Microforms and Technical Information*

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Microforms provide many advantages for the dissemination, storage, and retrieval of documents for technical information systems. This paper describes a system based on the production of original microfiche, using in-house equipment, for over 50,000 internal technical documents. The development, installation, and use of this system in a centralized technical information indexing and search environment are described. Other uses of microforms for processing technical information are discussed.

In 1964, a number of departmental report centers in Du Pont were consolidated as one of the units in the Information Systems Division of the Secretary's Department. The combined collection consisted of 50,000 indexed technical reports, with 4000 new accessions received annually. The inquiry rate approximated 3000 per year. Thesauri and computerized searching capability were consolidated to establish a more efficient operation at a lower cost.[5]

This merger had to be implemented in a coordinated manner to assure uninterrupted service to the many inquirers throughout the Du Pont Company.

In brief, this large information center operates as follows:

Input. New accessions are indexed by technical personnel. Depth of indexing approximates 30 terms per document. Input is keyboarded using either IBM card punches or Mohawk 1101 data recorders, and the computer files are updated periodically.

Searching. Searches of the coordinate index can be made by computer or manually from the computer printouts.

The result of either a computer or manual search is a listing of report accession numbers.

The searcher is provided copies of abstracts of the documents, printed using thermal copying equipment from a card file containing 3- × 5-inch abstract cards.

Abstract copies are screened by the searcher to eliminate nonpertinent references. In many cases, reference to a report is required for accurate screening. This necessitated providing the consolidated information center with copies of all indexed reports.

The inquirer currently receives the pertinent abstract card copies as the answer to his inquiry.

DISCUSSION

It was the requirement for report storage that turned our attention to microforms. The storage of 50,000 documents, averaging 33 pages each, in paper form requires the equivalent of 84 five-drawer file cabinets or 40 three-foot sections of seven-tier shelf files. Making the required duplicate paper copies of documents for the centralized facility at various locations was considered difficult and expensive. In addition, the anticipated removal and replacement problems associated with an active paper file of this size were judged to be almost insurmountable.

Various microforms were considered for use:

Aperture Cards would provide unit record capability, but multiple cards would be required for practically all reports unless reduction ratios were raised to 36× or higher.

Sixteen Mm. Cartridge-Loaded Roll Microfilm was low in cost but was limited in random duplication capability, a necessary future requirement.

Microfiche, while relatively high in initial photographic cost, had the advantage of adequate duplication. It was chosen as the microform to be used.

As of November 1964, the use of microfiche in the United States was still in its infancy. Although the Atomic Energy Commission, the National Aeronautics and Space Administration, the Clearinghouse for Federal Scientific and Technical Information, and the Defense Documentation Center were using microfiche in various compatible formats, their COSATI (Committee on Scientific and Technical Information) Federal Microfiche Standards were not issued until September 1965. We had maintained close liaison with the Government agencies, and it was our conclusion that, since they were issuing such large numbers of microfiche with a compatible format, any future Federal standard, or standards, developed by the National Microfilm Association must at least be compatible with these preliminary "standards."

Since the system was to deal exclusively with Du Pont proprietary information, a total in-house operation was required. A detailed proposal for establishment and operation of a microfiche system was prepared, presented to management, and the project authorized.

Implementation Procedures. There are many difficult and time-consuming problems associated with the implementation of a program of this magnitude. You must: develop work flow procedures; establish quality standards; provide work space; specify, purchase, and test equipment; and hire and train personnel.

The need for technical competence in microfilm production cannot be overemphasized if a high-quality product is to be produced. We were extremely fortunate that the photography was placed under the supervision of the

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Vital Records Section in our own Information Systems Division. For 13 years, this group had been active in microfilming Du Pont information for security purposes.

At this point, a disclaimer must be entered. To describe our microfiche system effectively, equipment names must be mentioned. This should not be construed as endorsement by the Du Pont Company. Since new competitive equipment has been introduced since our acquisition, it should be evaluated for use for any new system.

Procurement and preparation of reports to be photographed on a schedule to keep the camera in operation on a two-shift basis during backlog filming were difficult. Some of the preparatory steps required were as follows:

1. Reports were collected from over nine departments including 30 Du Pont locations on a schedule to permit efficient processing.
2. All were reviewed for obsolescence. This operation resulted in the classification of 8000 documents as "Inactive," a preferred name since no technical effort is ever obsolete. Separate search capability for inactive reports was maintained, but microfiche were not produced.
3. New consolidated report system accession numbers were stamped on the cover page of the reports in ⅜-inch characters to permit a visual check without magnification during inspection of the microfiche.
4. Reports were disassembled to individual sheets with all staples removed, checked to assure completeness, and each report placed in a separate file folder.
5. Abstract cards were collected and placed in their proper folders.
6. The microfiche title block information was produced according to a standard format. Information included was: the consolidated report accession number, other previously assigned departmental report numbers, the date of publication, report title, and author(s).

   Initial title block typing for backlog reports was accomplished using IBM Executive proportional-spaced typewriters with 12-point, Mid-Century type font. Current title block information is automatically produced as a by-product of abstract card typing, using Friden, Inc., SFD-President Model Flexowriters, also proportional spaced and using Mid-Century type font. Proportional spacing with this condensed 12-point type font permits placement of approximately 40% more characters per lineal typing inch than 12-point standard pica type, at no loss in readability.

   A carbon ribbon was used for typing on a translucent parchment, Patapar-Code 27-45. An orange carbon back-up sheet was used to improve the opaqueness of typed characters. Title block information was copied using an Ilford, Inc., Ilfoprint Processor to produce a correct reading negative copy of photographic quality for title block photography. The copy paper used was Ilford, Inc., No. 54-1P, classified as glossy, single weight, and extra hard. Prior to the selection of these materials, controlled tests were made using combinations of 18 different typing papers, parchments, and films; six different carbon papers; and various Ilford copy paper types.

The fully prepared reports were arranged in ascending numeric order and sent to the camera on a predetermined schedule.

Microfiche Production and Duplication. A Microcard Corporation Model SR-1 Step & Repeat Camera was purchased and delivered in February 1965.

The microfiche production standards used are compatible with the COSATI Federal Microfiche Standards[6] and the Microfiche Standard Specification M-1-1967, published by the National Microfilm Association.[4] The format shown

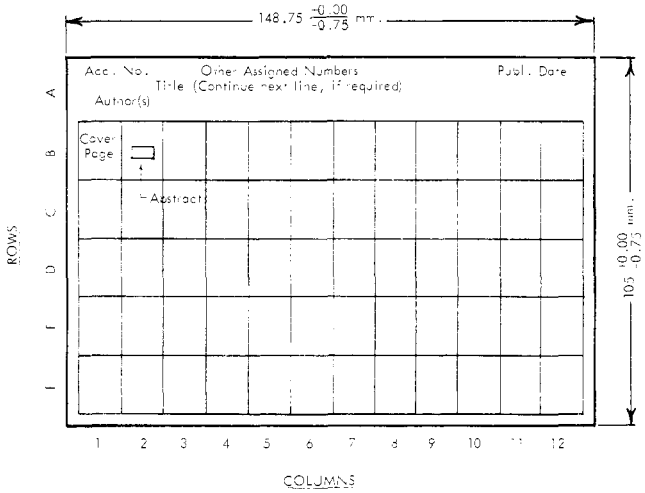

Figure 1. Microfiche format

in Figure 1 specifies space for six rows from top to bottom on the 4- × 6-inch (105 × 148.75 mm.) microfiche, identified by the letters A through F. Each row contains space for 12 images, numbered from 1 through 12, from left to right.

The title block identification is placed on all microfiche, including continuation microfiche, in row A to facilitate identification and handling. The cover page of the document is always photographed in frame B-1 and the abstract card in frame B-2 of the first microfiche for each report.

Camera output is in 100-foot rolls of 105-mm. silver film. Approximately 180 microfiche are produced from each roll. Exposed film is processed using a Smith UT-105 processor manufactured by the Philadelphia Air Transport Co. This equipment can also process 16-, 35-, or 70-mm. films. Microfiche are thoroughly inspected while still in roll form.

Duplicate microfiche are produced using the diazo process. A Tecnifax Corporation Hi-R Roll Film Duplicator is used. The master silver film is then stored in roll form for security purposes or to be used to provide future rolls of duplicate film.

The diazo duplicate film, still in roll form, is inspected and then cut to microfiche size, approximately six inches long, using an Eastman Kodak Corporation Model 12-K Master Roll Paper Cutter.

Individual microfiche are placed in specially printed envelopes for distribution to use areas.

Microfiche Costs. Costs for producing microfiche can vary considerably due to: volumes produced, equipment amortization procedures, overhead factors, space rental, equipment leasing practices, report length, quality standards, and other factors. Our *material* costs to produce one master and one duplicate microfiche, including silver camera film, diazo duplicating film, processing solutions, a storage envelope, etc. are $0.204 per microfiche. *Labor time* including photography, processing, inspection, duplication, cutting, and placing the duplicate in the storage envelope, approximates nine minutes per master and duplicate. These calculations are based on a two-shift camera operation. They do not include equipment amortization or costs associated with title block typing or the collection and preparation of reports for photography.

Microfiche Storage and Use. The central facility has a complete set of technical reports on microfiche. The current files contain approximately 52,000 technical reports, including the initial 42,000 active and 10,000 new reports received since conversion. Approximately 65,000 microfiche were required, or an average of 1.3 per report. The collection contains approximately 1.7 million page images.

Microfiche are stored in two six-tiered, lazy susan–type rotary files manufactured by the Wassell Organization. With the two files placed adjacent to each other, two searchers can use the single collection simultaneously, removing any of the 52,000 reports from the file without getting out of the chair. Figure 2 shows one searching station. Another is located facing the opposite direction of the same side of the files. The floor space required for storage measures 10 × 5 feet. If desired, two additional viewing stations could be placed on the opposite side to provide simultaneous access to the file by four searchers. It is highly unlikely that they would require the same document at any one time. File integrity is maintained, as each searcher removes only one microfiche at a time for viewing and/or printing, marking its place, and returning it prior to making a subsequent removal.

The reader used is the Bell & Howell Headliner 509. It has a magnification ratio of 24×, providing an image on the 14- × 14-inch screen approximately 20% larger than the original. This unit provides for 360-degree image rotation and efficient insertion and removal of the microfiche.

If paper copies are required, they are printed using the 3M Company "Filmac 400 B" Reader-Printer with microfiche attachment.

Field tests and evaluations are currently being made for the establishment of satellite microfiche libraries containing all or selected parts of the total centralized technical information file to serve the individual needs of various Du Pont locations. Diazo microfiche duplicates for a series of reports are prepared from the original silver film stored in roll form. Duplicates of individual microfiche can also be provided.

Figure 2. Microfiche storage and reading station

DU PONT INFORMATION NETWORK

The centralized information facility just described is one part of a large and rapidly changing information network within the Du Pont Company. The various components of this network are operated on a centralized, decentralized, or a combined basis. Personnel assigned can vary in number from one to as many as 40, depending on the requirements of the specific system. Information processing equipment varies with the individual need.

This Du Pont Information Network processes both proprietary (internally generated) information and nonproprietary (externally generated) information. Some of the types of proprietary information which are produced at most of Du Pont's more than 80 plants and laboratories are:[1]

1. Scientific–Research
2. Process development
3. Engineering
4. Manufacturing
5. Commercial
6. Product
7. Internal business information
8. General and miscellaneous

Some of the sources of nonproprietary information are:[1]

1. United States Government
2. State, county, and city government
3. Commercial information sources
4. Publishers
5. Universities and research institutes
6. Industrial corporations
7. Professional societies and trade associations

You can easily visualize the sheer bulk of this information which is currently being collected from the many sources in ever-increasing quantities. Although established retention periods and efficient records management programs are in effect, the physical volume continues to grow.

Microform Use. Microforms are playing an increasingly important role in providing efficient dissemination, storage, and access to this vital storehouse of information.

Cartridge-loaded 16-mm. roll microfilm is receiving increased usage at numerous locations for internally generated records, such as computer printouts, sales reports, correspondence files, purchase requisition information, and other similar materials. Several locations are using this form purchased from the outside: for example, U.S. patents, vendor catalog files, and *Chemical Abstracts*. Some technical journals have recently been made available and are being used by several Du Pont technical libraries for reference purposes.

The use of 35-mm. aperture cards is increasing at a rapid rate, particularly in the engineering drawing field, and also for unit record-type applications where the pages per document involved do not warrant the use of microfiche.

Microfiche applications are also increasing. In addition to the large centralized technical report file discussed, other internally generated information which requires use of the unit record concept is being placed on microfiche. This permits selective duplication for distribution of any part of the file quickly and economically. External information is also purchased for use in microfiche form.

Examples are: vendor catalog files, Government reports, and other materials.

Future of Microforms and Technical Information. Although not done at the present time due to the lack of microfiche duplicating facilities and the availability of reader or reader-printer units at various locations, we are approaching the "D" (for Duplicating) library proposed by Heilprin several years ago.[2] With this system, copies of the requested material would be duplicated in microform by the information store and given to the requester with instructions that it should *not* be returned.

Many present-day design engineers, notably in the Bell Telephone Laboratories,[3] consider an aperture card reader for viewing engineering drawings as important as the desk telephone. The technical scientist or engineer in the near future will require a personal, desk-type microform viewer with hard copy printout capability located nearby. Savings possible in technical information distribution costs and technical time will easily justify this equipment.

Microforms are receiving increased usage, but not because people actually prefer them. Studies indicate that most users still prefer paper documents. The fantastic proliferation of published information, which greatly exceeds the actual development of new information many times over because of the multiplicity of publishing efforts, has made it impractical and uneconomical to attempt to store the necessary part of the collection in paper form, particularly at several locations. Microforms are currently providing us with a more efficient and economical method for handling technical information.

However, this use of microforms for the distribution of technical information is just another interim step in the information continuum. The battle to improve technology for information storage techniques continues. In the not-too-distant future, the larger central information store will be perfected. It may use holographic techniques for high-density storage in crystal-type materials. This will eliminate the need for many satellite information storage files. The user will key-in the desired document number from his remote location, and input-output equipment coupled with possibly a laser-type, high-speed transmission facility will give him the option of viewing the information on a screen or receiving either a microform or paper copy. The technology is here. It is only a matter of lowering costs to a justifiable level.

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Current Information Dissemination: Ideas and Practices*

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A detailed description and a tabulated summary of the salient features of 17 current awareness information services are presented to illustrate various approaches to handling the current information dissemination problem.

The American Institute of Physics, a federation of the seven leading American societies in physics and astronomy, is the single largest publisher of physics in the world today. It produces about 85% of the physics journal material published in the U.S. and, with its translation program, about 35% of the world's total physics journal output. Although an information program has been in existence since 1958, it has recently been reorganized and expanded. The new Information Division now has the responsibility for conducting studies that will lead to the design of a national physics information system. This program is being supported by the National Science Foundation as part of its effort to promote the development of discipline-oriented information systems.

The current work and plans of the AIP's Information Division emphasize the following interrelated areas: intellectual organization of physics information; computer-based photocomposition; creation and maintenance of a computer store of physics literature; and dissemination of information. The study, whose findings are reported below, is part of this last activity. A detailed description of 17 awareness systems for current literature is presented together with a comparison table (Table I) from which similarities and differences can be noted. In undertaking this study, AIP intended to determine the range of products and services available outside of physics for the dissemination of current research developments.

Several criteria were applied in selecting the services for inclusion. Because of AIP's role as publisher, an examination of the current publishing scene was of paramount importance. All indications are that publishers, regardless of whether or not they are producers of primary

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