ity. We learned that better enlarged paper prints can be made by establishing quality standards for the hard copy of the original reports. We recommend that reports writers should avoid using:

1. Foldouts over 11 × 17 inches.
2. Photoreductions greater than 50% for the original report duplication.
3. Pen or pencil markings on pages, flow-charts, or graphs.
4. Pictures and printing on the same page.
5. Colored background paper (especially for covers).
6. Copies that have been poorly mimeographed or photocopied.

Each year's collection of about 1800 reports requires about forty 100-ft rolls of microfilm. Duplicate sets are made for our nine satellite report centers. Our costs are summarized in Table I.

Of course, the main factor in making this project economically feasible is having enough satellite reports centers which want a microfilmed set of company reports. The filming cost is shared equally by each center, which at present has to pay only one ninth of the total cost.

To determine relative costs,[1] the actual charge for a single set of report microfilms was compared to space costs for storage of a hard-copy file in office file cabinets, seven-tier open shelves, and in an off-site records center. There are differences in storage or space charge for various locations, but the general relationship is probably the same. The storage figures used in Table II apply only to Esso Research and Engineering Co. in the Linden area, of course.

Table I. Unit Costs for Microfilm File of Company Reports

Microfilm	Cost/Set	Cost/Image
On reels	$472.00	0.6 Cent
In cartridges	$580.00	0.7 Cent

Table II. Annual Storage Costs for 260 Inches of Reports

Office File Cabinets
260″/26″/drawer = 10 file drawers
Two 5-drawer file cabinets @ 5.8 sq ft floor space/cabinet = 11.6 sq ft
11.6 sq ft × $8.25/sq ft/yr = $95.70
Seven-Tier Open-Shelf Files
260″/36″/shelf = 7 shelves
1 shelf occupies 7.5 sq ft of floor space
7.5 sq ft × $8.25/sq ft/yr = $61.88
Records Center Storage
260″/15″/box = 17 boxes
17 boxes × $3.00/box/yr storage charge = $51.00

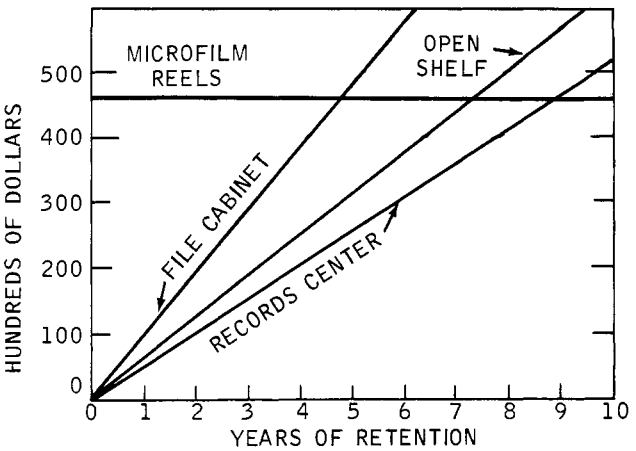

Figure 1. Storage cost for one year's company reports

Company technical information must be kept for an indefinite period. Hard-copy storage costs continue year after year, but microfilm production costs are paid only once, since storage costs are negligible. Therefore, when annual costs are plotted against file retention time, Figure 1 shows that even if a hard-copy file were to be stored in our off-site records center, the savings in storage alone would pay for the microfilm within nine years. Similar savings are also realized by each of our world-wide reports centers that would otherwise retain hard copies of reports.

In-house microfilming of company reports is therefore an effective, economical method of storage when satellite report centers need duplicate sets. Internal controls help to insure microfilm quality, and operations are not difficult to manage. We intend to continue producing 16-mm roll microfilm copies for the indefinite future.

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(2) Porter, John W., "Legal Requirements with Respect to the Microfilming of Records," Administrative Management Society, Willow Grove, Pa. (Undated bulletin).

Use of Microfilm in Internal-Mail Control*

T. J. DEVLIN
Esso Production Research Co., Houston, Tex. 77001

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Mail control systems are designed to help insure the proper distribution, timely handling, and prompt filing of important correspondence. Most of these systems operate around a record control card that is prepared for each piece of correspondence when it is received.[2] The distribution information contained in the record card is used to institute follow-up procedures if there is a break in the circulation, or if the material does not return to files in the proper time.

In spite of this control, a significant amount of material is still "lost" during circulation. While these mail control systems can establish this fact, they can do little about producing the document or the information it contained.

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Use of Microfilm in Internal-Mail Control

Protection of important correspondence being circulated to multiple addressees is a fairly common problem in mail and file operations. Some organizations have developed systems using microfilm to replace conventional "receipt-required" circulation methods. Both unit-form and roll-form microfilm have been employed. The unit form was capable of organization by subject, and no further indexing was done. The users of the roll form, however, needed to devise an indexing system in order to locate specific images on the rolls. Because of the high cost of maintenance, the organization using the unit-form system has abandoned it in favor of a direct-paper-copy system. The systems using roll film are still operating. In addition to the advantages that microfilm provided over previous mail-control procedures, the indexing systems used in conjunction with the microfilm proved to be very effective. These indexing techniques have been expanded and applied to the organization and retrieval of a variety of materials. Operating details of the various systems are presented. The impact of new microfilm equipment and paper-copying equipment on the future use of these systems is also discussed.

Positive protection of important correspondence can be obtained by copying the correspondence on receipt. Microfilm is being used for this purpose in mail control systems with good results.

1. It provides the positive protection required.
2. Its cost is lower than paper copy.
3. The clerical burden in the mail control system is reduced.
4. Filing costs are reduced, and file efficiency is improved.

These results have been achieved at Esso Research and Engineering Co., and elsewhere, with systems that combine microfilm and data processing techniques. Before discussing the details of a particular system, it might be well to review mail control systems in general.

Most mail control systems have these elements in common:

Mail is received, opened, screened, and distributed from a central point.

Routine mail is forwarded with no further processing, but a control record is created for important correspondence before it is released for distribution.

The type of information contained in the control record, usually a 3- × 5-inch card or form, is shown in Figure 1. This card provides the record of receipt and distribution of the correspondence, and can be used to initiate any follow-up action that may be required.

A mail control system in fairly common use is shown in Figure 2. Appropriate information concerning an important item of correspondence is recorded on the control card, which is filed in order of follow-up date. The correspondence is then sent to each addressee in turn, through the mail clerk, and each transaction is recorded on the control card. If the correspondence is not returned by an addressee in the prescribed time, follow-up measures are taken to get the item back in circulation or back to the files. When circulation is complete, the material is returned to the files, with the control card.

- CONTROL (ACCESSION) NUMBER
- DATE
- AUTHOR
- ADDRESSEE(S)
- TITLE AND/OR SUBJECT
- DISTRIBUTION
- ACTION DATE

Figure 1. Document-control record entries

In the system shown in Figure 3, the control information is recorded on a multipart routing slip. One part is sent to the files and the other parts are attached to the correspondence. As each addressee forwards the correspondence, he detaches his portion of the routing slip and sends it to the files. This method provides the same degree of control, but it avoids the delays caused by repetitive handling of the mail.

Systems of the general type just discussed can fix responsibility in cases where correspondence is "lost," but they can do little about replacing the lost document, or providing the information it contained.

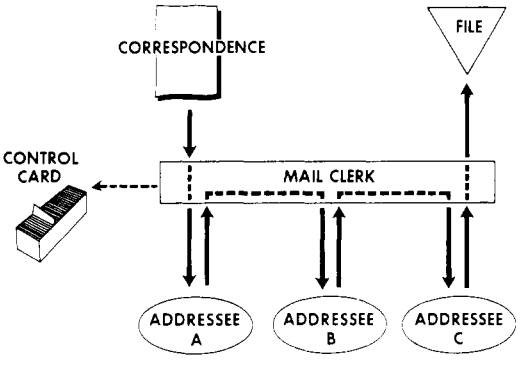

Figure 2. Basic mail control system

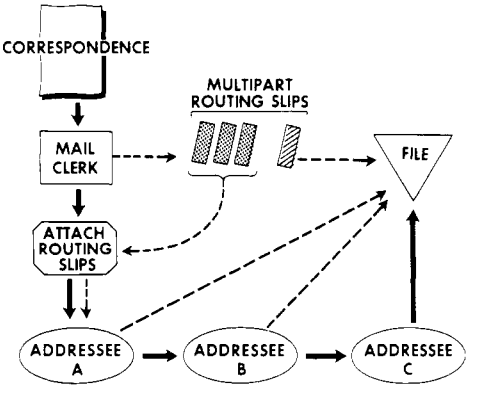

Figure 3. Mail control with multipart routing slips

In the mid-1950's, therefore, some organizations began to photocopy important incoming mail on receipt, to protect against loss in circulation. These copies were sent directly to the files and were retained until the originals returned, were used to replace originals if they were lost, or sometimes obviated the need to return the originals.

The high cost of paper copies at that time, however, brought about the use of microfilm for the purpose of providing security copies. The system used at the Parma Technical Center of Union Carbide Corp., for example, is shown in Figure 4.

Here, important incoming mail was copied on 16-mm microfilm, and the original was then released for distribution. After processing, the microfilm was cut into strips to allow insertion into microjackets in subject order. While copying costs were reduced, the added clerical effort needed to cut and file the film strips took up most of the savings. In addition, the one-week delay between the filming of the letter and the availability of the processed film presented some problems. When lower-cost photocopies became available, the Parma Technical Center abandoned the microfilm procedure, and is again operating a mail control system with paper copies.

Although unit microfilm did not prove satisfactory in the foregoing situation, roll microfilm offered a possible solution. A basic requirement, however, was an index to the roll microfilm that could be prepared conveniently and economically. This was achieved at Esso Research and Engineering Co.[1] with a system that combined roll microfilm and electronic data processing techniques, as shown in Figure 5.

The important documents are filmed sequentially (control number order) and the film is kept in roll form. When the originals are returned, they are filed by subject in the conventional manner.

The significant difference, however, is the use of a Flexowriter to record the document control information on a log sheet and to produce, simultaneously, a punched paper tape containing the same information in a machine-readable form. Electronic data processing equipment can then be used to prepare a variety of indexes to the microfilm file.

The elements in a typical log sheet entry, shown in Figure 6, are identified in Table I.

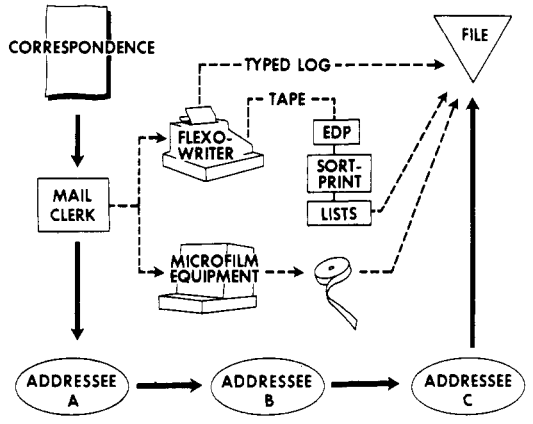

Figure 5. Mail control with roll microfilm and data processing techniques

After the manual addition of appropriate information, the log sheet serves as the control record as well as a reference list to the microfilm, as both are in control number order.

Any of the elements in the log sheet entry can serve to generate listings. Those most commonly used are corporate source, personal author, and subject class. A sample index entry from a corporate source list, shown in Figure 6, is detailed in Table II.

An example of the type of request handled through the "corporate source" index is: "...a memo that had some information about the resiliency of butyl rubber. I don't know the author, but the memo came from the Chemicals Research Division about three weeks ago." Once located in the index, the memo can be retrieved from the microfilm file by searching for item #40236 or from the subject file #6175.000, where it will be found in date order.

This combination of the techniques of microfilming and electronic data processing not only provides the desired control of mail, but also increases the efficiency of the file operations. About 75% of the Esso Research file requests are for specific letters or memos. The availability of the index makes it possible to use the microfilm to fill these requests. Copies can be made from the film and given to the requestor. Because these copies need

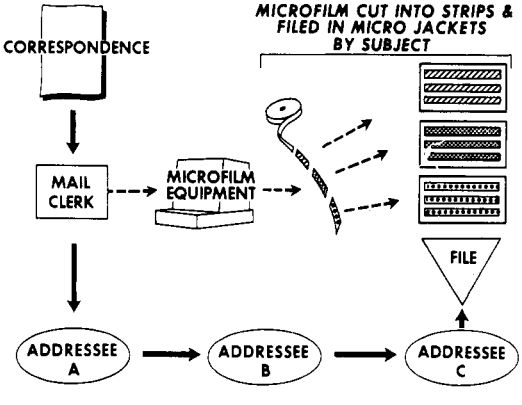

Figure 4. Mail control with unit microfilm

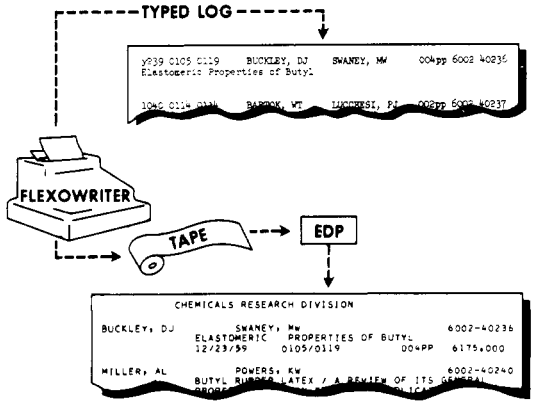

Figure 6. Conversion of log sheet data to index form

Table I. Elements in a Typical Log Sheet Entry

	Corporate		Personal			
Date	Source	Addressee	Author	Addressee	No. of Pages	Serial No.
Y239	0105	0119	Buckley, D. J.	Swaney, M. W.	004	6002–40236
Title			Subject Class[a]			
Elastomeric Properties of Butyl			6175.000			

[a] Generally added to record when material is filed. Can be recorded upon receipt if desired.

Table II. A Corporate Source Index Entry

Chemicals Research Division		
Author	Addressee	Serial no.
Buckley, DJ	Swaney, MW	6002–40236

Title
Elastomeric Properties of Butyl

Date	Corporate Source Addressee	No. of Pages	Subject Class
12/23/59	0105/0119	004pp	6175.000

not be returned, the withdrawal and refile operations normally associated with such requests are eliminated. When a large number of documents are required to answer a request, however, such as for state-of-the-project reviews, the conventional subject files are used.

About 100,000 pieces of incoming mail are handled each year by the mail clerk in the central files of Esso Research and Engineering Co. About 25,000 of these are considered important enough to be processed through the mail control system. Equipment costs (Flexowriter, microfilmer, and microfilm reader-printer) filming time and material costs, and computer charges amount to about $4000 a year more than for a simple, card-control system. In return for this additional expense, the following results were achieved:

1. The clerical effort required was reduced by 50%.
2. The time required to fill file requests was reduced to an average of 5 minutes.
3. The percentage of file requests filled was increased from 78% to 96%.

The success of the system led to its further development and application. At Esso Production Research Co., for example, the system was modified to provide detailed subject indexing and is now used for company reports, abstract files, and other special collections in our library. I understand that a similar system with equal flexibility has been developed and successfully applied by U.S. Steel at Monroeville, Pa.

The future configuration of these systems can certainly be affected by technological advances in office copying machines and in microfilm equipment. If they become economic, paper copies of incoming correspondence filed in control number order could be used in place of the microfile in Esso's operations. At present, however, the advantage still remains with microfilm from the standpoint of cost, file space requirements, file maintenance, and file security.

Automated microfilm search systems such as Eastman Kodak's "Miracode" must also be considered. Here, the indexing information and the document are both contained on the microfilm. The microfilm reader-printer can "read" the index code. Thus, automatic searching of the microfilm for specific documents can be done directly, without the use of printed indexes.

A system of this type could potentially replace all hard-copy filing, with attendant economic advantages. The accuracy of this statement, of course, depends on individual file situations. In our own case, we can see potential areas of successful application, such as employee-relations files, product-specification files, and other specialized areas where a relatively small number of documents will answer the file request. In situations where many documents are required as background material, hard-copy subject files still appear to have the advantage.

No one mail control system will fill all needs effectively, of course. The flexibility provided by the separation of the index information from the document is presently quite attractive. It allows us to take advantage of new developments in copying or storage techniques, and in retrieval techniques, with a minimum of change. The system design will also permit consolidation of the indexing information and the document, if this should prove desirable.

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