

LAW ENFORCEMENT ASSISTANCE ADMINISTRATION (LEAA)

POLICE TECHNICAL ASSISTANCE REPORT

SUBJECT Filing and retrieval of fingerprint cards
in the Colorado Bureau of Investigation.

PROJECT NUMBER 76-089/060

FOR Colorado Division of Criminal Justice,
Colorado Bureau of Investigation

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FORWARD

The technical assistance reported in this paper was requested by W. G. Buckley, agent in charge of the Crime Information Section for the Colorado Bureau of Investigation. The request was approved by Paul G. Quinn, Director of the Colorado Division of Criminal Justice, and by George S. Kondos for the LEAA region.

The technical assistance was provided by Robert L. Marx, an independent criminal justice systems consultant, under contract to Public Administration Service.

SECTION I. INTRODUCTION

The Criminal Identification Section of the Colorado Bureau of Investigation is the State Identification Bureau for Colorado.

The Criminal Identification Section (CIS) is in the earliest stages of development. As such it is unencumbered by the large historical files found in many state identification bureaus, and has been able to structure an approach to its future characterized by major automation and relatively little use of labor.

CIS has already made major strides in the implementation of a modern and effective identification bureau. A computerized namesearch system is on line, as is a computer assisted technical search system. Technical assistance was requested in order to receive advice concerning the next major change, replacing existing manual files for fingerprint cards and other source documents with files more in keeping with the automated nature of the bureau.

SECTION II. UNDERSTANDING OF THE PROBLEM

In order to understand the desirability of changing the medium for master fingerprint file and "jacket file" within CIS, it may be instructive to trace the process of source documents through CIS.

Incoming arrest fingerprint cards, received by mail at CIS, are logged in, counted, and then distributed to fingerprint technicians on the basis of a geographical division of the state (this allocation of workload by region is unusual and is intended to provide additional motivation to the technicians for accurate and responsive identification work).

The fingerprint card is next subjected to a computerized namesearch routine, in which all soundex equivalents in the computerized file are displayed for selection of a single candidate by the technician. If a "hit" is made at this point, the computer provides additional information in the form of a computer compatible fingerprint classification, which is converted by another computer program to a standard Henry classification. Using this classification, the fingerprint technician enters the manual master fingerprint file at the correct subclassification, looks through all cards in that file, and carries out fingerprint verification as appropriate.

Since the computer namefile is still relatively small, an unsuccessful computer namesearch is followed by a manual namesearch against "older" arrest records, which if successful is followed by fingerprint verification in the master fingerprint file as described above. In such a case the manual namefile is subsequently purged so that no name record exists both in the manual file and the computerized file.

If both namesearches are unsuccessful, a computerized fingerprint technical search is next attempted. The fingerprint card is classified in accordance with a specialized scheme similar to the NCIC fingerprint classification code, but including extensions in the form of further breakdown in the arch and tented arch categories, ridge counting on whorls, and special coding of scars.

The computerized file is searched, and if a hit is indicated the computer generates the equivalent Henry classification, the technician enters the manual master fingerprint file and attempts fingerprint verification as described above. If the computer assisted fingerprint search is unsuccessful, the computer returns the appropriate Henry classification, and the fingerprint technician enters the master fingerprint file for the search process.

Regardless of the outcome of the search processes, the appropriate computer files are updated by the technician (rather than by a separate clerical staff as is more usual). Information is extracted from the fingerprint card (front and back) and used to establish or update identification segments and arrest segments in the computerized criminal history (CCH) file. Finally the source document (arrest fingerprint card) is placed either in the manual master fingerprint file or in the jacket file as appropriate, response is generated for computer transmission to the submitting agency, and (for some departments within the state) a card is forwarded to the FBI if the arrest represents a first arrest in Colorado.

Similar processes are used for applicant/licensee fingerprint cards, except that such cards are handled on a "process and return" basis on which updates are not made to either computerized or manual files on the basis of the submission. Another source document within the bureau is the "tissue" on which FBI provides a correspondence between state identification number (SID) and FBI identification number (FBI). These source documents are used to update the computerized identification segment.

The three major manual files in CIS are the master fingerprint file, the jacket file, and the manual namefile. Of these the third is of little importance since it will gradually disappear in favor of the automated file already implemented. Two concerns exist with regard to these manual files. First, they represent a substantial use of limited floor space within the bureau, and more seriously a substantial loading weight on the bureau's floors, which are not specially reinforced for such purposes. Second, they represent, in their use and maintenance, a substantial labor cost to the bureau. For these reasons,

and perhaps also because such manual files seem strangely archaic in the highly automated setting of CIS, technical assistance was requested to suggest alternatives.

SECTION III. ANALYSIS OF THE PROBLEM

Consider first what we are trying to accomplish by replacement of the manual files. We wish to reduce the total floor space devoted to file storage, and also the total weight of files. Second, we wish to avoid problems associated with lost, misfiled, or temporarily out of file records. Third, we wish to reduce the total cost of file maintenance, especially the labor component of that cost.

Generally speaking there are two available media for replacing the existing paper files: magnetic tape and microfilm.

Magnetic tape media have been used in a few identification bureaus (e. g. Washington and Illinois). The most attractive feature of such magnetic files is the ability to provide document images to remote work stations from a single master tape file. Because of the relatively small size of CIS, and the ability to provide multiple work stations from a single master file, this positive feature of tape media is not of sufficient importance to Colorado to justify the substantially higher cost of tape media (compared to microfilm). The fact that magnetic tape systems are usually sold as totally integrated systems in which computerized namesearch, technical search, and file handling are all provided in a single package, whereas Colorado has already independently purchased the namesearch and technical search capability, further argues against strong consideration of tape media for file replacement. Thus we will limit our further discussion to microfilm systems.

When considering microfilm, we can select first between strip microfilm and microfiche. Microfiche has been used in some state identification bureaus (e. g. Oregon) for jacket files but never for a master microfilm file. Strip microfilm has been used in state identification bureaus for both master fingerprint files and jacket files (e. g. Florida). Equipment costs for true microfiche systems are higher than for strip systems, although a "quasi-fiche" can be purchased using strip microfilm which is placed into pockets in a fiche sized transparent envelope. The chief advantage of fiche or quasi-fiche lies in the ability to duplicate inexpensively the fiche itself for transmission to end users

of the information contained on the fiche. Since Colorado intends to provide information directly from the computer rather than from the source documents filmed, this advantage of fiche is not important. Sophisticated storage/retrieval devices are available for fiche which provide file integrity equivalent to strip film systems with access time slightly faster than strip systems (e.g. Image Systems Corporation devices). The slight increase in access speed is unlikely to be important, when compared with the slightly lower mechanical reliability of the retrieval systems and higher cost of the overall procedures. Therefore for the remainder of this discussion we will assume strip microfilm is the medium selected.

Next we can select between 35mm microfilm and 16mm microfilm. Use of 16mm film, of course, reduces the total size of the file in its microfilm form. Since the entire master fingerprint file, for example, will fit on a single standard desk top in either form, however, this advantage of 16mm film can be discounted. The smaller film also has a lower materials cost associated with the ongoing operation of the bureau. Even though the smaller film costs less than half as much as the larger film per document stored, this difference in cost will be only fractions of a percent of the total operating cost of the bureau. For this reason, film costs should be considered, but given a relatively low weight in the selection of film size.

The larger film, (35mm) has two advantages. First, the large image size on the film allows higher definition in the image and resulting greater clarity in the projected image, especially important for fingerprint search/verification (both 10 finger identification and latent work). Nevertheless this feature should not be overemphasized. State bureaus (e.g. Florida) have used the smaller film for years with satisfactory results.

Second, the 35mm film is compatible with a fully automated technical search system presently under evaluation at the Arizona state identification bureau. This system, developed by Sperry, uses 35mm microfilm as the input medium. Although this feature of compatibility should be considered, it should not be overemphasized; if the Arizona system is successful Sperry will undoubtedly attempt to modify the system to allow use of 16mm film. Furthermore, Colorado

has just made a major investment in its present computer assisted fingerprint search system, so that further investment in the very near future for fully automated search system seems unlikely. Thus the decision between 16mm and 35mm film rests primarily on the professional judgment of practitioners within CIS concerning the adequacy of the projected image for fingerprint search and verification purposes.

Having decided, at least in general terms, the medium to be used for a file, we next turn to the manner of application of that medium to the two files under consideration: the jacket file and the master fingerprint file.

First let us recall the purpose of the microfilm jacket file. It is not to be used in normal operational retrieval and transmission of criminal history information; such information is available directly from the computer, and will be sent to end users from the computer itself. The microfilm file will not be used as a "backup" to the computer since the computer installation is fully duplexed and can be expected to have an extremely low down time; during the infrequent periods of computer non availability the criminal history information will simply not be available to any users. The purpose of the microfilm file, then, is primarily for quality control within the bureau, and for use in processing challenges to the accuracy of criminal history information. Thus we can be confident that the microfilm jacket file will be consulted only infrequently, and never under conditions requiring extremely rapid access. With this in mind we wish to assure that we have chosen the cheapest method, also the method which results in the lowest "error" rate in terms of misfiles and missing records. We believe that this is best accomplished by filming records in the sequence in which they are entered into the computer storage. Since "date of entry" is already a required data element in each record of the computer file, that same date of entry can be used to access the microfilmed source documents from which the computer entry is derived. This simple and inexpensive file organization has been used successfully in state identification bureaus (e. g. Florida) and will work in Colorado.

Next we consider the master fingerprint file. The master microfilm fingerprint file will be accessed only after a tentative hit has been made either by computerized namesearch or by computer assisted fingerprint technical search.

In either case, the number of candidate images to be examined can be expected to be rather small, averaging slightly over one in a good namesearch system and about four in a good technical search system. Therefore, elaborate organization and subcategorization of the microfilm file is not necessary to cut search/retrieval time, unless it can be accomplished very inexpensively. The other major reason for subdividing a microfilm file is to provide a method by which incoming fingerprint cards can be "aimed at" a single file segment so that a fingerprint technician need not leave his work station in order to retrieve the proper subfile. Files are sometimes divided by age group, or by fingerprint classification group in order to provide such file segmentation. Any such segmentation, of course, raises total file maintenance costs and adds to the possibility of misfiling. With this in mind, and also considering that the Colorado bureau will remain relatively small (about eight work stations) for several years to come, such file segmentation is not deemed necessary for CIS.

Finally we get to the matter of cost and cost justification for a microfilm system in CIS. Full discussion of these areas was not requested in the technical assistance and is beyond the scope of analysis possible within the time constraints of this activity. Nevertheless a few preliminary comments can be made.

A full microfilm system would include a single filming station, one or two cameras, film processing equipment, film duplication (diaz) equipment, and eight viewer work stations probably sharing two working copies of the master files in the case of the fingerprint file, and a single file in the case of a jacket file. Such an equipment setup will cost in the general vicinity of \$50-75K. Ongoing costs include film and chemicals (less than \$0.05 per document filmed) and labor costs for the filming and duplicating (less than one half shift per day operation of the bureau). More precise financial estimates are easily obtained once fundamental decisions have been made in this area, since vendors (e.g. Kodak, Bell and Howell) are very cooperative in developing such estimates, and because equipment from alternative vendors is closely priced with strikingly similar characteristics.

Can such costs be justified for CIS? Again, such analysis was not in the scope of this technical assistance. Nevertheless we predict that such an analysis would result in an affirmative decision concerning microfilm usage. This is especially true in the case of the master fingerprint file, and need not even take into consideration of the increased accuracy and file integrity resulting from microfilm usage. Anyone who has watched the fingerprint verification process realizes the substantial amount of time used "leafing through" the fingerprint file to find the appropriate card for verification. If we use a conservative estimate of \$0.10 for the fully burdened cost of a technician minute we can expect a labor cost avoidance in the general area of \$0.20 per identification, which easily offsets the cost of the microfilm operation. Cost avoidance resulting from small physical size of the file, and increased accuracy from higher file integrity and lower technician fatigue need not even be considered to make the economic justification.

SECTION IV. FINDINGS

The analysis conducted during this technical assistance considered retention of the existing manual files, use of magnetic tape files, and use of microfilm files for the jacket file and master fingerprint file of the CIS. Our finding is that microfilm is the appropriate medium for these files.

The analysis considered strip microfilm, strip microfilm stored in fiche-like jackets, and microfiche for these files. Our finding is that strip microfilm (in cartridges) is the appropriate medium for CIS.

The analysis considered 16mm and 35mm microfilm. Our finding is that either size film could be appropriate, and that the final decision should be made by CIS, primarily on the basis of adequacy of the projected image for the verification process.

The analysis considered positive (black on white) and negative (white on black) projection for the microfilm images used during the verification. Our finding is that either method works, that selection between the two should be up to CIS, primarily on the basis of technician comfort, and that bureaus already using microfilm should be questioned before the decision is made.

We considered the equipment needed in CIS and found that the minimum equipment set includes one filming station, two cameras, (one for master fingerprint file and one for jacket file), one film processor, one diazo duplicator, eight viewers, two cartridge storage facilities for the master fingerprint file, one cartridge storage facility for the jacket file, and adequate storage for the master film copies.

The analysis briefly considered the costs associated with establishment of such microfilm files, and found that accurate costs depend on decisions yet to be made by CIS. Nevertheless, total one time costs to establish the two microfilm files should be in the range \$50-\$75K, not including labor costs associated with file conversion.

We find that establishment of the microfilm files will result in a reduction in space required for file storage; total file space should be about equivalent to

that of a few standard desks, assuming that the paper files are either destroyed or placed in archival storage offsite. Weight reduction for the files will also be accomplished so that floor loading will no longer be a problem.

Use of the microfilm medium for the master fingerprint file should result in higher file integrity, a lower misfile rate, and a lower "out of file" rate during verification process. Thus, microfilm will result in a somewhat higher accuracy rate.

Use of the microfilm medium will result in a faster verification process since large subfiles of the manual file need not be viewed. This will result in lower operating costs measured in technician time per card processed, and these lower operating costs should more than offset the operating costs of the microfilm file maintenance processes.

SECTION V. RECOMMENDATIONS

General Recommendation

CIS should make an immediate commitment to microfilm for the master fingerprint file and jacket file, on a schedule directed toward operational use of such microfilm in one year.

Specific Recommendations

The microfilm master fingerprint file and the microfilm jacket file should be coterminous in contents with the computerized criminal history file. That is, the source documents for each and every entry for CCH should be on microfilm, and no other source documents should be microfilmed.

The master fingerprint file should represent new subjects only. Only the front of the arrest fingerprint card should be microfilmed, and microfilm frames should be added to the master file in the order in which they are entered into the computer. For the initial bulk conversion, the cards can be microfilmed in any convenient order.

All source documents for the CCH file should be microfilmed for the microfilm jacket file. This includes the arrest fingerprint cards (front and back) even if they have already been microfilmed for the master fingerprint file. Disposition reports, FBI tissues, and any other source documents should be filmed. Before filming the source documents should be stamped with a "date of entry" data element from GCH.

Eight work stations should be used for namesearch, technical search, and CCH updating. Each station should be equipped with a CRT for computer access and a microfilm viewer for master fingerprint file access. The microfilm viewer should be of the type which uses a cartridge film and keyboard entry to locate/display a desired frame under operator control. The work stations should be positioned in two clusters of four work stations each, each cluster holding one working copy (diaz) of the entire master fingerprint file.

The CCH computer record format should be modified to allow reel/frame number as a data element, and to display this data element at the completion of namesearch and technical search.

The computerized namesearch routine should be modified to provide higher selectivity in this process. The present namesearch provides all soundex equivalents of the last name. Procedural and technical modifications are available to allow presentation only when an exact match occurs on last name, sex, race, and month/day of birth. (The same goal could be achieved by using the same namesearch routine but using highlighting, reverse video, or blinking in the CRT display to show a more selective namesearch).

A computerized technical search method should be modified to provide adequate notification to the operator when the results of the technical search are negative. The present situation, in which the entire computer file is searched before negative results are announced, represents a flaw in the system software. Discussions with a representative of the software vendor during this technical assistance suggest that the vendor will fix this flaw under warranty.

Action Plan

The following major steps, presented in rough order of chronological sequence, could lead to the implementation of the microfilm system in CIS in about twelve (12) months.

Summer 1976

CIS should commit itself to the concept of microfilm files for the master fingerprint file and the jacket file in accordance with the recommendations given above. Immediately after this commitment, the new entries to the master fingerprint files should be marked in some way so that they can easily be retrieved from the manual file when microfilming begins. We recommend that the lower lefthand corner of each master fingerprint card be clipped so that clerical personnel can easily retrieve them later. At the same time we recommend

"trapping" those unprocessed arrest fingerprint cards now in backlog. During the period when the computerized system was being implemented, a three month backlog of arrest fingerprint cards built up. It would be better to set these aside temporarily and process incoming cards as they arrive, so that CIS is sure that the present staffing is capable of handling the present load. As time permits this backlog can be worked off. Also at this time, CIS should either arrange travel to states which already use microfilm master fingerprint files or arrange to have samples of microfilm from those states provided to Colorado, and for vendors to bring in viewing equipment for testing. Samples should be obtained of 16mm and 35mm films, in both positive and reversal formats. States to be considered include Arizona, Florida, and Minnesota.

Fall 1976

CIS should make the decision between 35mm and 16mm film, and between positive and reversal projection. Potential vendors should then be called in for rough price estimates of the configurations described earlier in this paper. Potential vendors include Kodak and Bell and Howell (of course other vendors exist and should be consulted when the actual purchase is made). At the same time modifications described in this paper should be provided for the computerized namesearch technique. CIS may also consider providing a check digit for the SID number in the computerized file since this number is so important in providing file linkages. Techniques of developing and producing SID with check digits are well known. Also at this time a decision should be made by CIS concerning the location of the film processing equipment for the microfilm files. Film processors require water, drains, electric power, and sometimes air filtration/exhaust. At the conclusion of these activities a grant application for microfilm equipment procurement and initial conversion can be prepared, assuming CIS intends to use LEAA grant funds.

Winter 1976

CIS should investigate the progress of the evaluation project now getting underway concerning Arizona automated technical search system, and decide whether such a system should be installed in Colorado and what changes in the microfilm plans are appropriate. Similar technical search systems are also being developed by Rockwell Corporation and Calspan Corporation and should similarly be investigated at this time. Also, the New York identification bureau project to develop a man-computer system for classification assistance should be investigated to determine its impact on the Colorado decision. At this time CIS should also perform a simple statistical experiment to determine the reliability and selectivity of the computer assisted technical search system now employed. It is possible that the fine breakdown of pattern types and extensive ridge counting in the implemented system will result in too many errors in level. If so, simple patches are available to make the system work satisfactorily. Also at this time, the computer records for CCH can be modified to allow inclusion of reel/frame number on the individual record segments. Such modification is necessary in order to provide the necessary linkage to the master fingerprint file.

Spring 1977

At this time CIS can develop an RFP and go out on bid for the necessary microfilm equipment.

Summer 1977

At this time the microfilm equipment can be procured and conversion of files begun. Initial filming will consist of the master fingerprint file entries which have the corners cut in accordance with the earlier recommendation. Following that, entries from the CCH file can be extracted and printed in order of their Henry classification; clerks can then extract those cards from the master fingerprint file for filming. Similarly entries to the jacket file can be extracted from the present files and filmed in a bulk conversion form. Once the master fingerprint file has been filmed, there will remain a manual master

fingerprint file consisting of older arrest fingerprint cards not in CCH, and applicant cards (which are no longer being retained). These older applicant cards should be purged from the manual file (a small statistical experiment conducted during the technical analysis indicates that at least 1/3 of the master fingerprint file consists of applicant prints). The small remaining master fingerprint file can be slowly brought into the CCH/microfilm file as time permits.

What remains after these functions is the "old backlog" which consists of fingerprint cards delivered by local law enforcement agencies when the Colorado bureau was established. As time permits these can be integrated into the CCH/microfilm files, although no great loss would be suffered if they were destroyed.

Final Comment

Colorado has made major strides to becoming a "model" state identification bureau. It already operates with substantially lower labor costs than most bureaus its size. With the establishment of microfilm files, its operational costs will be even further reduced and its service level improved.

END