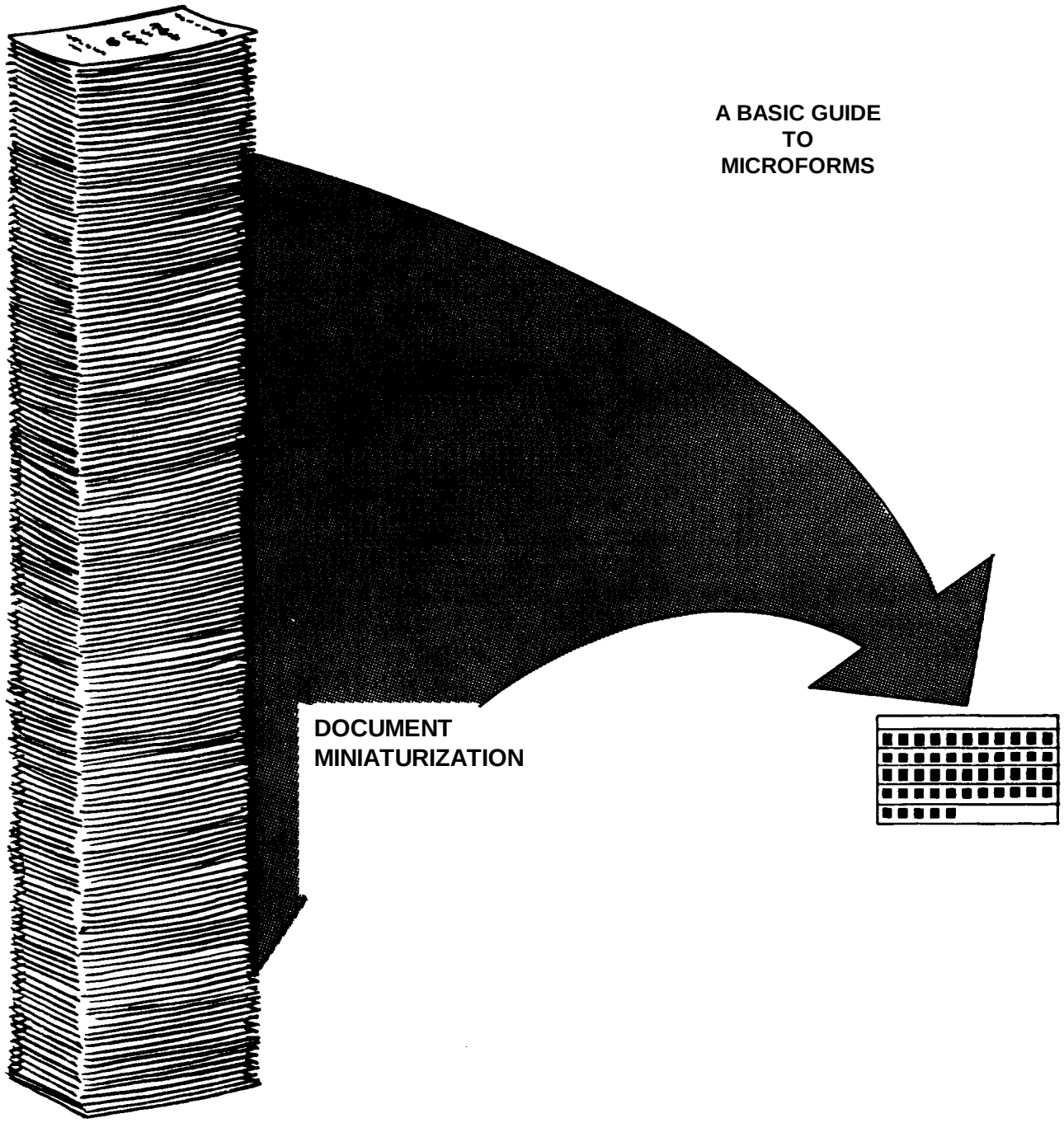
A BASIC GUIDE TO MICROFORMS



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DOCUMENT MINIATURIZATION

CHAPTER 1

INTRODUCTION

1-1. Purpose and scope. *a*. This bulletin is intended to supplement the policies in AR 340-22, as well as to provide a guide to Army officials involved in developing a document miniaturization system. It discusses basic microform types, formats and equipment, and in addition touches on video tape. Then it outlines objectives of and approaches to planning, financing, and selecting a record miniaturization system.

b. The various terms used in this bulletin are listed in appendix A, with brief explanations. At appendix B, selected articles are reproduced to aid Army officials in broadening their knowledge of certain aspects of records miniaturization.

c. Technicalities of producing microfilm and other microforms are not discussed in detail, as these subjects as well covered in Army and commercial publications. Computer Output Microfilm (COM) is discussed generally to acquaint the reader with its characteristics and uses.

1-2. History of microfilm. The development of microfilm has an interesting history, which can be found in many publications relating to the subject. Although the principles of photography were known for several centuries, the concepts of reducing a life-size object to a small picture did not become a reality until the early 1800s. The year 1839 marked the first successful experiment of document reduction on film, but it was not until 20 years later that its potential was recognized. It immediately became the tool of spies during that period and was used extensively to record secret documents. The development of practical equipment fostered the use of microfilm by private industry in the 1930s, but it took almost 20 more years before microfilm was considered for use in active records systems. From 1950 on, new innovations in both supplies and equipment were rapidly developed, until microfilm reached the state of the art it is today.

1-3. Background. *a*. During the last few years, hard copy paper documents have increased so greatly that two problems were created: (1) availability of space became critical, and (2) referencing operations became more difficult because of the sheer volume. Space problems were easily solved in many instances by turning to microfilm, but conversion solely for space reasons often proved costly.

b. In recent years the concept of microfilm has changed from simply a dead-storage medium to its potential as an active record. Initially, only rare books and aging documents were microfilmed in the interest of preservation. As technology improved, easier and faster methods were developed, resulting in the use of microfilm for other records purposes.

c. Many problems have arisen in the maintenance and retrieval of hard copy paper documents, due in part to an increasing shortage of competent files personnel. Attempts by hardware manufacturers to automate folder retrieval equipment met with only minimal success, because of the enormous difficulties in mechanically transporting larger documents. Consequently, the microfilm and hardware industries joined forces to develop automated equipment for miniaturized documents.

d. Microforms are now automated in various ways. Following closely behind are companies interested in promoting pictures of forms on video tape, as a television program is taped for future use.

e. Many problems and difficulties are still to be overcome, but progress continues to be made. All individuals involved in records management should become conversant with new developments in miniaturized document systems.

1-4. Archival considerations. *a*. Federal law permits acceptance of microfilm copies as admissible evidence under certain conditions. Most states are in accord with the law, although they are not bound by the Federal Act. Section 1732 of Public Law 129 is quoted in figure 1-1.

b. Only silver film has been accepted as being of archival quality. Although other types of film

are widely used for operational purposes, microfilming of permanent records must be on silver film. Because it is a relatively new process, video (magnetic) tape has not yet been put to a legal test and no legislation is being conducted in this regard. Likewise, archival quality is an unknown factor.

c. Although much data may be maintained in digital or computer language, certain documents must be retained in human readable form because of their long-term values.

(1) *Legal*. Documents containing evidence of legally enforceable rights or obligations of an individual, the Army or the Government. These involve such matters as contractual agreements and financial commitments for which a signature is in question.

(2) *Audit trail*. Documents that permit tracing computerized information to its source.

(3) *Historical.* Documents concerning an individual or an event which derive their importance from the prominence of the person or the impact of the incident on society.

1-5. Psychological outlook. A look into only the barest essentials of document miniaturization will reveal the broad, complex, and often confusing array of equipment, methods, systems, supplies, and services. Industry has millions of dollars invested in new ideas, plans and concepts, and potential users must learn to distinguish the practical from the impractical.

a. Ever since stone tablets were replaced by paper products and writing implements, people generally have become accustomed to having complete control of a record, book, or folder when taking any official action. Watching a story in a movie or on television is one thing, but reviewing documents on a lighted screen is something else. In the latter case, the viewer can observe only one item at a time; he cannot compare documents side by side as he was accustomed to doing with paper records; he cannot make notes on, the document he sees; he cannot carry the file to his superior for consultation; he cannot visually see what the entire file looks like. In short, he feels he has lost the command he previously exercised over the file.

b. If management has recognized the advantages of miniaturizing large collections of documents, the users generally have not. They are normally resistant to a change which severely modifies their way of doing the job, and indeed, often jeopardizes their very continuance on that job. For this reason, special consideration must be given to the effect such a changeover will have on the personnel involved. Special effort should be made to keep them informed of their relationship to the new system.

c. Users are accustomed to having the document in their hands, and to have assurance that they can quickly "put their hands on it" again. Some may try to go overboard with equipment which has reproducing capability simply for this reason. This should not happen. Printers which are indiscriminately scattered throughout an office will, in a few years, create private files and negate the purpose for which the system was established.

d. Conversion to a miniaturization system can seriously disrupt a large files activity. If the change can be accomplished within a matter of weeks, the transition may cause nothing more than a few ripples. However, large, sophisticated systems take months of planning, more months for delivery of equipment, still more months for conversion, and finally, additional months or years to make the system operate effectively. Depending on the size of the system, one, two, three, or more years is not uncommon, and during this time, the old system must also be maintained. In the interim, improved processes may have been developed, but the investment already made prohibits retracing steps.

1-6. Reaching a conclusion. Deciding on a miniaturization system is not a simple matter of selecting pieces of equipment off the shelf, but rather a matter for intensive study to determine the most useful arrangement for a particular application. Microfilm as an active medium has shown itself to be the most manipulable and convenient of any hard copy form. Video tape, which is just emerging as a medium, has some distinct advantages, but acceptance has been slow. In time this may become a major means of storing and retrieving documents. Other processes for recording are continuously under study, including laser and holography, as well as some exotic methods which may never materialize. In spite of the tremendous advances in technology, we have only scratched the surface.

1732 RECORD MADE IN REGULAR COURSE OF BUSINESS; PHOTOGRAPHIC COPIES

(A) In any court of the United States and in any court established by Act of Congress, any writing or record, whether in the form of an entry in a book or otherwise, made as a memorandum or record of any act, transaction, occurrence, or event, shall be admissible as evidence of such act, transaction, occurrence, or event, if made in regular course of any business, and if it was the regular course of such business to make such memorandum or record at the time of such act, transaction, occurrence, or event or within a reasonable time thereafter.

All other circumstances of the making of such writing or record, including lack of personal knowledge by the entrant or maker, may be shown to affect its weight, but such circumstances shall not affect its admissibility.

The term "business," as used in this section, includes business, profession, occupation, and calling of every kind.

(B) If any business, institution, member of a profession or calling, or any department or agency of government, in the regular course of business or activity has kept or recorded any memorandum, writing, entry, print, representation or combination thereof, of any act, transaction, occurrence, or event, and in the regular course of business has caused any or all of the same to be recorded, copied, or reproduced by any photographic, photostatic, microfilm, micro-card, miniature photographic, or other process which accurately reproduces or forms a durable medium for so reproducing the original, the original may be destroyed in the regular course of business unless its preservation is required by law. Such reproduction, when satisfactorily identified, is as admissible in evidence as the original itself in any judicial or administrative proceedings whether the original is in existence or not and an enlargement or facsimile of such reproduction is likewise admissible in evidence if the original reproduction is in existence and available for inspection under direction of court. The introduction of a reproduced record, enlargement, or facsimile does not preclude admission of the original. This subsection shall not be construed to exclude from evidence any document or copy thereof which is otherwise admissible under the rules of evidence. As amended Aug. 28, 1951, c. 351, #1, 3, 65 Stat. 206; Aug. 30, 1961, Pub.L. 87-183, 75 Stat. 413.

Figure 1-1. Legal status of microfilm.

CHAPTER 2
THE SHAPE OF MICROFILM

2-1. General. Microfilm is normally produced in roll form, regardless of the desired final format. It is available in five widths:

8mm (approx 5/16 in.)
16mm (approx 5/8 in.)
35mm (approx 1 3/8 in.)
70mm (approx 2 3/4 in.)
105mm (approx 4 1/8 in.)

Of these, the most widely used are 16mm and 35mm. This chapter deals essentially with the types of film, its various formats, its characteristics, and how it can be used.

2-2. Problems in converting to microfilm. Microfilming of records is a slow, deliberate process, regardless of the speed of the equipment. It is not just a simple matter of setting up a camera and photographing the documents. Managers contemplating a conversion must recognize these two major conditions:

a. Once put in any format of microfilm, the documents will stay in that order. For this reason, an existing file must be arranged in correct sequence to prevent serious reference problems when the job is completed. If this is not done, development of a complex indexing system is necessary. Otherwise, a user has no way of quickly recognizing deviations from the standard filing pattern as in the case of folder filing. In addition, many manual operations (e.g. removal of staples, straightening of papers, and mending tears) must be performed prior to filming documents.

b. Wide variations exist in the physical characteristics of documents, particularly in paper color, contrast, density, and size. These make the production of good quality microfilm a demanding process for most persons to undertake. When large numbers of documents are photographed day after day, the precise adjustment of exposure can be critical.

2-3. Types of film. There are three basic types of film being used, and each has different properties. Tests are being conducted with new varieties but most have not yet reached the marketing stage.

a. *Silver halide*. From a physical standpoint, this film is very similar to that used in ordinary still and motion picture cameras. However, film used for microfilming is of a much higher quality and capable of recording fine detail. This is a reversing type of film and, when used photographically, it always produces a negative image, i.e., the opposite of the original. (Copies made on silver film' from this negative produce a positive image.) At present, silver film is the only type accepted as having archival quality when properly processed. Processing is best accomplished by persons knowledgeable in this field, as it requires the utmost care in developing, washing, and drying to meet archival standards.

b. *Diazo.* Because of its low light sensitivity, diazo film cannot at present be used as camera film successfully. However, it is widely used as copy film. The primary use of diazo film is as a *non-reversing* medium, i.e., the image produced is a positive if the original is positive, or negative if the original film is negative. Reversing diazo film is obtainable, but its use has been rather limited. Production of duplicates on diazo film can be done rapidly and inexpensively by the using agency. The film base itself is highly resistant to scratching, tearing and breaking as well as to fungus attack. Images on diazo film are subject to some fading over long periods of time, and it is a good practice to protect them from extended exposure to bright light. Although diazo film copies do exist which are more than 25 years old, no determination has been made regarding their archival quality.

c. Vesicular. This is a thermal (heat) type film, and although some experimentation has been done, it is not used as camera film. As with diazo, it is also widely used as a copy film. It is mostly used as a *reversing* medium, i.e., the image produced is a positive when the original film is negative, or a negative when the original film is positive. Non-reversing film is obtainable, but has not been used extensively. Duplicates can be produced

rapidly and inexpensively on this film, and new improvements promise even greater speeds. Light and heat are the only agents necessary for processing and chemicals are not required. Although vesicular films exist which are over 10 years old, no determination has been made on their archival quality.

d. Films of the future. A number of methods of recording on film, as well as new types of film, are continually under study.

(1) A process called "photochromic imaging" records and produces an image without the need for development. Through this process, ultrahigh reduction ratios have been achieved and images can be erased and rerecorded in the same area. Only a few pilot applications have been tested.

(2) Dry silver film is currently used solely for specific applications by its manufacturer. Its major advantage is that it is developed by a heat process and requires no chemicals.

(3) Recording by laser which requires no lens but records by reflected light, is being studied in several areas. A hologram, which provides a 3-dimensional image, can be produced by this method. However, since the printed word has only two dimensions, document applications may be limited for some time pending further technical developments.

(4) "Updatable" microfilm has received periodic publicity. This process would theoretically permit unexposed portions of a microfiche to be available for repeated additions of documents at future times. However, little concrete information is available on this technology. Some experimentation has been conducted with vesicular and electrostatic types of film.

2-4. Microfilm formats. A number of different formats can be designed from standard roll microfilm. The choice of format depends on the use intended, the amount of reference required, the kind of storage or retrieval equipment to be used, and the number of persons involved in its use. Each is discussed below.

a. Roll film. Microfilm wound on standard reels is generally used only where there is a low reference activity. Although it is useful in certain applications, loading the reader and locating a record is a slow process. For purposes of this bulletin, roll film will be considered primarily as the first step to one of the other formats. Photographic arrangements (fig 2-1) for roll film are as follows:

(1) *Simplex,* with pages filmed in sequence using full film width. Page orientation can be "comic," with pages right reading along the length of the film, or "cine," with pages right reading from edge to edge of the film.

(2) *Duo*, with pages filmed in sequence using first one-half of the film width, then reversing the reel to continue filming on the remaining half.

(3) *Duplex*, with front (F) and back (B) of documents filmed side by side.

b. Cartridge. The cartridge, sometimes called a magazine, is a roll of film to which has been added some extra features (fig 2-2). No hand threading in a reader is necessary, as this is done automatically by the reader mechanism. The film winds onto a separate reel, and rewinds into the cartridge when the search is completed. Although cartridge film can be coded in various ways to facilitate searching, it still has some of the inherent disadvantages of roll film:

(1) The cost of viewing and film duplicating equipment is higher than for most other formats.

(2) Because many documents are contained on the same reel, it is possible that while one person is using the cartridge, others must wait their turn.

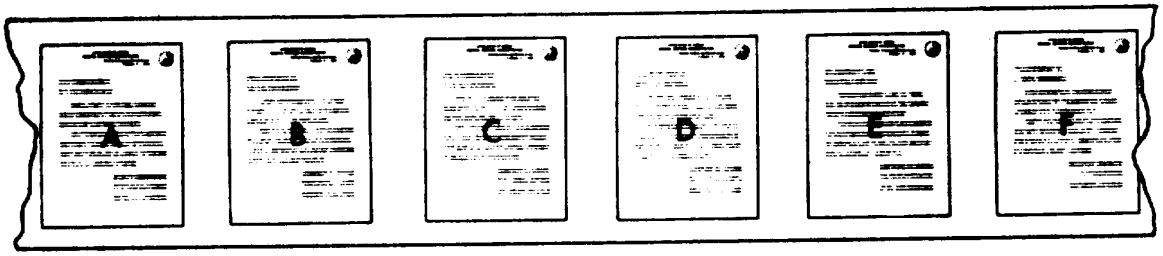
(3) It is difficult and time-consuming to add documents. Either the new frame is spliced into the master, or the added documents are filmed on a supplemental roll for which additional indexing is required.

c. Cassette. From an operating standpoint, the cassette is very similar to the cartridge (fig 2-3). The major difference is that it has two self-contained reels instead of one, which provides the advantage of never having to rewind the film. It can be inserted and removed at any point at which searching has stopped.

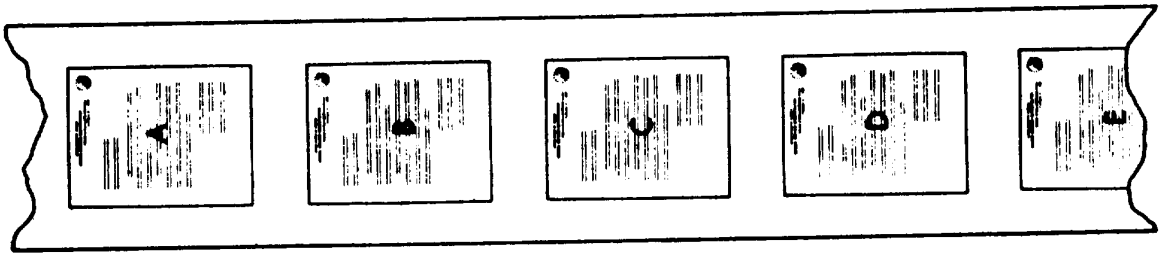
d. Aperture card. This is ordinarily a "tab" size card, with an opening into which a frame of film is mounted (fig 2-4). The largest single use is for engineering or architectural drawings. Some types may have several openings for a limited number of related documents. The film size most commonly used is 35mm, but 16mm sizes are also available. Aperture cards provide a flexibility in filing, searching, and updating because of their "single document" nature. They can also be punched and used in sorting devices, - although there is the possibility of damage to the film surface in sorting and collating machines.

e. *Jacket*. Jacketed film probably has the widest

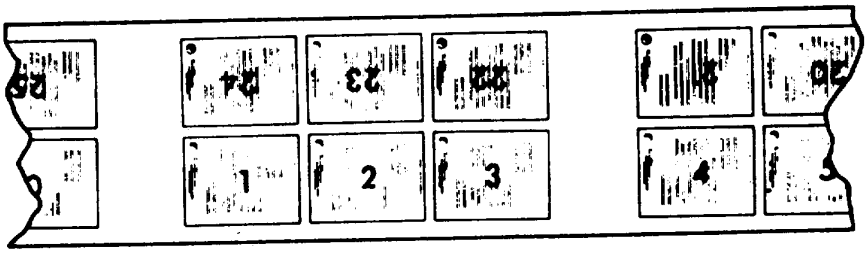
IMAGE FORMATS ON 16mm. ROLL MICROFILM



Simplex — Comic



Simplex — Cine



Duo

Duplex

Figure 2-1. Microfilm formats.

use of all the formats because of its versatility (fig 2-5). The jacket is made from two thin sheets of clear acetate, laminated together in even segments to form channels. Strips of roll film, usually 16mm, or in many cases individual frames, are inserted into these channels. They are available in several sizes, the most popular being 5 x 3 inches, 6 x 4 inches, 8 x 5 inches, and "tab" size. This is one of the few microfilm media in which the documents can be changed or added to without disturbing or redoing the remaining document images. Although it is not difficult to do this, there is presently no way to do it rapidly, especially in a large file collection.

(1) A type of jacket is also available as a

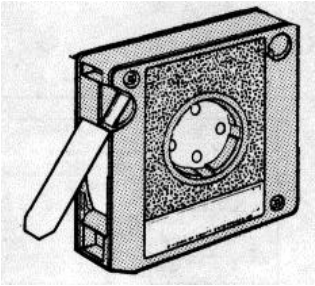


Figure 2-2. Cartridge.

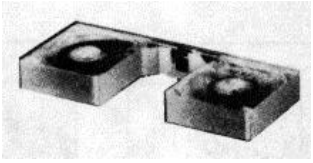


Figure 2-3. Cassette.

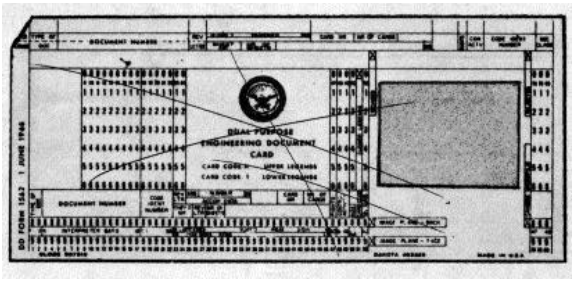


Figure 2-4. Aperture card.

modified aperture card, in which the apertures are placed to form channels by mounting clear acetate on both sides of the openings.

(2) Another type fastens the strips of film to a clear sheet of acetate by an adhesive method, instead of inserting them into channels.

(3) Jacketed film can be used as the main file, but it is better to use it as a master record from which duplicate film (microfiche) is made for searching and retrieval purposes. The loss of a master jacketed film is equivalent to losing 60 to more than 100 pages.

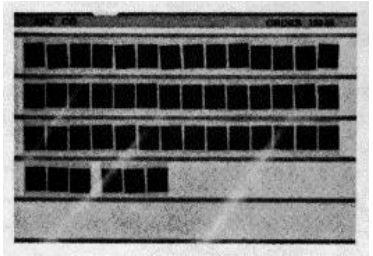


Figure 2-5. Jacket.

f. Microfiche. Usually, microfiche are diazo or vesicular film duplicates of a master jacketed silver film. It is gaining wide acceptance in many applications because of its many practical aspects. It is also possible to make microfiche directly on silver film with a specific type of camera, but this method is not feasible for files in which interfiling is done regularly. The various microfiche formats are shown in figures 2-6 and 2-7 for which the most accepted standard is the 6 x 4 in either the COSATI format or the NMA format. These figures show the high reduction (HR) types, which provide gross compaction of documents on one fiche. Beyond space saving, an extremely high reduction ratio provides no known benefit in operational use. Its production cost is much greater than that of the commonly used reductions; compaction of so many documents on one fiche severely restricts availability; viewers must be more sophisticated because of the extremely small tolerance between frames. From a practical standpoint, it would appear that a reasonable reduction in size is all that is needed at the present time. Microfiche has several advantages over roll film:

(1) It can be duplicated at very low cost, and furnished to users in its entirety. Because it is inexpensive, the duplicate can be discarded when no longer needed by the user.

(2) It can be mailed as simply as a letter.

(3) It can be notched, coded or indexed for a variety of types of retrieval equipment.

(4) Viewing equipment is less costly than that for roll film.

(5) One or two microfiche can contain an average file of related documents.

2-5. Film indexing. Some means is required for locating the desired individual image or series of images on microfilm. Without an indexing system, documents must be visually scanned to locate a particular image.

a. Microfiche and jacket indexing is based on, a simple X-Y coordinate system. This means only that an image is located at the juncture of a specified row and column. If, for example, the columns in a 98-frame format are identified as 1 through 14, and the rows as A through G, a document in coordinate B3 would be found in the second row, third column. Starting point is usually at upper left frame, but can be at other

MICROFICHE FORMATS (4X 6)

THE 4" X 6" MICROFILM CARD (105MM X 148.75MM) IS ONE SIZE COMMON TO ALL FICHE STANDARDS. ALL STANDARD FICHE HAVE A HUMAN READABLE TITLE AREA.

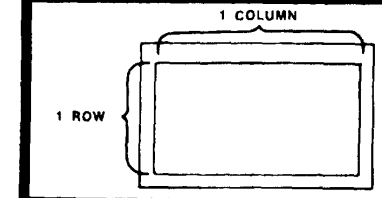
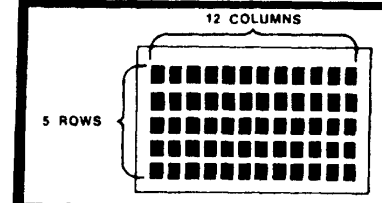
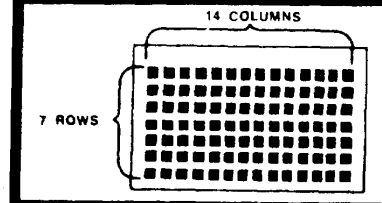
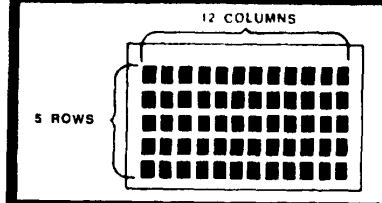
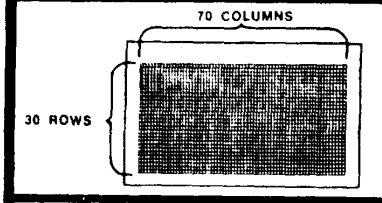
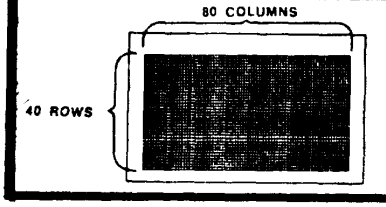
NUMBER OF ROWS (X-AXIS) AND NUMBER OF COLUMNS (Y-AXIS)	STANDARDS	MAXIMUM REDUCTION RATIOS	TOTAL NUMBER OF MICRO-IMAGES, PAGES OR FRAMES
	**105 MM** FOR ENGINEERING DRAWINGS AND GRAPHIC ARTS	**12:1**	**1** SIZE OF DOCUMENT: (ENGINEERING DRAWING)
	(THIS FORMAT BEING PHASED OUT) **COSATI** (COMMITTEE ON SCIENTIFIC AND TECHNICAL INFORMATION) **MICROFICHE**	**20:1**	**60** SIZE OF DOCUMENTS: (8½" X 11")
	**NMA** (THE NATIONAL MICROFILM ASSOCIATION) **MICROFICHE**	**24:1**	**98** SIZE OF DOCUMENTS: (8½" X 11")
	(THIS FORMAT CONVERTING TO NMA) **DOD** (DEPARTMENT OF DEFENSE) (AND EUROPEAN) **MICROFICHE**	**24:1**	**60** SIZE OF DOCUMENTS: (LEGAL SIZE) OR (EUROPEAN LETTER SIZE)
	**HR-FICHE**	**120:1**	**2100** SIZE OF DOCUMENTS: (8½" X 11")
	**HR-FICHE**	**150:1**	**3200** SIZE OF DOCUMENTS: (8½" X 11")

Figure 2-6.

MICROFICHE AND APERTURE CARD FORMATS (Tab Size)

THE TABULATING CARD, EDP CARD (ELECTRONIC DATA PROCESSING) OR THE EAM CARD (ELECTRIC ACCOUNTING MACHINE)... ALL HAVE A STANDARD SIZE OF 3.250 INCHES BY 7.375 INCHES.

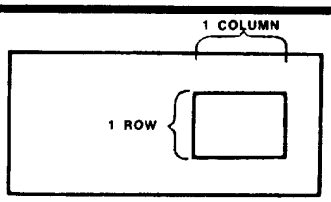
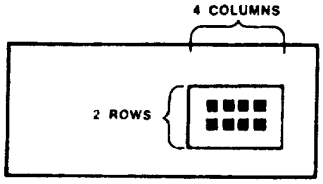
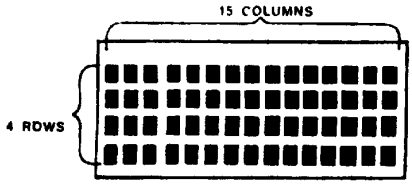
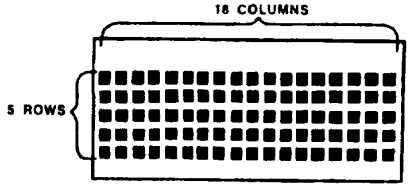
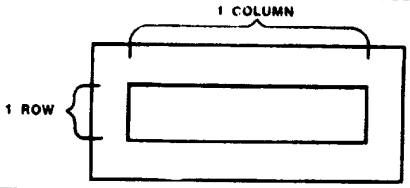
NUMBER OF ROWS (X-AXIS) AND NUMBER OF COLUMNS (Y-AXIS)	STANDARDS	MAXIMUM** REDUCTION RATIOS	TOTAL NUMBER OF MICRO-IMAGES, PAGES OR FRAMES
	APERTURE CARD	30:1	1 SIZE OF DOCUMENT: (ENGINEERING DRAWING)
	"PACKED" APERTURE CARD	24:1	8 SIZE OF DOCUMENTS: (8½" X 11")
	NMA MICROFICHE	20:1	60 SIZE OF DOCUMENTS: (8½" X 11")
	NMA MICROFICHE	24:1	90 SIZE OF DOCUMENTS: (8½" X 11")
	CIM-CARD (CONTINUOUS IMAGE MICROFILM)	40:1	1 SIZE OF DOCUMENT: UP TO A 3 FOOT BY 12 FOOT ENGINEERING DRAWING

Figure 2-7.

locations. Reading pattern can be either left to right or top to bottom.

b. Roll film in all formats requires a more positive type of indexing, which ranges from the simple to the sophisticated. Some of the more common types are described below, and are illustrated in figure 2-8.

(1) *Flash card or flash target*: a distinctive, bold image used to separate file segments or sets of documents, which identifies the images that follow.

(2) *Film measurement:* method which uses a device like an odometer on the viewer which sequentially measures the film length transported,

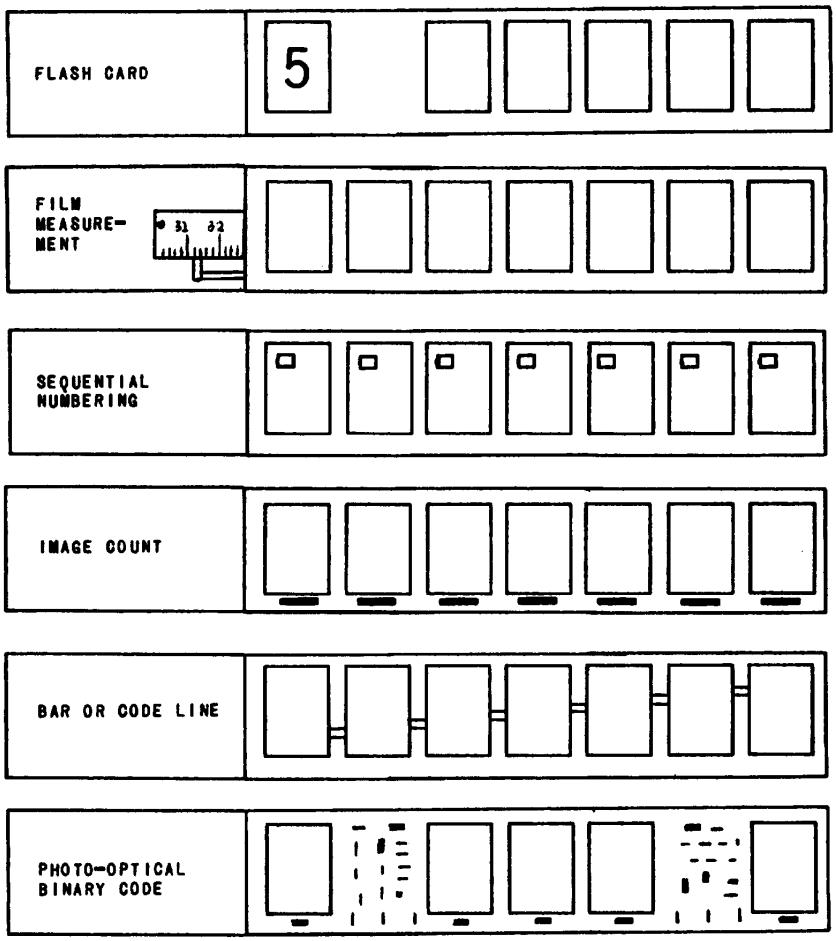


Figure 2-8. Methods of indexing.

and locates documents within one or two frames.

(3) *Sequential numbering*: a number placed in a fixed position on each document prior to filming which can be identified on the viewer screen. Although numbers may be skipped, they must be in strict numerical order.

(4) *Image count*: marks (blips) below the frames are counted electronically and used by the machine to control image retrieval in a linear sequence.

(5) *Bar or code line*: bars or lines between the frames have positional value as related to a scale along the edge of the viewer screen.

(6) *Photo-optical:* binary code: document numbers or index terms recorded in optical binary code before each document; used with electronic logic systems for retrieval.

2-6. Basic uses of microfilm. There are generally six broad uses of microfilm:

a. Procedural (to effect economies in labor and improve efficiency). Certain record functions can benefit by converting a file to a microfilm format, such as an active records collection which is used in day to day activity.

b. Security (to insure continuity in event of possible destruction of essential records). Essential records sometimes are microfilmed as insurance against loss or destruction. The paper records may then be retained at the point of origin and the microfilm stored at a more secure location. Because microfilm greatly reduces the bulk, this condensed volume can be accommodated in a relatively small vault or insulated safe.

c. Intermediate (to use the microfilm as a master for reproduction of paper copies). Where large volumes of identical documents are to be reproduced for distribution to two or more recipients a microfilm intermediate may offer advantages in speed, cost, and efficiency. In this sense, the documents are rapidly filmed, processed, and immediately copied in paper form, and the microfilm destroyed.

d. Disposal (to save space and files equipment). This application is generally reserved for those documents which have a very low reference activity, but which must be retained permanently or for many many years. Space and equipment savings must be equal to or more than the cost of microfilming. Approximately 200 file drawers of letter-size material can be stored on microfilm in one 9-drawer microfilm file cabinet, and floor space requirements reduced from 300 square feet to 6 square feet.

e. Preservation (to preserve deteriorating records). When records of permanent value are found to be deteriorating, becoming brittle, or fading, microfilming may prove to be an economical method of preserving the information contained in the records.

f. Micropublishing (to duplicate film in multiple copies for broad distribution). This type of microfilming lends itself to various types of publications used as reference material. It includes technical reports, scientific papers, catalogs, repair manuals, and similar items. It operates by providing a copy of the microform instead of the paper copy.

2-7. Computer Output Microfilm (COM). This process is a method of *converting* data from magnetic tape to readable images on film, as opposed to the conventional method of *photographing* paper documents. The primary use of COM has been to provide a faster and more convenient reference medium, and to replace the drudgery of repetitive printing of computer-printer paper copy output for mass distribution. Itemized listings, catalogs, and columnated reports, all of which normally require frequent updating of data, are the types of records most suitable for COM, simply because they are extremely compatible with computer manipulation. As a matter of interest, the methods are briefly explained:

a. Cathode Ray Tube (CRT) recording is the most widely used method. It is accomplished by a recorder mechanism, in which a camera photographs pages of data as it appears on the CRT. The CRT is much like a television tube, which displays readable images converted from magnetic tape. High speed recording, reaching an output of 100,000 characters per second, is typical of this type of unit. The film used in the camera is of the silver halide family, which is processed with wet chemicals in the conventional manner.

b. Fiber optics recording generates readable characters to silver halide film in a dot array through light-emitting diodes. It records one line at a time at a rate of about 30,000 characters a second. As with the CRT, the film must be processed by conventional methods.

c. Electronic Beam Recorder (EBR) records readable data on film directly from magnetic tape. Speed attains a rate of about 60,000 characters per second. No camera is involved, and the film is a thermal type which requires no wet processing, but is dry developed within the unit.

2-8. Care of microfilm. Although film is not overly sensitive to normal use, it can be damaged by indiscriminate handling.

a. Silver film is the most vulnerable to careless handling because scratches, fingerprints, and dust can damage the emulsion and eventually render it useless. For this reason, duplicates should be made if the microform is to be used for reference purposes.

b. Reasonable caution should be exercised in the handling of any microfilm. Any sliding action between pieces of film will cause minute scratches or abrasions. They can be caused by pulling the end of a roll of film to tighten it on the reel, or by collapsing a "telescoped" roll of film. Dust or foreign matter on the mechanical devices in which film is used can likewise cause abrasions.

c. Film created for archival purposes should be stored in specially constructed cabinets in which temperature and humidity conditions can be controlled. The recommended conditions under which such film should be kept for extended periods of storage are 40 to 50 percent relative humidity and 60 to 80 degrees F, but preferably closer to 70 degrees.

d. Diazo and vesicular films are less likely to be damaged by handling than is silver film, because they have no actual emulsion. They are not overly sensitive to humidity and changes in temperature, and can be cleaned with soap and water.

CHAPTER 3

MICROFILM EQUIPMENT

Section I. GENERAL

3-1. Scope. This chapter discusses types of microfilm equipment and lists those of known manufacturers. No attempt is made to describe all the various models or their specifications in view of the many items available, the frequent additions and deletions of models, and the continuing changes in design and capabilities.

3-2. Procurement sources. Equipment for use in document miniaturization systems is varied and may come from different sources.

a. In advanced .microfilm configurations, one company may furnish the filming devices, another the supplies, and a third the retrieval and access equipment.

b. If many control factors and complex indexing are being used, still another company will probably be involved in supplying computer hardware and software. Also, a microfilm system may be interfaced with an existing computer configuration on a time-sharing basis.

Section II. TYPES OF MICROFILM EQUIPMENT

3-3. Major items. There are several major types of microfilm equipment which can become part of a total system. Generally, manufacturers of film retrieval equipment do not market film producing equipment, and except in a few instances, the reverse is also true. Even some large companies do not produce certain supplies, but obtain them from other firms that specialize in particular items. The chart in table 3-1 shows known manufacturers and their line of products. Each type is discussed in succeeding paragraphs.

3-4. Cameras. *a. Rotary or flow*. Rotary cameras operate much like roll fed copiers in that the original document is fed into the machine while the film is also advancing. At a steady pace, an operator can film an average of 3,000 letter-size documents an hour, provided the documents have been well prepared. Rotary cameras are limited in that they do not have a density control. To partially compensate for this lack, samplings can be made and the exposure set for average lighting (fig 3-1).

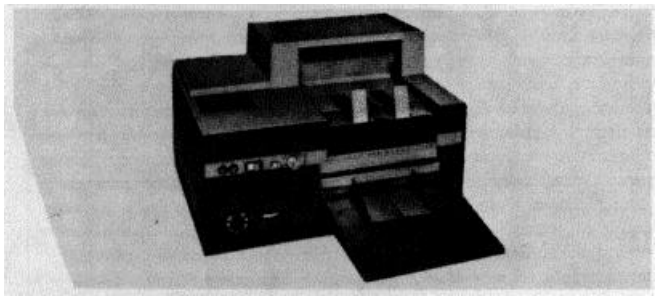


Figure 3-1. Camera (rotary).

b. Planetary. This type has the camera above the copy board, with lights on either side. The document is manually positioned. Most planetaries are precision instruments, and provide for control of light exposure, lens setting, and position in the film frame. Filming by planetary

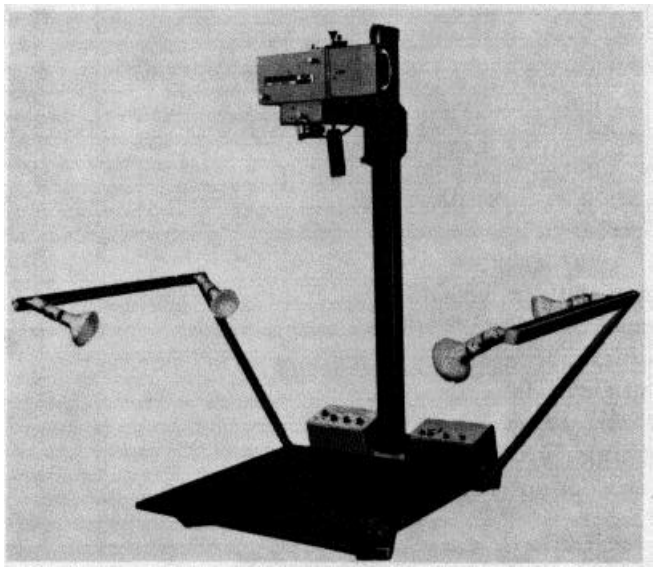


Figure 3-2. Camera (planetary).

Table 3-1. Microfilm Equipment Manufacturers

COMPANY NAME	CAMERAS	FILM PROCESSORS	FILM DUPLICATORS	JACKET FILLERS	CARTRIDGE LOADERS	APERTURE CARD MOUNTERS	READERS (Only)	PRINTERS (Only)	READER/PRINTERS	PROJECTORS	STORAGE (Only) UNITS	SEARCH-RETRIEVAL SYSTEMS	COM EQUIPMENT
ACCESS INFORMATION CONTROL SYSTEMS												X	
ACME VISIBLE											X	X	
ADVANCED TECHNOLOGY CORP.	X	X					X		X		X		
ADVANCED TERMINALS, INC.	X												
AGFA-GEVAERT	X	X					X						
ALLEN PRODUCTS, INC.		X	X										
ALOS, AG (Switzerland)							X						
ALPHA-VECTOR							X					X	X
ARCATA MICROFILM CORP.		X					X				X		
BELL & HOWELL	X	X	X				X		X		X		
BENDIX													X
BERKEY GRAPHIC MICROFILM	X	X				X		X					
BETA INSTRUMENT CORP.													X
BLUE-RAY, INC.			X										
BOLLE, GEORGE							X						
BOORUM & PEASE											X		
BRUNING		X	X				X				X		
BURROUGHS CORP.							X	X					X
BUSINESS EFFICIENCY AIDS											X		
CALCOMP													X
CAMERONICS	X												
CANON, USA	X	X	X				X		X				X
CAPS EQUIPMENT	X						X						
CASCADE MICROFILM	X	X				X	X		X		X		
CBS LABORATORIES		X	X										
CENTRAL MICROFILM SERVICE CORP.	X	X				X	X		X		X		
CINTEL CORP.		X											
C.O.M. CORP.							X		X				
COMPUSCAN													X
COMPUTER MICRO-DATA SYSTEMS							X						X
COMPUTER MICROGRAPHICS							X		X				
COMPUTER MICRO-IMAGE SYSTEMS													X
COMPUTER MICROVIEWING, INC.							X		X				
CONTROL DATA CORP.													X
CORDELL ENGINEERING		X											
CYTEK												X	
DASA CORP.	X	X				X	X		X				
DAKOTA MICROFILM						X						X	
DATAFLOW SYSTEMS												X	
DATAGRAPHIX	X	X	X				X	X	X		X	X	X
DATA REPRODUCTION SYSTEMS							X						
DENNISON								X	X				
DIETZGEN	X						X						
DIOPTRIX							X						
DOCUMENTATION, INC.			X				X		X				
DODGE, F. W.							X						
DSI SYSTEMS												X	
DUKANE							X						
DURST INDUSTRIAL ENGINEERING								X					

Table 3-1. Microfilm Equipment Manufacturers - Continued

COMPANY NAME	CAMERAS	FILM PROCESSORS	FILM DUPLICATORS	JACKET FILLERS	CARTRIDGE LOADERS	APERTURE CARD MOUNTERS	READERS (Only)	PRINTERS (Only)	READER/PRINTERS	PROJECTORS	STORAGE (Only) UNITS	SEARCH-RETRIEVAL SYSTEMS	COM EQUIPMENT
EASTMAN KODAK	X	X		X			X		X		X	X	X
EDNALITE CORP.							X						
ELLIOTT, B. K.	X	X	X	X			X	X	X	X	X		
ELECTRO PRODUCTS CO.							X						
ELECTRO-WORD	X											X	
EXTEK MICROSYSTEMS		X	X										
FOTO-MEM, INC.							X					X	
FREDERIC LUTHER CO.	X	X				X	X		X		X		
FUJI PHOTO, USA	X	X					X		X				
GAF CORP.			X	X			X						
GEORGE LITHOGRAPH CO.	X						X						
GRAFLEX							X						
GRAPHIC MICROFILM OF N.E.	X	X				X	X		X		X		
GRAPHIC PRODUCTS, INC.							X						
HEITZ, KARL							X						
H F IMAGE SYSTEMS	X	X	X						X		X	X	
H. WILSON CORP.											X		
I.B.M.	X		X						X				
IMAGE ENTERPRISES							X		X				
INFORMATION DESIGN, INC.					X		X				X		
INFORMATION HANDLING SERVICES, INC.							X				X		
INFORMATION INTERNATIONAL		X											X
INTERFACE SCIENCES CORP.	X							X					
ITEK	X	X	X			X	X		X				
JERSEY MICROFILM SERVICE	X	X				X					X		
JTC MICRO COM CORP.							X						
KALVAR	X	X											
KEUFFEL & ESSER	X	X	X			X	X		X				
KLEER-VU INDUSTRIES			X				X						
KONICA CAMERA CORP.	X												
LABTRON CORP. OF AMERICA							X						
LEET-MELBROOK	X												
LIBRARY RESOURCES							X						
MEAD-HATCHER ASSOCIATES											X		
MECHANICAL TECHNOLOGY, INC.			X										
MEMOREX		X	X				X	X					X
METAGRAPHIC SYSTEMS							X						
MICROBIZ	X						X		X		X		
MICROBOX	X												
MICROCARD EDITIONS											X		
MICRO DESIGN, INC.							X				X		
MICRODISPLAY SYSTEMS			X				X						
MICRODYNE CORP.	X												
MICROFILM EQUIPMENT, LTD.	X												
MICROFILMEX (France)							X						

Table 3-1. Microfilm Equipment Manufacturers - Continued

COMPANY NAME	CAMERAS	FILM PROCESSORS	FILM DUPLICATORS	JACKET FILLERS	CARTRIDGE LOADERS	APERTURE CARD MOUNTERS	READERS (Only)	PRINTERS (Only)	READER/PRINTERS	PROJECTORS	STORAGE (Only) UNITS	SEARCH-RETRIEVAL SYSTEMS	COM EQUIPMENT
MICROFILM FOTOSTAT							X						
MICROFILM PRODUCTS							X						
MICROFORM DATA SYSTEMS							X		X			X	
MICROGRAPHIC TECHNOLOGY CORP.	X											X	
MICROIMAGE CORP.							X						
MICRO INFORMATION SYSTEMS									X				
MICROMATION TECHNOLOGY CORP.							X						
MICROREADER MANUFACTURING CORP.							X						
MICRO-SCAN SYSTEMS			X				X				X		
MICROSEAL CORP.			X	X		X	X						
MINNESOTA MINING & MFG. (3M)	X		X		X	X	X	X	X		X	X	X
MINOLTA	X	X	X	X					X				
MOHAWK INDUSTRIAL LABORATORIES												X	
MORGAN INFORMATION SYSTEMS												X	
MOSLER												X	
MOTIVA, LTD.							X						
MULLENS, J. H. (Holland)	X												
NB JACKETS CORP.			X	X									
NCR	X						X	X	X				
NEUMADE PRODUCTS											X		
NOXA (France)							X						
OCE-ELLIOTT, INC.	X	X					X		X				
PAMTEK MFG.							X		X				
PEERLESS STEEL											X		
PERIPHERAL TECHNOLOGY													X
PROTI MICROREADER CORP. (Holland)							X						
QUANTOR	X	X	X				X						X
RANDOMATIC DATA SYSTEMS												X	
RCA													X
READ, INC.							X						
READEX MICROPRINT							X		X				
REALIST, INC.							X						
REAL TIME SYSTEMS							X						
RECOGNITION EQUIPMENT													X
RECORDS SECURITY CORP.	X												
REGISCOPE CORP.	X												
REMINGTON RAND	X	X	X	X		X	X		X		X	X	X
REPRODUCTION SYSTEMS							X						
RETRIEVEX, INC.												X	
RICOH CO., LTD.									X				
SANDERS-DIEBOLD												X	
SAXON BUSINESS PRODUCTS									X				
SCAN GRAPHICS CORP.													X
SCOTT GRAPHICS			X										
SEACO COMPUTER DISPLAY		X					X		X				X
SEQUENTIAL													X
SINGER													X
STORCH & ZEUTSCHEL									X				

Table 3-1. Microfilm Equipment Manufacturers - Continued

COMPANY NAME	CAMERAS	FILM PROCESSORS	FILM DUPLICATORS	JACKET FILLERS	CARTRIDGE LOADERS	APERTURE CARD MOUNTERS	READERS (Only)	PRINTERS (Only)	READER/PRINTERS	PROJECTORS	STORAGE (Only) UNITS	SEARCH-RETRIEVAL SYSTEMS	COM EQUIPMENT
TAB PRODUCTS CO.											X		
TAM MFG.											X		
TAPE-STOR											X		
TAYLOREEL CORP.											X		
TAYLOR-MERCHANT							X			X			
TELEDYNE-POST			X	X			X						
TERMINAL DATA CORP.	X	X											X
TRANSAMERICA REPRODUCTION SYSTEMS							X						
TRIESE ENGINEERING		X											
UNIVERSITY COMPUTING CO.													X
UNIVERSITY MICROFILMS							X				X		
U. S. MICROFILM SALES							X			X	X		
VARIAN-ADCO												X	
VISU-FLEX											X		
VUETECH CORP.							X		X				
WALLACH & ASSOCIATES											X		
WASHINGTON SCIENTIFIC INDUSTRIES							X						
WATSON MFG. CO.											X		
WILSON JONES				X							X		
WOLLENSAK	X						X		X				
WRIGHT LINE											X		
XEROX							X	X	X				
XIDEX			X										
XITRON CORP.							X						

camera is usually much slower than with a rotary (fig 3-2).

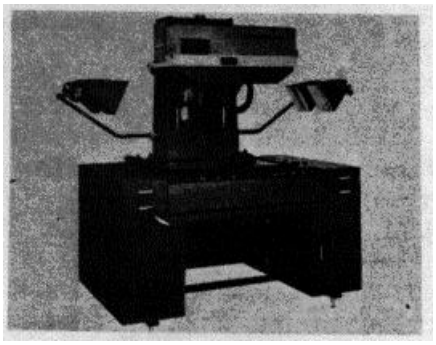


Figure 3-3. Camera (step and repeat).

c. Step and repeat. These are basically planetary models, with the capability of producing fiche. They operate by filming each frame in a row, then going back and exposing the frames in each successive row (fig 3-3).

d. Camera/processors. These are merely combinations of a camera and a film processor, from which a finished microfilm format is automatically produced (fig 3-4).

3-5. Film processors. This equipment automatically develops silver film, washes it, dries it, and delivers the completed film on a reel (fig 3-5).

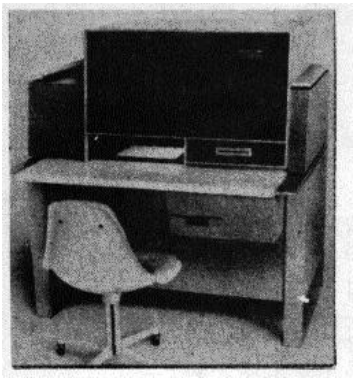


Figure 3-4. Film camera/processor.

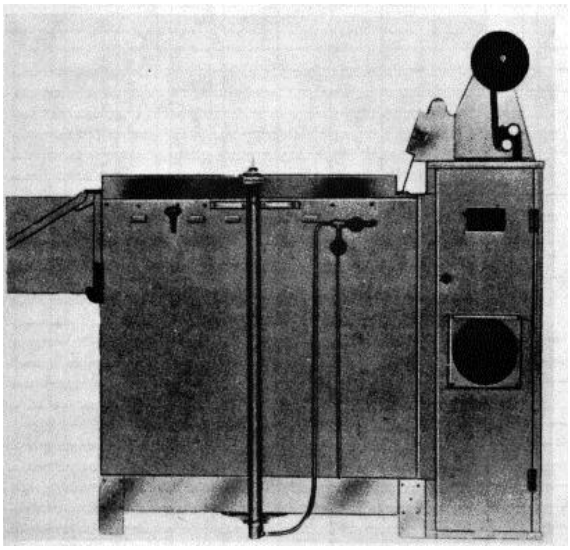


Figure 3-5. Film processor.

3-6. Film duplicators. Also called contact printers. They are used to make additional film copies on silver, diazo, or vesicular film. Available for roll to roll, card to card, roll to card, and jacket to fiche (fig 3-6 and 3-7).

3-7. Jacket fillers. These devices are designed to insert a strip of film from a reel into a selected channel of a jacket. Several models are available, from a hand-held type of semiautomatic. The larger model (fig 3-8) provides a viewing screen to permit the operator to determine visually the correct frames for insertion. For the most part, jacket fillers require some manual operation, and productivity is low when compared to related microfilming operations.

3-8. Cartridge loaders. These devices automatically load roll file into cartridges after it has been processed. Some manual operation is necessary (fig 3-9).

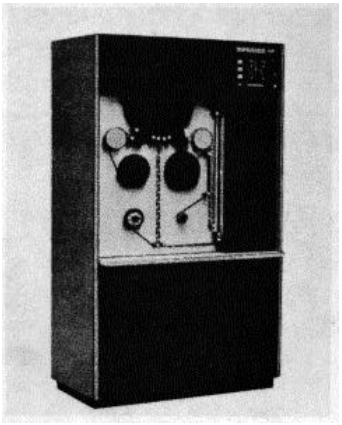


Figure 3-6. Duplicator (roll film).

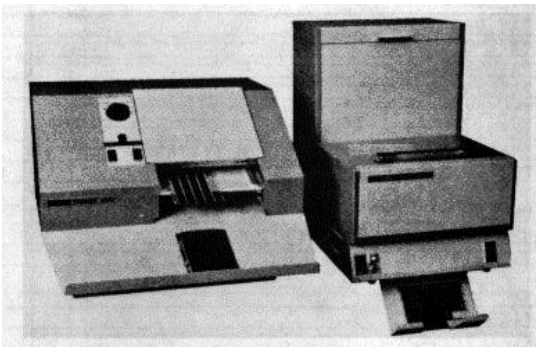


Figure 3-7. Duplicator (jacket to fiche).

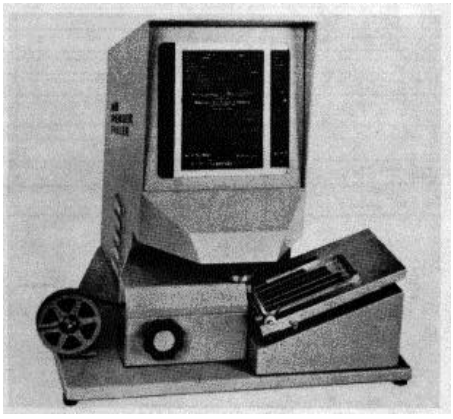


Figure 3-8. Jacket filler.

3-9. Aperture card mounters. This is a device which cuts and mounts a 35mm frame into an aperture card opening. They range from a manual type to automatic models (fig 3-10 and 3-11).

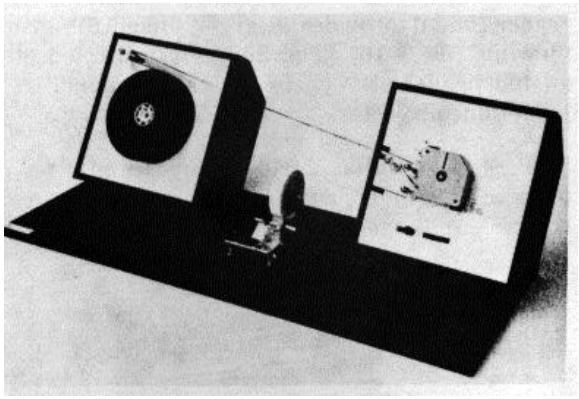


Figure 3-9. Cartridge loader.

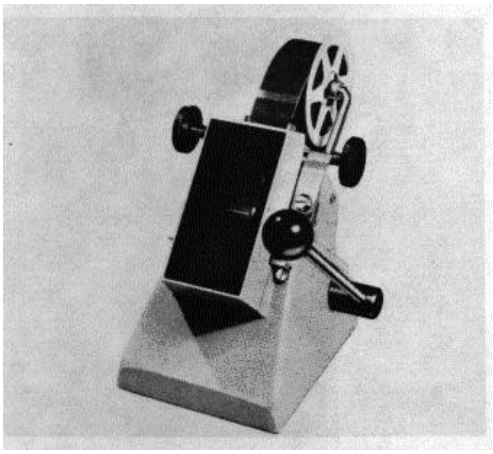


Figure 3-10. Aperture card mounter, hand operated

Figure 3-11. Aperture card mounter, semiautomatic.

3-10. Readers. Also called viewers. They come in all shapes, sizes and styles. In general, they are designed to accept a specific format, such as roll, cartridge, or fiche. Some however, provide a capability for two formats, usually with adapters. Most are manually operated, but a few are motorized. Cartridge readers are generally the most expensive, with roll film readers next, and jacket, aperture, and fiche types (fig 3-12) at the lower end of the price scale. Many readers are especially designed for Computer Output Microfilm (COM) to provide the wider screen necessary for computer listings. Section III below provides some guidelines on the selection of readers and reader/printers.

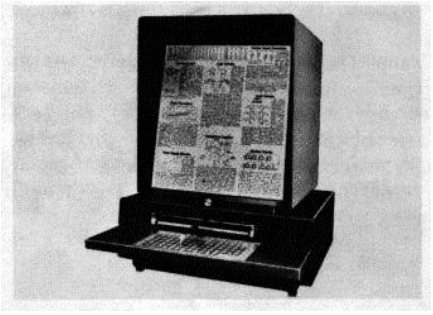


Figure 3-12. Readers (microfiche).

3-11. Printers. Also called enlargers. This equipment consists of devices which are designed to make full-size prints only, as they have no viewing capability (fig 3-13 and 3-14). Most models are intended for automatic, high speed paper copy production.

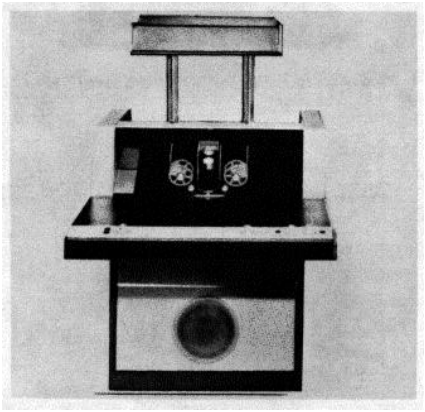


Figure 3-13. Printer (enlarger)

3-12. Readers/Printers. This equipment performs

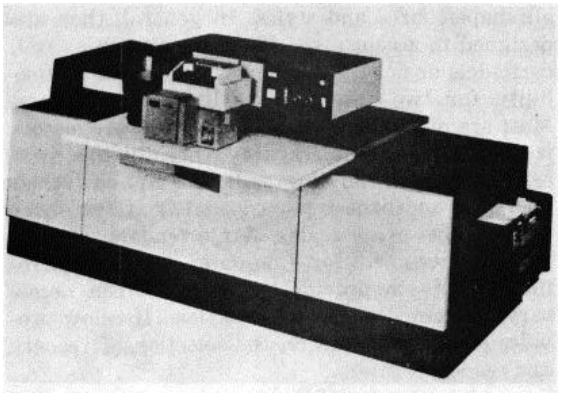


Figure 3-14. Aperture card printer (enlarger)

the same function as the readers, but has the additional capability to provide automatically a paper copy on demand (fig 3-15). Reader/printers are not intended for volume production, and should not be used for this purpose because they are rather slow and copy cost is comparatively high.

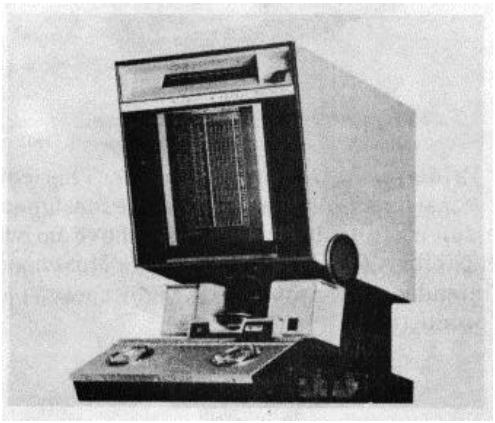


Figure 3-15. Reader/printer (cartridge).

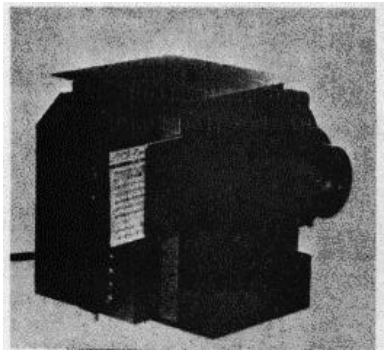


Figure 3-16. Projector.

3-13. Projectors. This equipment is, in effect, a reader, but it provides a larger image for group viewing (fig 3-16). The image is projected onto an independent screen in the same manner as a home slide projector.

3-14. Storage units. Various shapes and sizes of units are available, such as drawer cabinets, carrousels, and open top cases (fig 3-17—3-19).

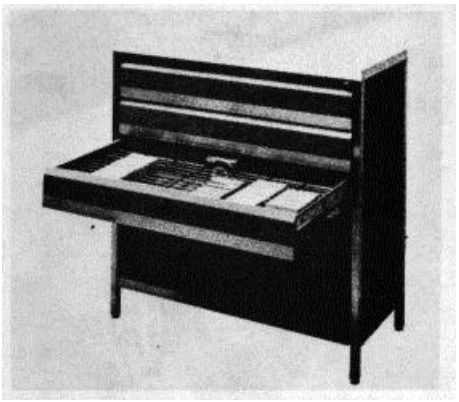


Figure 3-17. Storage unit (drawer).

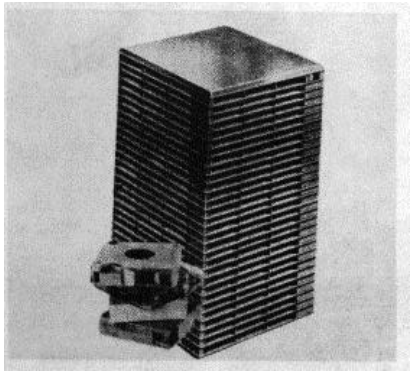


Figure 3-18. Storage unit (carrousel).

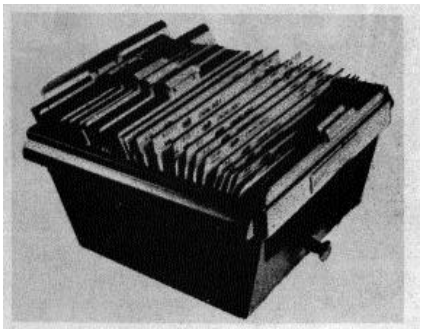


Figure 3-19. Storage unit (open top).

3-15. Search-retrieval systems. Basically, these are storage units which have an automatic or semiautomatic capability to locate or retrieve

specific microforms by depressing buttons. They are available in various sizes, from small, desktop units to large, sophisticated configurations. Unlike most other microfilm equipment, search retrieval systems are not represented by typical models. Descriptions and demonstrations are best obtained from each manufacturer. Trade names of the various units are provided in table 3-2.

3-16. COM equipment. This equipment is explained generally in chapter 2. A type of recorder unit is shown in figure 3-20.

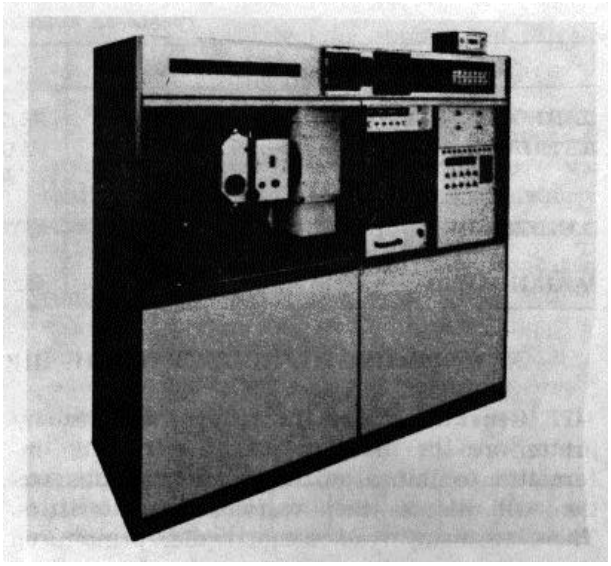


Figure 3-20. COM recorder.

Table 3-2. Retrieval Systems

Company	Name of system	Microfilm mode	Maximum capacity in documents
ACCESS INFORMATION CONTROL SYSTEMS	SYSTEM M	FICHE CARD SPECIAL JACKET.	160,000
ACME VISIBLE	ELECTROFILE	FICHE CARD SPECIAL JACKET.	VARIABLE
AIL INFORMATION SYSTEMS	FILESEARCH IV	ROLL FILM	32,000 per roll
ALPHA-VECTOR	AV-100	CASSETTE	.....
AUTOMATIC INFORMATION RETRIEVAL, INC.	DCS-1000	FICHE	600,000
BCD COMPUTING CORP.	INFO-TRIEVE 10	.....	310,000
CYTEK	MIRS	FICHE	62,000
DAKOTA MICROFILM	MAUL SELECTOR	PUNCHED APERTURE CARDS	.....
DATAFLOW SYSTEMS	SCAN-MATCH	.....	
DATAGRAPHIX	MICROSEARCH	CASSETTE	3,500 per cassette
DSI SYSTEMS	MICROSEARCH 400	CASSETTE	.....
EASTMAN KODAK	MIRACODE	ROLL FILM	900,000
ELECTRO-WORD	ELECTRO-WORD	.....	.....
FOTO-MEM, INC.	RISAR	.....	2,500,000
H F IMAGE SYSTEMS	CARD	FICHE	130,000
MICROFORM DATA SYSTEMS	MINDEX	ULTRASTRIP	120,000
MICROGRAPHIC TECHNOLOGY CORP.	MTC 95S	FICHE	Unlimited
MIRACLE SYSTEMS	MIRA	ROLL FILM	1,000,000
MINNESOTA MINING & MFG. (3M)	MICRODISC	CARTRIDGE	414,000
MOHAWK INDUSTRIAL LABORATORIES	SYSTEM 4000	FICHE CARDS SPECIAL JACKES.	360,000 per module
MORGAN INFORMATION SYSTEMS	MORGAN 200	ROLL FILM	100,000 per roll
MOSLER	410	FICHE CARD	14,000,000
RANDOMATIC	RANDOMATIC	FICHE CARD SPECIAL JACKETS.	1,800,000

Table 3-2. Retrieval System-Continued

Company	Name of system	Microfilm mode	Maximum capacity in documents
REMINGTON RAND	REMKARD	FICHE	144,000
RETRIEVEX, INC.	AUTOMATIC RETRIEVAL DEVICE.	CASSETTE	18,000 per cassette
SANDERS-DIEBOLD	SD-550	FICHE CARD VARIABLE JACKET.	
VARIAN-ADCO	626	SPECIAL	18,000,000

Section III. SELECTION OF READERS AND READER/PRINTERS

3-17. General. Because the reader and reader/ printer are the usual means of retrieving information contained on the microform, this section will discuss their various characteristics. There are many readers and reader/printers on the market, and for this reason the observations in this section are general in nature.

3-18. Guidelines on requirements. *a*. Selection of microfilm equipment is not a simple "yes" or "no" decision. It must be based on all available information such as need, work methods, and the microforms available, their content, and the nature of the references to that information. A person may comfortably use a microform reader all day to retrieve information about the status of an inventory or a series of accounts, but a user who must annotate document pages may. be best served by having hard copies of pertinent information. For the individual user, the prime factor in equipment selection will be the kind of information contained in the microform collection and how it is used in his work.

b. One of the most persistent problems in the implementation of microfilm information systems has been determining the true needs of the ultimate user of the system. Only when this has been done can the proper choice of equipment be made. The individual responsible for the purchase of equipment for a number of users must have a knowledge of all factors, including the following:

(1) Whether the microform collection will contain one or several different formats.

(2) Whether the users will require readers only, reader/printers, or both.

(3) Whether the information in the collection will be made available through loans of the microform or by furnishing microform copies, thus indicating a possible need for portable reference equipment which the user may borrow.

c. Since readers and reader/printers vary widely in detail, there are a number of important features to look for in making a selection. Some of these are -

(1) Ease of loading.
(2) Protection of film against scratching.
(3) Ease of searching.
(4) Minimum noise level.
(5) Ease of focusing.
(6) Brightness and clarity.
(7) Minimal screen reflection of surrounding light.
(8) Even distribution of illumination.
(9) Ability to rotate the image.

3-19. Types. Readers and reader/printers are available in a variety of models to suit the environment in which they will be used, the user's need, the system, and the availability of funds. The basic types are -

a. Lap readers. Designed for portability and personal use, they are available at present only for microfiche format.

b. Portable readers. These are readers which either fold into a case similar to a portable typewriter case or are compact and easily carried. They are available for 16mm and 35mm film, aperture cards, jackets and microfiche, and are intended to supplement the use of desk readers when more convenient.

c. Desk readers. These are usually intended for more continuous use and have more flexibility than the above types. They sometimes are equipped with their own stands.

3-20. Screens. *a.* In most microform systems it is desirable to have the reader screen present an entire page of information at or near the original size. Half page or partial page images on a screen can be useful and are acceptable with some types

of document systems, such as newspapers and engineering drawings. However, in making a decision about a reader or reader/printer, the purchaser should be aware of the following facts regarding reduction, enlargement, original document size, and reader screen size:

(1) The original sheet size of common documents are (in inches) -

Federal Government letters	8W x 10 1/2H
Federal Government legal documents	8W x 13H
Commercial letters	8 1/2 W x 11H
Commercial legal documents	8 1/2 W x 14H
European letters	8 1/2 W x 11 3/4 H (approx)
Computer printout	14W x 11H
Engineering drawings:	
A size	11W x 8 1/2H
B size	17W x 11H
C size	22W x 17H
D size	34W x 22H
E size	44W x 34H

(2) The reader screen must be equal in size to the original document if it is necessary to project the entire document page at the original size. However, most documents have unused margins, and a screen slightly smaller than the original document may adequately display the information area of a document page at original size.

(3) A smaller screen will also display a full page of text when the reader enlarges the image to less than original size. For example, an 8 1/2 x 11 inch document, originally reduced 24x, can be accommodated on a 7 1/4 x 9 1/2 inch screen when enlarged 20x. The characters in the text and illustrations will be proportionately smaller also.

(4) A letter-size image that must be rotated 90 degrees to be right-reading will require a screen 11 inches wide as well as some form of image rotation capability. Such images often contain tabulated data and charts or graphs.

b. Screens can be of a neutral color, when lighted, or have a slight tint. The tinted screens are used by some manufacturers to reduce potential eye strain. Images photographed in color will show better color fidelity when projected on a neutral screen.

c. Most readers and reader/printers project images from the rear onto a translucent screen. These screens often have a matte surface on one side and a shiny surface on the other. The matte surface facing out will reduce glare and ambient reflections. The shiny surface facing out will give an apparent increase in image sharpness. Some readers have an opaque reflecting screen, on which the images are projected for viewing.

3-21. Optical system. *a*. Manufacturers specify readers and reader/printers by image magnification (24x means the image is magnified 24 times). Most units have fixed magnifications that cannot be easily changed.

b. Some units are available with changeable magnifications. Variation in magnification is important to the user who will receive microforms from more than one source at significantly different image reductions. In this case, interchangeable lenses or continuously variable magnification can be considered. For the user who will require reference to images of documents over a broad size range, such as newspapers and smaller publications, continuously variable systems or dual magnification units should be considered. These are generally available in three types:

(1) Units with lens systems that are interchangeable by removing one lens from the holder and inserting another;

(2) Dual magnification units, with magnification changed by means of a lever or other mechanism.

(3) Systems that provide continuously variable magnification over a specified range using zoom lenses or mechanically varied optical paths.

c. When the microforms contain images which are not right-reading in the normal orientation of the microform in the reader, some type of image rotation is needed:

(1) By optical rotation, in which images are rotated by a lever or knob that rotates a prism in the optical system;

(2) By mechanical rotation, which is accomplished by turning the film transport 90 degrees.

(3) If the machine is not equipped for image rotation, the user must turn his head to view the image sideways. In the case of microfiche and aperture cards, the microform may be removed, turned 90 degrees, and reinserted. Some readers can be turned on their side for reading.

3-22. Human factors. A reader or reader/printer should be comfortable to use. Since human factors are largely subjective, they can be evaluated only by testing the equipment under actual operating conditions. These are some of the factors to keep in mind:

a. The controls should be located where they

are easily accessible while the user is in the normal viewing position.

b. The film loading operation should be simple and readily understandable after the first explanation and demonstration.

c. The control of the film movement should be smooth, allowing for rapid movement to specific document areas and for fine adjustments to center pages on the screen.

d. The unit should stay in focus when moving from one page to the next. Any large-scale film movement should necessitate no more than a minimal focus adjustment.

e. When indexing systems are part of the unit, they should be simple to comprehend and use.

f. With the exception of hot air vents, no external part of the reader normally touched by the user should be more than warm to the touch.

3-23. Maintenance. In general, the quality of the image displayed or of the paper copy produced is directly related to the cleanliness of the optical system and the printing mechanism. Microfilm's worst enemy is dust. Dust on reader screens, mirrors, and other optical elements decreases light and illumination levels, sometimes significantly. Dust particles on the film or film holding mechanism can damage the film and, when enlarged 20 to 40 times, may look like confetti on the screen and impair readability.

a. Preventive maintenance will make a considerable difference in the long-term usability of the equipment. Use of a dust cover when the equipment is not in use is recommended. Following the manufacturer's recommendations, cleaning of the screen, lens, internal mirrors, and condenser elements should be done routinely.

Lamps should be replaced when they show signs of darkening or otherwise reducing light output. Most units provide easy access to the lamp, and some have a clip inside for storage of an extra lamp.

b. Glass fiats or optical fiats of plastic are often used to hold the film flat in the optical system. They should be easily removable for cleaning or should be easily accessible, and cleaned in place. On reader/printers, cleaning of the printing mechanism should be easy and convenient.

c. Manufacturers' warranties and maintenance service vary considerably. Most will warrant their hardware against defective parts from 30 days to one year. The warranty does not normally include lamps. Some manufacturers have service contracts available after the initial warranty period expires. Rental contracts usually include maintenance service by the supplier. Some smaller manufacturers may request the return of the hardware to the factory for service if they do not have locally available service representatives.

d. In general, the simpler the device, the less the purchaser need be concerned with length of warranty or availability of local service. Once the simplest microfiche reader has been received and installed in good repair, there is little to go wrong. If defective parts are discovered, replacements can often be obtained from the factory and installed by the user. Conversely, for reader/ printers and the more sophisticated readers, length of warranty and the availability locally of trained service personnel and service contracts should be discussed prior to equipment selection and purchase.

Section IV. READER/PRINTER PROCESSES

3-24. Characteristics. Several processes are used by the manufacturers of reader/printers to produce enlarged paper copies of microimages. Some may be familiar to users, since they are also common to those used in office copiers. Although each of the processes produces a useful print, they vary considerably as to cost, characteristics, and printing time. Some are capable of reproducing acceptable prints of halftones and photo images as well. However, the enlarged copy can be of no better quality than the image on the film. Before it is purchased, a reader/printer should be tested by making copies from several microfilm samples of a quality and format typical of the system involved. If it is planned to store and use prints for long periods of time, long-term print stability will be a critical factor. Coated papers will vary in their archival quality, although manufacturers are constantly endeavoring to upgrade this and other paper qualities. If archival quality is an important consideration, information should be requested concerning the life expectancy of prints under certain storage conditions. In evaluating the paper copy processes, the purchaser should consider the following factors:

a. Cost of supplies.

b. Quality of print.

c. Warmup time.

d. Print cycle time.

e. Convenience of operation.

f. Convenience of routine maintenance.

g. Shelf life of paper before exposure.

h. Print life and rate of image deterioration after processing.

3-25. Image mode. *a.* The user will encounter microfilm images in a negative mode (clear image, black background); and a positive mode (black image, clear background). The tones of negative images must be reversed in the paper copy process to produce black on white enlarged prints. Several of the processes used in reader/printers do this, to produce a positive print from negative images or a negative print from positive images.

These processes are -

(1) Silver halide papers, using either monobath or stabilization immersion processing.

(2) 3M Co.'s Filmac process, in which an image is deposited by surface treatment of the paper with a liquid activator.

(3) The Itek "RS" process in which an image is formed when the exposed paper is surface treated with a liquid carrying the image-forming chemicals.

(4) 3M Co.'s dry silver paper in which the image is thermally developed without use of chemicals.

b. One process which has been used in a few printers, the diazo process, is non-reversing and will produce only positive prints from positive images, or negative prints from negative images.

c. Other processes will produce black on white enlarged prints from either negative or positive microfilm images by changing the toner and/or developer and making other adjustments in the machine before switching from one to another. If the need for changeover exists, the entire procedure should be explored before any purchase is made. The processes requiring changeover procedures are-

(1) The transfer electrostatic (Xerographic) process.

(2) The direct electrostatic processes using coated papers and either dry or liquid toning systems.

d. Another process, the "OPC" electrostatic process, has the capability of changing from mode to mode by means of a switch on the reader/ printer.

e. With the exception of the transfer electrostatic process, which uses plain paper, all papers used in the foregoing processes are coated papers. The cost of supplies will vary with the manufacturer, usage volume, and the process itself. The cost of supplies is only one factor in finished print cost. The purchaser will also want to consider machine rental or amortization, plus the cost of direct and preventive maintenance. Print cost is the sum of costs for supplies, the proportionate machine rental or depreciation cost, and machine maintenance cost, divided by the monthly volume.

CHAPTER 4

A NEW DIMENSION: FILING ON VIDEO TAPE

4-1. General. The television industry has used video tape for "stored programs" as well as "instant replay" for several years. In comparison to other media, it is still a relatively new method for capturing visual data for recurrent use. Video tape recorders have been improved and simplified so that today they are used in many applications other than for home television.

4-2. Tape characteristics. Video tape has characteristics similar to those of magnetic tape used as a storage media for computer data; however, there are some basic and operational differences.

a. Video tape is usually 1 to 2 inches wide, instead of the normal 1/2 inch for computer tape. The actual document recording area is about 1/3 inch wide (i.e., along the length of the tape). One edge of the tape is reserved for an identity code and the other edge for locator control data.

b. Most important is the nature of *what* is recorded. Computer tape records *data*, i.e., information from source documents. Video tape, on the other hand, records a miniaturized version of an image of the *document* itself; however, unlike microfilm, the image is in a magnetic impulse format. Both tapes require conversion to human readable form: the computer tape to the format in which the data was programmed; the video tape to an exact reproduction of the document image.

c. Approximately 160,000 documents can be recorded on a reel of video tape, but this mass collection of records is inaccessible until mounted on a tape drive. In a large tape library, however, it would be impractical to provide sufficient equipment to keep all tapes mounted at all times. Therefore, some delays may be involved in order to mount tapes.

d. The outstanding advantages of video tape are the capability of immediate updating, purging, instant access to filed documents, and the assurance that no document is ever out of file.

e. The most serious question is the durability of the tape, and that of its recorded images. The official acceptance of video tape as a permanent vehicle for records must be established before full use can be made of this medium in records operations.

4-3. Method of recording. In speaking of video tape document storage, recording is referred to as "filing." Imaginary "folders" are established on each tape, segmented in a manner similar to that of filing cabinets.

a. Filing is accomplished by placing the document before a special video camera and keystroking in the appropriate identity code for the particular folder. Recording is instantaneous, and the camera is ready for the next document.

b. Filing can be done either sequentially (as usually is the case in any paper document file) or in a random manner. A combination of both is also possible. Each method, however, has inherent disadvantages. The very nature of a reel of tape, like a reel of film, requires one image to follow another, but unlike film, gaps can be allowed on tape for later insertion of additional documents.

(1) In sequential filing, such as an alphabetical or numerical plan, the length of the gaps would be predetermined to allow for normal buildup of the folder. As new documents are received, they are filed in the folder in the order they would have been filed in a paper folder. The problem here is that it is frequently not possible to predetermine the correct length of gap for each folder, and an average length must be established. This results in empty spaces of varying length all along the tape, as well as slower filing (fig 4-1).

(2) In random filing, each document is added to the tape after the last filed document without regard to its proper sequence. This filing plan requires no gaps, and results in much faster filing (fig 4-2).

4-4. Document retrieval. Documents on video tape can be retrieved in both soft copy (viewer)

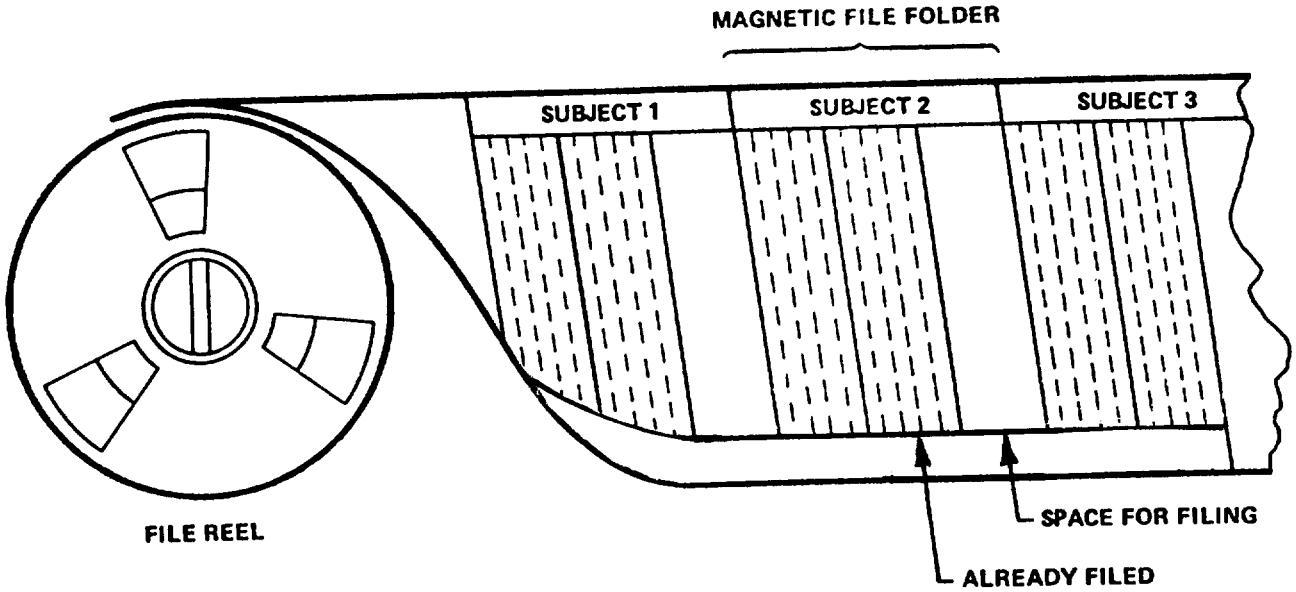


Figure 4-1. Sequential filing.

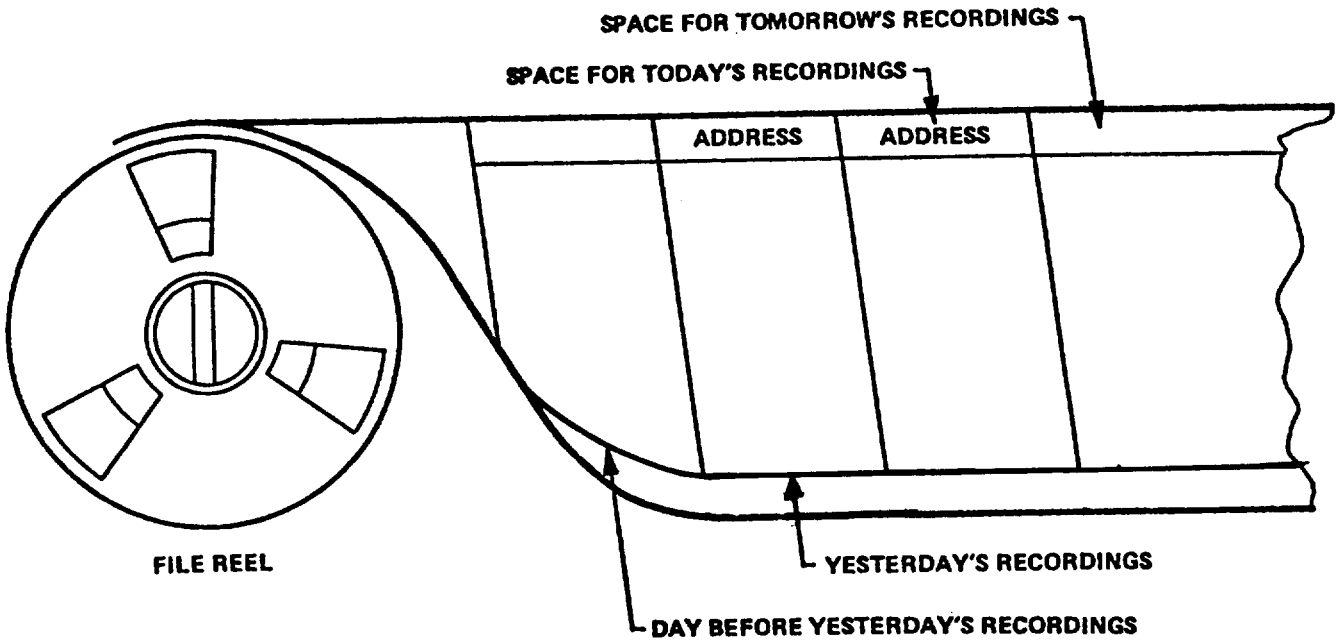


Figure 4-2. Random filing.

and hard copy (printout). There are indications that retrieval can also be in the form of microfiche. For certain operations, it may be an advantage to duplicate a "working tape" for a specific day's activity. By doing so, the folders or documents can be sorted into an appropriate order for faster access.

a. The speed of retrieval will depend on the method of filing. Sequential filing provides fast retrieval because the search system is not required to shuttle between locations. Random filing, on the other hand, results in a much slower retrieval speed due to shuttling between locations.

b. Viewers are identical in appearance to home television screens in that they project the image on the face of the tube. The major difference is that they have more than 1200 scan lines as compared to 525 for the home TV screen. This feature provides a much better resolution for printed forms and documents, although in some instances, a "flicker" is present in the picture. This becomes less noticeable after one

becomes accustomed to using the viewer. A file is retrieved by keying in the appropriate identifying code; when the first document appears, the user can view the other documents in the "folder" at will by hand operated controls.

c. Hard copy can be produced either directly from the tape to a printing device, or by choice at the viewing screen. Quality of image is reasonably good.

d. At least one company offers an output from video tape in the form of silver microfiche. The process is claimed to be practical, and if so, could be very useful in providing a file to many users simultaneously without making individual demands on the master tape.

4-5. Equipment. *a*. There presently are only three video tape systems known to be available:

(1) Videofile Information System, by Ampex Corporation.

(2) Trans-A-File Systems, owned by subsidiaries of Transamerica Corporation and the Singer Company.

(3) CMX Systems, a CBS/Memorex company.

b. Developing an equipment configuration is generally done by the industry experts in this field rather than through selection by the user. Equipment listed in (1) through (5) below is necessary to make a system operable. The need for items (6) through (8) will depend on the complexity and degree of sophistication required.

(1) Main control module, which includes a small or medium-size computer.

(2) Magnetic tape module. Usually there are several, depending upon the extensiveness of the file system.

(3) Buffer module. There may be several required for controlling display, input, output, batching, and other functions.

(4) Filing module. Again, several may be needed according to the size of the file.

(5) Display module. Several probably will be needed to provide viewing capability at various stations.

(6) Printer module. Makes full size hard copy on demand or as programmed. Usually one is sufficient.

(7) Microfiche output module. Consists of a modification of a COM recorder.

(8) Auxiliary units. Foil various stages of control where needed.

4-6. Protection of tapes. *a*. The threat of damage by fire or water, intentional damage by subversives, and other occurrences are common to all records holdings, whether paper, film, or tape. However, certain damage, peculiar to tape alone, has been known to occur. There are reports of the close proximity of magnets scrambling recorded data either accidentally or intentionally; of internal sabotage by erasure of data; and of disconnecting pertinent wiring arrangements. Such damage may do more harm than physical damage, since it is noiseless, and goes unnoticed until the tapes are used.

b. How often this kind of damage occurs is unknown, nor is there any clear knowledge as to how serious such a threat might become. However, this possibility does point out the need for special security precautions for a video tape file.

CHAPTER 5

DEVELOPING A DOCUMENT MINIATURIZATION SYSTEM

Section I. FACTORS TO BE CONSIDERED

5-1. General. *a.* This chapter outlines the objectives of a document miniaturization system, and suggests approaches in evaluating requirements.

b. A solution to existing records problems should first be viewed in terms of re-evaluating the current methodology for the purpose of correcting deficiencies. If a review determines that procedural changes will not provide the needed improvement, conversion of the records to film, tape, or other medium should be considered. Producing miniaturized records is costly in terms of manpower, equipment, and supplies. A miniaturization system should either cure existing ills of a poor system, or measurably improve an already good, but inadequate system. If it cannot be reasonably expected to accomplish this with significant success, it should not be undertaken. In a few words, the theme should be "Proceed With Caution."

c. Automatic retrieval may be a feature of a miniaturization system, and one which makes a proposed system appear particularly desirable. However, no matter how automatic a retrieval system may be, there are certain human elements that cannot be avoided, and which demand consideration in the overall evaluation. Aside from inherent system functions, there also must be-

(1) time to organize work into a competent and practical arrangement;

(2) time to read the request and determine what is desired;

(3) time to instruct the system (selecting an index, depressing a button, etc.);

(4) time to locate the document if browsing methods are used;

(5) time to search the document for the required data;

(6) time to make the necessary reply to the inquiry;

(7) time for necessary "housekeeping" after each request and to mentally adjust for a new one;

(8) and finally, time for the never-ceasing interruptions for special duties.

5-2. Objectives. There are five objectives to be considered in establishing a document miniaturization system. It should-

a. significantly improve the efficiency of the current operation;

b. reduce the cost of making information available;

c. reduce floor space requirements;

d. insure the integrity of the file and preservation of data; and

e. use fewer personnel spaces than the existing operation.

5-3. Potential benefits. Many reasons can be given for the use of microform systems, some of which are discussed below. However, potential benefits must be weighed against initial cost, equipment investment, employee training, user acceptance, and other factors before a final commitment is made.

a. For many years, the classic reason for microfilming was the resulting savings in storage space for large accumulations of records. Although this benefit is still an important factor, it no longer is the primary consideration.

b. Because miniaturized documents are so greatly compacted, mailing costs are reduced to a fraction of that for paper records.

c. Protection of documents from wear and alteration is another advantage. This is particularly true in systems where projected views or copies of the master file are provided.

d. Random filing and retrieval systems which provide access without withdrawing the file assure integrity and reasonable proof against loss.

e. There is much greater freedom in working with paper prints of the microform. Unlike original documents, which must be protected from damage, the reproduced paper copies can be written on, tabbed, or used in any other appropriate manner without causing problems.

f. A microform system may be the best answer for distributing identical information to many locations or different users concurrently. If the system has been tailored to the specific function, and the files have been properly coded, multiple user inquiries can be handled efficiently.

Section II. PLANNING THE SYSTEM

5-4. The need for change. From time to time, various published reports are seen citing "successful" installations of microform retrieval systems. Such reports represent only a fraction of the number of proposed systems which have been investigated and found either unsuitable or too costly. Moreover, many of the successful applications may not have met all of the desirable objectives. Some of the problems have arisen because of a lack of compatibility of one format or system with another. To alleviate such situations, the DOD is considering the need to establish standards for reduction ratio, format, reader capabilities, and other factors which affect the end user. Although problems cannot be totally avoided they can be minimized by a comprehensive, analytical study of the operation. The following questions must be answered in planning the adoption of a document miniaturization system:

a. Can any documents be eliminated, combined, or redistributed in order to reduce the bulk of the file?

b. What is the rate of interfiling added documents? What is the daily volume? Do the new documents replace other documents?

c. How heavy is the reference volume? Does it fluctuate? Are some categories of references heavier than others?

d. Are documents loaned to other offices? For how long? What is the daily volume? Where are the offices located?

e. What is the rate of productivity under the present system? Does the proposed system indicate that this could be increased significantly?

f. What is the monthly or annual cost of the proposed operation as compared to that of the present one?

g. Is the amount of space saved sufficient to permit gainful use for another purpose?

h. Will the proposed system require new personnel or can the existing staff be trained easily? How will the changeover affect morale?

i. How much delay now exists in servicing requests? Are backlogs created? What are their causes? Will the proposed system significantly reduce delays and backlogs?

j. Will the product be compatible with the users' present system, or will they need to obtain special retrieval equipment?

5-5. Finding some answers. An operating official who is planning to investigate a document miniaturization system for a sizeable document collection may seek to find his own answers to the questions raised above. He may engage in the following activities and draw his own conclusions prior to adopting any system:

a. Attend equipment demonstrations, trade exhibits, seminars, and other meetings to become acquainted with various types of microform systems.

b. Obtain and study brochures and other literature issued by manufacturers.

c. Read trade magazines and publications dealing with document maintenance and retrieval, specifically in the area of miniaturization. Selected excerpts from some of these are quoted in appendix B.

d. Visit governmental and commercial activities which have already installed a document miniaturization system. These visits can often best be arranged through an appropriate sales representative.

e. Discuss the specific problem with manufacturer's representatives. They are often willing to make a general survey of requirements without cost and outline a proposed system.

5-6. Professional consultants. Determining if a document miniaturization system is needed may be beyond the in-house capability of an office. In that case, consideration should be given to engaging a professional consultant who will make a detailed survey of the operation, develop an outline of procedures, and submit a formal

Table 5-1 Comparison of Systems

Located in Back of Manual

proposal. Such services are usually rather expensive.

a. Large manufacturers of miniaturization equipment and systems often maintain their own consulting service. However, keep in mind that every manufacturer, no matter how honest and principled, has a product to sell in which he has great faith. He will naturally be motivated to seek a "cure" for your problem which will involve an application of his product. He may feel it is the best solution available, but the customer must evaluate his proposal dispassionately and comparatively, weighing strengths and weaknesses, relative advantages and disadvantages, without leaping at the easy solution the proposing firm offers in a tempting package.

b. Services of an independent consultant usually have the important advantage of impartiality. He will normally have no axe to grind, either on behalf of a particular manufacturer or system, or toward the parochial interests of the requesting office.

c. In view of the sizeable expenditure which may develop, caution is necessary in determining the extent of these services before a commitment is made. Basically, the hiring of a professional consultant should be considered only where a very complex retrieval problem is involved. Established consulting firms can usually offer the following services:

(1) Technical advice on the selection of equipment.

(2) Briefings on the state of the art.

(3) Survey of operations, followed by a general outline of a system.

(4) Arrangements with various manufacturers to supply, modify, or design specific equipment.

(5) Training of personnel.

(6) Direction of a project.

(7) Supervision of installation and initial operation.

5-7. Comparison of systems. An initial broad look at the nature of filing systems can give the potential user an idea of the general direction he may wish to pursue. Table 5-1 shows comparative characteristics of paper, microfilm, and videotype systems. Although this is not all inclusive, it provides a basis for a first consideration.

5-8. Making the conversion. Conversion to a new system almost always causes an upheaval in office operations. A factor frequently overlooked is that during conversion, both the old and new systems will be in operation simultaneously. For a large files collection, the time frame could be as long as 18 months to two years to accomplish conversion. During this time, extra supervision, training, and controls are needed, not only for servicing the dual files, but for the project itself. It may be advantageous to have this operation performed on a contract basis, rather than to use regular office personnel.

Section III. FINANCIAL CONSIDERATIONS

5-9. Estimating costs. Even experts in this field find it difficult to arrive at firm costs for a specific application. There are numerous factors to be considered by both labor and equipment, not the least of which is the preparation of documents for filming or recording. An estimate must include equipment for converting the documents, as well as the cost of operating supplies, housing equipment, labor, and personnel. If the system includes microfilm in any format, a variety of supplies and accessory equipment will be needed.

5-10. Microfilming expenses. *a*. A fair estimate of the cost of the actual microfilming can be determined from the fees quoted by the General Services Administration under its service contract. These are shown in table 5-2. These prices assume that documents have been prepared by the document custodian.

b. Expenses of providing for the use of the microfilm may include such items as-

(1) Storage equipment.

(2) Viewing devices.

(3) Film duplicating equipment.

(4) Paper copy printing devices.

(5) Retrieval systems.

c. The cost of producing microfilm varies greatly, depending on the format used. A comparison of format cost can be shown as follows, in descending order:

(1) Aperture card (most costly).

(2) Jacketed.

(3) Cartridge.

(4) Roll film.

(5) Microfiche (least costly in NMA or COSATI format). HR fiche and Ultrafiche, however, generally increase in cost by at least 100%.

Table 5-2

GSA FEE SCHEDULE FOR MICROFILMING SERVICES
(1972)

16mm ROTARY CAMERA (Automatic Feed)	
3 x 5 inches	3.30 per 1,000 frames
5 x 8 inches	5.25 per 1,000 frames
165m ROTARY CAMERA (Hand Feed)	
3 x 5 inches	6.35 per 1,000 frames
5 x 8 inches	7.50 per 1,000 frames
8 x 10 1/2 thru 11 x 17 inches	14.60 per 1,000 frames
16m. PLANETARY CAMERA	
For microthin jackets	15.50 per 1,000 frames
12 inches thru 16 inches (width)	.03 per frame
35mm PLANETARY CAMERA	
8 inches thru 15 inches (width)	.05 per frame
16 inches thru 34 inches (width)	.15 per frame
DEVELOPING ROLL FILM (Negative)	
16mm	1.45 per 100 ft. roll
35mm	1.70 per 100 ft. roll
DIAZO ROLL FILM DUPLICATION	
16mm	3.00 per 100 ft. roll
35mm	3.50 per 100 ft. roll
APERTURE CARDS MOUNTED (D type card only)	
Including cards	.07 per card
Cards furnished by agency	.05 per card
CARTRIDGES	
Kodak	1.04 each
3M	1.45 each
Loading cartridges	.35 each
MICROTHIN JACKETS MOUNTED	
4 x 6 inches	.20 each

Note

The above figures do not include preparation time. Such labor can be estimated to be about $5.00 per hour.

5-11. Video tape expenses. The actual cost of recording documents on video tape is difficult to estimate. Since the tape itself can be erased and re-used, it could be held that there is no real cost, except for personnel time, once the tapes have been purchased. However, this would be unrealistic, since there is a costly investment in equipment. Nevertheless, it is difficult to compare the cost of video tape with microfilm on a per document basis. The only practical method of comparison is total system cost, assuming that no great disparity exists between the end results.

Section IV. HYPOTHESIS OF A SYSTEM

5-12. General. There are almost as many system designs as there are functions to which they may be applied - which is just another way of saying that most systems are tailor-made. Although many components are off-the-shelf items, they must be fitted together to create the most effective and practical configuration for the application in question. A hypothetical system is discussed in this section for illustrative purposes only.

5-13. Microfilm system. *a. System configuration.* The graphic outline shown in figure 5-1 consists of three files: the Working File, the Master File, and the Alternate File.

(1) The Working File consists of the original silver film in jacketed format. It constitutes the permanent record and is used for updating and to fulfill legal and archival requirements. It is contained in a semiautomated, random access/ refile storage device without inherent image transmission capability.

(2) The Master File consists of duplicate microfiche prepared from the jacket in the Working File and is for the exclusive use of answering inquiries. The file is maintained in an automated mass storage and retrieval system designed to provide random access and refile, automatic indexing, viewing, fiche duplication and copy printout. The system permits retrieval via keyboard entry as well as through automatic bulk programming.

(3) The Alternate File is a duplicate of the Working File, updated only periodically. It is remotely located as a means of safeguarding the records. Manual searching is possible in the event of a power failure in the Master File. The Alternate File is contained in a single, relatively inexpensive, retrieval device with shelf-stored trays that can be inserted into the retrieval device as needed.

b. Input. All documents must be screened for validity for entry into the system, photographic quality, and required identification data. Once determined acceptable, the document is photographed, processed and stripped into coded jackets. Following this, a duplicate is made and integrated into the Master File. The jacket is retained in the Working File.

c. Updating. Photographic images of new documents to be added to existing files are stripped into the current jacket in sequential order. A new duplicate is made to replace the existing fiche in the Master File.

d. Output. The system provides for the following methods of output:

(1) Optical display devices to provide immediate access capability for certain classes of users as well as for particular types of inquiries. Transmission of images is accomplished by television cameras included in the Master File system.

(2) Duplicate microfiche produced automatically by the Master File system upon demand by an operator, and forwarded by ordinary means to the requester. Reading capability would be provided by low-cost microfiche readers.

(3) A capability to reproduce automatically each frame of the microfiche on paper in the original size and format. Unless there are exceptional reasons, paper copies would normally be produced only for users not having any other means of access.

5-14. Video tape system. *a. System configuration*. The document storage outline shown in figure 5-2 consists of two identical tape files and two equipment arrangements.

(1) One tape library constitutes both Working and Master Files. A separate tape library is maintained as an Alternate or Security File.

(2) One equipment system is used to maintain the Master File tapes by updating and purging. The second system is used for providing service to users. Both systems can be used jointly at times of heavy demand. The entire system is totally automated with random input and retrieval.

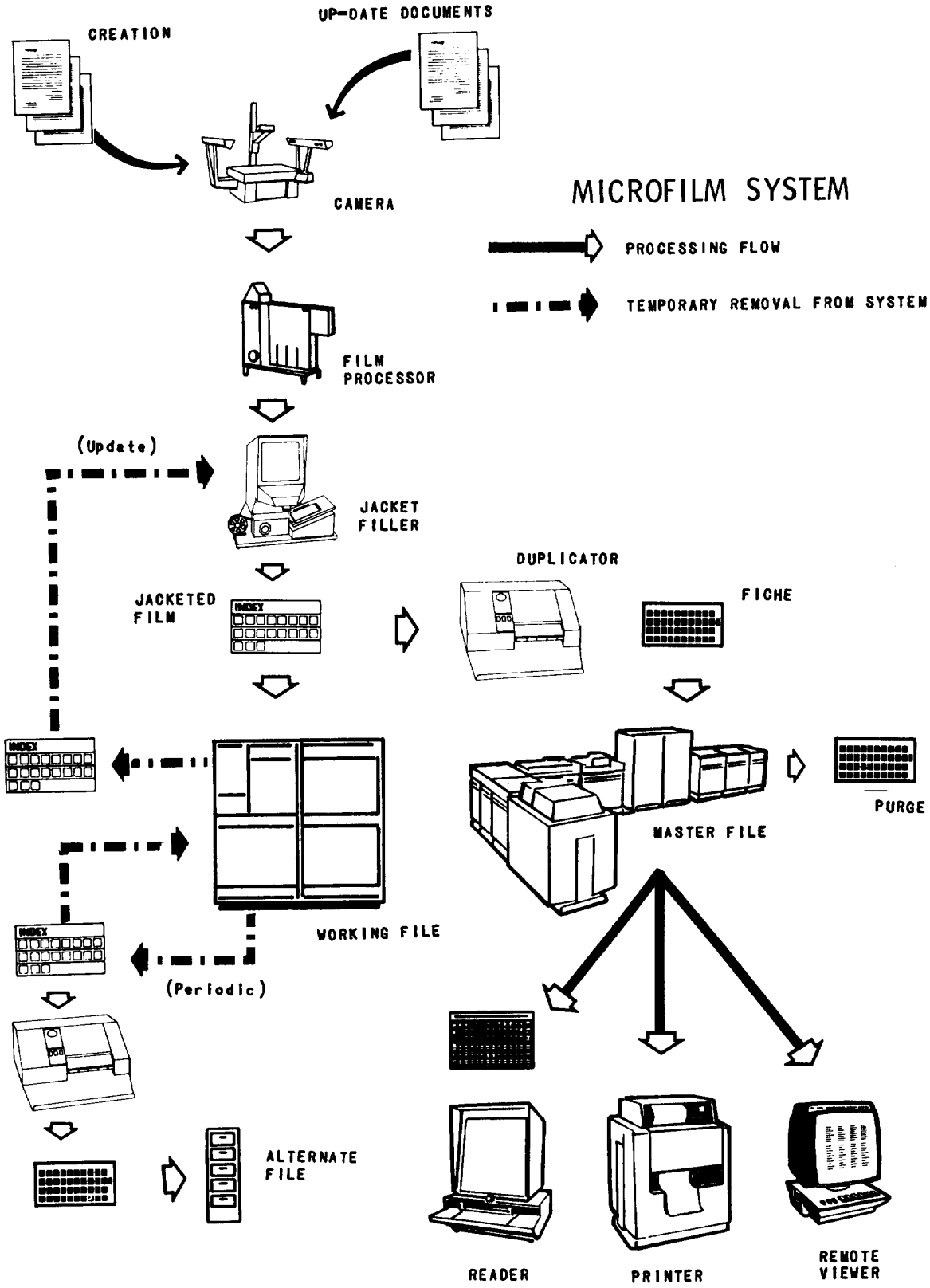

MICROFILM SYSTEM
PROCESSING FLOW
TEMPORARY REMOVAL FROM SYSTEM
CREATION
UP-DATE DOCUMENTS
CAMERA
FILM PROCESSOR
(Update)
JACKET FILLER
JACKETED FILM
INDEX
DUPLICATOR
FICHE
INDEX
MASTER FILE
PURGE
WORKING FILE
INDEX
(Periodic)
ALTERNATE FILE
READER
PRINTER
REMOTE VIEWER

Figure 5-1.

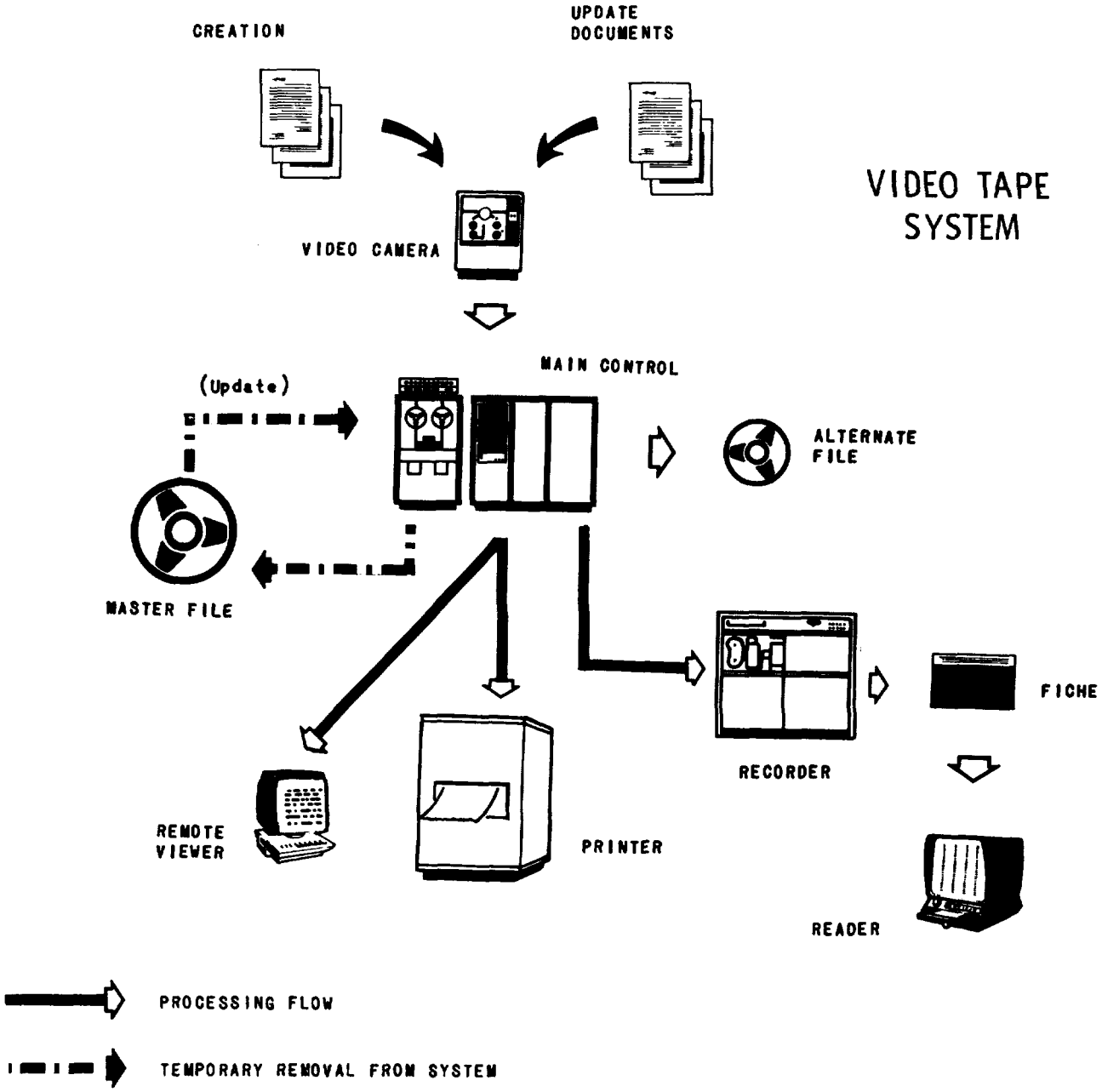


Figure 5-2.

b. Input and updating. Files are established as the video camera enters documents onto the tapes. Updating is accomplished by adding new documents to the appropriate tape by means of the coding which designates the existing file. There is little difference in the manner of creating a new file and adding new documents to an existing file.

c. Output and retrieval. Three methods of output are available:

(1) Optical viewers linked directly to the taped image through control units.

(2) Microfiche output for users as well as purging, if needed.

(3) Printers for paper copy production.

APPENDIX A

GLOSSARY OF TERMS

aperture card-Card (usually EAM) with a rectangular opening specifically prepared for the mounting of a frame of microfilm.

archival quality-The ability of material to resist deterioration. Usually thought of in terms of 200 to 300 years for records.

background-Non-image area of a document or film.

blowback-To make a paper copy enlargement of a microfilm image.

browse-To review, at the reviewer's own pace, in forward or backward motion, a series of document images.

buffer-An internal portion of a system serving as an intermediate storage or collection point of recorded images from different parts of an information handling system.

camera, planetary-Type of microfilm camera in which the document being photographed and the film remain in a stationary position during the exposure. The document is on a plane surface at the time of filming.

camera, rotary-Type of microfilm camera that photographs documents while they are being fed through a roller system. The document movement and film movement are synchronized.

camera, step & repeat-Type of microfilm camera which can individually expose a series of images of film according to a predetermined format, usually a microfiche. Camera is modeled after the planetary type.

card to card printer-Equipment used to produce a duplicate of card-mounted microfilm by contact printing.

cartridge-A container which holds film (generally 16mm) to be used on a reader or reader/ printer. It is designed to automatically thread the film to a take-up reel and rewind itself.

cassette-A self-contained roll film container which has two cores, enabling film to wind and rewind without leaving the container.

cine-Roll film which reads top to bottom, as in movie film. Permits a slightly larger image than comic mode.

COM-Computer Output Microfilm.

comic-Roll film which reads left to right, as in a comic strip.

configuration-A planned arrangement of units of equipment.

contrast-The relationship of light areas to dark areas in exposed film or image on a viewer.

cosati-Committee on Scientific and Technical Information.

CRT-Cathode ray tube, similar to a television picture tube.

densitometer-Instrument to measure the density of an image.

density-The depth or heaviness of exposed areas on a photographic image; degree of opacity of film, and of blackness for prints.

document-An instrument having recorded information, regardless of its physical form or characteristics.

duo-Roll film on which documents are photographed first on one-half the width, and on completion, other documents on the remaining half.

duplex-Roll film on which one-half the width is used to film documents. Used for documents requiring front and back photographing side by side on the film.

EBR-Electronic Beam Recorder. Records readable data on film directly from magnetic tape.

emulsion-Light-sensitive coating on photographic film.

facsimile-A precise reproduction of an original document; an exact copy.

film transport-Mechanical portion of a camera which moves the film.

flash card-Card bearing a special legend photographed as a reference marker on roll film.

frame-Area of microfilm used in one exposure.

generation-One of a series of stages of reproductions. Each duplicate made from a preceding copy is a new generation.

hard copy-A human readable document which can be read with or without optical aids.

interface-A common boundary between different systems or parts of a single system. The method by which one system complements another.

jacket-Transparent plastic carrier with multiple sleeves or channels to hold microfilm in flat strips.

mag tape-Any tape which has the capability of recording magnetic impulses for the purpose of storing information.

microfiche-Sheet of microfilm containing multiple microimages in a grid pattern.

microfilm--(1) Fine grain, high resolution film containing an image greatly reduced in size from the original. (2) To record microphotographics on film.

microform-A generic term describing any miniaturized form containing microimages, e.g., microfiche, aperture card, microfilm, and similar media.

military D-Term applied to location of aperture in a data processing card under government specifications.

module-A component or part of a configuration of equipment.

optical display device-A specialized viewing device which utilizes a cathode ray tube (CRT) to generate an image from internally stored information.

original-Material from which copies or microfilm are made, even though some of it may be a carbon duplicate or printed reproduction.

polarity-A term sometimes used to denote a negative or positive condition.

printer-A mechanical device (either remote or adjacent to the equipment configuration) capable of producing paper copies of selected images from the microform.

processing-Treatment of exposed film to make the image visible and permanent.

purge-Deletion of images from the microform system, either by elimination of by output in the same or a different mode.

random access-Access to any storage position without regard to its location.

random input-Entering information or documents into a system without regard to its sequential order.

reader-Device for viewing an enlarged microimage with the unaided eye.

reader/printer-Device which has the capability of producing a paper copy of a microimage in addition to providing an enlarged viewing.

reduction ratio-The number of times a document is reduced when filmed, such as 20X, 24X, etc.

remote-A device for viewing or reproducing an image directly from the main storage area, but which is at a location separate therefrom.

resolution-The ability of optical systems and photo-materials to render visible fine detail of a document; a measure of sharpness of an image.

retrieval-Technique of searching a document collection to recover specific documents or information.

roll to card printer-Machine for producing card-mounted microfilm from roll microfilm.

roll to roll printer-Machine for producing duplicate rolls of microfilm from existing rolls.

unitized film-Term applicable to frames of film which have been mounted in a format, such as a jacket or aperture card.

viewer-Optical device whereby images may be viewed on a screen either locally or distantly remote from a miniaturized document collection.

video-Relating to or used in the transmission or reception of the television image.

video tape-Tape used to record visual images in magnetic impulse form.

APPENDIX B

SELECTED WRITINGS ON MICROGRAPHICS

B-1. Opinions of experts. Much knowledge can be gained from the writings of recognized experts in the field of document miniaturization. Their expertise is available in many commercial publications if the potential user of such systems has the time and inclination to search for it. Several pertinent articles are reproduced herein to provide the reader with various viewpoints and assist planners in determining their own approach to miniaturization problems. These articles are reprinted with permission from the following publications:

a. Getting Into COM Is Harder Than It Looks. October 1970. *Information* and *Records Management.* Information and Records Management, Inc., 250 Fulton Ave., Hempstead, N.Y. 11550.

b. Microfilm-A Systems View. Summer 1970, Vol. 3, No. 4. *The Journal of Micrographics*- National Microfilm Association, Suite 1101, 8728 Colesville Road, Silver Spring, Md. 20910.

c. The Uses of Microfiche. January-February 1971 *Data Systems*-United Business Publications, Inc., 200 Madison Ave., New York, N.Y. 10016.

d. Evaluating COM Costs. December 1970 *Data Systems.*

e. Microfilm Can Contain Paper Pollution. December 1970 *Reproductions Review*-North American Publishing Co., 134 N. 13th St., Philadelphia, Pa. 19107.

f. Protecting Records on Microfilm. October 1969 *The Office*-Office Publications, Inc., 1200 Summer St., Stamford, Conn. 16904.

g. COM: A View From Two Directions. October 1970 *The Office.*

h. Further Thoughts on Readers. September 1970 *Reproduction Methods*-Gellert Publishing Corp., 33 W. 60th St., New York, N.Y. 10023.

i. Microfilm To Hard Copy. October 1970 *Reproduction Methods.*

j. Microfilm-Predicting the Future. (Date unknown) *Reproduction Methods.*

k. Factors Dictating Characteristics of Systems Utilizing Microforms. Spring 1970, Vol. 3, No. 3 *The Journal of Micrographics*-National Microfilm Association.

l. How Microforms Help Solve Typical Information Problems. May-June 1970 *Navy Management Review*-Office of the Special Assistant to the Secretary of the Navy.

B-2. Other references. Although trade magazines are a valuable source of information on the subject of microforms, special publications relating to miniaturization systems are available. Some of these are -

a. *The Microfilm Newsletter,* a subscription periodical, P.O. Box 2157, Grand Central Station, New York, N.Y. 10017.

b. *Microfilm Source Book*, published in association with The Microfilm Newsletter.

c. *Using Microfilm Effectively,* by Thomas G. Nanney, Geyer-McAllister Publications, Inc., 51 Madison Ave., New York, N.Y. 10010.

d. *Office Automation*, a looseleaf service, published by Business Press International, 288 Park Ave. West, Elmhurst, Ill. 60126.

e. *Guide to Microreproduction Equipment,* 5th Edition, 1971,. published by the National Microfilm Association, Suite 1101, 8728 Colesville Road, Silver Spring, Md. 20910.

f. The Journal of Micrographics, a periodical furnished to members of the NMA.

g. *Microfiche Viewing Equipment,* (AD-701 600), March 1970, published by the Defense Documentation Center, Defense Supply Agency, Alexandria, Va. 22314.

h. *Microform Retrieval Equipment Guide*, (FPMR 101-11.3), 1970, published by the General Services Administration, Washington, D.C.

i. *Microfilming of Records*, (TM 12-257), November 1969, published by The Adjutant General's Office, Department of the Army, Falls Church, Va. 22041.

j. Micrographic Weekly, a subscription periodical, published by Technical Information, Inc., 6331 Hollywood Blvd., Los Angeles, Cal. .90028.

k. *Business Automation,* a subscription periodical, published by Hitchcock Publishing Co., Hitchcock Building, Wheaton, Ill. 60187.

Getting Into COM Is Harder Than It Looks

by

Joseph T. Peterson, President, Atcom Division, Arcata Microfilm. Reprinted from the October 1969 issue of The Office, by permission of Office Publications, Inc.

For companies with the output volume to justify the cost and time factors involved in the purchase or leasing of COM equipment the hiring and training of personnel, and the purchase of materials, the total investment may well be worth it. What many COM owners or lessees are discovering, however, is that once the initial crush of converting previously-generated tape to microfilm is completed, only a few hours a week of COM operation is required to keep pace with day-to-day output.

For many companies there is also another complicating factor that may dictate against an in-house installation as opposed to using a service company-handling the microfilm generated, itself.

At first glance, it may seem illogical to say that a company operating highly sophisticated data processing systems might not be able to handle a COM installation. It isn't. In relation to computer related activities there would be no stumbling blocks but it is in the areas of microfilm technology and capabilities where in-house facilities can present problems. And, it should be added, so can the facilities of a service company if they are not adequate.

You Get What You Pay For

Today's COM service bureau market is highly competitive. It has become similar to the situation that existed in the computer service bureau field soon after the initial impact of EDP was felt in the late 1950's. Due to the great demand for electronic data processing in the U.S. market, and the first broadbased breakthrough of a cost result ratio offered by second generation equipment, it appeared relatively easy to get into the EDP service business.

The situation was further aggravated by the fact that so many companies who took early delivery of their own in-house systems were greatly dismayed to learn that the computer salesman had over-simplified the time necessary to convert their previous systems to EDP. Most found that they were months and years behind in their schedule due to lack of programming and systems experience. As a result, their equipment utilization was very low and most users offered to rent out time and thus provided an even lower overhead for many more service bureaus to be created. Many customers of these service bureaus experienced serious problems when the need for the hardware grew. The prime lessee and the service bureau ended up competing for hardward time in order to meet the demand of both. Needless to say, when the computer "went down," it was the service bureau customers who came last. Many jobs got out late and some were too late to run. In such instances as payroll jobs or daily operation reports, many customers began looking for service bureaus with their own back-up hardware.

Costs of Operation

The facts of the matter were, however, that the costs of the hardware represented the smallest portion of the costs of operating a service bureau. Most dollars were spent on custom systems design and custom programming. Those service bureaus that tried to get along without offering these services found it difficult to survive. Their competitors who had total capabilities, hardware and software, took away considerable business that earlier in the game had gone to the low overhead organization. The smaller service bureaus offered "give-away" prices in order to get work. Often the work was done at cost or' below, just to bring in enough revenue to stay in business.

You have heard of the many service bureau customers who got into trouble when they were unable to meet payroll deadlines, etc. Some companies even went into bankruptcy when a yearend audit proved that the incomplete system produced statistics that were less than accurate.

Today's COM service bureau industry has reacted in a similar manner. Many are offering "give-away" prices by cutting out some of the required services that experienced microfilm service companies know are a must. These include quality control inspection at every step and reruns when required.

Some COM bids do not include the above, but customers are not aware of it until they get into trouble. One would think that the sophisticated computer user today would remember the lessons learned in the last ten years and would carefully check out the COM service bureaus that they entrust with the important and costly output from their in-house computer systems. The fact of the matter is, however, that the industry is

growing at such a rapid rate that the men who were aware of the problems that existed a few years ago, have moved upstairs to jobs of greater importance. Many of the younger men who are given the assignment of selecting the COM service bureau are not, aware of the problems that put most of these smaller operations out of the computer service bureau business.

COM Service Bureau

Bids Recently, one very large nationwide organization threw out a COM service bureau bid that was at a rate of one-half of the average bid submitted by other COM service organizations on a given application because they recognized the shortcuts that would be taken to offer such a price. This is encouraging and helps the quality COM firm hold faith that quality service is the only way to survive in the long run.

For the computer user interested in deriving the full range of benefits offered by computer output microfilming either initially or eventually, the right way to do this is to go with a full capabilities COM servicing organization, or go into the microfilming business yourself. And going with a COM service organization that offers total microfilm capabilities in most cases may be more practical at the outset.

Microfilm-A Systems View

by

Eli Nadel, Reprinted form The Journal of Micrographics, Vol. 3, No. 4, Summer 1940, by permission of the National Society of Controllers.

Summary

This paper attempts to give guidelines usable by associations of all sizes in sensibly evaluating how to use microfilm for permanent record keeping and for the distribution of information to interested users. The following details suggest that more than half of the solution to microfilm problems is either to keep records in their original paper form or, simply, not to keep the original records.

There is a natural hesitancy to throwing out records but this problem should be continually reviewed. It is a myth to think that items can always be filmed at a later date or that record keeping costs are not significant. Good management knows that microfilming can be a productive addition to efficiency and profits and can be imaginatively used to provide new or better service.

Reasons for Using Microfilm

This section lists many reasons that others have advocated for using microfilm. There are many ways in which microfilm can be profitable. Consider the following:

1. Space Savings: This is the historical reason; this is why microfilm was invented. And it is still the primary reason of most users. Microfilming provides reductions of 12:1 up to over 150:1 in required office filing space and storage (not counting the width of the aisle leading to the microfilm which remains just as wide). The advantages of space reduction are:

    a. Easier movement of data. Data shipment over long distances becomes feasible and the originals are not subject to danger of loss.

    b. A central records location. After a point, certain file sizes in an organization become incompatible with total size. Microfilm can provide the necessary relief.

2. Cost: Cost is another popular rationale. It is the author's feeling that cost should never be used as a direct reason. Where possible, all other reasons should be expressed in terms of cost. More is said below (in Guidelines) regarding costing microfilm.

3. Accuracy: In some systems, no updating is done to microfilmed records. Instead, entire replacement microfilm files are issued. This results in the faster distribution of the replacement file and, because pages are never inserted into an existing file, never having a misfile.

4. Multi-record Availability: Microfilm is also the best answer, in many situations, for distributing identical information to many locations or when different users must have simultaneous access to the same records. It replaces paper catalogs, telephone or TV systems, routing the original documents, facsimile systems, etc. In one interesting savings and loan use, an entire customer signature file is reproduced for identification of any customer at any branch location. (This particular method of signature verification provides security through optical distortion. Images can be read only by those with the proper viewers.)

5. Reduction of Total Number of Records Produced: Another association prepares their dividend checks in the original copy only and films them prior to mailing. They then retain their permanent association record without ever having produced one on paper. (The new equipment for making microfilm direct from computer produced magnetic tape also provides this benefit. See Techniques below.)

6. Disaster Preparedness: There are now three different kinds of disasters ordinarily mentioned in this connection: 1) natural events, e.g., fire, flood, hurricanes, tornadoes, etc.; 2) riot, civil commotion; and 3) nuclear or other warfare. Each of these disasters appears to suggest a different microfilming arrangement. A well designed installation should strive for some degree of preparation for all.

In each of these hazards, the security of records is provided for by having microfilm and hardcopy at separate locations, or by providing extra microfilm copies at protected locations. The microfilm planning for these situations should be consistent with other plans of the association for the same disaster. That is, if it is your association's philosophy that there need by no concern about nuclear disasters (since it is so unlikely, or since, if it occurs there won't be any survival) then just as you will take no steps for the restoration of your buildings you will also take no steps for the security of your records.

On the other hand, if you feel that there must be recovery plans for large scale disasters, then

your filming, storage, and reconstruction plans will include all of the following:

a. frequent updating of the film library and the reconstruction guides;
b. storage of reconstruction indexes, guides procedures, etc., with the same degree of protection as the film itself;
c. delegation of the authority to request delivery of the stored information;
d. realistic plans for communicating with the storage location after the disaster;
e. realistic plans, after the disaster, for delivery of records to work location, and for the provision of proper quarters, bookkeeping equipment, utility services, etc., as well as the required microfilm reading and printing equipment.

The planning for smaller scale disasters will be commensurate with the disaster.

It should be noted that upon installing a computer or data processing system, microfilm provisions established prior to that time should be reviewed.

7. Easier Lookup: There are many ways that microfilm use can provide this advantage to operations. There is first of all the convenience of having the records at hand compared to old systems in files so large that necessitate separate records storage locations. Even though the hardcopy might be as well indexed as the microfilm must be for proper retrieval, with mechanized retrieval techniques, "instant" retrieval is provided. For a microfilm system to provide this use advantage, the entire data store should be provided at a single, well planned location. The reduction in scale, in effect, is compared to putting an entire file room into a single desk.

8. Access to Non-retained Items: Items passed on to others in the normal course of business; e.g., checks, or satisfied notes can be captured on microfilm while in your possession. Microfilm is also a tool for continual access to records that are no longer available or that are inaccessible in their original form.

9. Protection to Original Records: A built-in advantage of microfilm is the protection it provides to original papers from a variety of normal use hazards. In particular, the following are valuable protections:

a. Document security. This applies especially to negotiable paper, notes, etc.
b. Document wear. How fast a paper wears out is a function of both its quality and the frequency and conditions of use.
c. Document loss. With microfilm, documents are not removed from files and cannot be misplaced while in use or misfiled. And since they are not removed from the film, they are never "out of file" to any searcher.
d. Document mutilation or alteration. The original document is safe from coffee stains as well as text alterations because access to it is protected and the microfilm image used instead. Also, the mere existence of the microfilm copy and the general knowledge that any suspicion about the original can be checked against the microfilm serves to discourage attempts at altering the text.
e. Finally, with use of blown-up printed copies of the microfilm, there is a much greater freedom and efficiency of use. The copy can be written on, adjusted, marked and notated without any damage to the original record and without any of the precautionary steps necessary when using the original.

10. Customer Service: Our "customers" include our account holders, their related agents, attorneys, brokers, etc., our business debtors and creditors, trade organizations and professional groups, and the supervisory and regulatory agencies. In many cases, the frequency of future service to all these customers can only be guessed at. Regardless, the ideal system does try to make provision for the expectation that files will have to be sufficient for the reasonable future information requirements of all these customers. A proper argument or justification for microfilm, whenever it can be used, is its improving of the customer-association relationship.

11. Creation of New Files: If you keep one set of records in a certain manner and microfilm them in another, the result is a new file with duplicate information but entirely different access. For example, making chronological filmings of all additions to a subject file results in a new file. It is better than a date index to the subject file because once the date is found, so is the data, and no further lookup is needed. Most of the situations in which microfilm is justified on this basis rely on the date feature for file distinction.

12. To Edit Files: Several microfilm justifications have been noted based on the contention that the act of microfilming serves as an impetus to go through the records and put them in order, clarify discrepancies, purge obsolete and outdated items, etc. Thus, it is claimed, one of the advantages of microfilming is that the original records are made more usable. All of these benefits, however, can be obtained through proper records maintenance and without buying an inch of film.

COORDINATION WITH OTHER PROGRAMS

The scheme for microfilming adopted in an association must consider other related records activities so that protection of vital records without undue duplication or overlapping is assured. It is particularly important to take careful measure of the association's records retention and destruction policies. The two are intimately related. Records destruction programs apply to microfilm as well as hardcopy records. The film should be arranged, dated and catalogued so that it receives the same destruction consideration as any paper records.

The day before destruction of hardcopy records is the last opportunity to microfilm those records. It is a poor practice to automatically create film at this time, though it sometimes provides an important record that would otherwise be lost. The practice, however, wastes a lot of film, leads to duplicate films ("destruction filming") of items that frequently are already on film for other programs, and negates the fact that records destruction has occurred. The original paper might have gone up in smoke, but the information is still on file.

MICROFILM TECHNIQUES

This section will give a very brief summary to convey some appreciation of the vast array of microfilm methods now available. Because developments in microfilm have been so fast in recent years, any microfilm equipment over five years old, even if in top shape mechanically, is probably both functionally and economically obsolete in the comparative sense of its limited flexibility and higher cost to today's machines. "Higher cost" is meant not only in the sense that 1963 dollars will buy more machinery today, even if devalued to 1968 purchasing power, but also in the sense that other costs of a microfilming program, e.g., operator wage costs, will be reduced due to greater automation of the equipment, faster speeds, etc. It appears that any particular microfilm method of which you can conceive is now commercially available from competing sources.

Exposing the film is generally done two ways. The best method for documents in varying sizes, colors and condition, such as loan file folder contents, is from originals exposed one at a time on a flat table before an overhead camera. Checks, ledgers and other such items are best copied in flow copiers, which have rollers and feed trays so that a whole stack of items is transported past a camera read station without individual handling. Film index marks (targets) to facilitate retrieval can be added at this time or as part of the film processing. This is entirely dependent on the retrieval methods to be used: There is equipment that films and produces finished aperture cards in seconds and equipment for filming of continuous forms for extremely high volume situations. Lately becoming economical for the larger associations are machines which produce microfilm directly from computer magnetic tape in much the same way as images and sound can be broadcast from videotape. These machines are "programmed" like computers and can insert targets, format the data, insert forms, overlays, and generally result in a microfilm record without the original paper ever having been produced.

Exposed film is then used to produce the following usable media. Newer developments are being announced continually:

1. Roll Film. 16mm and 35mm films are generally kept in 100 foot reels. Up to four images fit across the film width, depending on the document size, film width, and reduction ratio. A variety of cartridge devices are used to facilitate handling, to provide automatic threading into readers, to safeguard the film from wear, and to provide faster access to the desired images. On some equipment, the film is sliced into segments up to one foot long and stacked in long cartridges. This is still a "roll" method of use, but access time is faster since the right cartridge and right strip within are selected manually, and the entire rest of the roll does not have to pass before the lens before the desired one is reached.

2. Aperture cards. These are film segments of just one or two frames inserted into standard tabulating cards. There are a variety of standard film sizes and aperture sizes that may be used. The significant feature of this method is that other areas of the card may be punched and interpreted and the deck of such cards is subject to further filing, sorting, manipulation,

processing, item finding, and updating just as conveniently as any other punched card.

3. Fiche. The standard size for a microfiche card is about 4" x 6" (105mm x 148.75mm exactly) and contains a minimum of just one 105mm image at a 12:1 ratio, at the largest, to a maximum of 3,200 or more images so small that a microscope, rather than a reader, must be used for viewing. The typical fiche, however, is neither extreme. It conforms to the standards of the National Microfilm Association and has up to 98 letter size pages, in 7 rows and 14 columns, at a 24:1 reduction ratio. Fiche is mass produced photographically from roll film or aperture card images and is used primarily when multiple images of the same record must be distributed to a variety of locations. On the other hand, fiche jackets are individual file folders in the 4" x 6" size in which segments of strip film are inserted.

A savings and loan use for fiche would be for a procedures manual. The manual is updated by replacing the fiche instead of issuing revision pages. A savings and loan use for fiche jackets would be for individual loan files where the entire file-the mortgage, note, insurance policy, correspondence, everything-would be replaced for each loan by just one or perhaps two fiche jackets.

Just as there are reader-printers for producing hardcopy blow-ups from roll film, complete control of fiche originals is provided through contact printers which duplicate the fiche and are usable in readers and printers.

It should also be noted that there are now available many auxiliary microfilm .equipment items which make it possible for associations to consider doing all of their film processing "in-house". Automatic overnight unattended processing, without dark rooms, is now possible. Microfilm technology has fortunately developed after the standards and there are few situations where the best camera can't be selected independently of the best reader, etc. with free mixture of brands, so that the best equipment solution is provided.

LEGALITY OF MICROFILMING

Federal law and most state regulations now provide that microfilm records are as fully acceptable for all uses as the original records as long as the filming was done "in the regular course of business".

Most states have adopted the Uniform Photographic Copies of Business and Public Records as Evidence Act based on the Model Uniform Microfilm Act. Controllers should satisfy themselves that the use of microfilm is legal in their states by reviewing the uniform code as enacted in their states or other legislation which might be in force. Further, if dealing across state lines, inquiry as to the microfilm laws of all pertinent states should be made. The similar provisions assuring acceptability on a federal level is Sec. 1732, Title 28, United States Code. A search of federal regulations including the FHLB, FSLIC, IRS, Federal Labor Standards Act, Social Security Administration, General Accounting Office and Equal Employment Opportunities Commission has not uncovered any provisions whatever discriminatory to microfilm use.

GUIDELINES FOR USE OF MICROFILM

Like any other system change, fitting microfilm into the total association operations is a matter of adjustment and compromise. Hopefully, the following rules will help.

1. Coordinating with records retention/destruction program: The question of records retention is not a proper part of the question to use microfilm. Do not confuse the two. The question of records retention is: "Should certain records be kept?" The question of microfilm is: "How should certain records be kept?" Settle the records retention question first to avoid putting on film that which you wouldn't keep in paper form.

2. Cost: The question of whether or not to microfilm, or how to microfilm, should be made solely on the basis of all the reasons therefor, pro and con. These reasons, in turn, should be expressed in terms of their valuations. Then, as a last step, these values lead to comparative cost indications for the various alternatives. It is a mistake to work out the direct cost of available equipment and then to rationalize it in terms of how to superimpose it onto existing situations. The primary consideration for the specific decision of what to do must be the solution's practicality.

It is further improper to take a simplistic cost view of the situation because:

a. Costs to create film are usually understated. It is extremely difficult to guess the cost of a microfilm program. In conversion, for example, all of the following are involved: locating missing papers; putting files in order; removing staples, binders, etc.; facing items; preparing targets, captions, indexes, labels; inspecting, then finding

specific documents for refilming and the consequent refilming, reinspection, and splicing in or cross-indexing; putting original papers back into original use or original format, and so on.

b. Other costs are also very hard to guess and are usually understated. Among use costs there are: the need to copy the microfilm occurs more frequently than with hardcopy records and at a higher per copy cost; the wasted time due to a limited number of copiers, or the higher cost to provide a greater number of expensive readers; and the cost of protective storage cabinets and files for microfilm sometimes equals the costs of the larger cabinets needed for hardcopy records. There are many other areas of such costs.

3. Conversion Problems: The microfilm equipment must be closely matched to the job requirements. As a general rule-the older a document is when it is filmed, the more difficult the filming will be and the less successful the result. Indexing and paper arrangement must meet exacting standards for filming. Inserting images after the filming is an extremely tedious and expensive task. Perhaps special cameras or equipment must be provided for folded or oversize pages. Will old, frayed, ragged records get copied, or shredded further? Will colored tissue, hectograph and mimeograph items, or those with shaded background come out on film? Do your originals distinguish credit balances solely by their red color and thus need encircling or other special notation? These questions, and all the other situations peculiar to your own situation that only you know about, must all be answered before stepping off the gangplank.

4. Use Problems: All of the following use qualifications should also be resolved before deciding that a certain microfilm arrangement will be satisfactory:

a. In contrast to hardcopy file searching, the user cannot view several images at once, the essential nature of microfilming being only the successive revelation of images.

b. The system must justify a multiavailability of film readers and reader-printers, or the increased cost of travel to centralized viewers.

c. Lookup in microfilm is not necessarily faster or slower than with hardcopy systems. It all depends on the quality of the indexing, the machine features selected, and the arrangement of the facilities.

d. It is much easier, either through accident or peculation, to lose or misplace a roll of film compared to an equal volume of hardcopy records On the other hand, it is much harder to lose an individual microfilm record.

e. The loss of a roll of film could be considerably more disastrous to operations than the loss of the comparable hardcopy. It is also more costly, as it represents the investment in the filming as well.

f. Microfilm techniques, per se, are usually feasible only for volume operations. They present no solution at all for the many small individual files and situations which present nagging problems to management.

g. Some "customers" receiving service through microfilm records might not be receptive to it. Their frowning and upset might well be a harassment that hardcopy records would have avoided.

SPECIFIC RULES TO FOLLOW

This section will state several standards of good use. Many of these rules are stated from the point of view of complying with the various government authorities which exert regulatory power over savings and loan associations. To the extent that it also appears that much of the following applies to hardcopy records, the resemblance is intended. Many microfilm problems are solved by good management of hardcopy. The best solution, indeed, of microfilm problems is to throw away the problem.

1. Concentrate on high volume records. Do not lose any sleep over records which have only a slight effect on overall storage costs or problems.

2. Comply with the intent of regulations. Do not read into any regulations an interpretation which works to your disadvantage. The loosest sensible construction should always be taken. For example, FHLB regulations state minimum retention periods for keeping appraisals. In the absence of any other internal use, do you keep appraisals for closed and satisfied loans? The regulation is silent on this point.

3. Be reasonable. In the absence of specific government requirements or clear operating considerations, vague regulations and the practices of your competitors should be ignored. You know your own shop best, and only you know just how capable you must be, in terms of your management's policies, to answer questions five years from now. Keep your records accordingly.

4. Look for uniformity in regulation. By complying with obvious and basic regulations:

a. You will automatically meet the requirements of numerous other regulations.

b. In questionable circumstances, your actions to consider the problem and to select the course of action that you did take will be persuasive constructive proof of your intent to comply.

5. Segregate and keep records on an exception basis. Even if your retention requirement for accounts payable is, say, four years, after just one year you can be pretty sure which few will be subject to dispute. All the rest may be discarded. Volume reductions, even without filming, approach 100:1 when this is done ruthlessly.

6. Plan to substitute other evidence. For records kept solely to substantiate oral testimony and written affidavits often are as acceptable and, certainly, more expedient than the actual details themselves. A good set of diaries or memoranda, if kept, should be used as justification for destruction of the detail records.

7. Ignore vague regulations. Do not keep bulky detail records when there is no clear requirement. Argue that general books of account are sufficient.

8. Consider taking calculated risks. Consider the possibilities of arbitrary settlements. The risk, including penalties, might very well be less than the cost of keeping detail records. When planning on this defense, consider how many times in the past that general records have sufficed without any looking into the details of records you did have.

9. Do not follow copy retention or filming schedules adopted by others. This could be very costly to your association in that:

a. It might be more or less conservative than you need.

b. It might reflect a different level of technology. You cannot necessarily know what shortcomings a schedule has by other records or other procedures.

c. It might be serving an intra-office or inter-office situation which does not pertain to your operations.

d. It might be serving the needs of certain customer services, regulations, etc., which do not pertain to your operations.

10. Know your state's statute of limitations and apply it with common sense. There is an extraordinary variety of differences in the various state and federal time limitations.

a. Most statutes establishing time limits do not themselves require the keeping of records. Keep records merely for the protection of your own exposure. Do not try to meet your presumption of government requirements.

b. Even when observing a specific statute of limitations, this still doesn't mean to keep everything. Records should still be culled and thrown away per a formal destruction program.

c. Federal statute of limitations for IRS purposes is three years from the date of filing of return, including IRS permitted delays for filing. This three year period is extended only for false and fraudulent returns, for willful attempts to evade taxes, or if no return is filed. There is a six year limitation for omissions equal to or greater than 25% of reported gross income.

11. Have a formal program for the destruction of records. Merely having and following such a program is your best defense against any future charge of improper record keeping. It proves you have conscientiously tried to provide a sensible plan for future needs and it makes impossible any charges that records are being destroyed negligently or whimsically.

12. Meeting all known requirements is hardly practical. There are too many different and conflicting requirements of too many different authorities for an association to expect to comply with the specific details of them all. Try to steer a reasonable middle course of general conformity.

13. Do not blindly follow the apparent meanings of regulations as written. When it suits your convenience, you should plan on arguing that some other comparable or general record serves the purpose of the specified record. In addition to following this rule to destroy

specified records, use it to avoid their creation.

14. Do not assume that you are subject to particular record keeping requirements. It might very well be that due to the nature of your activities for the form of your organization, you are actually exempt from requirements which your competitors face. For example, federal associations often adhere to certain state requirements, and vice versa, which safely can be ignored.

15. Identify records. General regulations say, for example, that "payroll" records must be kept for three years. But another rule specifies that time cards should be kept two years. Time cards shouldn't be kept for the third year. Further, there are many other "payroll" records which were never intended by the regulation for retention at all. Keep the summaries and the 941's. Do not put the rest on microfilm. Do not even keep them.

16. Do not assume that regulations are inflexible. If you have valid reasons, ask for exceptions and for waivers of requirements. Government officials do have understanding and they do cooperate, and they grant reasonable requests. There is no sense keeping records for someone else's need, particularly if they don't need them.

17. Specify records retention requirements contractually. Remember to include your requirements or preferences, where possible, as part of your business dealings, e.g., participation agreements, property leases. Frequently, those you do business with can keep responsible records which meet your requirements.

CONCLUSIONS

No filming question can be considered in a void. It must be related to your association's other practices and objectives. (It doesn't matter how much sense it makes to the controller to throw out the cards for last year's closed accounts. If management wants to be able to tell, two years from now, if Mrs. Jones ever had an account, then the information must be kept in usable format.)

The computer age provides much more to film than ever before. We still have all the input and, transaction data as with our manual systems and, in addition, massive streams of summaries, reports, reconciliations, exceptions. There are the choices of filming it all, along with its data base, or of sensible selective and judicious filming per a continuously reviewed film program, or of filming nothing. Both extremes must be avoided. Both invite a negative effect on income due to the costs of excess records-no easy retrieval, no disaster preparedness, chaos, disorganization and staff demoralization. Unplanned and uncoordinated use of microfilm also results in excessive attention for some items and neglect for others and no provision for interdepartmental interchange of equipment, equipment use, or information.

Microfilm is an extremely valuable operating technique, but usually only when carefully matched and installed for certain specific high volume record situations, and for certain peculiar records dissemination situations.

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The Uses of Microfiche
by

C. David Broeker, Marketing Manager, Microfilm Div, Kleer Vu Industries, Inc. Reprinted from Data Systems, January-February 1971, by permission of United Business Publications, Inc.

The term microfiche is relatively unknown to many people in the business community. For the uninitiated, it is a sheet of microfilm which is a recording of multiple micro-images in a grid pattern to make a unitized record. Uppermost is the current problem which would cause someone to look to microfilm for a solution. What are the problems ?

There is an increased number of white collar' workers in business offices. The figures show that in the engineering and technical field there has been an increase of 60 percent in personnel. There is a 42 percent increase in clerical workers. Managerial positions have increased by 30 percent. And service workers have increased approximately 50 percent. The overall average increase in working manpower is about 40 percent and, because of this increase, there is a rising degree of need for communication between people.

Up until now the common method of communications has been by paper-letter, memos, etc. -and paper causes problems. First, it is expensive to create, it is costly to use (it is estimated that just to type and file one letter costs about $3.00), costly to store and difficult as well as costly to retrieve. That is why microfiche is beginning to be the answer, since it reduces the cost of maintaining recorded information.

For example, it costs about $50.00 to store 3,000 pages of 8 1/2 x 11 paper, whereas one can store approximately 468,000 microfiche copies in the same amount of space. This means, of course, that by using microfiche you reduce the time to file 60 pieces of paper, compared to the time required for one (60 images) microfiche. It also reduces the amount of search time in retrieval. It is obvious that looking for microfiche would take much less time than is required for looking for one of 60 pages of letter-size documents. Most importantly, the cost to reproduce is substantially reduced. One microfiche with 60 images reproduces for 4 cents compared to a minimum of 1 cent per page in paper reproduction. And, finally, there is a substantial saving in the cost of mailing. Sixty sheets of paper weighs 1.05 lbs. in comparison to the less than one ounce for one microfiche. In other words, you can ship 16 times more material on microfiche than paper for the same price.

Microfiche can do it better than any other microfilm because fiche readers cost less pier unit than roll or cartridge. As mentioned earlier, fiche costs less to store, particularly in the case of cartridge microfilms, which require special housing. It also can be up-dated and changed without having to up-date the entire roll, as on a cartridge. And finally, fiche can be transported and mailed much more easily than roll or cartridge forms.

The question is, where does microfilm stand at this time and where is its future? As in any industry, there are certain semantics. In our industry we have such terms as: retrieval; thruput digital; graphic; ultrafiche; on-line; random access.

It wasn't so many years ago that all we had available to us was film, and we set about putting ourrecords on microfilm. Microfilm has changed; it is no longer considered the security file. It's the today file-the active, dynamic new method for storage and retrieval of information. In 1960 two revolutionary changes took place in the microfilm field. First was the advent of the unitized micro-image called the aperture card or jacket. Second, was the introduction of the first computer recorder of micro-images.

Let's reflect for a moment and see just why these milestones occurred. There was a growing demand for better communication between the engineering and the manufacturing departments of many large companies. The time required from the design to the actual manufacturing of that part became so long, that often the new parts never got into the machine without costly reworks. At the same time reproduction managers were evaluating their systems to find new methods of reducing the overall cost of their systems. Since EAM equipment and microfilm presented such a logical marriage, the aperture card was born and a whole new way of life started for the engineering departments. They not only received their information faster, but they were able to maintain access to far greater stores of knowledge, since it cost so little to have all the information at one's fingertips.

In 1965, another birth took place. Stromberg DatagraphiX introduced the first computer output microfilm system. The needs were there, as they were in the engineering departments.

The computer was being called upon to perform more and more of the day-to-day tasks of industry;

The demand for access to this information became more urgent;

The print speed of the impact printers was limited.

To sum up, the cost of maintaining information was increasing while the ability to retrieve it was diminishing. COM was the answer.

What is the impact of this explosion? Well we estimate that there will be approximately 100 million engineering drawings placed on microfilm this year. We also estimate that there will be approximately 1000 COM recorders in use this year.

As we said, things are changing. The needs and demands of management are far greater than they have ever been, and microfilm and microfiche, heretofore underutilized, offer some of business' best hopes for control of the information explosion.

Evaluating COM Costs

by

Joseph Kish, vice president, Iron Mountain Inc., Information Systems Div., Hudson, N.Y., from Data Systems, December 1970 by permission of United Business Publications, Inc.

Computer Output Microfilm (COM), a technique that enables the production of microfilm directly from magnetic tape, by-passing the hard copy, is the hottest item in microfilm technology today. Increasingly, data processing managers are making more and more use of COM in their EDP reports distribution procedures, where once only hard copy was involved.

As an integral member of most EDP systems study terms, the Forms Manager needs to have some basic understanding of COM, its cost and applications.

Unhappily, however, I find that COM is not being carefully justified on the basis of cost and operations value in many cases. Just as conventional microfilm-based systems were oversold 15 to 20 years ago by many microfilm dealers and manufacturers, COM-produced microfilm is often oversold today. In far too many instances, one COM system or another is being touted as the panacea to EDP printout storage, distribution and retrieval problems, without any prior cost or operational justification.

Generally, COM can be cost justified in those instances where:

(1) Its use results in the elimination of hard copy entirely, and with it all supplemental forms handling operations, such as bursting, decollating, etc.

(2) Its use results in the reduction of copies from the multi-part EDP report, so that one additional printing pass can be eliminated (e.g., a 9-part report reduced to 6 parts that can be reduced to 7 hard copies and 2 microfilm, therefore the entire distribution is being printed in one pass rather than two, etc.)

Likewise, COM can be operationally justified under conditions where: (1) no need to continuously compare one record to another exists; (2) it is not necessary to make significant notations on the record; (3) retrieval practice generally does not require an actual hard copy of the record.

If these conditions exist, the analyst should conduct his cost justification comparing original hard copy output to COM and continuous forms camera-generated microfilm. Let's examine each of these methods in detail.

Cost of Hard Copy

The cost factors involved in the creation, storage, retrieval distribution of computer output in hard copy format may be determined as follows:

1) *Forms:* Multiply the number of forms used in the average run (as determined from the EDP Department's production log), by the cost of the forms per thousand (as determined from Purchasing's last order).

2) *Printing Cost:* This cost is determined by multiplying the average production time for each report (as contained in EDP's log sheets) by the current' hourly charge for computer printer operation (as furnished by EDP).

3) *Bursting, etc.:* This cost is determined by multiplying the usual forms handling time required for each job (available from the Forms Handling Department), by current hourly charge for forms handling operations.

4) *Binding Boxing*, etc.: This cost is determined by multiplying the number of binders, boxes, etc., currently required to contain this record, by the current cost of that binder, box, etc., (the number of binders, boxes, etc., may be established by sampling; their prices can be furnished by the Purchasing Department.

5) *Office Storage*: This cost is determined by multiplying length of time the various records are currently retained in active office areas, by the number of cubic feet of records stored per square foot of office floor space (available from Office Services).

6) *Transportation:* This figure was determined by multiplying the number of cubic feet of records involved by the contractual or internal pick-up and delivery charge to the storage area (available from Office Services).

7) *Storage Cost*: This figure was determined by multiplying the number of cubic feet of records involved, by the annual cost of storage and reference per cubic foot (available from Office Services).

8) *Destructive Charge*: This figure was determined by multiplying the number of cubic feet involved, by the current charge per cubic foot for records destruction (available from Office Services).

9) *Other Costs: Other costs-mailing, indexing, etc.-should be determined by the most expeditious, reliable method (e.g., sampling, examination of records, pricing based upon the time study, etc.)*

To put COM in perspective, we will next discuss briefly the basic cycle for producing microfilm by means of a continuous forms microfilm camera, such as Eastman Kodak's List-O-Matic or Bell and Howell's Tab-Tronic. This is a well established pre-COM method of utilizing microfilm in the print-out cycle. It generally results in the same cost factors as the production of hard copy records, plus the' following additional costs: (1) lease or amortization of the microfilm camera and processor; (2) cost of microfilm; (3) cost of labor involved; and (4) cost of processing chemicals.

Production of microfilm via the continuous forms microfilm camera will yield cost savings over a hard copy output system only if the savings resulting from the elimination of copies of the multiple-part continuous form set and from simplified forms handling, distribution and filing exceed the additional cost of preparing the microfilm output.

Finally we come to the cost factors involved in a full-fledged Computer Output Microfilm production cycle:

1) *Microfilm Stock:* COM Camera Rental or Service Charge. This charge or rental is calculated based upon the following: (a) the actual service charge made by the COM service bureau for the COM conversion; or (b) an average inhouse cost of 1 1/4 cents per page multiplied by the number of pages of data to be converted.

2) *Microfilm Stock*: This figure is determined by multiplying the number of rolls of microfilm required annually by the typical cost of $5 per roo foot roll.

3) *Film Processing:* This figure is determined by multiplying the number of microfilm rolls to be processed, by an average 12 minutes processing per roll, by a $4 per hour labor cost for in-house production or by the actual Processing cost if a commercial processing laboratory is used.

4) *Disk-Tape Conversion:* By multiplying the number of hours required to convert data from disk to magnetic tape, by the typical hourly charge for this conversion-$25.

Application of these cost comparisons will help assure that microfilm-based information storage and retrieval systems are actually economical.

Microfilm Can Contain Paper Pollution

by

Howard A. Floyd, Reprographics Management Consultant. Reprinted from Reproductions Review, December 1970, by permission of North American Publishing Co.

"Paper explosion," "paperwork proliferation" and "paperwork glut" are terms we have been hearing with increasing frequency during the last decade. Now we must add a new term, "paper pollution." Business is truly being polluted with paper. Believe it or not, in business, paper actually occupies more space than people. If you doubt this, consider these facts:

The paper on and in the desk of the average business man will make a stack three or more feet high.

The office of an executive will contain at least one book case and one file cabinet, both full of paper, some of it loose, some in folders, and some in binders. This is in addition to the papers in and on his desk.

A file cabinet occupies as much space as two people and access to the file cabinet occupies as much space as two more people.

A general office will contain rows and rows of file cabinets plus related access space.

The file cabinets in a secretary's office will occupy 20 to 50 percent of the total floor space.

Entire Floors Used

Entire floors and entire buildings are devoted to the storage of paper records. These storage or file centers may contain records that are active, inactive, or both. These centers have shelving, transfer cases, or other types of containers that extend from floor to ceiling.

At least 25 percent of the floor space of any stationery storeroom is devoted to paper storage.

At least 25 percent of the floor space of any reproduction room is occupied by paper. This paper may be in the presses, in collators, on tables, on shelving, in and on counters, and in cartons on the floor.

Many office moves are necessitated, not by the need of more space for people, but by the need of space to put more file cabinets. File cabinets have usurped "people space."

Records Production

Although business has been concerned about paperwork proliferation, the paper-producing equipment has become more sophisticated and more and more productive. For example, a large computer will produce a stack of papers 10,000 feet high in the same period of time taken by a typewriter to produce a stack 25 feet high. One copier, one copier-duplicator, and one high speed offset press in one office have the combined potential to produce more than 100,000 copies in one day. This sophisticated paper producing equipment is being used to the utmost and the result is paper proliferation that builds up to paper pollution.

Paper is originated, reproduced, distributed, collected, sorted, referenced, and filed or stored.
Filing or storage may be in desks, in file cabinets, or ill file storage areas. Then it is retrieved to be used, to be worked on, to be up-dated or to be reproduced or redistributed. Regardless how or where filed, the act of retrieval of any one bit of information may occur many times.

Vital to Business

Paperwork is vital to business and the origination of information, statistics, reports, forms, and other materials cannot be curtailed. As business gets more intricate and complex, as it grows and as it asks more questions, compiles more answers, and distributes more information, it increases paperwork.

If most of the papers originated were discarded within a short period after origination, this proliferation would not cause pollution problems. However, most of the papers originated are retained for extended periods of time. Further, duplicate copies of the same papers will be in numerous file and they are all retained. It is this retention of vast quantities of paper that is creating paper pollution.

Reducing Storage Space

The means to eliminate paper pollution has been available to business for many years-microfilm. But it has been used primarily for security, to make duplicate records to be used in case the paper originals were lost or destroyed. Since this was the main purpose and since the expectancy was that these back-up records would be referred to very seldom, not much attention was paid to methods to find and retrieve information placed on microfilm. "Film it, file it, forget it" was the cliche applied to microfilm.

The prime factor, over the years, that has militated against the use of microfilm for recording active papers has been the lack of systems and equipment that would provide easy reference, prompt access to and quick retrieval of any information that was placed on microfilm.

During World War II, the United States government created vast files of microfilm and then, when it wanted to use information in these files, it found that finding one frame of film out of millions on thousands of reels of film was a time consuming, tedious, costly and sometimes impossible operation. This led to the invention of the aperture card which was nothing more than a tabulating card with an opening in which the microframe could be placed. These cards were punched with reference codes, which, when cards were run through tabulating machines, facilitated the retrieval of any information wanted. This was the start of a new dimension for microfilm. Now it became a way of mechanical or mechanized information handling.

Business jumped to the use of aperture cards for recorded engineering drawings, specifications, and for other similar papers that were large and voluminous. This eliminated the need for reproducing, storing, and distributing the out-sized paper copies of this material. The handling of this type of work is normally a centralized function, and the volume handled is sufficient to justify the expense of tabulating equipment and labor required to punch and sort the cards and retrieve drawings as wanted.

Not the Answer

However, aperture cards were not the answer for replacing all papers in an active category that were being used and referred to frequently. The volume of tabulating equipment that would be required and the expense involved in its operation made this field of use prohibitive.

Aperture cards could be made and indexed, filed and retrieved manually the same as paper copies but this would require extra clerical effort that conceivably could cost more than the value of the floor space that would be saved. Further, the equipment available for viewing was bulky and costly.

Retrieval Devices

As a result of these factors little or no consideration was given to using microfilm on tab cards to store active information to be used for frequent or constant reference. Microfilm producers had failed to provide reference and retrieval devices that would enable users to have the widespread use otherwise possible.

A few years ago retrieval devices, other than tabulating, were introduced. Today these devices have been perfected. Information-retrieval hardware is available that will permit an executive to have all the information, to which he must refer, stored on microfilm reels or microfiche cards in a small container on his desk. He can view or have a hard copy of any of this information in less time than it would take his secretary to get him a copy from a conventional file of paper copies.

These same devices will enable clerical workers to have all the working information they need on microfilm at their desks. They will have immediate access to any information as it is wanted.

Far Less Space

What effect will all this have on paper pollution? Microfilm will occupy 98 percent less space than paper containing the same information. For example: A 3" diameter, hundred-foot reel of 16mm microfilm will contain the same information as a half mile of computer output paper. One 5" reel of microfilm can contain the equivalent of the paper stored in from two to four 5-drawer file cabinets, dependent on the microfilm used. If microfiche or ultrafiche were used, several drawers holding 4 x 6" cards could replace all the file cabinets in an office.

To illustrate the space saving possible and how it would reduce paper pollution: 2 million sheets of paper would fill 80 five-drawer file cabinets. These cabinets and the access space required to use them would occupy more than 500 square feet of floor space. On microfilm these 2 million sheets would occupy from one to two cubic feet on the top of a desk. (In this instance savings would be 100 percent since no floor space would be occupied.)

Devices Now Available

The reference systems and the retrieval devices that are now available will permit any one of these two million pages to be found and viewed in seconds. The final barrier to the use of microfilm for the storage of active records has been removed. Business has the means to eliminate paper pollution and in so doing to get a bonus-a savings of several billion dollars in the cost of filing, storing and handling paperwork.

Business is starting to cash in on these savings. Microfilm is being teamed with computers. Some companies put all their payroll and personnel records on microfilm. Airlines are putting ticket sales reports, freight records and flight information on microfilm. Other specialized and centralized operations are being put on microfilm, but all of these just scratch the surface. The

ultimate use of microfilm to eliminate paper pollution is still in its formative stages. As management accepts and becomes educated to microfilm possibilities, it will see many new uses for microfilm.

Overcome Resistance

The microfilm situation is now in a phase where it has the retrieval hardware that will permit widespread use for recording and storing a high volume of active working information now on paper in desks and file cabinets. But, business needs a lot of help to overcome the resistance to the changeover from paper to microfilm, help to develop a faith in the integrity of microfilm records and it needs help in applying this new concept to its various operations.

Protecting Records on Microfilm

by

Joseph L. Kish, Jr., Vice President, Information Systems Div., Iron Mountain, Inc. Reprinted from The Office, October 1969, by permission of Office Publications, Inc.

Microfilm, during its storage and use, may be subjected to many hazards. Since it is a delicate records media (more delicate than paper, for instance), users must recognize and take precautions against these hazards. Due to uncontrolled temperature and humidity, microfilm may become brittle and crack; or it may warp and not feed properly through reading and reproduction equipment. It can be readily scratched in normal reference use. Most important, it can be damaged through mishandling.

Many of these hazards result from microfilm's primary advantage: its miniature images. A scratch or small spot of mold, barely noticeable on a paper record, may seriously impair the legibility of a microfilm image. Small particles of dust or dirt on the optical flats of a reader may cause a scratch throughout an entire roll of microfilm, making thousands of images less legible. Excess humidity can lead to molds or fringe that, thriving upon the emulsion of the microfilm, can quickly spread throughout the entire roll, rendering it illegible. Water damage, chemical gases and intense heat can soften the emulsion, leading to unusable film. Residual hypo or storage near ammonia vapor can likewise lead to deterioration.

Microfilm records may seriously deteriorate over a period of a few years if stored where temperature and humidity are uncontrolled. Ideally, microfilm should be stored in an area in which humidity ranges between 40% and 50%, and temperature between 50° and 75°. Failure to maintain these conditions can lead to serious deterioration. If, for example, humidity drops below 20% or rises above 60% for extended periods, the microfilm may become brittle and ultimately break, or cracks may appear in the emulsion coating holding the image.

Slight excesses of humidity in the air can cause the formation of mold and fungi on the microfilm. In areas where the climate is generally damp, the life expectancy of microfilmed records will be less than those stored in reasonably dry areas. Therefore, humidity must be controlled, if the records will be retained for more than two or three years. There are basically four ways to assure adequate temperature and humidity controls:

1) Store microfilm in air-conditioned, heated buildings.
2) Dehumidify the air through the use of small quantities of such moisture absorbing chemicals as sodium dichromate and calcium cyclamate. Put the chemical in small bags in each drawer of microfilm stored in nonair-conditioned areas.
3) Store the microfilm in humidified cabinets.
4) Use a vaporizer to add moisture to the air when humidity is low.

Regulation of temperature and humidity in a nonair-conditioned area requires the use of a simple thermometer and a hygrometer to keep a check on the storage environment, as well as a periodic inspection of the actual microfilm to uncover any mold, mildew, fungi or rust that may have formed. Any such growths can be removed easily and inexpensively by a commercial processing laboratory if discovered in time. At the same time, the film is examined for mold, it should be tested for brittleness. Merely bend it back and forth six or seven times without actually creasing it. If the film breaks easily, it is too dry and should be reconditioned.

The odor of residual sodium hyposulphite (hypo) is easily recognizable. Its presence in a microfilm drawer generally indicates that some of the film was not washed thoroughly enough after developing. Whenever such an odor is present, prompt action should be taken. In addition, the actual microfilm images themselves should be examined for signs of discoloration or fading, indications that excessive residual hypo is present. A major danger is the possibility that other films that have been properly processed will be contaminated by the improperly washed film nearby.

Microfilm is especially susceptible to water damage. For this reason, certain specific precautions should be taken to minimize this possibility:

1) Never store microfilm underneath water or steam pipes that might leak.
2) Raise all microfilm cabinets at least 6" off the floor.
3) Provide drains in the floor to reduce the possibility of water rising to the level of the microfilm.

4) Use other than sprinklers for fire control. High expansion foam; heat sensing devices, etc., provide less hazardous alternatives.

Deposits of dust and dirt on the film, or in the optics of reading and printing equipment, frequently lead to scratches and abrasions in the film's emulsion. This can be prevented by the following:

1) Clean all optic fiats prior to use.
2) Clean all microfilm prior to use by passing it through a piece of clean, dry cheesecloth while winding it on a movie rewind.
3) Have operators handle film only by its edges or, better still, handle it only while wearing clean, cotton gloves.
4) Store microfilm in closed cabinets when not in use.

Industrial gases, such as sulfur dioxide and hydrogen sulphide, will lead to discoloration and deterioration of microfilm. This can be reduced by storing film in its paper mailing carton in closed cabinets when not in use. Rarely, is the expense involved in installing gas filtration units justified or necessary. Before doing so, atmospheric tests by chemical engineers will determine the necessity of such controls.

Protection against fire is of prime importance when converting to microfilm. This will result in a certain amount of risk-taking since:

1) The proper atmosphere for preservation of microfilm requires, if possible, the free circulation of air. This means air-conditioning ducts that can be possible avenues for the spreading of fire.
2) Microfilm can be endangered by fire resistant vaults constructed with a crystalline insulating material that generates interior steam when heated by fire. Microfilm cabinets that normally allow air to enter will also permit the passage of steam, that could likely soften and separate the thin emulsion from the film base, destroying the records.

It is the considered opinion of experts that the need for temperature and humidity controls outweigh the possible fire hazard provided that Underwriter-Approved automatic fire control dampers are installed in the ducts of fire-resistant vaults and cabinets in accordance with the recommendations of the National Fire Protection Assn. Adoption of these precautions will generally assure the continued, safe preservation of microfilmed records.

COM: A View From Two Directions

by

Charles P. Yerkes, President, Yerkes-Wolf Associates, Inc., Scarsdale, N.Y. Reprinted from The Office, October 1970, by permission of Office Publications, Inc.

A COMPUTER-OUTPUT-MICROFILMER is a business machine. Its purpose is to process digital computer output: convert and record it on microfilm in a form that is useful, and compatible with present business systems. Two distinct business entities are involved in this process and its output: the data processing group and those who design and use microfilm systems.

The initial reaction of the data processing manager is to view the computer-output-microfilmer as another peripheral with the potential of breaking the computer output bottleneck. It does that but, without good systems backup, the film output could be of low, or no, value. Speed does not determine the total value of a system. The key is the usefulness of the information after it is on film. The data processing manager has significant interest in achieving better output efficiency, but the user and his needs are more important. A good systems analysis requires that we look in two directions before taking the big step to COM.

What are the advantages and systems considerations for a data processing manager who wishes to use COM instead of a mechanical printer ?

1. Output speed is the most obvious. The slowest COM units operate at 10,000 cps, the fastest at 100,000 plus. This is a significant increase over hard copy printers, with a decrease in central processing time and expense.

2. Supply costs can be cut. Film costs run from a half to an eighth of manifold forms costs. This does not include the labor required to decollate, burst and bind hard copies.

3. Records storage space and shipping costs can be reduced as much as 90 %. with film.

4. COM has great flexibility in generating microfilm copy. Most units offer upper and lower case characters, some use different type fonts.

5. There is no need to maintain an inventory of printed forms. Most COM units can superimpose and record forms together with generated data on the film.

6. There is a wide choice of COM hardware at prices from about $40,000 to several hundred thousand dollars. Additional units needed to process master film and to make duplicate copies are available for a total of between $10,000 and $20,000. Leases generally can be arranged. All these operations can be integrated into the EDP installation without difficulty.

The foregoing facts might indicate that COM could be installed on the basis of these parameters. Unfortunately, such limited analysis is insufficient and such a headlong approach has proved to be strewn with pitfalls. The needs of the data processing installation must be a prime factor in deciding to go the COM route and in the selection of equipment. Before even that, it is well to consider the user and the types of documents he needs. For example:

1. Certain business documents can be eliminated as COM candidates. These include hard copies for individual distribution; file copies which are normally burst and filed individually (such as paychecks, credit memos, invoices, etc.); single copy documents used to update, containing handwritten notations for eventual data reentry via keypunching.

2. Documents which can be successfully reproduced by COM and used on microfilm are those which are referenced frequently, require multiple copies for distribution, are produced often, or are normally lengthy (several hundred pages) in original form. Such documents include:

a. Customer account or status reports, listings, daily stock records, vendor analyses, inventories, payroll summaries, purchase order reports, customer transactions, etc. A properly designed microfilm system for such information will reduce production and reference costs.

b. Published documents such as catalogs, price lists, maintenance parts lists, rates, schedules and similar material. Here production, distribution and reference cost savings for microfilm are normally very significant.

c. Management information systems may eventually benefit most from COM because many of the machines can produce essential graphics. Reports can be generated in several formats to meet the varying needs of different management and operating levels. Filmed pages can be displayed on readers for individual use, reproduced as hard copy, or projected at conferences.

While there are COM units designed just to replace mechanical printers, COM offers the opportunity to expand information and reporting capabilities through the use of graphics. Varying degrees of increasing graphic capability start

with units which generate alphanumeric and superimpose or overlay forms with alphanumeric data; merge prerecorded film image pages with data output pages from the computer; generate graphics for business graphs and charts, or high resolution graphics for scientific, engineering and even graphic arts use. Restraints of mechanical printers are overcome. For example, pages can be printed in 8 1/2" x 11" format as well as 11" x 14".

From a user's viewpoint, a COM system need not be detrimental to any existing internal microfilm system. It should enhance it and present new dimensions. Formats from COM are compatible with existing microfilm formats and equipment. Basic film sizes include: (1) 16mm on reels or in cartridges; (2) 35mm on reels or aperture cards; (3) microfiche in 4" x 6" or tab card size.

Some COM units can produce 16mm, 35mm and microfiche directly. Some produce only roll film masters. Other equipment produces microfiche masters from roll film off line. If storage, retrieval and user needs call for a large-scale microfiche system; a time, manpower, cost and operations study is necessary to determine whether it will be better to produce microfiche masters by the COM unit or off line.

With any information system, the user must be able to conveniently locate, retrieve and utilize relevant data. The computer makes microfilm a stronger information tool than it has ever been.

The computer can structure data into the most usable form, create indexing and coded addresses for microfilm systems. Addresses can be simple sequential numbers, lines, bars, frame markers ordinary optical codes. COM units differ in their coding capability so the ultimate use and present internal microfilm systems should be reviewed before choosing a COM model.

It may not be always possible to justify COM on the basis of pure cost analysis. Output rate may be so high that the equipment utilization factor will be very low. In this case a service bureau may be the answer for an interim or longer period. While using a service bureau you will have time to study and determine your true COM needs. Deciding when to switch from a service bureau to an in-house operation involves many factors. A rule of thumb, which does not necessarily apply to all situations, is that 300,000 frames or pages per month justifies in-house operation.

There are no pat answers to any decisions affecting the balance of interacting functions. COM is a computer peripheral. It also is an input device for a microform information and retrieval system. The justification, usefulness and economics of all these elements must be considered while viewing the total problems from every angle.

Further Thoughts on Readers

by

Jacque A. Locke. Reprinted from three issues of Microfilm, September-October 1970 by permission of Gellert Publishing Corp.

As in the past, my remarks will be in a general non-technical vein for a twofold reason. First, this column is a primer whose purpose is to explore the basic principles of a subject. Second, as a user my primary experience is in the selection, procurement, and application of readers, not in their design and manufacture.

All other advantages of microfilm are quickly discounted by a user when he discovers his job performance and efficiency are being reduced by a troublesome or improperly designed reader. The novelty and newness of microfilm will sustain interest for awhile, but once this period has passed the systems planner had better take cover if he has selected readers on the basis of a low bid rather than optimum performance for the use.

From the start, planner and user face a difficult situation. Reading microfilm is an unnatural and awkward task when compared to reading books and office paperwork. This may not be of significant importance to the infrequent user, but to anyone who must read microfilm for prolonged periods it can be an exasperating and fatiguing experience.

If a system has a film to hard copy capability, reading problems can frequently be detected through an upsurge in hard copy output. Without exception, the user will revert to the means for performing his job to which he is most accustomed when he encounters obstacles. With microfilm, it's hard copy.

Every microfilm systems planner at least once in his career is guilty of the reader standardization syndrome--the persistent, if only brief, desire to find or build the one reader that will fill everybody's needs at the lowest possible cost ($100 or less)-and with this miracle device solve all paperwork problems.

Most planners discover fairly rapidly that this is not only an unrealistic objective, it is probably an undesirable one as well. Except for catalogs or libraries, for example, where reading is intermittent and of short duration, and a standardized reader can be justified to simplify procurement and maintenance, a mixed complement of readers with differing characteristics will best meet the requirements of various film forms and job functions.

A user who reads microfiche eight hours a day will have greater need for the optimum reader and reading environment than a user who refers to microfiche an hour a month. A person who uses a number of different film forms such as roll film, aperture cards, and microfiche would require at least two readers to gain optimum design characteristics. Cases where users have required at least three different types of readers to perform a job are not rare.

The search for the economical, universal, standardized reader continues. But the answer lies with the proliferation of microfilm forms and formats. The number available today, including those used by computer output microfilm, are almost beyond comprehension. The indiscriminate use of available forms and formats can only lead to the indiscriminate acquisition of readers. Limiting the use of forms and formats to the bare minimum necessary to satisfy total needs will simplify reader acquisition. With the existing state of design and development, however, it will probably never reach the point where one reader will satisfy all needs.

The rate at which manufacturers introduce readers makes standardization unlikely. Also the threat of obsolescence is always present.

Alternatives range between buying large lots of one or two standardized machines to achieve low unit and maintenance costs, but with a high probability of obsolescence and user dissatisfaction, to buying smaller lots of a number of different machines to minimize obsolescence and user dissatisfaction, but with the penalty of high unit purchase and maintenance cost.

Somewhere within this range of alternatives is the right one for every systems planner. The only advice I can offer on how to find it is careful and comprehensive testing and evaluation of all reader equipment in cooperation with users in their job situations and environment. Do not ignore or underestimate the importance of user acceptance. It can make the systems planner a hero or a villain.

Microfilm to Hard Copy

During the early years of the microfilm renaissance in the 1950's, manufacturers and applications planners thought that devices for making hard copy from microfilm would perform a minor role, producing paper copies to meet an infrequent user demand. Proceeding on this assumption, machines were designed to serve a dual purpose: first, as microfilm readers and second, as paper copiers of microfilm images. In practice these devices became known as microfilm reader-printers. Experience soon revealed, however, that hard copy usage had been underestimated and a new machine for producing paper copies rapidly, inexpensively, and in volume, was needed. These devices became known as microfilm printers or enlarger-printers, and since their main purpose was hard copy production, they usually did not contain a full-size reading screen. In some cases manufacturers did build in a screen for operator inspection of image placement and legibility, but design philosophy usually made reading incidental to copying. During the intervening years the number of printers placed on the market grew to the point where a user can now choose from a plethora of machines using almost every known copying process, capable of producing a handful to hundreds of copies per hour. Prices vary from : a few hundred dollars for the simplest reader-printer to tens of thousands for the most sophisticated printer.

Technology and the intransigence of microfilm users have created a systems planning dichotomy, which, when resolved in application, often results in a compromise of basic microfilming objectives with all the potential of a major monetary disaster. Users, during the planning phases of an installation, are frequently enthralled with the newness and novelty of microfilm and its ability to minimize or even eliminate paper work through miniaturization. They therefore tend to underestimate, possibly subconsciously, their hard copy requirements, creating a "halo effect." Unless detected and placed in proper perspective this effect will lead the planner to believe he has finally succeeded in solving the paper problem. Reader-printer acquisition is planned accordingly on the basis of infrequent demands but then in the cold light of day-to-day operation he senses user betrayal as copy costs inexorably exceed estimates. Technology, however, has anticipated such a situation with the enlarger-printer to which the planner must resort in an effort to control costs. Designed to replace hard copy, microfilm has become, at least temporarily, a relatively inefficient intermediate for creating hard copy when compared to other processes. Under these circumstances the planner feels compelled to compromise, hoping to gain time, possibly, for the mounting of an attack against hard copy. Simultaneously he searches for new machines to produce hard copy from microfilm less expensively, knowing he has an uphill battle. Those of us in the industry who find this strange may have to reconcile ourselves to the situation where microfilm and hard copy in some combination may be more acceptable than hard copy alone-hoping all the time that industry technologists will create innovations for reducing hard copy costs to a more comfortable level.

The two most significant contributors to hard copy costs, other than capital and labor, are material and maintenance costs. Except for transfer xerography, papers require special coatings or processes that can be a major cost item-especially for patented materials not licensed for manufacture by companies other than the patent holder. Competitive bidding is eliminated, thereby creating a single source buying situation. Coated papers may have a shelf life that can complicate inventory control. They may also require special toners, developers or chemicals that create similar problems. Transfer xerography, on the other hand, uses a variety of standard papers which simplify buying and inventory practices.

Thorough and regularly scheduled preventive maintenance is critical and should not be under-emphasized to achieve what, in the final result, would be false economy. Operators can perform a number of essential but routine cleaning tasks on machines using either dry or wet chemicals, but adjustments and parts replacement should be left to skilled technicians. Leased machines invariably include maintenance as part of the agreement, but when buying machines, service contracts must usually be negotiated separately with the seller. Service contracts, over the long-run, provide positive maintenance reliability and control of repair expenses. They are worth their cost if they are properly administered.

Commercially applied processes for copying microfilm image onto paper fall into three broad classifications: electrostatic (xerography), electrochemical, and silver emulsion. The diazo process has also been used but with limited success.

The electrostatic or xerographic process involves

two basic approaches. In one, the transfer-type, a selenium coated plate or drum is used as a photoconductor to receive the electrostatic image. The image is developed by minute pigmented particles called toners and transferred to a medium which is then heated to fuse the toners permanently. The process is fast, dry and uses low-cost, uncoated materials. Equipment, however, is complex and subject to more maintenance than in other processes. In the second approach, the direct-type, the photo-conducting surface is coated on a paper medium and usually consists of zinc oxide combined with various additives and binders. Charging, development, and image fusing are essentially the same as with the transfer process. Materials are expensive and have a tendency to mar easily and crack when folded. Maintenance is less than with transfer-type equipment.

Electrochemical machines use a sandwich material consisting of a paper backing, a center layer of deposited metal-usually aluminum and a top coating of zinc oxide. The process is similar to electroplating, in that silver salts in solution are plated on the zinc oxide surface which has been exposed by the projected microfilm image. Equipment is simple, requiring minimum mechanical maintenance, but care should be exercised in controlling corrosion caused by chemical action. Being wet, the process has all those disadvantages associated with handling chemicals and damp prints.

There are two basic wet silver emulsion processes: stabilized development and monobath development; and one dry process, using heat to develop the image. Stabilization uses two baths to develop and fix; monobath, as the name implies, uses one. Raw materials are light sensitive and require care in handling; chemical exhaustion and contamination cause most problems with processed prints. The dry process, called "dry silver," has overcome the problems of the wet processes to a great extent with one distinct added advantage: speed. Materials for the silver emulsion processes are expensive, more so for the wet than the dry. Consistent reliability in processed prints hinges on chemical quality control in the wet processes and good maintenance practices in the dry process.

Producing hard copy from microfilm in prodigious quantities has now apparently achieved a position of grudging legitimacy from users in spite of high cost. Manufacturers of printers have, it seems, done little to aid in the reduction of user costs. Rather they expend resources developing machines that produce hard copy at ever increasing speed. Possibly future innovations will reverse this trend but even so, it will always remain strange that microfilm should be used to reproduce the hard copy it was designated to replace.

Microfilm-Predicting the Future

Forming conjectures about the future is a fairly new parlor game in the microfilm industry. Practitioners of the game issue pronouncements and prophecies about the latest innovations and their impact on the future of the industry. They state, often with finality, that because of these technological advancements, the industry will experience growth rates of two, three, five or even ten times the present rate, or that the "paperwork explosion" will be eliminated, or that education will be saved by a new low-cost microfiche, or that the entire Library of Congress will shortly be available on a piece of film no larger than a pinhead. Review the literature for the past few years and examine the claims for computer output microfilm (COM) and then wonder if reasoned judgment wasn't perhaps overwhelmed by Madison Ave. exuberance. Instead, what is needed is solid rational evaluation and critique.

Innovative turmoil

The microfilm industry has been and remains in a competitive and innovative turmoil. Manufacturers, ideas, hardware, and authorities on every aspect of microfilm appear, disappear, and reappear virtually overnight. The situation is comparable to the early years of the computer industry when everyone was a prophet expounding the merits of the forthcoming computer age.

The metamorphosis of microfilm from a static storage medium to a highly useful information handling tool is generally recognized and fully documented. To expect this phenomenon to parallel the growth of computer technology may be unrealistic at this time, but experience to date indicates that the potential does exist. Recognition of this potential has spawned a bewildering array of ideas, hardware, as well as materials, methods, and techniques, of which many can expect a short life. Hardly unexpected, but at least in this respect the situation does parallel computer expansion. Whether it will continue to remains to be seen.

About all that can be said for the future of microfilm is that its possibilities are excellent, but the probability of things being radically different from what they are today is not too great. Change and progress in our society are inevitable, but a microfilm revolution of staggering proportions is indeed remote.

Ten years from now there will still be a hue and cry over the "paperwork explosion," while manufacturers continue to announce the very latest model of their copying machine.

Students will still be reading from books, and libraries will still shelve them. Microfilm users will probably still be clamoring for the $100 reader that does everything, while commiserating with each other over the sad state of reader development in general, and the possibility of manufacturers ever building a reader that will really do a perfect job.

Fully automated film retrieval systems will still be announced with regularity at conventions and through mass mailings. Costs will be exorbitant as now and few, if any, units will ever be sold.

Market surveys will continue to predict fantastic growth rates for the industry and someone, somewhere, will publish a research report on the lastest super microfiche that will indeed enable every citizen to have his personal Library of Congress.

Progress will come in microfilm and it may even be as dramatic as some predict, but for what it's worth from an experienced user, planner, and cynic, let the bandwagon slow down a little before jumping on.

Factors Dictating Characteristics of Systems Utilizing Microfilms

by

Thomas C. Bagg, from The Journal of Micro-graphics, Vol. 3, No. 3, Spring 1970. Reprinted by permission of NMA Headquarters.

The importance and growth of microform systems are best illustrated by the growth of the National Microfilm Association and the popularity of the annual meetings. The use of micro-images is like other concepts, in that when it is applied to a particular purpose, it fires the imagination to apply such practices to other problems. Today's uses cover an almost unbelievable range of applications-from catching diamond thieves and cattle rustlers to the most sophisticated information storage, retrieval and remote display systems. The effectiveness of these systems is due to the properties of microimages which make them efficient mass memory media.

The purpose of this session is to bring together some of the experience gained from these various applications to help others effectively apply microform techniques to their problems. This is not to be a sales pitch; it is a discussion on how best to use microforms after it has been determined that they are the most suitable storage media for a specified information handling problem.

Microfilm is so important that the basic concepts have been outlined in an NMA brochure titled "Micro Image Information Systems-What it is, How it works, Why it provides a new key to modern business effectiveness-Instant Information".

This paper will expand on some of these points.

When considering the design of a microform system for a particular application, certain questions always arise. These questions are listed below and the effects of the various answers on a microimage system are discussed.

1. What is the goal of the system and how is it best achieved?
2. What type of output is required?
3. How many copies of a document are required?
4. How many pages are there per document?
5. What is the size of the pages?
6. What is the size of the smallest significant character?
7. How important are half-tones and color?
8. What is the size of the file?
9. What is the method of file organization for retrieval?
10. Is machine manipulation of document images efficient?
11. Is this system compatible with other document handling activities?
12. What are the savings in time and money?

It is hoped the following discussions will serve as a guide for choosing the most appropriate formats and equipment. Unfortunately, the answers are often interrelated and seldom simple. Questions 1 and 12, the goals and savings, are most important and frequently determine the final answer to the other questions.

1. What is the goal of the system and how is it best achieved? Will a multipurpose system handle all documents, or would several independent systems be more effective and economical? These are questions that must be answered according to the goals of the user. The main goals or uses of a system using microforms are: Archival storage, Space savings, Dissemination of documents, Intermediate, Memory for a document retrieval system, High speed printout (i.e., computer output).

a. A major goal of most users, and an historic application for microfilm, is archival storage-the economical preservation of an essential security copy. Records may be needed for various periods of time. Most business records require short term storage, while some scientific data and great literary works are invaluable and must be permanently retained. Between these limits are many kinds of documents, each with its own particular requirements. These requirements are well documented by the records managers and archivists.

b. Space savings is frequently an economic advantage for micro-recording records. Conversion costs must, however, be compared to space savings costs.

c. Dissemination of information by microforms, especially of scholarly works, is an old technique. High volume production of micro editions, however, has now become common chiefly in the form of microfiche. The dissemination in microform of

other types of documents such as engineering drawings, parts lists, service manuals, catalogs, to name a few, are also becoming economically feasible.

d. Intermediates or microimages of documents used within a process are finding more and more uses. The National Library of Medicine uses such a microimage system to economically obtain copies of documents shelved throughout the library for enlargement printing to fulfill interlibrary loan requests. Similar operations are followed by other holders of massive files including computer files where computer output microfilm (COM) systems generate the film copy. For distribution, hard copy is also generated from microforms by the Clearinghouse for Federal Scientific and Technical Information and commercial micropublishers. The U.S. Patent Office uses a microform for generation of hard copy of out-of-print patents.

e. Microimages are very convenient to handle in automated document storage and retrieval systems. This will be discussed later.

f. Direct recording of computer output onto microfilm (COM) is proving most useful in getting readable printouts of massive amounts of computer-generated information.

A well-planned microform system can fulfill all the required goals.

2. What type of output is required? The choices of output include the same and different format, positives or negatives, hard copy of same or different size, and remote displays. The term "format" when used in this discussion, refers to the physical size, spacing, and arrangement of the images and their support. There are roll film and unitized (microfiche) formats as well as A & B image positions. Fortunately, standards exist for these formats. The ANSI standards apply to roll film widths while COSATI and NMA standards apply to the microfiche formats. The American Library Association has adopted the notation A & B for image positions on roll film. In the A position the page length is parallel to the film length, and in the B position the page length is at right angles to the film length. The symbols 2A or 2B refer to two pages being recorded. adjacent to each other, as in an open book. The 1 and 2 image positions frequently appear in enlargement prints.

The choice of the output must be dictated by the ultimate user. Certainly the low reproduction and distribution costs of micro-copies are enticing to a systems designer. If the copies are to be used in the field, small office, laboratory, home, etc., readers or reader-printers frequently are not available and a hard copy output is essential. Further, many workers need to add comments to their documents and it is difficult to mark-up a microimage. The designer must know if the user requires the distribution microimages to be positive or negative, and if they will be used to generate additional microform copies or enlargement prints.

If the primary system uses roll film, should the distribution copies be unitized records, or if the primary system uses a unitized record, should the distribution copies be in a roll form? When generating hard copy for distribution output, pages smaller than the original are frequently quite acceptable and more convenient, particularly with very large drawings.

Regardless of the output copy format, legibility is the key to systems success.

3. How many copies of a document are required? When a large number of copies are required of a single item, or when there is a high printout rate of individual items, it may be more economical to use an expensive format suitable for automatic handling, since the higher format cost will be recovered in savings on handling and paper costs. For a system containing low usage items, the most inexpensive format, which has the required quality, should be used despite a possible higher retrieval and print cost. The costs must be carefully compared between those of handling convenience and conversion to different format.

Many microimage systems make use of multi-generation copies (copies of copies generated at different levels or regions in the system). With such systems it is possible that the ultimate reader will receive a 4th or 5th generation copy. Since there is a loss of resolution in each photographic process, even small losses, must be allowed for and the original filming done to a high image quality standard. In practice, these losses are frequently higher than originally anticipated, due to "just slightly" sloppy techniques.

4. How many pages are there per document? The number of pages of a document or item may

vary from a single page, such as a drawing, to several hundred pages, as in a bound book. Most systems are adaptable. A particular class of documents allows a designer to pick the format most suited to his class of documents, such as unitized format, roll or strip format, etc. However, almost every class of documents has a small number of items which have too numerous or too few pages. The designer therefore must make provisions to handle these exceptions.

The various unitized record formats were designed for different classes of documents, as well as economy of distribution. They serve this purpose well, but they do create problems in maintaining file integrity. Roll film on the other hand, has good file maintenance characteristics and is inexpensive to generate and duplicate, but it creates problems in search and isolation of short individual' items. Devices for minimizing these problems are under development.

5. What is the size of the pages? The variation of the size of the pages in a collection creates numerous problems and may well dictate frame size and therefore the reduction ratio. One system need not do everything. Pick a page and frame size to do most of your job, handle the rest by page sectioning or by a separate system.

6. What is the size of the smallest significant characters? This particular point, the fineness of details or the smallest significant characters appearing in the original document and required in the user copies, must be carefully analyzed. Typewritten copy, books set with 10or 12point type, controlled drawings, invoices, etc., with good contrast between the ink and paper, are not too difficult to record and duplicate with adequate quality. Type-set technical journal articles, newspapers, architectural drawings, etc., contain much fine detail which is essential to the user. For these systems, great care in recording detail is mandatory and a high-resolution system is necessary. Resolution is only one of several image parameters required for legibility; contrast, sharpness, line density, etc., are also necessary qualities, but only resolution and gross densities can be conveniently measured by the quality control inspector. Unfortunately, there are no good legibility targets so one must rely on subjective evaluations and resolution measurements. A relationship has been established between legibility and resolution which can serve as a guide.

Due to physical characteristics of lenses, films, camera design, etc., the reduction ratio is directly related to resolution and therefore an important factor in image legibility. The lower the reduction ratio, with a specific camera, the greater the detail recorded.

7. How important are half-tones and color? For most microimage files neither half-tones nor color are important thereby permitting the user to use the common recording microfilms and techniques which are designed to have some contrast enhancement of basically black and white line originals. In some areas, however, such as USDA's Meat Inspection and Labeling program, patents on flowers, biological and medical materials, etc., color is essential as is recording with shades of gray for reproducing photographs, architectural renderings, X-rays, etc. For these applications, special films and illuminating systems are required.

8. What is the size of the file? If the collection to be recorded is small it may be more economical to have the filming done by a local commercial microfilmer. If it is a very large collection, or one which grows rapidly, in-house filming may be quicker and more economical. Under these circumstances it might be advisable to have special equipment designed and constructed. This, however, should be done only after a thorough study of the requirements is made. The study should include the costs associated with increase in staff for camera operations, processors, duplicators and quality control inspectors.

9. What is the method of file, organization for retrieval? The method of file organization is highly dependent upon its size, rate of use, amount of updating, and speed of response required. Will the file material be organized for direct search or will there be auxiliary indexes or computerized search facilities? Does the material have obvious filing keys such as primary identifiers like policy, invoice, drawing numbers, or specific subject headings, or must the material be located from a variety of retrieval categories? 10. Is machine manipulations of document images efficient? Microforms do have the advantage over paper copy in that they can be mechanically handled more conveniently. Systems for handling microforms cover the relatively simple devices, such as sorting by address with punched holes or by needles with edge notches to those using elaborate index codes sensed by photo detectors. The more sophisticated systems can retrieve on many subjects and utilize roll film, film strips, and microfiche formats.

11. Is this system compatible with other document handling activities? Many organizations

have need for several information systems using microforms as the storage medium. Since cameras, processors, duplicators, readers and printers may be required for each system, it would be desirable if the formats were the same. here possible, an effort to minimize the number of formats should be made, but each application should be carefully studied because the economics in time and money may well prove that totally different formats and equipment would have an overall advantage.

Unfortunately there are only a few standards at this time for detailed microimage formats. Where these are applicable, they should be used. The NMA, ANSI, DOD, ALA and others are working on additional standards which will greatly help all users.

12. What are the savings in time and money? For other than archival purposes, if it is to be practical, any microform system must result in savings in either time or personnel or money. Here the systems designer must make his most careful calculations.

CONCLUSIONS

Questions that must be answered before a designer can determine the film formats include image quality, reduction ratios, packing densities, etc., which are the crucial factors for all microform systems-from the simplest roll film to the most sophisticated using ultrafiche and holograms.

I'm sorry that I cannot answer these questions for you-only you, the information handling managers and the ultimate users can tell the system designer what is required. In conclusion I would like to quote John Luke's remark about image quality and cutting corners, "If a user has difficulty interpreting the images, the effectiveness of the system is lost. If you can't read it, you can't use it".

How Microforms Help Solve Typical Information Problems

by

Rober H. Cain, from Navy Management Review, May-June 1970.

With the advent of the computer, management turned its attention from microform and looked to the computer as the new medium for solving its information processing-and-storage problems. During the years that followed, however, there have been many advocates who never wavered in their conviction that the unique qualities of microform will cause it to become increasingly important to national, state, and local government and to industry. These supporters have been improving the quality and versatility of the microform and its related equipment so that it is a far different tool now than it was a few years ago.

Future computerized data banks; the extension of the computer as a daily working tool of an office; and the widespread use of remote terminals will dictate a need for maintaining selected, essential, high-use data in machine-language code. And, on the other hand, future needs for greater compactness, speed, convenience, and economy in the storage, retrieval, and dissemination of large volumes of static or semi-static data, as well as documentary and reference materials, will dictate increased usage of the microform.

Consequently, management needs to challenge and reappraise all of its information-handling practices from cradle to grave. Each record series and each document collection should be analyzed with a view to determining which data should be recorded in machine-language code and where it would pay to use the microform. All steps and processes involved in document preparation, distribution, and use should be studied similarly.

Typical Problems

This article is concerned with identifying a dozen typical information problems or needs which might be solved, all or in part, by the use of the microform. It is not possible to ignore the computer altogether, however, since, in many instances, it is a full partner to the microform or it plays another important role in providing the answer to a particular problem or need.

It is not the intention of this article to imply that the microform should be considered a panacea for all of the dozen problems cited in the following paragraphs: (Nor is it likely that in any given situation, only one of the following problems exists. One objective, therefore, should be to find out, in any given situation, how many of these problems exist. Each existing problem becomes, in effect, another vote for a microform system. A detailed cost/benefits study and some testing always are needed to arrive at the final conclusion.)

Problem: File Integrity

Errors in filing;
Accidental loss or destruction of information;
Alteration and obliteration of information; and
Users failure to return documents.

Errors in filing occur in spite of the best efforts of file supervisors. If the file is a large one, it may be days, months, or years before a missing document turns up. Whenever a document is removed from a file and forwarded to a user, it risks being lost in transit, accidently destroyed, damaged, or not returned. These, of course, are serious problems when dealing with important documents such as those affecting individual rights and claims.

Often, the best way to insure absolute file integrity is by converting documents to a microform system. The user is provided access by furnishing a film-to-film copy, or an enlarged paper copy for his use.

Problem: Document Accessibility

Travel problem; and
Competition problem.

It is usually possible to keep small collections of documents that occupy a file cabinet or book case near the users. But, the larger document collections, by necessity, usually are located at some distance. This means that either the document or the user has to travel back and forth to the storage site.

Further, there are times when the same document is needed at the same time by more than one user and each has to wait his turn to get it. These problems, of course, cause work delays. They also tend to reduce the usefulness of the information contained in the documents, since the users are inclined to try to do without them if they can.

Both problems could be solved through the use of a microform system. Once the documents are

converted to a microform, inexpensive duplicate sets can be established at various locations in the users' work areas. A second choice, which solves the competition problem, only, is to make film-to-film copies and send them to the users when they ask for them.

Problem: Document Preservation and Protection

Prevention of wear and defacement of valuable irreplaceable documents; Protection of indispensable operating records against a disaster; and Protection of classified documents.

The Library of Congress and the National Archives use microfilm extensively for preservation of important documents. The microfilm copies, rather than originals, are made available to scholars and researchers.

Microfilm is used by many agencies for protection of indispensable operating records against a fire a national disaster. The film is usually kept in a remote, protected depository which, in most instances, is equipped with machines and supplies for making film-to-film copies or paper enlargements.

The original copies of classified documents may be microfilmed so that either the original or copy of the document is always secure. However, control of the microfilm copies presents its own special problems.

Problem: Storage and Handling of Large- and Nonstandard-Size Documents

Special equipment needs; Folding and unfolding of oversize documents; and Storage of documents with irregular sizes and shapes.

Oversize documents, such as tracings, drawings, and maps, can be recorded on microfilm, thus eliminating the problems of special-equipment requirements and the need for unfolding and folding the documents each time they are used. However, the original documents must conform to certain quality standards in order to produce a satisfactory microfilm substitute.

Documents having irregular sizes and shapes can be reduced to a uniform size through microfilm. Improved color microfilm is available if color is a significant factor.

Problem: Document Servicing and Control

Man-hour requirements for pulling folders and preparing document charge outs; Man-hour requirements for filing returned documents; Man-hour requirements for following up on unreturned documents; and Man-hour requirements for routine document maintenance.

If a microform system is used, inexpensive diazo copies of the documents can be made and given to the user instead of loaning the file copy. he user disposes of the duplicate copy when he is through with it. Thus, there is no document charge out and refile problem, and file maintenance is reduced to a minimum. Because personnel costs are increasing constantly and it is difficult sometimes to obtain file clerks, it is to be expected that there will be increasing situations where it will pay to change to a microform system.

Problem: Document Acquisition

Rising cost of hard copy publications; and Acquisition of rare and one-of-a-kind documents.

The rising costs of publications printed in paper copy are making it necessary for many libraries, offices, and others to curb their document-acquisition programs. In those instances where a document is available in either paper copy or microform, savings of 70-to-90 percent can be realized by purchasing it in microform.

There are many times also when desired documents are rare or out of print. If such documents are needed urgently, the simplest and, usually, cheapest way is to have microform replicas made.

This may make it necessary for the acquisitioning office to bear the microfilming costs. It is a small price, however, to pay for valuable documents. Many governments and private organizations follow such a practice.

Problem: Document Printing, Distribution, and Stocking

High costs for printing, collating, and packaging of paper documents; Transportation and handling costs; Stock control and replenishments costs; and Time-delay problem.

Many government agencies discovered some years ago that the most economical and efficient way to reproduce, distribute, and fill individual requests for unpublished reports is by means of the microform. Federal agencies within the Department of Defense, in particular also are saving untold thousands of dollars each year by using the microform for reproduction and distribution of engineering drawings of military equipment. The U.S. Patent Office is following a similar course for publication and distribution

of patents. The Naval Supply Systems Command has decided to use a microform system for publishing its 9,000-page, 20-volume series of Navy Catalog Data.

As the use of microforms expands and microform readers become more commonplace, there will be an increasing demand to make printed documents available in microform as well as paper copy. In instances where government agencies are not preparing a microform copy, commercial publishers often fill the void.

Not only is it sometimes possible to reduce the initial printing costs, but significant savings are realized in handling and transporting of documents. Stocking usually can be eliminated altogether, since the microform at the original source or at any distribution point can be used to reproduce on demand low-cost film-to-film copies or enlarged paper copies. The original microform can be produced readily by photographing paper documents. However, with the advent of computer-assisted document preparation, editing, index preparation, formatting, and Computer-Output-Microfilm (COM) equipment, direct publication of documents in microform is now possible. The computer-output magnetic tape also can be used to automatically print paper copies. For many agencies, these new techniques offer the means for substantial reduction in the time lag between document drafting and receipt by the users.

Problem: Updating and Maintenance of Manuals and Catalogs

Total costs for individual updating of manuals and catalogs kept at numerous locations; Errors and delays in individual updating of manuals and catalogs; and Keeping large, heavily-used manuals and catalogs intact and in good condition.

The updating of maintenance and procedural manuals, catalogs, and similar publications can be a time-consuming and thorny problem if there are many of them and they are maintained at numerous locations. Errors are made in entering the changes, while the insertion of some changes is delayed or never made at all. If the manuals and catalogs receive heavy use as they often do in a maintenance shop, the pages are likely to be torn and lost. When detailed information is needed at the job site, the mechanic may have to copy the information by hand or remove the page.

In most agencies, no one knows just what this is costing or the full effects of not having current, accurate data on hand at each user location. However, in those instances where a detailed study was made, such as at some of the airlines, the savings were sufficient to pay for the cost of the microform system in a short time. Additional benefits, appearing under other problem headings in this article, also are being realized.

One of the ways to solve these problems through microform is to maintain a single master copy in cutsheet form at a central point. Changes are entered in this master copy as they occur. The entire master copy is periodically re-photographed, reproduced in microform copy, and distributed to the users; whereupon, they simply dispose of the entire old copy. The microform readers are often equipped with a paper copier so that mechanics can make throw-away copies to take back to their job sites, if desired. The microform might also be produced, in some situations, through the use of the computer and COM equipment, as previously described.

Problem: Equipment and Space for Document Storage

Availability of adequate space to house documents;
Space costs; and
Equipment costs.

While space-and-equipment savings are often an important plus in a microform cost/benefits analysis, it is seldom that microfilming can be justified for this purpose alone. Inactive records, for example, can sometimes be stored at a General Services Administration Federal Records Center for a period of perhaps as long as from 10 to 70 years for what it would have cost to microfilm them. The current annual cost for maintaining documents in a Federal Records Center is approximately 65.6¢ per cubic foot.

Problem: Retrieval Speed and Costs

Random lookup of individual items of data; Examination of graphic information; and Scanning and retrieving information in textual documents and indexes.

In situations where there are a large volume of data which can be converted readily to a microform, retrieval speeds sometimes can be increased for a very small additional cost by use of this medium. This is particularly true of instances where retrieval involves random lookup of individual items of discrete data such as a social security number, date of birth, or street address. Special devices and techniques are often used to make retrieval easier and faster.

Manufacturers of roll microfilm equipment, for example, offer self-threading readers using film cartridges. Techniques such as automatic image counting, binary-coded film, code lines, and an odometer-like device can be employed to locate rapidly specific microfilm images. The Division of Disbursement, Treasury Department, for example, has, through the use of microfilm, reduced file searching time on check issues by 80 percent.

If there is a continuing need for examination of graphic information-such as large maps, engineering drawings and photographs-microform often will make the job faster as well as easier. Also, scanning or browsing of large collections of textual material and indexes is sometimes easier and faster if they are available in microform.

Over-all retrieval speeds and costs can often be improved because of the fact that when using a microform system it is possible to store needed documents and data at the user's work station, rather than having to keep them at a remote location.

Problem: Procedural Bottlenecks

Collection and transportation of large volumes of data;
Verification of data on documents passing through the system; and
Logging documents.

Collection and transportation of large volumes of data such as questionnaires and reports can be a "knotty" problem if they are retained in their original paper form.

The U.S. Census Bureau, Department of Commerce, solves this problem by having the census questionnaires microfilmed at various locations in the field. The microfilm is then shipped to their headquarters office at Suitland, Maryland, where it is placed upon a microfilm optical mark reader known as FOSDIC ("Foto" Optical Sensing Device for Input to Computer). It converts the data to machine language code for processing by computers. The Census Bureau also uses the FOSDIC system for collecting and converting internal administrative data.

The Veterans Administration and other agencies receive large volumes of checks from the public. The checks are microfilmed while being processed through the system in order to verify any data that may later be questioned. For similar reasons, organizations using Optical Character Recognition equipment for computer input sometimes microfilm incoming documents.

The Division of Disbursement, Treasury Department must maintain a record of each of the 1 1/2 million checks it issues each day. In the past, this was done by preparation of a paper record. Using COM equipment now, the record is produced directly from magnetic tape, making it possible to place the issue record for 102,000 or more checks on a single roll of microfilm. Duplicate microfilm copies of each month's veterans'-benefit check issues are sent to over 50 Veterans Administration regional offices throughout the United States where the microfilm is used to answer approximately 8,000 inquiries a month, conduct post-audit operations, obtain an historical record of payments in specific cases, and locate addresses.

If it is necessary to log documents in and out, microfilming is usually a far simpler and cheaper method than keeping records by hand. Many libraries use this technique for charging out books.

Equipment manufacturers have developed lightweight portable cameras, including some that are battery operated, which add to the practicability of using a microform for all of these purposes.

Problem: Computer Data Storage and Accessibility

Storage and retrieval of machine language backup data;
Storage and retrieval of static or semistatic data; and
Direct access to computer master file.

It doesn't take long for a computer to fill a 1,500-foot reel of magnetic tape with data. If it is kept busy all day, the computer may have produced dozens of tape reels to add to the tape library. It is little wonder, then, that some computer installations have thousands of tape reels or millions of punched cards in their file and must often restrict the computer master files to summary data. While this backup data resulting from input processing end other machine runs is essential usually to system documentation, it is often too costly, due to its great volume, to retain it in machine language and search it by computer. The Social Security Administration was among the first to use the microform and the first to procure a COM device to solve this problem.

While the computer provides the fastest and most accurate means for compiling, updating, and organizing static and semistatic data, the size-and-cost limitations of mass memories and the time requirements often make it impractical to use the computer to retrieve data from

these files. Often, the best solution to the problem is to convert data recorded on magnetic tape to a microform by means of COM equipment. The Census Bureau has developed another version of its FOSDIC optical mark reader which can read and process data on a microfilm copy of punched cards. The U.S. Weather Bureau at Asheville, North Carolina, is using this system for processing its file of some 40 million cards.

Such computer data bases as inventories, transportation schedules, rates, and special tables can be converted periodically to microfilm and then searched by means of standard microfilm readers. Where static information such as airplane flight schedules ties in with dynamic data like reservations data maintained "on-line" with the computer, special remote terminals have been designed to permit the users to interrogate both data bases at the same time.

Most large Automatic Data Processing (ADP) systems, by necessity, must use batch-processing techniques and access the master file on a cyclical basis; perhaps, once or twice a day, once a week, or possibly less frequently. During the interim, the data is locked up in the tape reels and inquiries must wait until the next processing cycle comes around to be answered. The Air Force Finance and Accounting Center at Denver, Colorado, which processes and maintains pay and allotment data for Air Force military personnel, has solved the problem of round-the-clock inquiries by converting, periodically, the data to microform by means of COM equipment. Inquiries and requests for changes can now be handled quickly and efficiently by nonskilled personnel equipped with microfilm readers.

Information Retrieval Guidance

The National Archives and Records Services of the General Services Administration provides information and guidance in all phases of information retrieval, and also operates microfilming service centers throughout the country. It is, of course, aware that microforms are not without their faults and disadvantages. In addition to problems of personnel, equipment, and supply costs with microform information systems, a major obstacle may be obtaining user acceptance. For a microform to serve as a satisfactory substitute for paper copy, it must be as legible and easy to use as its paper counterpart. Success depends upon the quality of the original documents; the film; the camera; the camera operator's work; the quality of film processing; the suitability of the microform type; and the adequacy of viewing equipment. A weakness in any of these areas may cause the microform system to fail.

The condition of the documents not only largely governs the quality of the finished microform but is a major cost factor in the filming operation. Typical problems are poor light reflecting contrast between the reading matter and the paper; extremely fine lines of printing; lack of uniformity in color, sizes, and thickness of documents; intermingling of one-sided and two sided documents; need for removal of staples, pins, and other fasteners; and need for sequence checking and screening to remove extraneous material. Such problems as these account for the fact that, as mentioned earlier, it is often possible to maintain records in a Federal Record Center for many years for what it would cost to microfilm them. Within the next 10 years, it can be expected that most of the existing large-folder file systems in the Federal Government will be converted to microform. Steps should be taken as soon as possible, therefore, to clean up and revise such systems so that the essential papers will be susceptible to low-cost, high-quality microfilming.

Most of such problems could be avoided, of course, through proper planning and care in establishment and maintenance of a document file.

When establishing either a microform or paper-document file, serious consideration should be given also to capturing and maintaining key identifying data in machine language. Using source data automation techniques, this can be done for a small additional cost at the same time the labels are typed. The machine-language record should prove highly useful as a means for automatic preparation of finding aids, inventory lists, and new labels by a computer and the purging of the file.

The wisest course of action in establishing any new, long-term file is to plan and maintain it as though it were to be later microfilmed. The chances are that it will be !

The proponent agency of this regulation is The Adjutant General's Office. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications) direct to HQDA (DAAG-ASR-S), TAGO Building, Falls Church, VA 22041.

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CHARACTERISTIC	A PAPER DOCUMENT	B MICROFILM	C VIDEOTAPE
SPACE REDUCTION AND COMPACTION	Requires maximum space; approximately 200 documents in one linear inch of filing space; 100 index cards; 140 tab cards.	Provides a significant reduction of filing space; one 16mm cartridge holds about 200 letter-size documents at nominal reduction; two 4x6 microfiche can contain up to 200 documents at moderate reduction ratio.	Excellent compaction-one reel of tape can hold about 160,000 documents (equivalent to about 200 documents every six feet of tape).
FILE INTEGRITY	Normally very little with usual filing methods; loss possible with loan of records taken out of file; a reasonable degree of insurance against misfile can be achieved with some sophisticated systems; misfile of individual papers in folders is nearly undetectable.	Documents produced in roll film (cartridge/cassette) are almost 100% loss-proof, and misfiling other documents is not a factor. Unitized film (jackets/fiche) filed in conventional equipment is subject to loss and misfile; loss of one fiche is equal to loss of up to 100 documents; controls against misfiling are same as for paper copy files. Sophisticated retrieval systems offer most insurance against loss or misfiling because of individual coding; miscoding, and therefore misfiling, is possible, but built-in checks reduce the risk to a minimum; likelihood of locating misfiled fiche is greater because of the rapidity of search inherent in such systems.	Aside from the archival factor, probably offers the highest degree of integrity; absence of a 'physical' record, per se, may create skepticism as to validity; however, this very feature precludes possibility of loss; misfiling is possible only by miscoding new documents, but again, rapidity of search provides as assist in locating.
REMOTE ACCESSIBILITY	Not practical.	*Capability available but limited by reason of its ultimate high cost.* Beyond a certain local distance, expensive transmission media must be used. Can be either manual or automatic operation.	*Same as Column B, but is always automatic operation.*
DOCUMENT MANIPULATION	Must be physically manipulated and moved by hand or mechanical devices at time of retrieval. The rapidity of such devices is, of necessity, somewhat limited.	Since microfilm is, in effect, a form of hard copy, limitations of Column A apply; however, because of compacted form, manipulation can be significantly better.	Provides rapid manipulation because documents are in digital rather than physical form.
PROCESSING	None required. Documents immediately available.	Must be developed, washed, and dried under rigid controls to preclude danger of spoilage. Causes some delay in entering newly-filmed documents into the system. Preparation required, e.g. loading into cartridges, insertion into jackets or aperture cards, preparation of fiche.	Requires no processing. Recorded document is instantly available once it has been entered into the system.
COPYING	Can be copied on almost any modern copying equipment.	Any film format can be duplicated rapidly and inexpensively; normally done on diazo or vesicular film.	Duplicate tapes can be made automatically and rapidly; loss of resolution and clarity may be a debatable point.
INPUT	Minimal preparation required. Documents are very often ready for input when received.	Preparation of documents is time-consuming and laborious. With rotary cameras, staples must be removed, and any damage to the document repaired. For best results, photographing must be deliberately and carefully done. Completed film product usually requires arrangement into format.	Preparation of documents not quite as severe as with Column B, except if automatic camera feed is used. Once recorded by the camera, input is complete.
RETRIEVAL (Output)	Retrieval is mostly manually done, even in mechanized equipment. Some systems provide automatic selection by keying in identifying codes, but actual retrieval of document is manual.	May be viewed either on simple readers or reader-printers, as well as on remote video display units. In the latter case, transmitting video cameras are required at the central file location. Semi-automated systems require key operators to place the microform in a TV camera, while fully automated models are capable of searching for and selecting the microform and automatically positioning the camera. Sophisticated systems use identity codes for automatic searching. Paper copies can be produced on an individual, selective basis or in volume by special equipment. New models can automatically produce paper copies from fiche without manual handling for each frame.	Manual retrieval is not a factor. Identity coding a necessity because of the nature of magnetic tape media. Output can be to viewing screen, paper printer (selective or volume) or by microfiche. Only tape reels which are on line can be addressed and retrieved; the bulk are maintained in a tape library and must be mounted on tape drives to be accessible.
BROWSING	Normal procedure.	Can be done with either manual or automated systems using film reader or video camera transmission. Roll film format is dependent on frame sequence of documents.	Complete browsing capability.
PURGING	In manual systems accomplished by manual search or by system of filing in blocks; can be aided by color-coded designators. Scanning systems can eliminate manual search.	Withdrawal of individual microfiche, jackets and aperture cards upon termination of status or usefulness can be done automatically or manually, depending on degree of sophistication. Purging of cartridge microfilm not practical: cutting, splicing and regeneration of roll would be required	Files recorded on videotape can be purged rapidly, and transferred to another tape and in some cases to another media. *Primarily automatic operation.*
ARCHIVAL STABILITY	Indefinite, except in the case of some copy papers. All ordinary papers generally accepted for archival use.	Provided silver microfilm has been correctly processed, it can last indefinitely. The life span of diazo and thermal film used for making copies from original silver film has not been officially determined because of limited years of experience.	No standards have been set on life expectancy of magnetic (video) tape. Loss of resolution when regenerating one tape from another reportedly occurs with some systems.
UPDATABILITY (Infiling)	Offers no problems in either manual or automated systems.	Cartridge microfilm: adding new documents is highly impractical; cutting and splicing are necessary. Jackets: adding documents is feasible, but time-consuming when a regular flow of many documents is involved. Microfiche and aperture cards: not possible to add documents.	Recording of added documents is normal and rapidly done.
SIMULTANEOUS USE	None. Limited to single use.	Can be made available to several users at one time either in duplicate film or paper copies, as well as by remote viewer.	Available to several users simultaneously either by microfiche or paper copy, as well as by remote viewer.
COMPUTER INTERFACE	No practical application.	Computer can be used with automated systems to provide such features as control of queuing, simultaneous access, batching, indexing, and others.	Same as Column B.

Table 5-1. Comparison of Systems.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.

SOMETHING WRONG WITH PUBLICATION

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE

BE EXACT PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER	SIGN HERE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

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