontario R.C.M.P.
2	Type of system	Computer/M.F.	Computer/M.F.	Videofile
7	Classification	3 digit special	4 digit special	Battley (modified)
3	Area served	city	county	Nationwide
3	Population	360,000	1,500,000	22,000,000
4	Implementation date	September 1972	October 1973	10/73
5	System first implemented elsewhere?	no	no	no
5	What agency(ies)?	n/a	n/a	n/a
6	System available?	yes	yes	yes
12	Size of data base	13,500	6,000	19,000
14	Added per month	350	390	1,000
15	Is file purged?	no	yes	yes
17	Searches per month	25	unknown	200
18	ID's per month	1	unknown	8
19	Class. time (10 prints)	6 minutes	10 minutes	20 minutes (8 prints)
20	Time to enter record	unknown	15 minutes	3 minutes
21	Class. time (latent)	3 minutes	1 minute	5-10 minutes
22	Avg. search time	20 minutes	2 minutes	15 minutes
22	Maximum time	30 plus minutes	3 minutes	30 minutes
22	Minimum time	1 minute	7 seconds	2 minutes
23	Unidentified latents searched against incoming/arrest prints?	yes	yes - future	no
24	Searches per month	1	n/a	n/a
24	ID's per month	none to date	n/a	n/a
25	Use palm prints?	yes	yes	no
25	Classification?	no	no	no
27	Persons run system	5	4	9
28	Full-time equivalent	3.75	1.55	9.

EXHIBIT A-9

Questionnaire Responses to Selected Questions From Agencies Currently Employing Automatic or Semi-Automatic Search and Retrieval Equipment.

A. Oakland, CA Police Department

#8 Single print, basic pattern (e.g., arch, loop, whorl); subclassification and tracing ridge count or slant, in three digits.

#9 Physical descriptors, M.O., etc. (optional).

#10 Yes. Mug shots on same system but separate file.

#13 Arrestees for felonies and selected misdemeanors (e.g., prostitution, narcotics, gambling, etc.)

#31 Optical scanning for automatic classification.

B. Nassau County, NY Police Department

#8 Core or delta or fingerprint pattern.

#9 Race, sex, year of birth.

#10 No.

#13 Burglars, robbers and felony narcotics offenders 35 years of age or younger.

#31 Additional personnel to convert data base for use with automatic search equipment.

C. Royal Canadian Mounted Police

#8 Core area only, provided pattern can be determined and the print has good detail.

#9 Geographical location.

#10 Yes. Criminal Record File.

#13 Male arrestees up to 30 years of age.

#31 Improved quality of latent fingerprint images submitted for search.

Summary of Latent Print Questionnaire Responses

Question #	LOCATION AGENCY	Los Angeles CA County Sheriff	Los Angeles CA Police Department	Dade Co. FL Public Safety Department
2	Type of system	Manual	Manual	5-finger card
7	Classification	5 finger	5 finger	5 finger
3	Area served	county	city	county
3	Population	1,700,000	2,800,000	1,390,000
4	Implementation date	1965	1957	1965
5	System first implemented elsewhere?	no	yes	no
5	What agency(ies)?	n/a	FBI	n/a
6	System available?	n/a	no	no
12	Size of data base	50,000	74,000	7500
14	Added per month	2300	150	50-75
15	Is file purged?	death/ 80 yrs.	yes (death/court order)	yes
17	Searches per month'	15-20	"random"	75-100
18	ID's per month	4-5	2	10-15
19	Class. time (10 prints)	1 minute	3 minutes	5 minutes
20	Time to enter record	3 minutes	5 minutes	10 minutes
21	Class. time (latent)	10 seconds	varies	10 minutes
22	Avg. search time	10 minutes	unknown	60 minutes
22	Maximum time	30 minutes	unknown	480 minutes
22	Minimum time	3 minutes	unknown	15 minutes
23	Unidentified latents searched against incoming arrest prints?	no	no	yes
24	Searches per month	n/a	n/a	800
24	ID's per month	n/a	n/a	75-100
25	Use palm prints?	yes	yes	yes
25	Classification?	no	no	no
27	Persons run system	2	2	8
28	Full-time equivalent	2.	.10	7.2

Exhibit A-10: Operational Systems Using Manual Search Methods

Question #	LOCATION AGENCY	Miami FL Police Department	West Palm Beach FL Police Department	Kansas City KS Police Department
2	Type of system	computer/cards	1-finger card	1-finger card
7	Classification	Russak	none	Battley
3	Area served	city	city	city
3	Population	352,000	60,000	176,000
4	Implementation date	1962	unknown	1969
5	System first implemented elsewhere?	no	no	no
5	What agency(ies)?	n/a	n/a	n/a
6	System available?	no	no	no
12	Size of data base	700	125	300
14	Added per month	unknown	3	10
15	Is file purged?	unknown	yes	no
17	Searches per month	unknown	0	100
18	ID's per month	unknown	0	none
19	Class. time (10 prints)	15-20 minutes	n/a	30 minutes
20	Time to enter record	unknown	unknown	55 minutes
21	Class. time (latent)	3-5 minutes	n/a	unknown
22	Avg. search time	20 minutes	60 minutes	unknown
22	Maximum time	25 minutes	90 minutes	unknown
22	Minimum time	5 minutes	30 minutes	unknown
23	Unidentified latents searched against incoming arrest prints?	no	no	no
24	Searches per month	n/a	n/a	n/a
24	ID's per month	n/a	n/a	n/a
25	Use palm prints?	yes	yes	yes
25	Classification?	yes-Danish System	no	no
27	Persons run system	2	2	3
28	Full-time equivalent	1.5	.1	.15

Exhibit A-10 (Continued)

Question #	LOCATION AGENCY	New Orleans LA Police Department	Boston MA Police Department	Minneapolis MN Police Department
2	Type of system	1-finger card	5-finger card	5-finger card
7	Classification	Battley	Hood-Taylor	5 finger
3	Area served	metro area	city	city
3	Population	1,000,000	700,000	435,000
4	Implementation date	1930	1950	prior to 1960
5	System first implemented elsewhere?	unknown	yes	yes
5	What agency(ies)?	n/a	Scotland Yard	unknown
6	System available?	yes	no	no
12	Size of data base	10,000	35,000	5,000
14	Added per month	50-75	300	15
15	Is file purged?	yes	yes	no
17	Searches per month	100	100	unknown
18	ID's per month	20	20	unknown
19	Class. time (10 prints)	5 minutes	3 minutes	2 minutes
20	Time to enter record	10 minutes	5-7 minutes	10 minutes
21	Class. time (latent)	.5 minute	unknown	unknown
22	Avg. search time	unknown	unknown	60 minutes
22	Maximum time	unknown	unknown	180-240 minutes
22	Minimum time	unknown	unknown	2 minutes
23	Unidentified latents searched against incoming arrest prints?	yes	yes	yes
24	Searches per month	50-100	200	0-15
24	ID's per month	unknown	20	unknown
25	Use palm prints?	yes	yes	yes
25	Classification?	no	no	no
27	Persons run system	2	3	12
28	Full-time equivalent	1.0	.9	unknown

Exhibit A-10 (Continued)

Question #	LOCATION AGENCY	Atlantic Co. NJ Sheriff	East Orange NJ Police Department	New York DCJS
2	Type of system	1-finger card	5-finger card	5-finger card
7	Classification	Battley	5 finger	5 finger
3	Area served	county	city	state-except NYC
3	Population	175,000	79,000	8,000,000
4	Implementation date	1962	1960	1960
5	System first implemented elsewhere?	no	no	yes
5	What agency(ies)?	n/a	n/a	many agencies
6	System available?	no	no	no
12	Size of data base	900	3,000	40,000
14	Added per month	5	75	none
15	Is file purged?	yes	no	no
17	Searches per month	unknown	n/a	n/a
18	ID's per month	1	n/a	n/a
19	Class. time (10 prints)	15 minutes	3 minutes	.75 minute
20	Time to enter record	20 minutes	5 minutes	10 minutes
21	Class. time (latent)	5 minutes	unknown	unknown
22	Avg. search time	20 minutes	unknown	unknown
22	Maximum time	45 minutes	unknown	3 weeks
22	Minimum time	5 minutes	unknown	1 week
23	Unidentified latents searched against incoming arrest prints?	yes	no	yes
24	Searches per month	5	n/a	unknown
24	ID's per month	1	n/a	unknown
25	Use palm prints?	no	no	yes
25	Classification?	no	no	no
27	Persons run system	2	2	4
28	Full-time equivalent	.70	.1	3.5

Exhibit A-10 (Continued)

Question	LOCATION AGENCY	Vermont Dept. of Public Safety	
2	Type of system	5-finger card	
7	Classification	Del-core	
3	Area served	state	
3	Population	450,000	
4	Implementation date	1969	
5	System first implemented elsewhere?	yes	
5	What agency(ies)?	several in Canada	
6	System available?	no	
12	Size of data base	2,500	
14	Added per month	100-200	
15	Is file purged?	yes	
17	Searches per month	variable	
18	ID's per month	none as yet	
19	Class. time (10 prints)	2-5 minutes	
20	Time to enter record	5 minutes	
21	Class. time (latent)	1 minute	
22	Avg. search time	5-30 minutes	
22	Maximum time	60 minutes	
22	Minimum time	1 minute	
23	Unidentified latents searched against incoming arrest prints?	no	
24	Searches per month	n/a	
24	ID's per month	n/a	
25	Use palm prints?	yes	
25	Classification?	no	
27	Persons run system	2	
28	Full-time equivalent	.8	

Exhibit A-10 (Continued)

EXHIBIT A-11

Questionnaire Responses to Selected Questions from Agencies Currently Employing Manual Filing Cards and Search Techniques.

A. Los Angeles, CA Police Department

#8 A single fingerprint, sufficient to determine pattern type and an approximate ridge count between delta and core.

#9 None.

#10 No.

#13 Homicide, burglary, narcotics, forgery, forcible rape and sex crimes.

#31 (1) Additional qualified personnel to further subclassify fingerprint cards currently in file.

(2) Addition of a video retrieval capability to aid in solving storage problems, increase search capability (speed and range of classification references). The result would be manpower savings and more identifications.

B. Los Angeles County, CA Sheriff's Office

#8 Two fingerprints with pattern types observable.

#9 None.

#10 No.

#13 Arrestees for homicides burglary, robbery, sex offenders (felony) and narcotics.

#31 An additional fingerprint clerk.

C. Dade County, FL Public Safety Department

#8 Single print with core and delta.

#9 Geographical location and offense type.

#10 No.

#13 Arrestees for burglary, robbery, auto theft, sex offenses. Juvenile arrestees on felony charges are maintained in a separate file.

#31 An automated search and retrieval system for fingerprint (images) of selected previous offenders. Additional working space.

D. Miami, FL Police Department

#8 Type and core only on pattern only.

#9 Personal identification system ("Gotcha").

#10 Yes. "Armed robbery latent lift card indicates black or white male."

#13 Past record for breaking and entering, auto theft, armed robbery. Juvenile males on a revised and modified single fingerprint system.

#31 Computer and microfilming hardware dedicated to latent system. Four additional latent technicians.

E. West Palm Beach, FL Police Department

#8 Ridge detail sufficient to establish identification.

#9 None.

#10 No.

#13 Individuals selected by detectives on basis of current involvement in criminal activity.

#31 None.

F. Kansas City, KS Police Department

#8 Any one of several points of focus, delta, core, loop, slope with either delta or core, pattern type or lower tracing deltas.

#9 None.

#10 No.

#13 Felony burglars and car thieves and holdupmen.

#31 Automated retrieval system and additional personnel full time in latent fingerprint activities.

G. New Orleans, LA Police Department

#8 Single print with core and delta. Single print with a core and, when it can be determined, the delta will be located.

#9 None.

#10 No.

#13 Armed robbery, simple and aggravated burglary, car theft, rape, arson and safe burglary.

#31 Automation. Expansion of fingerprint card data base. Additional personnel for latent fingerprint work (particularly crime scene analysis).

H. Boston, MA Police Department

#8 One focal point-- either the delta or the core with additional ridge characteristics. (Position of print on object is of prime importance.)

#9 Name, date of birth, offense type, color and district of offense commission.

#10 No.

#13 Rape, robbery, murder, breaking and entering and all serious crimes including drug cases.

#31 Reduction of age group and possibly classifying the latent prints.

I. Minneapolis, MN Police Department

#8 A single print and ability to determine type of print.

#9 Race. (Males only in file).

#10 No.

#13 Male burglars and selected narcotics offenders.

#31 Additional clerical personnel for record keeping activities, freeing technicians for more search activities.

J. East Orange, NJ Police Department

#8 Single print with pattern area.

#9 None.

#10 No.

#13 Part I and narcotic arrestees. Other arrestees are included when circumstances indicate.

#31 Information, education and automati

K. Atlantic County, NJ Sheriff's Departmen

#8 Single print. Half of whorl type c
on loop type with partial ridge cou

#9 None.

#10 No.

#13 Burglary and auto theft.

#31 Computerized latent print system.

L. New York Division of Criminal Justice S

#8 A discernable pattern type.

#9 None.

#10 No.

#13 Burglary, robbery, bank robbery, c

#31 Planning a semi-automated latent f

M. Vermont Department of Public Safety

#8 Core and delta generally. If eith
more exhaustive search required.

#9 None.

#10 No.

#13 Major felony arrests. If officers feel so, finger-
prints of other subjects are included.

#31 Additional personnel and use of Miracode to increase
storage and retrieval speed.

Summary of Latent Print Questionnaire Responses

Question #	LOCATION / AGENCY	Los Angeles CA County Sheriff	Denver CO Police Department	Lakewood CO Department of Public Safety
2	Type of system	computer/file	computer/m.f.	Miracode
7	Classification	NCF	NCF	3 digit Miracode
3	Area served	county	metro area	city
3	Population	7,000,000	1,330,000	120,000
4	Implementation date	1974	early 1974	late 1974
5	System first implemented elsewhere?	no	no	yes
5	What agency(ies)?	n/a	n/a	Atlanta, Shreveport
6	System available?	no	yes	yes
12	Size of data base	2,000,000	250,000	n/a
14	Added per month	2000	1000	n/a
15	Is file purged?	death/ 70yrs.	yes (age/5 yrs inactive)	n/a
17	Searches per month	n/a	unknown	n/a
18	ID's per month	n/a	n/a	n/a
19	Class. time (10 prints)	3 minutes	3 minutes	unknown
20	Time to enter record	6 minutes	5 minutes	unknown
21	Class. time (latent)	n/a	1 minute	unknown
22	Avg. search time	n/a	unknown	unknown
22	Maximum time	n/a	unknown	unknown
22	Minimum time	n/a	unknown	unknown
23	Unidentified latents searched against incoming arrest prints?	no	yes-planned	yes
24	Searches per month	n/a	unknown	15-20
24	ID's per month	n/a	unknown	5 or less
25	Use palm prints?	yes	yes	yes
25	Classification?	no	no	no
27	Persons run system	n/a	unknown	1
28	Full-time equivalent	n/a	unknown	.5

Exhibit A-12: Agencies Implementing or Planning Latent Fingerprint Systems

Question	LOCATION AGENCY	Pensacola FL Police Department	Savannah GA Police Department	Illinois Bureau of Identification
2	Type of system	Miracode	Miracode	Videofile
7	Classification	6 digit Hood-Taylor	unknown	NCIC type
3	Area served	city	city	state
3	Population	75,000	115,000	11,000,000
4	Implementation date	July 1973	1974	1976
5	System first implemented elsewhere?	yes	n/a	no
5	What agency(ies)?	Shreveport LA	n/a	n/a
6	System available?	yes	yes	yes
12	Size of data base	5,000-future	n/a	unknown
14	Added per month	200	n/a	n/a
15	Is file purged?	yes	n/a	n/a
17	Searches per month	0 not used yet	n/a	n/a
18	ID's per month	0	n/a	n/a
19	Class. time (10 prints)	12 minutes	n/a	n/a
20	Time to enter record	unknown	n/a	n/a
21	Class. time (latent)	5 minutes	n/a	n/a
22	Avg. search time	30 minutes	n/a	n/a
22	Maximum time	45 minutes	n/a	n/a
22	Minimum time	10 minutes	n/a	n/a
23	Unidentified latents searched against incoming arrest prints?	no	no	yes
24	Searches per month	n/a	n/a	unknown
24	ID's per month	n/a	n/a	unknown
25	Use palm prints?	yes	yes	yes
25	Classification?	no	no	no
27	Persons run system	2	n/a	n/a
28	Full-time equivalent	.8	n/a	n/a

Exhibit A-12 (Continued)

Question	LOCATION AGENCY	Baltimore MD Police Department	Montgomery Co. MD Department of Police	Elizabeth NJ Police Department
2	Type of system	5-finger card	3-M Micro-Disc	Computer/M.F.
7	Classification	5-finger	NCIC modified	Datum
3	Area served	city	county	city
3	Population	895,000	600,000	120,000
4	Implementation date	late 1974	1975	June 1973
5	System first implemented elsewhere?	yes	yes	no
5	What agency(ies)?	Metro P.D., Washington, D.C.	Harrisburg, PA	n/a
6	System available?	no	yes	yes
12	Size of data base	n/a	n/a	n/a
14	Added per month	n/a	n/a	n/a
15	Is file purged?	n/a	no	n/a
17	Searches per month	n/a	n/a	n/a
18	ID's per month	n/a	n/a	n/a
19	Class. time (10 prints)	unknown	3 minutes	5-10 minutes
20	Time to enter record	unknown	unknown	unknown
21	Class. time (latent)	unknown	unknown	.5 minute
22	Avg. search time	unknown	unknown	unknown
22	Maximum time	unknown	unknown	unknown
22	Minimum time	unknown	unknown	unknown
23	Unidentified latents searched against incoming arrest prints?	yes	no	yes
24	Searches per month	unknown	n/a	unknown
24	ID's per month	unknown	n/a	unknown
25	Use palm prints?	no	yes	no
25	Classification?	no	no	no
27	Persons run system	n/a	n/a	5
28	Full-time equivalent	n/a	n/a	2.2

Exhibit A-12 (Continued)

Question #	LOCATION AGENCY	Jersey City NJ Police Department	Newark NJ Police Department	Paterson NJ Police Department
2	Type of system	computer/m.f.	computer/m.f.	computer/m.f.
7	Classification	Datum	Datum	Datum
3	Area served	city	city	city
3	Population	275,000	382,000	170,000
4	Implementation date	January 1974	late 1973	September 1973
5	System first implemented elsewhere?	no	no	no
5	What agency(ies)?	n/a	n/a	n/a
6	System available?	yes	yes	yes
12	Size of data base	n/a	100-just started	n/a
14	Added per month	200-projected	150-200	400-anticipated
15	Is file purged?	yes	unknown	yes
17	Searches per month	n/a	n/a	unknown
18	ID's per month	n/a	n/a	unknown
19	Class. time (10 prints)	10 minutes	5 minutes	unknown
20	Time to enter record	20 minutes	10 minutes	20-25 minutes
21	Class. time (latent)	5-15 minutes	2 minutes	15 minutes
22	Avg. search time	unknown	n/a	unknown
22	Maximum time	unknown	n/a	unknown
22	Minimum time	unknown	n/a	unknown
23	Unidentified latents searched against incoming arrest prints?	no	yes-planned	yes
24	Searches per month	n/a	n/a	unknown
24	ID's per month	n/a	n/a	unknown
25	Use palm prints?	no	no	no
25	Classification?	no	no	no
27	Persons run system	0	3	unknown
28	Full-time equivalent	0	.9	unknown

Exhibit A-12 (Continued)

Question #	LOCATION AGENCY	Trenton NJ DPS	Columbus OH Police Department	Toledo OH Police Department
2	Type of system	computer/m.f.	computer/m.f.	Miracode or Microdisc
7	Classification	Datum	Norfolk	unknown
3	Area served		Franklin County	metro area
3	Population		920,000	1,000,000
4	Implementation date		May 1974	pending
5	System first implemented elsewhere?		no	n/a
5	What agency(ies)?		n/a	n/a
6	System available?		yes	n/a
12	Size of data base		2000-5000 planned	n/a
14	Added per month		n/a	125-est.
15	Is file purged?		yes	n/a
17	Searches per month		n/a	n/a
18	ID's per month		n/a	n/a
19	Class. time (10 prints)		n/a	unknown
20	Time to enter record		n/a	n/a
21	Class. time (latent)		n/a	unknown
22	Avg. search time		n/a	n/a
22	Maximum time		n/a	n/a
22	Minimum time		n/a	n/a
23	Unidentified latents searched against incoming arrest prints?		yes-planned	no
24	Searches per month		n/a	n/a
24	ID's per month		n/a	n/a
25	Use palm prints?		yes	yes
25	Classification?		no	no
27	Persons run system		2	--
28	Full-time equivalent		n/a	--

Question #	LOCATION AGENCY	Tulsa OK Police Department	Portland OR Bureau of Police
2	Type of system	computer/card	not chosen
7	Classification	NCIC	unknown
3	Area served	city	city
3	Population	340,000	400,000
4	Implementation date	November 1973	n/a planned
5	System first implemented elsewhere?	no	n/a
5	What agency(ies)?	n/a	n/a
6	System available?	no	n/a
12	Size of data base	65,000	5000 manual system
14	Added per month	300	40
15	Is file purged?	no	yes
17	Searches per month	n/a	125
18	ID's per month	n/a	25
19	Class. time (10 prints)	10 minutes	n/a
20	Time to enter record	10 minutes	n/a
21	Class. time (latent)	1 minute	n/a
22	Avg. search time	unknown	unknown
22	Maximum time	unknown	240 minutes
22	Minimum time	unknown	120 minutes
23	Unidentified latents searched against incoming arrest prints?	yes	yes
24	Searches per month	unknown	40
24	ID's per month	unknown	5
25	Use palm prints?	yes	yes
25	Classification?	no	no
27	Persons run system	1	n/a
28	Full-time equivalent	1.0	n/a

Exhibit A-12 (Continued)

EXHIBIT A-13

Questionnaire Responses to Selected Questions from Agencies Currently Planning on Implementing Operational Latent Fingerprint Identification Systems.

A. Los Angeles County, CA Sheriff's Office

#8 Single print with pattern and ridge count.

#9 Age, sex, race and type of offense (optional).

#10 Yes. NCF fingerprint classification is an integral part of the Personal History Index which also contains the subject's name, Aka's, description, date of birth, arrest totals, etc.

#13 "Searches may be (made) against the total file. However, they may be limited to individuals with histories of certain offenses."

#31 In development stages.

B. Denver, CO Police Department

#8 Single print. Additional data reduce search time.

#9 Age, sex, name, date of birth, physical description, NCIC class., Henry Class., and 4 digit class.

#10 Yes, Physical description.

#13 All criminal offenders less than 70 years of age.

#31 N/A

C. Lakewood, CO Public Safety Department

#8 Single print with core and delta.

#9 Initially fingerprint classification only. Studies will be made to determine usefulness of data expansion to perhaps include geographic location, offense and M.O.

#10 No. Eventually plan to develop MIS to include M.O. and physical description interfaced with the latent print system.

#13 All individuals charged with Class I offenses and narcotics offenses.

#31 Additional qualified personnel.

D. Pensacola, FL Police Department

#8 Single print with a core.

#9 None.

#10 No.

#13 Felony arrests active within the past five years.

#31 One full time latent examiner.

E. Savannah, GA Police Department

#8 "Under study."

#9 "Unk.-under study."

#10 "Under study."

#13 "Under study."

#31 Additional personnel. More concentration on Latent Print Identification. Automated system.

F. Illinois Bureau of Identification

#8 Single print with core and delta.

#9 Offense and geographical area.

#10 No.

#13 Arrestees for selected felonies.

#31 _____.

G. Baltimore, MD Police Department

#8 Basic pattern type.

#9 Age, sex, offense, geographical location and M.O.

#10 No.

#13 "Not solidified at this time."

#31 N/A

H. Montgomery County, MD Police Department

#8 Single print with core, delta and approximate ridge count.

#9 Planning for age, sex and M.O. in selected offenses.

#10 Yes.

#13 Under study at this time.

#31 Planned 3M System.

I. Elizabeth, NJ Police Department

#8 Single print - core or delta area.

#9 Race, sex, and physical description.

#10 Yes. Tied to physical description.

#13 Initially all arrestees. Eventually will be more selective to include most Part I crimes and major Part II crimes, including sex offenses, narcotics, gambling and fraud.

#31 N/A.

J. Jersey City, NJ Police Department

#8 Single print with either core or delta.

#9 Age, sex and offense type.

#10 Yes. One file contains fingerprint descriptors. Another file contains physical and M.O. descriptors. Searches can be made with or without computer linking.

#13 All persons arrested for UCR Part I crimes and all narcotics arrestees other than those involving possession of less than 25 grams of marijuana.

#31 Additional equipment or personnel for recording, coding and entering of data.

K. Newark, NJ Police Department

#8 _____.

#9 Sex and race.

#10 No.

#13 Arrestees for robbery, breaking and entry, narcotics, rape and prostitution.

#31 N/A.

L. Paterson, NJ Police Department

#8 _____.

#9 Physical description, M.O. and name.

#10 Yes, physical description, M.O. and name.

#13 All Part I crimes and habitual Part II crime offenders.

#31 Complete interface with computer for larger storage of indices.

M. Trenton, NJ (Implementing Datum System. No Specific Answers to Questionnaire.)

N. Columbus, OH Police Department

#8 Single digit.

#9 Age, sex, physical descriptor/M.O., geographical location, type of offense, vehicle and name.

#10 Yes. Physical descriptor/M.O.

#13 All criminals arrested more than once in last three years for robbery, sex crimes and auto theft.

#31 N/A.

O. Toledo, OH Police Department

#8 Presumably core-delta, ridge count if loop's-whorl's more the type the pattern.

#9 Unknown. Hopefully, age, sex, offense, geographical location and M.O.

#10 Possibly.

#13 Not determined yet.

#31 No opinions yet.

P. Tulsa, OK Police Department

#8 "NCIC Fingerprint Class".

#9 Race, sex, age (range), physical description, offense type.

#10 Yes. Physical descriptor. Provision for M.O. but no data yet.

#13 Fingerprintable arrests.

#31 Additional field personnel to collect physical evidence. Improved latent print development techniques.

Q. Portland, OR Bureau of Police

#8 Either core or delta.

#9 Areas of known operation on area residence. (Not required).

#10 No.

#13 Burglars (any age group) are palm printed. Possible burglary suspects, robbers and auto thieves up to 25 years of age.

#31 An automated system similar to RCMP or Oakland, CA Police Department.

Summary of Latent Print Questionnaire Responses

Question #	LOCATION AGENCY	California State Dept. of Justice	Richmond CA Police Department	Kansas Bureau of Identification
2	Type of system	Computer	1-finger card	manual 5-finger
7	Classification	3 digit special	5 character special	5 finger
3	Area served	state	city	state
3	Population	20,000,000	85,000	--
4	Implementation date	1956	March 1972	1970
5	System first implemented elsewhere?	no	no	yes
5	What agency(ies)?	n/a	n/a	FBI
6	System available?	no	no	no
12	Size of data base	not in operation	500	200
14	Added per month	n/a	0	varies
15	Is file purged?	n/a	no	prison without parole/death
17	Searches per month	n/a	0	150
18	ID's per month	n/a	0	unknown
19	Class. time (10 prints)	5 minutes	3-4 minutes	5 minutes
20	Time to enter record	7 minutes	3-4 minutes	10 minutes
21	Class. time (latent)	1 minute	.5 minute	unknown
22	Avg. search time	unknown	5-10 minutes	hours
22	Maximum time	unknown	unknown	all day
22	Minimum time	unknown	unknown	1 hour
23	Unidentified latents searched against incoming arrest prints?	no	yes	no
24	Searches per month	n/a	20-30	n/a
24	ID's per month	n/a	4-5	n/a
25	Use palm prints?	yes	yes	yes
25	Classification?	no	no	no
27	Persons run system	0	0	1
28	Full-time equivalent	0	0	.9

Exhibit A-14: Agencies Whose Latent Fingerprint System Is Currently Inactive

Question #	LOCATION AGENCY	Pittsburgh PA Bureau of Police	Norfolk VA Police Department	
2	Type of system	1-finger card	computer/card	
7	Classification	Battley	8 digit special	
3	Area served	city	city	
3	Population	550,000	307,000	
4	Implementation date	1957	August 1972	
5	System first implemented elsewhere?	no	yes	
5	What agency(ies)?	n/a	Miami	
6	System available?	no	no	
12	Size of data base	15,000	300	
14	Added per month	n/a	Temporarily suspended	
15	Is file purged?	yes	n/a	
17	Searches per month	n/a	n/a	
18	ID's per month	n/a	n/a	
19	Class. time (10 prints)	5 minutes	15 minutes	
20	Time to enter record	10 minutes	30 minutes	
21	Class. time (latent)	1 minute	3 minutes	
22	Avg. search time	unknown	unknown	
22	Maximum time	30 minutes	10 minutes	
22	Minimum time	2 minutes	2 minutes	
23	Unidentified latents searched against incoming arrest prints?	no	yes	
24	Searches per month	n/a	20,000	
24	ID's per month	n/a	20	
25	Use palm prints?	yes	yes	
25	Classification?	no	no	
27	Persons run system	0	2	
28	Full-time equivalent	0	0	

Exhibit A-14 (Continued)

EXHIBIT A-15

Questionnaire Responses to Selected Questions from Agencies Whose Latent Fingerprint Identification System is Currently Inactive.

A. California Department of Justice

#8 Core or delta of each print.

#9 Generally geographic location. Occasionally age, sex, height, weight and race.

#10 Yes, latent coding usually entered in computer along with M.O. factors.

#13 Known active burglars.

#31 Revise coding system or devise an entirely new system.

B. Richmond, CA Police Department

#8 Single print with core and delta preferred. Good core alone can be searched, however.

#9 None.

#10 No.

#13 Burglars, car thieves and robbers on second arrest.

#31 Automation, such as Miracode.

C. Kansas Bureau of Identification

#8 Single print with sufficient number of points of identity.

#9 M.O.

#10 Yes. M.O. category: Burglary, rape, checks, etc.

#13 Suspect on the street, believed operating in the area.

#31 Additional personnel. Better facilities.

D. Pittsburgh, PA Bureau of Police

#8 Pattern and case type.

#9 Race and age.

#10 No.

#13 Any type crime or offense where it is likely that the offender might leave latent prints.

#31 Return latent print work back to identification personnel. Install Miracode System.

E. Norfolk, VA Police Department

#8 Single Print with core.

#9 N/A.

#10 _____.

#13 Burglars, car thieves, check forgers, drug addicts and robbers.

#31 Sufficient personnel to utilize (operate) the present system.

APPENDIX B

CLASSIFICATION SYSTEM DESCRIPTIONS

Appendix B

CLASSIFICATION SYSTEM DESCRIPTIONS

In completing the survey questionnaire, each respondent indicated the type of latent fingerprint classification scheme employed by his agency. In this appendix, a detailed description of each of the different classification schemes listed is presented. There are 20 different classification schemes employed among the respondents. Some of them are quite similar to each other and others differ significantly from the remainder of the group. For ease of reference discussion, a distinct name has been given to each of the classification schemes being discussed. They are indicated in the lefthand column in Exhibit B-1. The names used to describe the classification schemes may refer to the originator of the scheme (as in the case of the Battley system), to a characteristic of the scheme itself (such as the three-digit system), or to the name of one of the agencies using it. The vertical columns in Exhibit B-1 indicate the parameters that are used in classifying fingerprints. The matrix in the exhibit indicates the various parameters used in each of the classification schemes to be discussed. In the remainder of the appendix, each of the classification schemes will be described in detail and a list of the agencies using or planning to use the particular scheme will be presented.

B-1. The Battley Classification Scheme

The Battley classification scheme is used by the following respondents:

- New Orleans, Louisiana Police Department
- Kansas City, Kansas Police Department
- Atlantic County, New Jersey Sheriff's Department
- Pittsburgh, Pennsylvania Police Bureau
- Royal Canadian Mounted Police.

	Number of characters (maximum)	Pattern type	Ridge count (loops)	Tracing (whorles)	Plain Arch type	Tented Arch type	Ridge count (whorles)	Core type	Delta type	Core-Delta distance (Battley glass)	Minutia count (core)	Minutia count (delta)	Scars near core	Tented arch measurement (Battley glass)	Core size (Battley glass)	Whorl subpattern	Loop subpattern	Island count (Russak)
Battley	10	x	x	x			x	x		x				x	x			
NCIC	2	x	x	x														
NCF	3	x	x	x		x	x											
3 digit Miracode	3	x	x	x		x		x										
9 digit Hood-Taylor	9	x	x	x				x			x	x						
6 digit Hood-Taylor	6	x	x	x				x			x							
Russak	8	x	x	x		x		x		x			x			x	x	x
Nassau	4	x	x			x	x	x	x									
Oakland	3	x	x	x	x	x	x									x	x	
Berkeley	3	x	x	x	x	x	x	x										
Richmond	5	x			x	x		x		x				x	x			
Calif. ID Bureau	3	x	x	x		x	x											
Orange County	6	x	x	x		x		x			x		x					
Honolulu	3	x						x			x							
5-finger	2	x	x															
Datum	8	x	x	x		x		x	x				x					x
Cincinnati	6	x	x	x		x		x	x	x								
Texas DPS	6	x						x	x		x	x						
Del-core	4	x								x					x			
Norfolk	8	x	x	x		x	x	x	x	x			x	x		x	x	x

Exhibit B-1. LATENT FINGERPRINT CLASSIFICATION ANALYSIS

In the Battley system, a special fingerprint glass is used to code the fingerprints. This glass is equipped with a special reticule consisting of a glass disc with a dot in the center with seven concentric circles around it. The radii of the circles are 3mm, 5mm, 7mm, 9mm, 11mm, 13mm, and 15mm. The area within each circle is assigned a letter from A to G and the area beyond the 15mm circle is assigned the letter H. Linear distance measurements between two points are measured by placing the dot on one point and observing in what circle the other point lies. The distance is coded according to the letter assigned to the area in which the second point lies.

At the time of booking, individual prints are taken of each finger on cards which are numbered according to the sequence on a standard fingerprint card, i.e., right thum is No. 1, right index is No. 2, etc. Therefore, 10 separate cards are taken, one for each finger. Each of the cards is classified by utilizing the special Battley glass. The dot in the center of the reticule is placed in the center of the innermost recurving ridge in the case of loops and whorls. Arches and tented arches are not classifiable except to denote slant of pattern and the fact that it is an arch or a tented arch.

The Battley coding scheme results in a maximum of seven characters for each finger. The coding character sequence for whorls is as follows: first, an indication that the pattern is a whorl; second, the core type as seen on the Battley core type differentiation chart; third, a reading of the distance to the left delta; fourth, a trace from the left delta to the right delta core; fifth, the distance to the right delta; sixth, the ridge count from the left delta to the core; and seventh, the ridge count from the right delta to the core.

For loop patterns, the coding sequence is as follows: first, an indication of the slant of the loop; second, the core type, third, the ridge count from core to delta; and fourth, an indication in which circle the delta is located.

Other types of patterns, e.g., twin loops, are handled in a similar manner.

B-2. The NCIC Classification System

Three of the respondent agencies have employed an NCIC type classification system. These are:

- Illinois State Bureau of Identification
- Montgomery County, Maryland Police Department, which uses a modified NCIC system
- Tulsa, Oklahoma Police Department

The NCIC classification scheme is a simple scheme in which two characters are used to classify the fingerprint pattern found on each finger. As indicated in Exhibit B-1, the parameters coded in this system are pattern type, the ridge count in the case of loops, and a description of tracing in the case of whorls. Exhibit B-2 shows an example of the two-character coding used to classify single fingerprints according to the NCIC System. The Illinois State Bureau of Identification uses the numerical codes indicated in the right hand columns in its Videofile System. The classification scheme is straightforward; all the characters are alphabetic except in the case of the loops, where the classification code is simply the ridge count for ulnar loops up to a count limit of 50 and is the ridge count plus 50 for radial loops.

Exhibit B-2

NCIC Single Fingerprint Classification Code

Pattern Type	NCIC Code	Videofile Equivalent
Arches:		
Plain	AA	0 00
Tented	TT	1 00
Loops:		
Radial	Ridge Count Plus 50	5 00-50
Ulnar	Ridge Count to 50	6 00-50
Whorls:		
Plain		
Inner	PI	4 70
Meeting	PM	4 80
Outer	PO	4 90
Central Pocket Loop		
Inner	CI	2 70
Meeting	CM	2 80
Outer	CO	2 90
Double Loop		
Inner	DI	3 70
Meeting	DM	3 80
Outer	DO	3 90
Accidental		
Inner	XI	7 70
Meeting	XM	7 80
Outer	XO	7 90
Missing	XX	8 00

B-3. The NCF System

The numerical classification format (NCF) is planned for use by the Los Angeles County Sheriff's Office in the system about to be implemented there. It is also being planned for use by the Denver, Colorado Police Department and is in use in the Anchorage, Alaska Police Department system. In the Denver and Anchorage systems slight modifications are made to the basic NCF system.

Three characters are used to describe the fingerprint patterns in the NCF system. The parameters coded with the three characters include the pattern type and the ridge count in the case of loops, the tracing in the case of whorls, the tented arch type, and the ridge count for whorls. The Denver system adds a fourth character indicating a slope of loops or central pocket loops. Exhibit B-3 shows the basic NCF coding scheme.

Exhibit B-3

NCF Classification System

Amputation		____ 000
Bandaged		____ 010
Temporary Smear or disfiguration or pattern not recognizable (not to be incoded)		____ 020
Plain Arch		____ 100
Tented Arch	(Angular)	____ 210
	(Upthrust)	____ 220
	(Loop Type)	____ 230
Radial Loop		____ 300 + Ridge Count
Ulnar Loop		____ 400 + Ridge Count
Plain Whorl	(Inner)	____ 500 + Ridge Count
	(Meet)	____ 530 + Ridge Count
	(Outer)	____ 560 + Ridge Count
Central Pocket Loop	(Inner)	____ 600 + Ridge Count
	(Meet)	____ 630 + Ridge Count
	(Outer)	____ 660 + Ridge Count
Double Loop	(Inner)	____ 700 + Ridge Count
	(Meet)	____ 730 + Ridge Count
	(Outer)	____ 760 + Ridge Count
Accidental	(Inner)	____ 800 + Ridge Count
	(Meet)	____ 830 + Ridge Count
	(Outer)	____ 860 + Ridge Count
Scarred - Mutilated - Birth Defect		____ 900

NOTE: 900 = Fingerprint pattern so scarred that pattern type cannot be determined with reasonable accuracy.

1. Ridge count is made from left delta (right hand), right delta (left hand), to core (Loops and whorls)
2. When there are <u>two or more cores</u>, (usually applies to accidental whorls) the ridge count is made from the left delta (right) hand, right delta (left) hand, to the core which is the least number of ridges distant from that delta.
3. The double loop is counted from the delta to the core of the upright loop. Where the loops of a double loop are horizontal, the nearest core is used.

B-4 Three-Digit Miracode Classification System

The three-digit miracode system is used by several agencies employing the Miracode search and retrieval equipment. The parameters used to describe the fingerprint pattern include the pattern type, the ridge count in case of loops, the tracing in the case of whorls, the type of tented arch, and the core type. The responding agencies employing the three-digit Miracode system are: the Sacramento, California Police Department; the Lakewood, Colorado Department of Public Safety; the Palm Beach County, Florida Sheriff's Office; the Atlanta, Georgia Police Department; the Du Page County, Illinois Sheriff's Office; the Kansas City, Missouri Police Department; the Cleveland, Ohio Department of Public Safety; the Washington County, Oregon Sheriff's Department, the Rochester, New York Police Department; the Charlotte, North Carolina, Police Department; and the Charleston, West Virginia Police Department. Exhibit B-4 (on the following nine pages) indicates the relationship between the three digits used to characterize the fingerprint classification scheme and the actual fingerprint parameters.

FIRST DIGIT (Pattern Type)	SECOND DIGIT	THIRD DIGIT
0 = Amputation	0	0
1 = Arch	1 = Plain arch w/enclosures or spurs in pattern area. 2 = Plain arch w/o enclosures or spurs. 3 = Slant to right w/enclosures of spurs. 4 = Slant to right w/o enclosures or spurs. 5 = Slant to left w/enclosures or spurs. 6 = Slant to left w/o enclosures or spurs.	1 = Majority of bifurcations within three rings of Battley semicircle flow to right. 2 = Majority of bifurcations flow to left. 3 = Even number of right & left. 4 = No bifurcations (Place line on Battley circle even w/first level line)
2 = Tented Arch	1 = Slant to right. 2 = Slant to left. 3 = Vertical 4 = Exceptional w/slant to right. 5 = Exceptional w/slant to left. 6 = Nascent with slant to right. 7 = Nascent with slant to left. See illustration sheet	Height of upthrust 1 = Within first semicircle on Battley circle 2 = Within second semicircle 3 = Within third semicircle or beyond. Place line at point where ridge begins upthrust
3 = Right Slant Loop	Ridge count by Parameters 1 = (1 - 3) 2 = (4 - 5) 3 = (6 - 7) 4 = (8 - 9) 5 = (10 - 11) 6 = (12 - 13) 7 = (14 - 16) 8 = (17 - 21) 9 = (22 - Out)	Core type (See loop core type with illustrations)
4 = Left Slant Loop	Same as right slant loop	Same as right slant loop

Exhibit B-4 Three-Digit Miracode Classification System

FIRST DIGIT (Pattern Type)	SECOND DIGIT	THIRD DIGIT
5 = Plain Whorl	Core Type (See whorl core type with illustrations)	Place dot of full Battley circle on the core (determined from left delta) and count the number of bifurcations, ridge endings, etc. (See explanation sheet for full details.) (Use smallest circle.) 0 = (0 - 1) 1 = (2 - 3) 2 = (4 - 5) 3 = (6 - 7)
6 = Central Pocket Loop	Ridge tracing 1 = Inner 2 = Meet 3 = Outer	4 = (8 - 9) 5 = (10 - 11) 6 = (12 - 13) 7 = (14 - 15) 8 = (16 - Out)
7 = Double Loop	Core type or highest rising core. If cores are even use the one closest to the left delta. (Use core breakdown for loops)	Ridge count between cores placed on the outside shoulder of both innermost recurves. Use ridge count breakdown for loops.
8 = Accidental	1 = Lateral pocket loop w/slant to right 2 = Lateral pocket loop w/slant to left 3 = Combination of T and loop 4 = Combination of plain whorl and other 5 = Combination of loops other than lateral pocket	Use ridge count between loops, tented arch and loop, whorl and loop or tented arch. In case of T and two loops count both and reference. In case of three loops count between two closest, reference if necessary. Use ridge count breakdown for loops.
9 = Scarred or Mutilated	Use digit indicating pattern type if this can be determined.	If the core of a loop or whorl is visable use core type.

B-4 Continued

0 = Recurving ridge without rods.

1 = Recurve with one rod which does not touch recurve.

2 = Recurve with two rods which do not touch recurve.

3 = Recurve with three rods which do no touch recurve.

4 = Recurve with one rod that does touch recurve.

5 = Recurve which attempts unsuccessfully to make a whorl.

6 = Cores which have scars within Battley circle.

7 = Nutant Loop

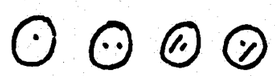
8 = All cores which do not conform to the above.

LOOP CORE TYPES

Exhibit B-4 Continued

WHORL CORE TYPE

0 = 

1 = 

2 = 

3 = 

4 = 

5 = 

6 = 

7 = 

8 = Cores which have scars within Battley Circle.

9 = All cores which do not conform to the above.

ARCH ILLUSTRATIONS

Plain Arch: 

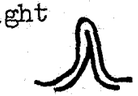
Slant to Right: 

Slant to Left: 

Determining Pattern Area: Place line on Battley semicircle on first level or nearly level line and place dot even with center of rise. The area within the first three semicircles is used to determine the second and third digits of the code.

TENTED ARCH ILLUSTRATIONS

1 = Slant to right



2 = Slant to left

3 = Vertical

4 = Exceptional with slant to right

5 = Exceptional with slant to left

6 = Nascent with slant to right

7 = Nascent with slant to left

Exhibit B-4 Continued

Rules for determining third digit for plain whorls and central pocket loops.

Fork of a bifurcation and part of each forking ridge must fall within the circle to be counted.

Ending ridge must definitely fall within circle to be counted.

Short ridge entirely within circle = 1 point.

Small enclosure entirely within circle = 1 point.

Bridge between two ridges = 2 points.

Bifurcation with one fork ending within the circle = 2 points.

Short gap in ridge = no points.

Exhibit B-4 Continued

CODE FOR RACE, D.O.B. AND HEIGHT

UTILITY BIT: 1

Race:

1) Caucasian
2) Negro
3) Mexican
4) Oriental
5) American Indian (Include Eskimo)
6) Other

D.O.B.

0) Prior to 1920
1) 1921 - 1930
2) 1931 - 1940
3) 1941 - 1945
4) 1945 - 1950
5) 1951 - 1955
6) 1956 - 1960
7) 1961 - 1965
8) 1966 - 1970
9) 1971 - 1975

Height

1) 5' and under
2) 5' - 5'3"
3) 5'3" - 5'6"
4) 5'6" - 5'9"
5) 5'9" - 6'
6) 6' - 6'3"
7) 6'3" - 6'6"
8) 6'6" - up

(If a person's height falls on the highest level in a category, e.g. 5'3", 5'6", 5'9", it will be given the higher value. Therefore, if a person is 5'6" the code assigned will be "4", if 5'9" the code will be "5")

CRIME CLASSIFICATION CODE

000 Burglary Residence
001 Burglary Business
002 Armed Robbery
003 Grand Theft Auto
004 Theft (other)
005 Fraud (checks, bunco, etc.)
006 Narcotics & Vice
007 Violent crimes (AWDW, Homicide, etc.)
008 Sex crimes
009 Other

B-5 The Nine-Digit Hood-Taylor Classification Scheme

The nine-digit Hood-Taylor classification scheme was developed by Captains Hood and Taylor of the Shreveport, Louisiana Police Department. This classification scheme is also used by the Jackson, Mississippi Police Department. The classification parameters indicated in the up to nine characters include the pattern type, the ridge count for loops, the tracing for whorls, the core type, the minutia count for the core and the minutia count for the delta. The nine-digit code system chart is illustrated in Exhibit B-5. The first three digits of the coding represent the pattern types, the ridge count or trace, and the core type. The second three digits represent the core type, the first identification point above the core. The last three digits represent the first identification in front of the delta, the first identification point to the right of the delta, and the first identification point at the left of the delta. A special fingerprint glass with a 3/16th of an inch reference disc is used to set the boundaries of the areas in which identification points will be sought. An alternate nine-digit code system chart is shown in Exhibit B-6.

HOOD-TAYLOR
NINE DIGIT CODE SYSTEM CHART

COLUMN I

PATTERN TYPE	RIDGE COUNT OR TRACE	CORE TYPE
0= Ampt	0= No count or trace	0= Plain recurve
1= Arch	1= 1-5 Ridges	1= Recurve with one rod
2= Tented Arch	2= 6-10 ridges	2= Recurve with Mult. rods
3= Right Slope Loop	3= 11-15 ridges	3= Any recurve that is spoiled
4= Left Slope Loop	4= 16-20 ridges	4= Clockwise twist
5= Plain Whorl	5= 21-out	5= Counter clockwise twist
6= Central Pocket Whorl	6= Inner	6= Complete enclosure
7= Double Loop Whorl	7= Meeting	7= Almond shaped whorl
8= Accidental Whorl	8= Outer	8= Upthrust - T. arch
9= Mutilated (cannot read)	9= Scar	9= Loop type - T. arch

COLUMN II

CORE TYPE	FIRST ID POINT ABOVE CORE	SECOND ID POINT ABOVE CORE
0= Plain Recurve	0= No ID Points	0= No ID points
1= Recurve w/one rod	1= Ending ridge right	1= Ending ridge right
2= Recurve w/mult. rods	2= Ending ridge left	2= Ending ridge left
3= Recurve that is spoiled	3= Bifurcation right	3= Bifurcation right
4= Clockwise twist	4= Bifurcation left	4= Bifurcation left
5= Counter clockwise twist	5= Short ridge or dot	5= Short ridge or dot
6= Complete enclosure	6= Island or enclosure	6= Island or enclosure
7= Almond shape	7= Bifurcation and short ridge	7= Bifurcation and short rdg.
8= Upthrust T. Arch	8= Double bifurcation	8= Double bifurcation
9= Loop type T. Arch	9= Scar	9= Scar

COLUMN III

First ID Point front Of Delta	First ID Point at right Of Delta	First ID Point at left Of Delta
0= No ID Point	0= No ID Point	0= No ID Point
1= Ending ridge right	1= Ascending ridge	1= Ascending ridge
2= Ending ridge left	2= Descending ridge	2= Descending ridge
3= Bifurcation right	3= Ascending bifurcation	3= Ascending bifurcation
4= Bifurcation left	4= Descending bifurcation	4= Descending bifurcation
5= Short ridge or dot	5= Short ridge or dot	5= Short ridge or dot
6= Island or Enclosure	6= Island or enclosure	6= Island or enclosure
7= Bifurcation and short rdg.	7= Bifurcation and short rdg.	7= Bifurcation and short rdg.
8= Double bifurcation	8= Double bifurcation	8= Double bifurcation
9= Scar	9= Scar	9= Scar

Exhibit B-5: The Hood-Taylor Nine-Digit Code System Chart

HOOD-TAYLOR
NINE DIGIT CODE SYSTEM CHART
COLUMN I

Alternate Code

PATTERN TYPE	RIDGE COUNT OR TRACE	CODE TYPE
0= Ampt	0= No count or trace	0= Plain recurve
1= Arch	1= 1-5 ridges	1= Recurve with one rod
2= Tented Arch	2= 6-10 ridges	2= Recurve with mutiple rods
3= Right slope loop	3= 11-15 ridges	3= Any recurve spoiled
4= Left slope loop	4= 16-20 ridges	4= Clockwise twist
5= Plain whorl	5= 21-out	5= Counter-clockwise twist
6= Central pocket whorl	6= Inner	6= Complete enclosure
7= Double loop whorl	7= Meeting	7= Almond shape whorl
8= Accidental	8= Outer	8= Upthrust
9= Mutilated (can't read)	9= Scar	9= Loop type

COLUMN II

CORE TYPE	FIRST OF IDENTIFYING POINTS	DELTA TYPE RIGHT
0= Plain recurve	0= No ID Points	0= Ridge dot
1= Recurve with one rod	1= Ending ridge right	1= Bifurcation
2= Recurve/multiple rods	2= Ending ridge left	2= Ending ridge in front
3= Any spoiled recurve	3= Bifurcation right	3= Ridge
4= Clockwise twist	4= Bifurcation left	4= Ending ridge parallel
5= Counter-clockwise twist	5= Short ridge or dot*	5= Ending ridge connected
6= Complete enclosure	6= Island	6= Enclosure
7= Almond shape whorl	7= Bifurcation & short ridge	7= Angle at ending ridge
8= Upthrust	8= Double bifurcation	8= Ending ridge that starts type line
9= Loop type	9= Scar	9= No Delta

COLUMN III

FIRST OF IDENTIFYING POINTS	DELTA TYPE LEFT	FIRST OF IDENTIFYING POINTS
0= No ID Points	0= Ridge dot	0= No ID Points
1= Ending ridge right	1= Bifurcation	1= Ending ridge right
2= Ending ridge left	2= Ending ridge in front	2= Ending ridge left
3= Bifurcation right	3= Ridge	3= Bifurcation right
4= Bifurcation left	4= Ending ridge parallel	4= Bifurcation left
5= Short ridge or dot*	5= Ending ridge connected	5= Short ridge or dot*
6= Island	6= Enclosure	6= Island
7= Bifurcation & short ridge	7= Angle at ending ridge	7= Bifurcation & short ridge
8= Double bifurcation	8= Ending ridge that starts type lines	8= Double Bifurcation
9= Scar	9= No Delta	9= Scar

* The short ridge and ridge dot will be considered as the same ID point.
The ridge dot should be as large as the ridges in the pattern.

Exhibit B-6: The Hood-Taylor Nine-Digit Code System Chart

B-6 The Six-Digit Hood-Taylor Classification Scheme

The Six-digit Hood-Taylor Classification Scheme is employed by the Pensacola, Florida Police Department and the Shreveport, Louisiana Police Department. The classification parameters characterized by this scheme include the pattern type, the ridge count for loops, the tracing for whorls, the core type, and the minutia count for the core. Exhibit B-7 illustrates the coding scheme for the six digit system. The first digit represents the basic pattern type, the second digit represents the ridge count or trace, the third digit represents the core type, the last three digits represent the more exact ridge count in the case of loops. In the case of whorls and tented arches, the last three digits represent the following:

- The first digit represents the core types;
- The second digit represents the first identification point above the core; and
- The third digit represents the second identification point above the core.

HOOD-TAYLOR
SIX DIGIT CODE SYSTEM CHART

COLUMN I

PATTERN TYPE	RIDGE COUNT OR TRACE	CORE TYPE
0- Ampt	0- No count or trace	0- Plain recurve
1- Arch	1- 1-5 ridges	1- Recurve with one rod
2- Tented Arch	2- 6-10 ridges	2- Recurve with mut. rods
3- Right slope loop	3- 11-15 ridges	3- Spoiled recurve
4- Left slope loop	4- 16-20 ridges	4- Clockwise twist
5- Plain Whorl	5- 21-out	5- Counter-clockwise twist
6- Central Pocket Whorl	6- Inner	6- Complete enclosure
7- Double Loop Whorl	7- Meeting	7- Almond shaped whorl
8- Accidental Whorl	8- Outer	8- Upthrust - T. Arch
9- Mutilated (cannot read)	9- Scar	9- Loop Type - T. Arch

COLUMN II

FOR WHORLS AND TENTED ARCHES ONLY:

CORE TYPE	FIRST ID POINT ABOVE CORE	SECOND ID POINT ABOVE CORE
0- Plain recurve	0- No ID points	0- No ID Points
1- Recurve with one rod	1- Ending ridge right	1- Ending ridge right
2- Recurve w/mult. rods	2- Ending ridge left	2- Ending ridge left
3- Spoiled recurve	3- Bifurcation right	3- Bifurcation right
4- Clockwise twist	4- Bifurcation left	4- Bifurcation left
5- Counter-clockwise twist	5- Short ridge or dot	5- Short ridge or dot
6- Complete Enclosure	6- Island or enclosure	6- Island or enclosure
7- Almond Shape	7- Bifurcation-short ridge	7- Bifurcation-short ridge
8- Upthrust T. Arch	8- Double bifurcation	8- Double bifurcation
9- Loop type T. Arch	9- Scar	9- Scar

COLUMN II

FOR LOOPS ONLY:

CODE NUMBER	RIDGE COUNT	CODE NUMBER	RIDGE COUNT
002	1-2	018	17-18
004	3-4	020	19-20
006	5-6	022	21-22
008	7-8	024	23-24
010	9-10	026	25-26
012	11-12	028	27-28
014	13-14	030	29-30
016	15-16	032	31-32

Exhibit B-7: The Hood-Taylor Six-Digit Code System Chart

B-7 The Russak Classification System

The Russak Classification System which was developed by Alex Russak of the Miami Police Department Identification Division, employs nine characters to describe the following parameters: the pattern type, the ridge count for loops, the tracing for whorls, the tented arch type, the core type, the core delta distance (using the Battley glass), scars near the core, whorl sub-patterns, loop sub-patterns, and island count information. Exhibit B-8 illustrates the coding digit format associated with the various pattern parameters. Exhibit B-9 indicates the actual digits used in the coding format to characterize the range of pattern parameters.

In this system, plain arches are not classified except to note the finger in which the pattern occurs. Tented arches are classified by placing the dot of the reticule of the fingerprint glass over the core. A reading is taken of the concentric circle in which the platform ridge appears. In addition, the slant of pattern is noted.

Exhibit B-8

Russak System Coding Scheme

Digit	Parameter	Loops	Whorls
1	Pattern Type		
2	Core Description		
3			
4		Core-Delta Distance	Core-Left Delta Distance
5		Ridge Count	Delta-Delta Distance
6		--	Core-Right Delta Distance
7	Pattern Twist		
8	Islands		
9	Scars		

RUSSAK SYSTEM

Exhibit B-9

SINGLE FINGERPRINT CLASSIFICATION

TYPE OF PRINT

0. AMPUTATED DIGIT
1. ARCH
2. TENTED ARCH
3. RIGHT SLOPE LOOP
4. LEFT SLOPE LOOP
5. WHORL
6. DUAL LOOP
7. ACCIDENTAL OR COMPOSITE

9. MUTILATED

1. ARCH: no breakdown

2. TENTED ARCH: core reading breakdown
   1. PLATFORM RIDGE FALLS IN FIRST CIRCLE,
   2. SECOND CIRCLE,
   3. THIRD CIRCLE, ETC.

   PATTERN
   1. NO SLOPE
   2. LEFT SLOPE
   3. RIGHT SLOPE
   4. UNUSUAL PATTERN
   9. MUTILATED

3.-4. LOOP PATTERN BREAKDOWN: (refer to Chart III for Loop & Whorl Core reading)
   0. PLAIN TYPE
   1. TENTED TYPE
   2. CONVERGING LOOP
   3. CENTRAL POCKET TYPE
   4. NUTANT LOOP
   5. UNUSUAL

5. WHORL TRACING
   1. INNER
   2. MEETING
   3. OUTER
   7. UNABLE TO TRACE
   9. DAMAGED DELTA

CHART NO. II

5. WHORL PATTERN
   1. LOOKS LIKE A DUAL
   2. CENTRAL POCKET
   3. SPIRAL
   4. ELONGATED
   5. ELIPTICAL
   6. NO TWIST (1 & 2 CORE)
   7. LEFT TWIST (1 & 2 CORE)
   8. RIGHT TWIST (1 & 2 CORE)
   9. UNUSUAL
   0. NO PATTERN

6. TWIN LOOP CORE READING (on ascending side, same as Loop; tracing same as Whorl.) PATTERN
   1. RIGHT ASCENDING LOOP
   2. LEFT ASCENDING LOOP
   3. HORIZONTAL

7. PATTERN READING
   1. LATERAL
   2. ACCIDENTAL
   3. COMPOSITE

ISLANDS in first circle
   0. NO ISLAND
   1. ONE ISLAND
   2. TWO ISLANDS
   3. THREE OR MORE ISLANDS

SCARS in first circle
   1. SCAR IN FIRST CIRCLE
   2. OUT OF CIRCLE — ABOVE CORE
   3. RIGHT OF CORE
   4. BELOW CORE
   5. LEFT OF CORE
   6. OUTSIDE BACK OF DELTA
   NOTE: REGISTER SCAR CLOSEST TO CIRCLE.
   9. DAMAGED DELTA IN LOOP
   0. NO SCAR

B-8 The Nassau System

A four-digit classification scheme is used by the Nassau County, New York Police Department. The four-digit code for each finger is preceded by the finger number. The classification parameters described by the four characters include the pattern type, ridge count for loops, tented arch type, ridge count for whorls, core type, and delta type. Exhibit B-10 indicates the four-character coding scheme for each of the basic pattern types. The first digit describes the basic pattern type. The second digit is used to represent the type of core. The third digit is used to indicate the type of delta in the case of loops and whorls. In the case of tented arches, the third digit represents the type of pattern which forms the tent. The last digit represents the ridge count for loops and whorls. Whorl patterns are classified twice. First, the ulnar position is coded and then the radial position is coded. In addition, double loops are also coded twice.

Exhibit B-10: The Nassau County P.D. Single Fingerprint Classification System

1st Digit	2nd Digit	3rd Digit	4th Digit
0 AMP	0 Right hand 1 Left hand	0 Thumb, 1 Index, 2 Middle, 3 Ring, 4 Little	0 One, 1 Two, 2 Three, 3 Four, 4 All
1 ARCHES	0 PLAIN	0	0
	1 TENTED	0, 1, 2, 3, 4, 5, 6, 7, 8 Others	0
2 LOOP \	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 Others	0, 1, 2, 3, 4, 5 Others	0 No count 1 1 to 3 2 4 to 5 3 6 to 7 4 8 to 9 5 10 to 11 6 12 to 13 7 14 to 15 8 16 to 17 9 18 & over
3 LOOP /			
4 CPL \			
5 CPL /			
6 DL			
7 PW			Counting Whorls: 1. Use common core. 2. Code ulner position count first. 3. Code radial position count next and circle. Counting Double Loops: 1. Use common core. 2. Use loop closest to center, in upward direction.
8 ACC			
9 SCARRED	0 Right hand 1 Left hand	0 Thumb, 1 Index, 2 Middle, 3 Ring, 4 Little	0 One, 1 Two, 2 Three, 3 Four, 4 All

B-9 The Oakland Classification Scheme

The classification scheme employed by the Oakland, California Police Department uses three digits to describe the pattern type, ridge count for loops, tracing for whorls, plain arch type, tented arch type, ridge count for whorls, whorl sub-pattern, and loop sub-pattern for each appropriate finger. The tables in Exhibit B-11 indicate how the parameters are described by the three digits. The first digit is used to describe the basic pattern, for example, arches, loops, and whorls. The second digit describes the sub-pattern within the basic pattern such as plain arch or plain loop, etc. The third digit is used: to describe the slant of the arch; to describe the ridge count in the case of loops, whorls and dual loops. For accidental type patterns or indeterminate or mutilated patterns, the third digit is not used and is always coded as a 1.

Exhibit B-11

The Oakland Single Fingerprint Classification Scheme

BASIC PATTERN		SUBPATTERN		SLANT
1 ARCH Plain or tent	1	Plain arch including plain arch reference any other pattern.	1	No apparent slant or not appreciable, definite or obvious.
	2	Tented arch including tent reference any other pattern.	2	Definite slant or tendency to slant down and to the right.
			3	Definite slant or tendency to slant down and to the left.

BASIC PATTERN		SUBPATTERN		RIDGE COUNT
2 Right Slope Loop	1	Normal plain loop without appreciable convergency of ridges in pattern area.	1	1-3
			2	4-6
3 Left Slope Loop	2	Loop pattern with fairly prominent to very noticeable convergencies of a type other than type 3 or 4 below.	3	7-9
			4	10-12
			5	13-15
	3	Loop having converging ridges giving pattern the form or appearance of a Central Pocket, or print should be reference to Central Pocket type as it may be one.	6	16-18
			7	19-21
			8	22-25
			9	26 and over
	4	Nutant loop - whether with or without convergencies. (All Nutants are classified as a number 4.)	0	Indeterminate

Exhibit B-11
(Continued)

BASIC PATTERN		SUBPATTERN		RIDGE COUNT
4 Right Slope Central Pocket	1	"Classical" Central Pocket form; that is, mostly loop pattern but with small valid Central Pocket formation in core area. (Includes Central Pocket reference loop.)	1	1-3
			2	4-6
			3	7-9
5 Left Slope Central Pocket	2	Central Pocket more whorl-like in shape or form in which "loop" character of print may not be so obvious. (Includes Central Pocket reference whorl.)	4	10-12
			5	13-15
			6	16-18
			7	19-21
			8	22-25
			9	26 and over
			0	Indeterminate

BASIC PATTERN		SUBPATTERN		RIDGE COUNT
6 Plain Whorl Inner Tracing	1	Very ROUNDISH Central pattern area or shape.	1	1-3
			2	4-6
7 Plain Whorl Meeting Tracing	2	Normal OVOID shape to pattern.	3	7-9
			4	10-12
8 Plain Whorl Outer Tracing	3	OVAL type (e.g., 3X to 4X high as wide, central circuit part).	5	13-15
			6	16-18
	4	Very LARGE OVAL (e.g., 6X or more high as it is wide, central circuit).	7	19-21
			8	22-25
	5	ALMOND type of pattern or ridge structure. Overall effect is that pattern formed of almond shaped circuits.	9	26 and over
			0	Indeterminate
	6	Whorl <u>should</u> be referenced to Dual Loop as it <u>may be one</u>, and this reference seems a better code that others for that reason.		

Exhibit B-11
(Continued)

BASIC PATTERN		SUBPATTERN		RIDGE COUNT
9 Dual Loop pattern (2 deltas, 2 separate shoulder to 2 looping formations, etc.)	1	INNER Tracing	1	1-3
	2	MEETING Tracing	2	4-6
	3	OUTER Tracing	3	7-9
			4	10-12
			5	13-15
			6	16-18
			7	19-21
			8	22-25
			9	26 and over
			0	Indeterminate

BASIC PATTERN	SUBPATTERN		RIDGE COUNT
0 Accidental type pattern OR indeterminate, mutilated, etc.	1	Accidental pattern type per FBI rules and exceptional prints.	1 Added to provide a full fingerprint code. (All Basic Pattern "0" will have a "1" in this column.
	2	Pattern shows mutilation or damage by scar, cut, etc., which prevents interpretation of basic pattern type on coding adequately.	
	3	Ridges so reticulated or broken up that pattern type not clear. (Unable to assign pattern type on this basis or unable to adequately code.)	
	4	Finger missing or mostly missing or not printed due to injury, etc.	
	5	Indeterminate due to poor inking or other factors and unable to assign adequate coding formula otherwise	

B-10 The Berkeley System

The Berkeley, California Police Department employs a three-digit special fingerprint classification scheme in conjunction with their Miracode search and retrieval equipment. The three digits are used to classify the pattern type, the ridge count for loops, the tracing for whorls, plain arch type, tented arch type, the ridge count for whorls, and the core type. Exhibit B-12 indicates the coding scheme employed to classify the various patterns. The first digit indicates the basic pattern type. The second digit describes the sub-classification or sub-pattern of the particular finger and the third digit describes the ridge count in the case of loops and whorls and is set to 0 for the arch patterns.

Exhibit B-12

BERKELEY POLICE DEPARTMENT
BERKELEY, CALIFORNIA

FINGERPRINT CLASSIFICATION CHART

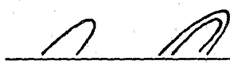
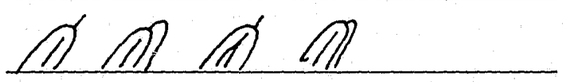
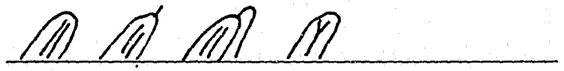
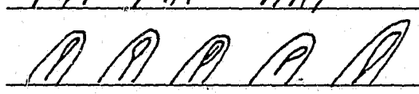
FIRST DIGIT	SECOND DIGIT	THIRD DIGIT
1. Arch	1. Plain Arch 2. Arch with right slant 3. Arch with left slant 4. Plain arch with features suggestive of tented arch	Always Zero (0)
2. Tented Arch	1. Spoiled Arch--Ridges in center of arch form a definite upthrust. 2. Definite upthrust rising above central plane. 3. Spoiled loop, right slant, good core, lacks delta. 4. Spoiled loop left slant, as in #3 5. Spoiled loop, right slant, spoil due to associated loop ridges running outside pattern area, good delta. 6. Spoiled loop, left slant, as in #5 7. Spoiled loop, right slant, spoil due to lack of delta and associated loop ridges running outside pattern area. 8. Spoiled loop, left slant, as in #7. 9. Recurves that attempt unsuccessfully to make a whorl. 0. Patterns that do not conform to 1-9 above.	Always Zero (0)

Exhibit B-12

Continued

BERKELEY POLICE DEPARTMENT
BERKELEY, CALIFORNIA

FINGERPRINT CLASSIFICATION CHART

First Digit	Second Digit--Loop Core Type	Third Digit--Code Count
3. Loop--Right Slant	1. 	1. 1-2 2. 3-4 3. 5-6 4. 7-8 5. 9-10 6. 11-12 7. 13-14 8. 15-17 9. 18-20 0. 21 and ove
4. Loop--Left Slant	2. 	
	3. 	
	4. 	
	5. 	
	6. 	
	7. 	
	8. 	
	9. 	
	0. ODDITIES	

CONTINUED

3 OF 4

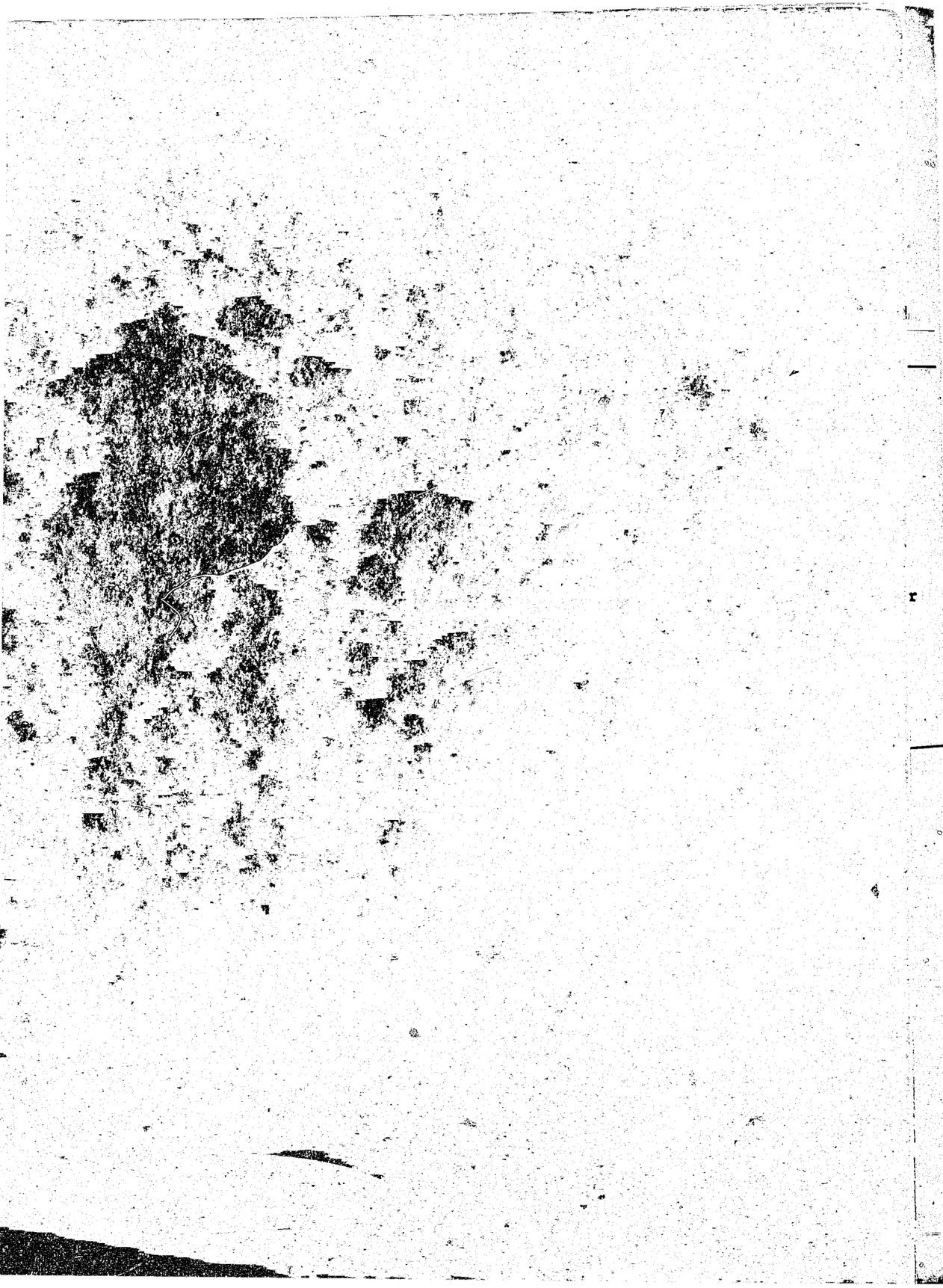
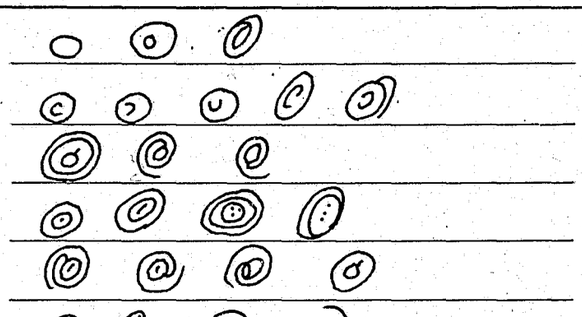
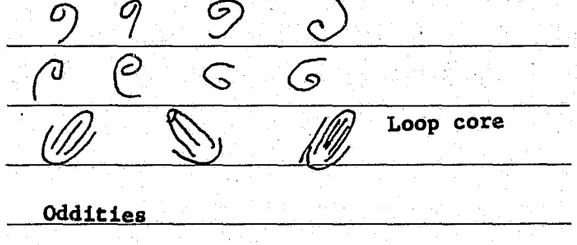


Exhibit B-12 Continued

BERKELEY POLICE DEPARTMENT
BERKELEY, CALIFORNIA

FINGERPRINT CLASSIFICATION CHART

First Digit	Second Digit--Core Type	Third Digit--Trace/Count
5. Whorl, Plain		T&C from core to left delta 1. I-9 2. I-10-16 3. I-17* 4. M-9 5. M-10-16 6. m 6. M-17* 7. O-9 8. O-10-16 9. O-17*
6. Whorl--Center Pocket Loop--Right Slant 7. Whorl--Center Pocket Loop--Left Slant	 Loop core Oddities	USE LOOP COUNT
8. Whorl--Double Loop	Use loop count to delta closest vertical loop (delta that loop leans towards). If cores are on a horizontal plane, use lower core and count to delta that loop faces.	1. Inner whorl 2. Meet whorl 3. Outer whorl
9. Whorl--Accidental	1. All loop over "T" pattern 2. All other accidental whorls	1. Inner whorl 2. Meet whorl 3. Outer whorl
0. Mutilated Pattern	1. Mutilated and scarred	1. Probable pattern before scarred or mutilated. 0. Amputated

NOTE: All "Fig" notations refer to illustrations from the FBI Manual, "The Science of Fingerprints."

B-11 The Richmond Classification System

The classification system employed by the Richmond, California Police Department uses up to five characters to describe the pattern type, the plain arch type, the tented arch type, the core type, the Battley measured core to delta distance, the Battley measured tented arch measurement, and the Battley measurement for the core size. Exhibit B-13 describes the fields of the classification scheme. The first field is the basic pattern type, the second field is used principally to indicate the flow direction of the pattern, usually right or left, and can use anywhere from zero to two characters. The third field is used to indicate distances obtained using the Battley concentric circle glass. The one or two character indicators are the letters corresponding to the concentric Battley circles which are obtained in the measurements. Exhibit B-14 provides examples of the basic fingerprint patterns and the classification coding associated with them.

Exhibit B-13

LAYOUT OF RICHMOND, CALIF. P.D. CLASSIFICATION SCHEME

FIELD	INFORMATION	NUMBER OF CHARACTERS
1	Pattern type	1
2	Arch: Flow direction	0 or 1
	Tented Arch: Flow direction	0 or 1
	Loops: Flow direction and number of core spikes	2
	Plain Whorl: Slant or spiral direction	1 or 2
	Double Loop: Flow of ascending loop	1 or 2
	Central Pocket Loop: Location of delta nearest core	1
	Elliptical Whorl: Slant	0 or 1
	Accidental Whorl: Blank	0
3	Tented Arch: Height of Tent (Battley Circle)	1
	Loops: Core to delta distance	1
	Whorls, Double Loops, Central Pocket Loops, Elliptical Whorl: Core to left delta; Core to right delta	2

Exhibit B-14

EXAMPLES OF THE RICHMOND, CALIFORNIA POLICE DEPARTMENT
SINGLE FINGERPRINT CLASSIFICATION SYSTEM

Coding*	Description
1	PLAIN ARCH
1L	LEFT ARCH - Ridges flow to the left.
1R	RIGHT ARCH - Ridges flow to the right.
2 A-H**	TENTED ARCH Height of Tent (A-H)
2L A-H	LEFT TENTED ARCH - Ridges flow to the left. Height of tent (A-H)
2R A-H	RIGHT TENTED ARCH - Ridges flow to the right. Height of tent (A-H)
3L-0 A-H	LEFT FLOW LOOP (core recurve only - no spike) Dot on core - Location of Delta (A-H)
3L-1 A-H	LEFT FLOW LOOP (core one spike) Dot on core - Location of Delta (A-H)
3L-2 A-H	LEFT FLOW LOOP (core two spikes) Dot on core - Location of Delta (A-H)
3L-3 A-H	LEFT FLOW LOOP (core three spikes or more) Dot on core - Location of Delta (A-H)
3R-0 A-H	RIGHT FLOW LOOP (core recurve only - no spike) Dot on core - Location of Delta (A-H)
3R-1 A-H	RIGHT FLOW LOOP (core one spike) Dot on core - Location of Delta (A-H)
3R-2 A-H	RIGHT FLOW LOOP (core two spikes) Dot on core - Location of Delta (A-H)
3R-3 A-H	RIGHT FLOW LOOP (core three spikes or more) Dot on core - Location of Delta (A-H)

*The first two fields of coding appear on the first line. Subsequent fields, when present, appear below the first two fields.

**Letters A through H are used to show distance with reference to the circles of the Battley glass.

3NL A-H	LEFT FLOW "NUTENT" LOOP Dot on core - Location of Delta (A-H)
3NR A-H	RIGHT FLOW "NUTENT" LOOP Dot on core - Location of Delta (A-H)
4 A-H A-H	PLAIN WHORL Dot on core - Location of Left Delta (A-H) then location of Right Delta (A-H)
4L A-H A-H	PLAIN WHORL - Slant to left. Dot on core - Location of Left Delta then Right Delta (A-H)
4R A-H A-H	PLAIN WHORL - Slant to Right Dot on core - Location of Left Delta then Right Delta (A-H)
4SL A-H A-H	WHORL SPIRAL TO LEFT Dot on core - Location of Left Delta then Right Delta (A-H)
4SR A-H A-H	WHORL SPIRAL TO RIGHT Dot on core - Location of Left Delta then Right Delta (A-H)
5L A-H A-H	DOUBLE LOOP (Ascending loop flowing to the left) Left core to Left Delta (A-H) Right core to Right Delta (A-H)
5R A-H A-H	DOUBLE LOOP (Ascending loop flowing to the right) Left core to Left Delta (A-H) Right core to Right Delta (A-H)
5TL A-H A-H	LAYING DOWN DOUBLE LOOP (Top loop flow to the left) Left core to Left Delta (A-H) Right core to Right Delta (A-H)
5TR A-H A-H	LAYING DOWN DOUBLE LOOP (Top loop flow to the right) Left core to Left Delta (A-H) Right core to Right Delta (A-H)
6L A-H A-H	CENTRAL POCKET LOOP - Left Delta closest to the core Location of Left Delta from the core (A-H) Location of Right Delta from the core (A-H)
6R A-H A-H	CENTRAL POCKET LOOP - Right Delta closest to the core Location of Left Delta from the core (A-H) Location of Right Delta from the core (A-H)

Exhibit B-14 Continued

7	ELLIPTICAL WHORL (Straight up and down)
C-H	Depth of innermost recurve with dot on top (More than B ring)
C-H	Location of Left Delta (C-H
C-H	Location of Right Delta (C-H)
7L	ELLIPTICAL WHORL - Slant to Left
C-H	Dot on Top of innermost recurve (depth more than B ring)
C-H	Location of Left Delta (C-H)
C-H	Location of Right Delta (C-H)
7R	ELLIPTICAL WHORL - Slant to Right
C-H	Dot on top of innermost recurve (depth more than B ring)
C-H	Location of Left Delta (C-H)
C-H	Location of Right Delta (C-H)
8	ACCIDENTAL WHORL

B-12 The California Department of Justice System

The California Department of Justice employs a three-character classification scheme to describe pattern type, the ridge count for loops, the tracing for whorls, the tented arch type, and the ridge count for whorls. Exhibit B-15 illustrates the coding scheme employed by this agency. The design is intended so that the classification pattern of a single finger can be key-punched into one column of a standard 80-column punchcard. The classification for a single finger, therefore, can be encoded with two characters from a base 12 system. Duplications such as 1-1 or 2-2 are not allowed because of the impossibility of punching the same number twice in a single column of a punchcard. Loops are classified as indicated in the upper part of the exhibit. Right slant loops with a ridge count between 1 and 4 are classified by punching the number 12 and number 1 in the column that corresponds to the finger of interest. The pattern continues as indicated for right slant and left slant loops. For whorls, the codes indicated in the righthand column are used to denote the ranges of ridge count from the core to the left delta (as indicated in the left column) and from the core to the right delta (as indicated in the center column). Other patterns are classified as indicated in the bottom of the exhibit.

Exhibit B-15

CALIFORNIA DEPARTMENT OF JUSTICE CODING SCHEME

LOOPS

Right Slant Ridge Count	Code	Left Slant Ridge Count	Code
1 thru 4	12-1	1 thru 4	12-6
5 thru 8	12-2	5 thru 8	12-7
9 thru 12	12-3	9 thru 12	12-8
13 thru 16	12-4	13 thru 16	12-9
17 plus	12-5	17 plus	11-0

WHORLS

Left Count	Right Count	Code
1-5	1-5	11-1
1-5	6-10	11-2
1-5	11-15	11-3
1-5	16-20	11-4
1-5	21 Plus	11-5
6-10	1-5	11-6
6-10	6-10	11-7
6-10	11-15	11-8
6-10	16-20	11-9
6-10	21 Plus	0-1
11-15	1-5	0-2
11-15	6-10	0-3
11-15	11-15	0-4
11-15	16-20	0-5
11-15	21 Plus	0-6
16-20	1-5	0-7
16-20	6-10	0-8
16-20	11-15	0-9
16-20	16-20	1-2
16-20	21 Plus	1-3
21 Plus	1-5	1-4
21 Plus	6-10	1-5
21 Plus	11-15	1-6
21 Plus	16-20	1-7
21 Plus	21 Plus	1-8

UNUSUAL WHORLS

Ridge Trace	Code
I	1-9
M	2-3
O	2-4

ACCIDENTAL WHORLS

Ridge Trace	Code
I	2-5
M	2-6
O	2-7

ARCHES	Code
Plain	2-8
R.S.T.	2-9
L.S.T.	3-4
N.S.T.	3-5

MUTILATED	Code
	12-11

AMPUTATIONS	Code
	12-0

B-13 Orange County Classification System

The fingerprint classification scheme employed by the Orange County, California Sheriff's Department is a six-digit numeric system used in conjunction with the Miracode storage and retrieval equipment. The classification parameters encoded are the basic pattern type, the ridge count for loops, the tracing for whorls, the tented arch type, the core type, the minutia count for the core, and an indication of scars near the core. In this classification system the little fingers are classified only with the first three digits of the coding scheme. Exhibit B-16 shows the breakdown of the basic patterns and sub-patterns and how the information appears in the six-digit coding scheme. In the case of ridge count, the numbers from 0 to 3 indicate four possible ranges of ridge count. A special combination Henry-Battley circle disc and magnifier illustrated in Exhibit B-17 is used in conjunction with the coding scheme description to determine the third through sixth digit of the classification code for the fingerprint.

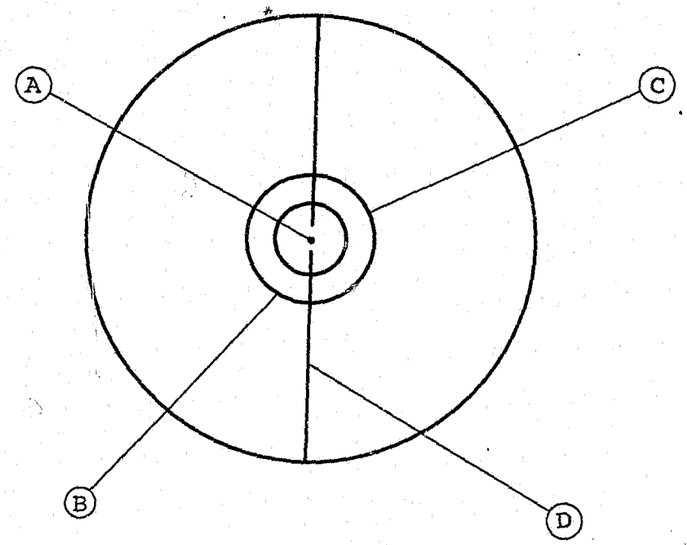
Exhibit B-16

LAYOUT OF CODING SCHEME OF ORANGE COUNTY SHERIFF'S DEPARTMENT

Pattern	Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6
Amputation	0	-	-	-	-	-
Right (Left) Slope Loop	1(2)					
Ridge Count		0-3				
Core Type			0-9			
Left Ridge Tracing				0-6	0-6	
Right Ridge Tracing						
Scar (if any)						09
Plain Arch	3	0	-	-	-	-
Tented Arch	3					
Sub-pattern		1-3	-	-	-	-
Plain & Central Pocket Whorl (Double loop and accidental whorl)	4(5)					
Delta Tracing		0-3				
Core Type			0-3			
Left Ridge Tracing				0-6		
Right Ridge Tracing					0-6	
Scar (if any)						09
Mutilated	6	-	-	-	-	-
Birth Defect Deformities	7	-	-	-	-	-

Exhibit B-17

Circle Disc and Magnifier Used in the Orange County Classification System



A. The red center dot of disc is always placed on top of the innermost upright recurve of core.

B. The inner disc circular line is the area within that is first checked for step 3 in loop coding and is the tracing line for the ridge characteristics in steps 4 and 5 of loop and whorl coding.

C. The second disc circular line is the second area checked within for step 3 in loop coding and is also the limit line in which the ridge characteristics may appear in steps 4 and 5 of loop and whorl coding.

D. The disc hairline is aligned along the axis of core for step 3 in loop coding and steps 4 and 5 of loop and whorl coding.

B-14 Honolulu Classification Scheme

A three-digit classification scheme is employed by the Honolulu Police Department to classify the pattern type, the core type, and the minutia code related to the core. The first digit is used to describe the basic pattern type as illustrated in Exhibit B-18. A special disc, which is a modified version of the Henry coding disc is employed to determine the second and third digit of the classification scheme. The disc has one line drawn through the center of the viewing glass which is called the base line. A second line is drawn exactly 1.5 millimeters above the base line. The top line is placed directly within the center of the innermost recurving ridge.

The location of the shoulders of the innermost recurving ridge and the baseline are critical aspects of the coding process as all rods or ridges are considered. The purpose of this procedure is to provide consistency in interpretation among various classifiers. The second and third part of Exhibit B-18 indicate how the second and third digit of the classification scheme are determined from the core type and the core minutia.

Exhibit B-18

HONOLULU CODING SCHEME

PHASE I. PATTERN TYPES

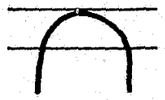
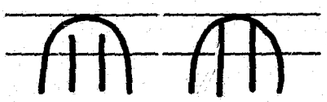
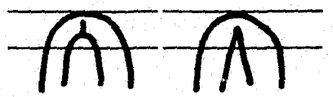
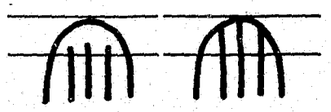
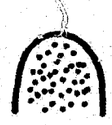
VALUE	PATTERN
1	PLAIN ARCH
2	TENTED ARCH
3	RIGHT SLANTED LOOP
0	LEFT SLANTED LOOP
4	WHORL (plain and central pocket loop whorls)
5	NOT CLASSIFIABLE (improper recording of print)
6	DOUBLE LOOP WHORL (must have two independent recurving ridges and shoulders and only the core of the upright loop is considered)
7	ACCIDENTAL OR ODDITY
8	SCARRING (pattern cannot be determined)
9	AMPUTATION

NOTE: Arbitrary values of 00 would be applied after the first digit on PLAIN and TENTED ARCHES, UNCLASSIFIABLE prints, ACCIDENTALS, SCARRED prints and AMPUTATIONS.

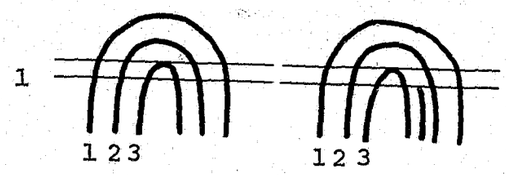
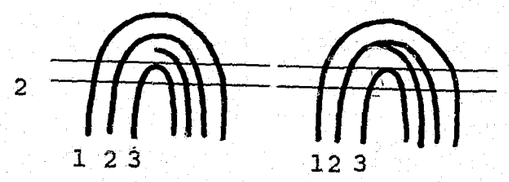
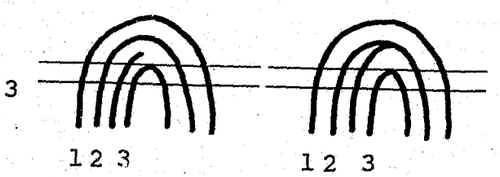
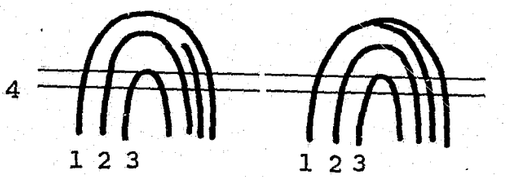
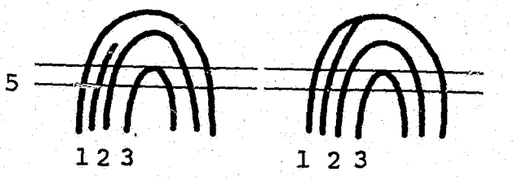
Exhibit B-18

Continued

PHASE II: CORE TYPES

VALUE	CORE EXAMPLES	
1		Core type in which the area within the innermost recurving ridge and base line is void of any rods or ridges.
2		Core type in which one rod extends above the base line into the area within the innermost recurving ridge.
3		Core type in which one rod extends above the base line and touches the top of the innermost recurving ridge.
41		Core type in which two rods extend above the base line into the area within the first recurve. Both rods must either touch or not touch the top of the recurve. Phase III of the coding process is eliminated when this core type is encountered.
42		Core type in which an abutment is present on the innermost recurve or in which two ridges converge within the innermost recurve. Both may or may not touch the recurve and must be above the base line.
51		Core type in which three or more rods extend above the base line and into the area within the first recurve. All rods must either touch or not touch the recurve to be considered.
71		An oddity or core type which cannot be placed into one of the aforementioned categories. Phase III of the coding process is eliminated.
81		Core type which cannot be interpreted as a results of scarring. Phase III is eliminated.

PHASE III: CORE CONSIDERATIONS

VALUE	CORE EXAMPLES	
1		Absence of any ridges extending above the base line between recurving ridges 1, 2 and 3. In the second example, the ending ridge between ridges 1 and 2 does not extend above the base line and is not considered.
2		Presence of an additional ridge extending above the base line and on the right side of the core between recurving ridges 1 and 2.
3		Presence of an additional ridge extending above the base line and on the left side of the core between recurving ridges 1 and 2.
4		Presence of an additional ridge extending above the base line and on the right side of the core between recurving ridges 2 and 3.
5		Presence of an additional ridge extending above the base line and on the left side of the core between recurving ridges 2 and 3.

NOTE: If additional ridges extending above the base line are presen on both the right and left sides of the core in any of the aforementioned categories, the ridge on the right side will take preference and the appropriate value assigned.

Exhibit B-18 (Continued)

B-15 The Five Finger Classification System

The Five Finger Classification System and slight modifications of it are used by the following agencies who responded to the survey questionnaire:

- Los Angeles Police Department
- Los Angeles County, California Sheriff's Office
- Dade County, Florida Public Safety Department
- Kansas Bureau of Identification
- Boston, Massachusetts Police Department
- Minneapolis, Minnesota Police Department
- East Orange, New Jersey Police Department
- New York Division of Criminal Justice Services

The Baltimore, Maryland Police Department is planning to use the Five Finger Classification Scheme in a latent fingerprint identification system which they will be implementing in the near future. In the Five Finger Classification System, the only parameters employed are the basic pattern type and the ridge count for loops. The inked fingerprint impressions for the right and left hand are maintained on separate cards for each subject in the file. The basic classification consists of five digits indicating the pattern type observed in the five fingers whose fingerprint images are on the card. The various pattern types are assigned numerical symbols according to the following table.

Pattern Type	Numerical Value
Amputated Finger	0
Arch	1
Tented Arch	2
Right Slope Loop	3
Left Slope Loop	4
Plain Whorl and Central Pocket Loop	5
Double Loop	6
Accidental	7
Scarred or Mutilated Pattern	8

The filing sequence for each hand is from 00000, 00001, 00002, and so on to 88888. In areas of the file where large accumulations of cards occur, such as in the all loop sections, subdivisions may be made by ridge count or ridge trace. For example, in an all loop section, the FBI extension method for this system suggests that values of S, M, or L, for small, medium, or large, be placed over the classification for the pattern of the index, middle, and ring finger according to the ridge count of the particular finger. Exhibit B-19 gives the range of ridge count value which results in assignment of the small, medium, or large characteristic to the respective fingers. Other extensions of this system are possible. For example, the Boston Police Department also includes information concerning the ridge count on the thumb and little finger.

Exhibit B-19

Five-Finger Classification System
Ridge Count Extension Coding
Scheme for All Loop Portion of File

INDEX FINGER

Ridge counts 1 to 5 are given the value of S
Ridge counts 6 to 12 are given the value of M
Ridge counts 13 and higher are given the value of L

MIDDLE FINGER

Ridge counts 1 to 8 are given the value of S
Ridge counts 9 to 14 are given the value of M
Ridge Counts 15 and higher are given the value of L

RING FINGER

Ridge counts 1 to 10 are given the value of S
Ridge counts 11 to 18 are given the value of M
Ridge counts 19 and higher are given the value of L

B-16 The Datum Classification System

The Datum single print classification code was developed for use with an automatic search and retrieval system being installed in eight cities in the State of New Jersey. The respondents to the survey questionnaire who will be installing this equipment were the cities of Elizabeth, Jersey City, Newark, Paterson, and Trenton. In the Datum scheme, eight characters are used to describe the pattern type, the ridge count for loops, the tracing for whorls, the tented arch type, core type, delta type, the scars near the core, and the island count. The classification scheme can be described in terms of the matrix shown in Exhibit B-20. Along the vertical column are numbers from 1 through 8 which indicate the eight characters in the classification code. Along the horizontal direction are the numbers 0 through 8 for the basic fingerprint pattern. The first digit indicates the finger number and the second digit indicates the pattern number as shown in the exhibit. The third and fourth digits are used to describe the core type for each particular pattern. The fifth digit is used to describe the race of the individual and whether or not there are islands in the loop pattern. The sixth digit is used to describe the delta in the loop pattern or whorl tracing and the seventh and eighth digit are used for loop ridge count or delta descriptions.

Exhibit B-20

Datum Classification System Coding Scheme

FINGER NUMBER 1	USE THE FINGER NUMBER FROM FINGERPRINT CARD								1 = 1 10 = 0
PATTERN 2	AMPUTATION 0	PLAIN ARCH 1	TENTED ARCH 2	RIGHT SLANT LOOP 3	LEFT SLANT LOOP 4	PLAIN WHORL or CENTRAL POCKET LOOP 5	DOUBLE WHORL LOOPS 6	ACCIDENTALS 7	SCARRED OR MUTILATED 8
CORE TYPE 3	0	SCAR 0=None 1=Scar Appears	SCAR 0=None 1=Scar Appears	LOOP CORE TYPE Use Loop Core Chart		WHORL CORE TYPE Use Chart	LOOP TYPE CORE Use Chart	0	PATTERN TYPE PRINT APPEARS TO BE
CORE TYPE 4	0	ISLANDS 0=No Islands 1=Islands	TYPE TENT 1=Upward Thrst 2=Angular 3=R/Slant Loop 4=L/Slant Loop	LOOP CORE TYPE		WHORL CORE TYPE	LOOP TYPE CORE	0	0
ISLANDS RACE 5	0=Black 5=White	0=Black 5=White	0=Black 5=White	NUMBER OF ISLANDS IN CENTER CIRCLE B "0".....NONE......"5" W L "1".....ONE......"6" H A "2".....TWO......"7" I C "3".....THREE OR MORE....."8" T K "4".....ANY ON CORE....."9" E				0=Black 5=White	0=Black 5=White
LOOP DELTA W/TRACE 6	0	0	0	DELTA TYPE Use Delta Chart		WHORL TRACING 0=Unable to trace 1=Inner 2=Meet 3=Outer		0	0
L/RIDGE COUNT & W/DELTA 7	0	0	0	LOOP RIDGE COUNT		LEFT DELTA TYPE Use Delta Chart		0	0
L/RIDGE COUNT & W/DELTA 8	0	0	0			RIGHT DELTA TYPE Use Delta Chart		0	0

B-17 The Cincinnati System

The Cincinnati, Ohio Police Department uses a special six digit classification scheme in conjunction with their Miracode search and retrieval equipment. The six characters are used to describe finger number, pattern type, ridge count for loops, tracing for whorls, tented arch type, core type, delta type, and the core to delta distance. Exhibit B-21 indicates the coding scheme used to classify the various parameters associated with each of the pattern types.

Exhibit B-21

The Cincinnati Classification System Coding Scheme

FINGERPRINT CHARACTERISTIC CHART

COLUMN #1	COLUMN #2	COLUMN #3	COLUMN #4	COLUMN #5	COLUMN #6
Finger Number	Pattern Type	Ridge Count or Tracing	Core Type	Delta Type	Delta Ring Number
Right Thumb = 1 Right Index = 2 Right Middle = 3 Right Ring = 4 Right Small = 5 Left Thumb = 6 Left Index = 7 Left Middle = 8 Left Ring = 9 Left Small = 0	Amputation = 0	No code used = 0	No code used = 0	No code used = 0	No code used = 0
	Arch = 1	No code used = 0	No code used = 0	No code used = 0	No code used = 0
	Tented Arch = 2	Angular = 1 Upthrust = 2 Loop = 3	No code used = 0	No code used = 0	No code used = 0
	Right slant loop = 3	RIDGE COUNT 1-3 = 1 10-11 = 5 4-5 = 2 12-13 = 6 6-7 = 3 14-16 = 7 8-9 = 4 17-21 = 8 22 out = 9	Use loop core; see Column #7	Use delta type; see Column #9	Use delta ring; see Column #9
	Left slant loop = 4		Use loop core; see Column #7	Use delta type; see Column #9	Use delta ring; see Column #9
	Plain whorl and central pocket loop = 5	By tracing Inner = 1 Meet = 2 Out = 3	Use whorl core see Column #8	Use delta type in Column #9 see rule #2	Use delta ring; see Column #9
	Double loop whorl = 6	By tracing Inner = 1 Meet = 2 Out = 3	Use loop core in Column #7; see rule #1	Use delta type in Column #9; see rule #2	Use delta ring; see Column #9
	Accidental = 7	No code used = 0	No code used = 0	Use delta type in Column #9; see rule #2	Use delta ring; see Column #9
	Scarred or mutilated pattern = 8	PATTERN TYPE as print appeared before scar if evident; if not use numeral 8	No code used = 0	Use delta type if evident; if not code as a scar.	Use delta ring if evident or approximate ring number.

COLUMN #7	COLUMN #8	COLUMN #9
LOOP TYPES	WHORL TYPES	DELTA TYPES
-0-	-0-	-0- Bifurcation
-1-	-1-	-1- An abrupt Ending Ridge
-2-	-2-	-2- A Dot
-3-	-3-	-3- A Short Ridge
-4-	-4-	-4- A meeting of Two Ridges
-5-	-5-	-5- A point on first recurving ridge nearest to center and in front of type lines.
-6-	-6-	-6- Scarred Delta
-7- All other cores not conforming to above examples.	-7- All other cores not conforming to above examples.	-7- DELTA RING 0 1 2 3 4 5 6
-8- Scarred in core.	-8-	-8-

RULES TO FOLLOW

1. Use highest rising core; if equal use left core.
2. Always use left delta when attempting to determine type of delta or delta ring position.
3. Appendages and bifurcations do not spoil recurves in the core area.
4. Rods must come to the shoulders to be considered

When attempting to define core areas, the drawings at left are to be used as guides.

Note that some whorl cores run clockwise while others run in counter direction.

Also note that some cores are oblong while others are more rounded.

Cores do not need to be perfectly round. If core resembles circle, that is enough.

In general, Henry Rules always apply, except those changed by fast rules above.

If delta ring falls on the delta, use inner number on the delta ring.

If delta does not appear on rolled impression and is beyond number 6 ring code as scarred delta in #7 ring.

B-18 The Texas Department of Public Safety Classification Scheme

The Texas Department of Public Safety, Identification and Criminal Records Division has developed a single fingerprint classification system for use with the Miracode search and retrieval equipment. In addition to the Texas Department of Public Safety, the following five respondents from Texas also employ this equipment and coding scheme:

- Austin Police Department
- Brownsville Police Department
- Galveston Police Department
- Harlingen Police Department
- McAllen Police Department

Six characters are used to describe the pattern type, the core type, the delta type, the minutia count for the core, and the minutia count for the delta. Exhibit B-22 illustrates how the fingerprint parameters are classified into the six digit coding scheme. The Battley glass is used for measuring information concerning the core type and minutia.

Exhibit B-22

THE TEXAS DEPARTMENT OF PUBLIC SAFETY CLASSIFICATION SCHEME

COLUMN I

DIGIT 1 ENTIRE PRINT PATTERN TYPE	DIGIT 2 COMPLETE 3/16" CIRCLE CORE TYPE	DIGIT 3 COMPLETE 3/16" CIRCLE NO. OF IDENT. POINTS
0 - Ampt.	0 - Plain recurve	0 - None
1 - Arch	1 - Recurve with 1 rod	1 - One & Two
2 - Tented Arch	2 - Recurve w/mult. rods	2 - Three & Four
3 - Right Slope Loop	3 - Any spoiled recurve	3 - Five & Six
4 - Left Slope Loop	4 - Clockwise twist	4 - Seven & Eight
5 - Plain Whorl	5 - Counter-clockwise twist	5 - Nine & Over
6 - Central Pocket Whorl	6 - Complete enclosure	6 -
7 - Double Loop Whorl	7 - Non-conforming	7 -
8 - Accidental	8 - Upthrust	8 -
9 - Mutilated (can't read)	9 - Scar	9 - Scar

COLUMN II

DIGIT 1 POINT NEAREST CORE TOP HALF OF 3/16" CIRCLE TYPE OF IDENT. POINTS	DIGIT 2 COMPLETE 3/16" CIRCLE DELTA TYPE	DIGIT 3 POINT NEAREST DELTA TOP HALF OF 3/16" CIRCLE TYPE OF IDENT. POINTS
0 - No ID points or scar	0 - Ridge dot	0 - No ID points or scar
1 - Ending ridge right *	1 - Bifurcation	1 - Ending ridge right *
2 - Ending ridge left *	2 - Ending ridge	2 - Ending ridge left *
3 - Bifurcation right	3 - Ridge	3 - Bifurcation right
4 - Bifurcation left	4 - Enclosure	4 - Bifurcation left
5 - Short ridge dot	5 - Non-conforming	5 - Short ridge or dot
6 - Island	6 -	6 - Island
7 - Bifur w/ending ridge(s)	7 -	7 - Bifur w/ending ridge(s)
8 - Dbl Bifur same ridge	8 -	8 - Dbl Bifur same ridge
9 - Dbl Bifur two ridges or more	9 - Scar	9 - Dbl Bifur two ridges or more

* - No attachments

B-19 The Del-Core System

The Del-Core System is used by the Vermont State Police in their latent fingerprint identification system and uses up to four characters to describe the pattern type, the core to delta distance, and the core size. In the Del-Core System, the Battley reticule is used for making measurements on the fingerprint image. This classification system was developed by the police departments in Canada and adapted for use by the Vermont Department of Public Safety. In this system, the thumbs and the index, middle, and ring finger are all classified but the little fingers are not. The fingerprint images are made on specially perforated cards so that the thumb print of each hand can be detached and separated from the prints of the remaining four fingers, thus a set of ten fingerprints results in four separate cards which are filed in four separate files. There is a file of left thumbs, a file of right thumbs, a file of cards containing left index, middle, ring, and little fingers, and a file of cards containing right index, middle, ring, and little fingers. The thumb cards and patterns are classified with up to four characters while the three fingers classified together are so done with a two character code. Exhibit B-23 shows the parameter coding for the Del-Core classification system. The left hand column indicates the various patterns that appear in the fingers. The second column indicates the first character of the coding which is the standard numerical indication of the basic pattern type. The third column indicates the secondary classification for those patterns which are given a secondary classification. The fourth column shows the sub-secondary classification which is the two-character code applied only to the thumbs which display either whorl or central pocket loop patterns. These two characters represent the two distances indicated in the exhibit.

Exhibit B-23

PARAMETER CODING FOR THE DEL-CORE CLASSIFICATION SCHEME

PATTERN	PRIMARY CLASS	SECONDARY CLASS	SUB-SECONDARY CLASS (THUMBS ONLY)
Arch	1	--	--
Tented Arch	2	--	--
Radial Loop	3	Core-Delta distance (A-H)	--
Ulnar Loop	4	Core-Delta distance (A-H)	--
Whorl	5	Core Size (A-H)	Core-left delta (A-H) Core-right delta (A-H)
Central Pocket Loop	6	Core Size (A-H)	Core-left delta (A-H) Core-right delta (A-H)
Twin Loop	6	Upper innermost ascending loop to lower innermost recurrence of descending loop distance (A-H)	
Accidental or Composite	7		
Scarred or Amputated	8		

B-20 The Norfolk System

The Norfolk Classification Scheme is an eight character classification system employed by the Norfolk, Virginia Police Department and also used by the Columbus, Ohio Police Department. The eight characters are used to code the pattern type, the ridge count for loops, the tracing for whorls, the tented arch type, the ridge count for whorls, the core type, the delta type, the core to delta distance, scars near the core, tented arch measurement, the whorl sub-pattern, loop sub-pattern, and the island count. Exhibit B-24 indicates in matrix form the coding scheme for this classification system. The first digit indicates the standard pattern types for those pattern types in which additional information can be used in the classification, the subsequent digits indicate how that is coded.

Exhibit B-24

CODING SCHEME FOR NORFOLK CLASSIFICATION SCHEME

PATTERN TYPE	CHARACTER NUMBER 1	2	3	4	5	6	7	8
Plain Arch	1	0	0	0	0	0	0	0
Tented Arch	2							
Core Type (from chart)		x	x					
Slope pattern				1-4				
Platform ridge (Circle Reading)					1-8			
Islands						0	0-3	
Scars								1-7
Loops (Right/Left Slope)	3/4							
Core Type		x	x					
Location of Delta				1-8				
Ridge Count					1-9			
Type Loop						1-5		
Delta Type							1-9	
Islands								0-3
Whorls								
Plain or Central Pocket	5							
Dual	6							
Accident or Lateral Pockets	7							
Core Type		x	x					
Left Delta				1-8				
Tracing					1-3			
Right Delta						1-8		
Ridge Count							1-9	
Whorl Type								1-8

APPENDIX C

HOOD-TAYLOR
PALMPRINT CODING SYSTEM

Edited material from Hood-Taylor Coding Manual.

THE HOOD-TAYLOR BASIC PALM PRINT CODE SYSTEM

Since palm prints were first recognized by the courts as a certain means of identification and as crimes frequently occur where the only evidence found is a portion of a palm print, attempts have been made to devise a way of retrieving that part of the palm that was found at a crime scene without looking through several thousand palm prints on file, which have been filed numerically.

Identification officers have long realized that some form of coding or classification for these prints which would permit chance impressions being searched with a view to identification would be of inestimable value to all fingerprint bureaus. Such coding system would have the effect of turning these dormant files into live ancillaries to the existing single fingerprint collection.

Although there have been various methods devised for classifying the ridge patterns of human palms, palm prints files are not generally included in identification bureaus in the United States.

Inasmuch as identity by impressions of these areas of the body has legal precedence in this country, as well as elsewhere in the world, it is believed by most identification officers that some type of palm print system should be devised that would facilitate rapid identification. In the past, the adaptability to convenient recording, classifying,

and filing of palm prints has limited it to a secondary position as a means of identification. In most bureaus in this country, the palm print serves as an adjunct to fingerprints when the latter can not be employed in some specific instance for one reason or another.

It is an accepted fact by identification officers, so far as palm prints are concerned, that no two individuals have the same papillary ridges in their fingers, palms of hands, soles of feet, and their toes and that comparisons of such prints is a positive means of identification. It is an undisputable conclusion that there is but one physiological basis underlying this method of identification, that the phenomenon by which identity is thus established exists, not only on the bulbs of the fingers, but also is continuous and coexisting on all parts and in all sections and subdivisions of the palmar surface of the human hand.

With this in mind, we devised a Basic Palm Print Code System which we named and labeled the Hood-Taylor Basic Palm Print Code System. This basic system is designed so that added information can be coded in as required in a follow-up to this basic code. The Hood-Taylor Basic Palm Print Code System is to be used in an automated system such as the IBM Key Punch or Kodak Miracode System. The IBM system is good, but is considerably slower than the Kodak Miracode system in searching several thousands of prints.

The development of our coding system has solved the problem of retrieving and comparing palm prints rapidly.

This system was devised to be used in the Kodak Miracode machine.

The palm prints are photographed and coded on microfilm by means of the Kodak Miracode Input Machine. Thousands of prints can be eliminated in a few minutes. Latent palm prints can be compared directly on the viewing screen of the Miracode Machine without the aid of the master palmprint file.

The Hood-Taylor Basic Palm Print Code System method of identification has fantastic advantages and many tedious hours of work on the part of a person can be saved when search of a palm print is being made. This method of palm prints identification is simple and can be used by one who is familiar with the art of fingerprints. It is a basic system and additional information can be added at any given time.

The Hood-Taylor Basic Palm Print Code System was developed by Captain James L. Hood and Captain Singleton C. Taylor of the Shreveport Police Department, Shreveport, Louisisana with the full cooperation of Commissioner of Public Safety George D'Artois and Chief of Police T.P. Kelley.

Additional information may be obtained by writing the Shreveport Police Department, Identification Bureau, Shreveport, Louisiana, zip code 71102, Attention: Captain

J. L. Hood, Director or Captain S. C. Taylor, Assistant Director, or by telephoning area code 218-1-422-1662.

PALM PRINT PATTERN ZONES

Palm print pattern zones have been divided into four pattern zones consisting of the following:

Thenar Zone: This is the large cushion at the base of the thumb. On it may appear loops, whorls, or a combination of them. On some palms there is no pattern at all, just a lot of more or less ridges that are straight. In other palms, there may not be any loops, whorls, or etc., but may contain irregular ridges that approaches an arch type pattern, but are known as oddities.

Hypothenar Zone: This zone contains the large cushion below the base of the little finger. It, too, may contain loops, whorls, and various patterns.

Palmar Zone: This is the area located at the base of the index, middle, ring, and little finger. There is a broad delta at the base of each finger. It, too, may contain loops, whorls, or a combination of them, or may have no pattern at all.

Carpal Delta Zone: This delta is located about the center of the palm, down near the wrist. In some cases, there is no delta found in this zone.

When a loop opens toward the ulnar bone, it is called an unlar loop. If it opens toward the radius bone, it is known as a radial loop. But, if the loop opens toward

the finger, it is known as a distal loop and if toward the wrist, it is called a proximal loop. For the purpose of coding, the terminology "ulnar" and "radial" loops are known as right and left slope loops. All the above information related to the palm is considered in the classification of coding of this system of identification. Each zone of the palm is considered alone for the Miracode System. Although each of the four zones; Thenar, Hypothenar, Carpal Delta, and Palmar zones are coded separately, all coded zones can be used alone or together in the Miracode System.

Each zone of the palm will be governed by the rules established for this system. Examples are presented in order to aid in the understanding and use of the palm print system in regard to its use in the Miracode System.

The basic system is designed so that added information can be coded in as required in a follow-up to this basic code.

It is believed that this palm print classification when coded into the Miracode System, will be a great advance in crime detection for law enforcement agencies all over the world.

Information that is added to each palm print will be as follows: race and sex, Digit I; date of birth, Digit II; and Digit III, the year of birth. The type of crime can be utilized, if desired, in another column of code.

THENAR SECTION

Column I

This is the thumb side of the palm and may contain arches, loops, and whorls. For Miracode purpose, this section is broken down into three digits of code, namely: Pattern, Core, and Scars.

1. Pattern: This is located in Digit I of the Miracode Retrieval. There may be loops, arches, tented arches, whorls, oddities or a multiple of each. In many cases, there won't be any type of pattern, only a straight open field of ridges, but if there is no other type pattern, the arch type pattern will be used in cases where the ridges tend to curve in an arch shape, but not exactly conforming to an arch. The first Digit is called the pattern area. It is coded to the type or types of pattern in this section and has different patterns or combination of patterns, which are listed as follows:

0=No pattern
1=Arch or Tented Arch.
2=Distal Loop
3=Proximal Loop
4=Whorl
5=Multiple pattern (same type).
6=Multiple pattern (different type).
7=Oddities only.
8=Oddities plus any pattern.
9=Distal and Proximal Loop.

Number five (5) is used where there are two loops flowing in the same direction or two whorls, regardless as to the type or flow. Listed below are the ten digits of code with an explanation of each.

0= When only an open field or ridges with little or no curvature and lack any type of pattern.

1= For this digit, any fairly sharp curve of ridges, but lack any other type of pattern.

2= This is a loop that flows or tends to flow toward the fingers of the hand.

3= This is a loop that flows toward the proximal of the hand.

4= The whorl may be a double loop whorl, almond shaped, central pocket or plain.

5= This means that all patterns in this zone are the same type, such as all loops or all whorls.

6= This means that the patterns in this zone may be whorls, loops, arches, or oddities.

7= This is not a designated pattern, but an odd shape of ridges which do not conform to any known type.

8= This may be any odd shape ridges and any type of pattern.

9= When two loops flow in the opposite direction.

2. Core: The core is composed of various shape ridges that are located in center of the pattern. It is determined by rods and ridges located within the innermost recurving ridge. If there are more than one pattern consisting of loop or whorls the pattern nearest to the carpal flexure will be considered only, for the core identification. The code chart is self-explanatory.

3. Scars: In this column, all scars within this area will be considered. In cases where there is multiple type scars, including a jagged puncture type scar or diagonal scar, it will be considered as a vertical or horizontal

multiple scars, code #7. The scar should be at least 10 mm in length before it is considered a scar.

HYPOTHENAR

The Hypothenar is that part of the palm located on the ulnar side of hand. This part of the palm contains friction ridges and may have various type of patterns. The patterns may be whorls, loops, or a form of tented arches. In some palms, there may be one or more of these patterns and in others, there may be a complete absence of any known pattern.

For code purpose, all patterns and non-conformery patterns will be considered. The loop pattern will normally flow from right to left or vice versa and will be coded right and left slope loops. In some instances, there may be two loops flowing in the same direction and in others, they may flow in opposite directions. This zone may have a combination of various patterns and will be coded accordingly.

One thing to remember is that the loop or whorl pattern closest to the Carpal Flexure will have its core type considered.

The Hypothenar will receive three digits of code: Pattern, Core, and Scar. The Scar can be of great value in a rapid search of the files, and should be considered very carefully. Be sure that it is a permanent scar and that it is large enough not to be overlooked on a latent.

This zone will appear in Column II of the Miracode machine as follows:

Column II

Digit 1- Pattern

Digit 2- Core

Digit 3- Scar

See Code Chart.

CARPAL DELTA ZONE

Column III

The Carpal Delta zone has three points of identification for Miracode purpose, broken down as follows:

1. Digit I- Measurement from delta to Carpal Flexure. This is done with a millimeter scale. Delta type can be used instead of millimeter measurements.

2. Digit II- First I.D. point above the delta flowing outward toward the hypothenar field. The first I.D. Point will be a bifurcation ending ridge, island, or short ridge, if they are located within the 3/16 inch disc. If the above characteristics are not within the disc, then a ridge dot can be used.

3. Digit III- Second I.D. point above the delta and within the 3/16 inch disc is obtained after the first I.D. point is made. In some cases, there may be no second I.D. point. The same rule applies as for first I.D. point.

4. In order to obtain the I.D. points, the 3/16 inch disc is placed on the delta facing toward the hypothenar field and the first and second I.D. points are taken from within the disc.

5. All reference points are to be considered that are located above the delta. This will include the type line if so located but not any ridge that is connected to the delta.

6. Whenever there are two I.D. points that are the same ridge count distance, the point to the right will be considered the first I.D. point and the point on the left will be the second I.D. point. This is to your right and your left as you look at the print.

7. A scar located below the delta will be coded as a scar in lieu of the millimeter measurement.

8. Whenever a scar is located above the delta and within the 3/16 inch disc, then the code for the first and second I.D. point will be the scar code.

9. In some cases, the whole carpal delta zone may be obliterated by a scar; when this occurs, all three digits of code for this zone will receive the scar code numbers- for example: 9 9 9.

10. I.D. points that are connected with the delta will not be considered when obtaining the first and second I.D. points.

PALMAR SECTION

This zone is broken down into the following: index and middle, middle and ring, and ring and little fingers. In most cases, the pattern will be located between the fingers. Whenever a scar is found in this zone, the appropriate code will be given. See code chart.

EXAMPLE: PALMAR

Digit I	Digit II	Digit III
Index and Middle	Middle and Ring	Ring and Little

Always begin the code with the index and middle fingers and proceed to the ring and little fingers.

The Palmar zone where loop and whorls are located could be classified the same as loops and whorls in a fingerprint if so desired.

DEFINITIONS

CARPAL DELTA- The delta that is located above the wrist or carpal flexure and is measured in 10 mm section.

DISTAL LOOP- These are loops that the loop or core part is extended toward the carpal flexure and it flows toward the palmar area.

PROXIMAL LOOPS- Loops that the loop or core part is extended toward the palmar area and it flows toward the carpal flexure.

SCARS- These have to be a permanent type scar and be at least 10 mm long or round.

RIGHT SLOPE LOOP- Loops on either hand that the loop or core part is extended toward the left side of the hand and flows or attempts to flow out the right side.

LEFT SLOPE LOOP- Loops on either hand that the loop or core part is extended toward the right side of the hand and flows or attempts to flow out the left side.

WHORLS- Any type. All whorls are designed as plain whorls.

MULTIPLE PATTERN- Any combination of two or more patterns in each section.

ODDITIES- Any ridges that do not conform to an established pattern. Ridges that break or zig zag from their line of flow, regardless of their direction of flow.

ODDITIES PLUS PATTERN- Any oddity and any pattern combination.

ARCHES OR TENTED ARCHED- All coded as plain arches or tented arches.

CARPAL DELTA TYPE- The actual delta itself, where it be a ridge dot recurving ridge, ridge ending or bifurcation.

CORE TYPE- For loops are plain, multiple rods or recurve spoiled by appendages, for whorls are clockwise or counter clockwise.

ONE LOOP, PALMAR AREA- One loop only, between any finger of the palmar area.

TWO LOOPS, PALMAR AREA- Two loops between any finger of the palmar area.

THREE LOOPS, PALMAR AREA- Loops on all three areas of the Palmar area.

BASE DELTA- Deltas directly at the base of each finger, which will be four.

INDEX- any pattern that is directly below the index or between the index and middle finger in the palmar zone.

MIDDLE- Any pattern that is directly below the middle or between the middle and ring fingers in the palmar zone.

RING- any pattern that is directly below the ring or between the ring and little finger, including the little finger in the palmar area.

THENAR- The area of the thumb or radial side of the palm and used in the first keyboard of code.

HYPOTHENAR- The flat part of the hand opposite the thenar area, usually the carpal delta is located in this area. It extends towards the fingers and ends at the palmar flexure. It is used as the second keyboard of code.

CARPAL DELTA- This is the delta located in lower edge of the Hypothenar zone and will be coded as a separate zone. Three digits of information will be considered. See code chart. It will be used in the third keyboard of code.

PALMAR- The area directly below the base of the fingers and is used as the fourth keyboard of code.

PALM PRINT- The ridges of the hand from the base of the fingers at the palmar area to the heel of the hand at the carpal flexure. It includes four areas which are the thenar, hypothenar, palmar and carpal delta areas.

THENAR

PATTERN	CORE	SCARS
0= No Pattern	0= No Core	0= No Scars
1= Arch or tented arch	1= Plain	1= Vertical Scar
2= Distal Loop	2= One rod	2= Horizontal scar
3= Proximal Loop	3= Multiple Rods	3= Vertical scar through pattern
4= Whorl Same type-	4= Spoiled	4= Horizontal scar thru pattern
5= Multiple pattern	5= Clockwise	5= Vertical multiple scars
6= Different type multiple pattern	6= Counter Clockwise	6= Horizontal multiple scars
7= Oddities only	7= Plain Recurve	7= Vert. & Horiz. multiple scars
8= Oddities plus any pattern	8= Arch	8= Jagged puncture type scar
9= Distal & Proximal Loop	9= Tented Arch	9= Diagonal Scar

* #5 Is used where there are two loops flowing in the same direction or two whorls, regardless as to the type or flow.

HYPOTHENAR

PATTERN	CORE	SCARS
0= No pattern	0= No Core	0= No Scars
1= Arch or tented arch	1= Plain	1= Vertical scar
2= Right slope loop	2= One rod	2= Horizontal scar
3= Left slope loop	3= Multiple rods	3= Vertical scar thru pattern
4= Whorl	4= Spoiled	4= Horizontal scar thru pattern
5= Same type multiple pattern	5= Clockwise	5= Vertical multiple scars
6= Multiple pattern different types	6= Counter Clockwise	6= Horizontal multiple scars
7= Oddities only	7= Plain recurve	7= Vert. & Horiz. multiple scars
8= Oddities plus any pattern	8= Arch	8= Jagged puncture type scar
9= Right and left slope loop	9= Tented arch	9= Diagonal scars

CARPAL DELTA

LOCATION	First ID Point-front of Delta	Second ID Point
0= No Delta	0= No I.D. Point	0= No I.D. Point
1= 0-10 mm	1= Ending ridge right	1= Ending ridge right
2= 11-20 mm	2= Ending ridge left	2= Ending ridge left
3= 21-30 mm	3= Bifurcation right	3= Bifurcation right
4= 31-40 mm	4= Bifurcation left	4= Bifurcation left
5=	5= Short ridge or dot	5= Short ridge or dot
6=	6= Island or enclosure	6= Island or enclosure
7=	7= Bifurcation and short ridge	7= Bifurcation and short ridg
8=	8= Double bifurcation	8= Double bifurcation
9= Scar below delta (only)	9= Scar	9= Scar

PALMAR

INDEX-MIDDLE	MIDDLE-RING	RING	LITTLE
0= Plain Pattern	0= Plain pattern	0= Plain pattern	
1= Tented Arch	1= Tented Arch	1= Tented Arch	
2= Loop	2= Loop	2= Loop	
3= Whorl	3= Whorl	3= Whorl	
4= Plain pattern with scar	4= Plain pattern with scar	4= Plain pattern with scar	
5= Tented arch with scar	5= Tented arch with scar	5= Tented arch with scar	
6= Loop with scar	6= Loop with scar	6= Loop with scar	
7= Whorl with scar	7= Whorl with scar	7= Whorl with scar	
8=	8=	8=	
9=	9=	9=	

(Additional Code that may be added)

PALMAR ZONE

BASE DELTAS

The Delta formation at the base of the index, middle, ring and little fingers will be known as Base Deltas for coding purpose.

1. Each base delta will receive three digits of code.
   a. Begin with the index and follow through to the little finger.
   b. Column 6 First digit will be #0 if no pattern exist to the left of the delta such as a loop, whorl, etc.
   c. Second digit will be the first identification point located in front of delta (toward this distal).
   d. Third digit will be the second identification in front of Delta.
2. The Base Deltas will be broken down as follows:

   Column 6- Index- Digit 1-2-3
   Column 7- Middle- Digit 1-2-3
   Column 8- Ring- Digit 1-2-3
   Column 9- Little- Digit 1-2-3

When a pattern appears in this zone, such as a loop, whorl, T-arch, etc., it will receive the appropriate code in the first digit of the column. In the second digit, the delta I.D. points that are located to the right of the pattern will be coded. The delta to the right means the delta to your right as you look at the Palm before you. The reason for doing the above is because many times a partial will exist and one can not tell which hand the pattern or delta may be on.

Examples are given on the following page.

EXAMPLES FOR BASE DELTAS

Column 6- Index

Digit I
0 Delta Only

Digit 2
3 Bif. right

Digit 3
2 Ridge end left

Column 7- Middle

Digit 1
2 Loop

Digit 2
4 Bif. left

Digit 3
5 Ridge Dot

Column 8- Ring

Digit 1
0 Delta Only

Digit 2
1 Ridge end right

Digit 3
5 Short ridge

Column 9- Little

Digit 1
2 Loop

Digit 2
3 Bif. right

Digit 3
4 Bif. left

PALMAR EXTENSION CODE

The below code will be used for all four Delta Base of the fingers.

COLUMN # 6-7-8-9

Digit 1 Pattern	Digit 2 First I.D. Point	Digit 3 Second I.D. Point
0- Plain Pattern	0- No I.D. Points	0- No I.D. Points
1- Tented Arch	1- Ending Ridge Right	1- Ending Ridge Right
2- Loop	2- Ending Ridge Left	2- Ending Ridge Left
3- Whorl	3- Bifurcation Right	3- Bifurcation Right
4- Plain Pattern w/Scar	4- Bifurcation Left	4- Bifurcation Left
5- Tented Arch w/Scar	5- Short Ridge or Dot	5- Short Ridge or Dot
6- Loop w/Scar	6- Island	6- Island
7- Whorl w/Scar	7- Bifurcation/short ridge	7- Bifurcation/short rdg
8-	8- Double Bifurcation	8- Double Bifurcation
9- Scared out	9- Scar	9- Scar

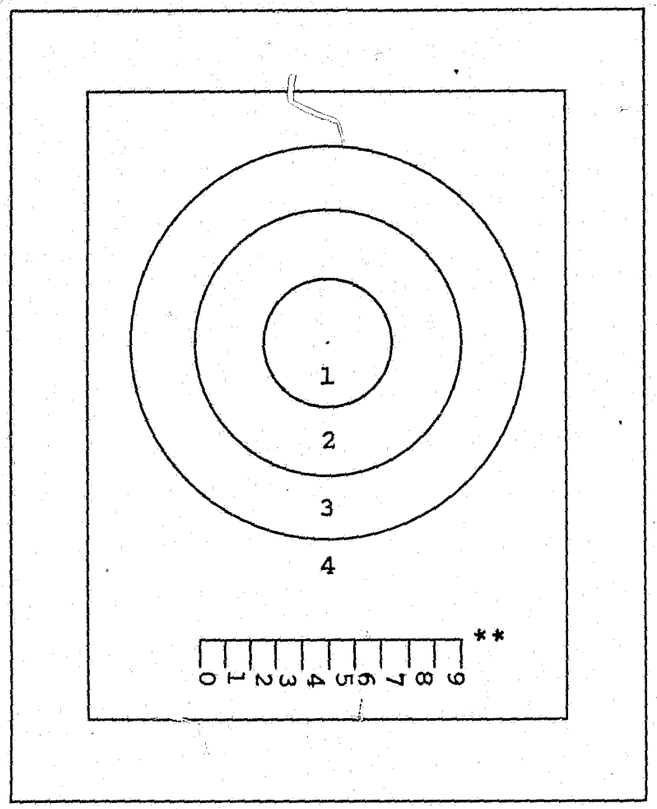
Example:

Digit 1	Digit 2	Digit 3	
Column 6 Index Digit 1-2-3	Column 7 Middle Digit 1-2-3	Column 8 Ring Digit 1-2-3	Column 9 Little Digit 1-2-3

COLUMN #5

Digit 1 Race & Sex	Digit 2 Decade	Digit 3 Year
Example: W/M 0	Example: Born in '51 5	Example: 1

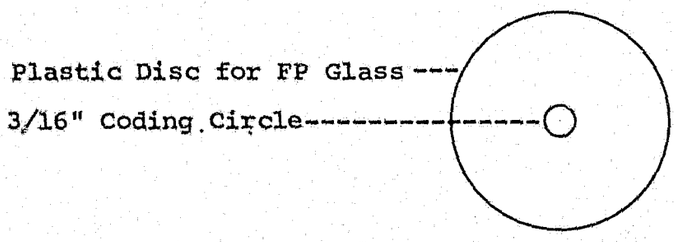
EXAMPLE



EXAMPLE: 10 MM SCALE

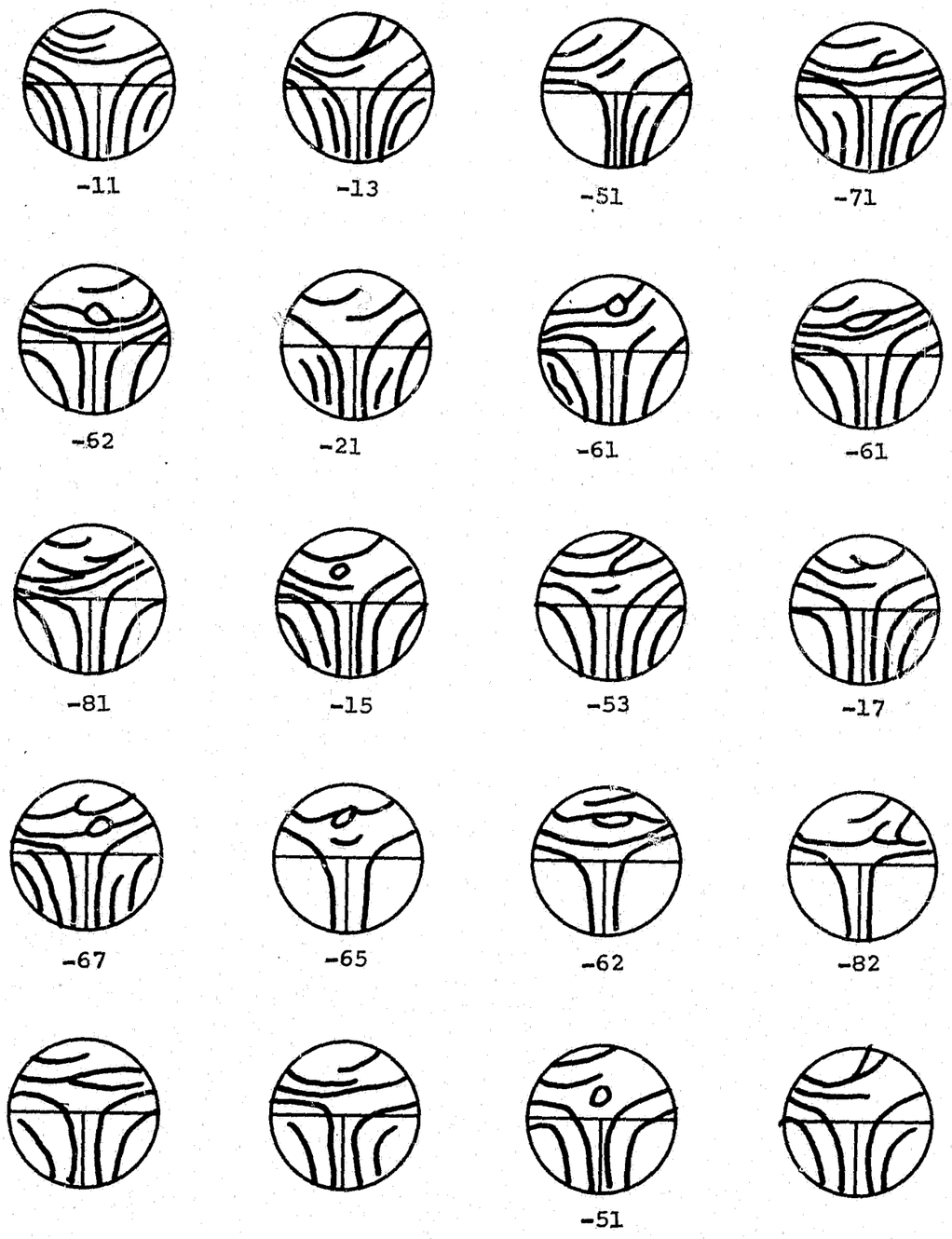
SCALE IN MILLIMETERS

The above scale in a clear plastic overlay for the measurement of the Carpal Delta. In order to determine the length between the Carpal Delta and the Carpal Flexure, place the dot of the circle on the delta and check the area that has the Carpal Flexure. If the distance is 40mm or over, the code will be "4".



EXAMPLE: Carpal Delta I.D. Points

- Represents millimeters measurement from CD to Carpal Flex. Last two numbers are the first and second I. D. points within the 3/16 inch circle.



EXAMPLE

51

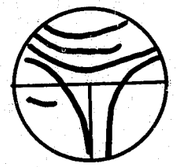
31

11

21

21

51



12

12

55

22

53

61

62

51

66

END