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Extra-library information services are helping libraries find solutions to the problems created by the changes in the information environment, the demand for current information, and the media by which the knowledge is distributed. There are three types of these services: (1) document handling systems, (2) data handling systems, and (3) information analysis centers. Extra-library information services have one major characteristic in common, they place greater emphasis than libraries on the organization of information for current and specialized uses rather than stressing long term future utility of the information. Recommendations made to the National Advisory Commission on Libraries are: (1) libraries and extra-library information services be considered as integral parts of the total information transfer process; (2) the professional library association develop an easy and efficient method to keep librarians informed of existing and new extra-library information sources; (3) professional library associations investigate the possibilities of acquiring terminal equipment connected to one or more of the extra-library information sources; and (4) a study be conducted to determine the feasibility of applying in libraries the indexing and file searching methods now used in extra-library systems. Detailed descriptions of twelve of these extra-library services are included. (CM)

POSITION PAPER

on

EXTRA-LIBRARY INFORMATION SERVICES

Science Communication, Inc.

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EXTRA-LIBRARY INFORMATION SERVICES

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EXTRA-LIBRARY INFORMATION SERVICES

Abstract

This paper discusses three types of extra-library information services: document-handling systems, data-handling systems, and information analysis centers. It gives reasons for the development of extra-library information services and enumerates the characteristics of these services. What extra-library services offer the user and what they offer the traditional library is discussed. One section is devoted to a discussion of media, the document and the electronics medium, employed in transferring information. The role of the computer with regard to both of these media is developed. Recommendations and examples of several extra-library information services are presented.

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SECTION II - Exhibit Descriptions of Selected Extra-Library Services

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EXTRA-LIBRARY INFORMATION SERVICES

I. Introduction

Over the past quarter century there has been a significant change in the relative position of the home, the office, the school and the library as sources of information. In the past the school and the traditional library far exceeded the home and office as places for acquiring information. Today this gap between the school and library on the one hand, and the home and office on the other has diminished. As sources of information the home and office have risen dramatically in relation to the other two, even though all four of them have increased significantly as sources for acquiring information.

Along with these changes in our information environment is the change of emphasis in the kind of information people seek today. Because of the rapidity of change and the pace of current events, people are faced with the difficult problem of keeping abreast of these changes, especially when these changes are related to one's own profession or vocation. Thus a special demand has been created for almost instantaneous information about a new hypothesis, a discovery, a scientific or technological breakthrough, a medical advance, or any other kind of finding. The media too have changed. The most prominent ones employed today to convey new information are newspapers, journals, reports, television, and convention papers.

In combination, the changes in the information environment, the demand for current information, and the media by which that information is distributed have created a number of pressing problems for our libraries. Helping the library establishment find solutions to the problems created by these changes are the extra-library information services that have developed in and out of government over the past several decades.

Many new library-like information services have been devised to cope with these changes. Today there are at least three basic types of extra-library information services attempting to store and retrieve information

and facilitate its transfer. The first type is the document-handling service which attempts to facilitate the flow of report literature of all kinds. The Defense Documentation Center and the Clearinghouse for Federal Scientific and Technical Information are two prominent examples of this type. The second type of service is the data-handling center which attempts to provide greater access to and use of data of all kinds. Several well-known examples are the National Space Science Data Center, the National Oceanographic Data Center, and the Bureau of the Census. Information analysis centers, which have as their expressed purpose the synthesizing of information within a particular discipline or among related disciplines, make up the third type of extra-library information service. The Nuclear Safety Information Center, the Battelle-Defender Information Analysis Center, and the Nondestructive Testing Information Analysis Center are examples of this type. Although extra-library information services vary in structure and function and often perform the functions of more than one of these basic types, it is useful to categorize them in this manner for discussion purposes.

In dealing with extra-library information services this paper will confine itself to those types of efforts that have as a common denominator with libraries the storing and retrieving of information for public and governmental use. Excluded for this reason are the mass media such as radio, television, and newspapers, and such arrangements as command and control systems and corporate management information systems.

II. The Rise of Extra-Library Information Services

A number of reasons can be given for the rise of extra-library information services. The first and most popular one is that these services have developed as a response to the tremendous increase in the number of documents being published. To control the information explosion it became necessary, therefore, to establish a number of information storage and retrieval centers and to develop new techniques to cope with the flood of printed material.

The inadequacy of libraries to meet new information demands is a second reason given for the emergence of extra-library information services. However, to blame the traditional libraries for not recognizing the need for innovation and for new services, and further for not taking steps to alleviate the situation by experimenting and adopting new methods of information transfer, is rather short-sighted. The information explosion did not occur in the number of books being published but in the proliferation of other forms of documents. When these other forms began to create storage and retrieval problems, information systems came into being. For the most part, these problems arose initially outside the normal purview of the traditional library.

More important than the information explosion or the lack of initiative on the part of libraries as reasons for the development of extra-library information services are the social changes that have taken place in our society. Already mentioned is the change in our information environment and the kinds of information people are seeking. Tied closely to these changes is the attitude with which we view information. The dictum "You can't get today's job with yesterday's skills," illustrates the fact that life is now considered a continual learning process. Today information is regarded as a vitally important commodity but one that has the tendency to become obsolete over a short period of time. Rapid change produces the obsolescence and the necessity of having quicker access to a store of up-to-date information. A person cannot act responsibly as a citizen or keep abreast of his profession without continually keeping up with the changes taking place. It is not the library that fails in this respect but the medium of the book that is at fault. The book's ability to convey knowledge of broad and permanent value cannot be challenged; it can only be questioned as a means for conveying up-to-date information. The report literature and the various types of information services serve this purpose in a much more adequate way.

Technology is another important explanation for the development of information systems. It first provided the means to publish economically a wide assortment of documents in paper-bound form. The proliferation and use of this form of literature resulted in many problems for libraries but it answered, at the same time, the need for a rapid means of communicating information. Libraries were ill-equipped to handle this wide variety of documents. The lifespan of these documents was short and therefore created archival problems that were extremely difficult to

manage within the library. At the same time, the immediate utility of these documents had widespread importance, creating and intensifying the problems of dissemination for libraries. To store, retrieve, and disseminate these kinds of documents it became obvious to many people that new methods were required to handle them.

Technology not only made possible numerous types of documents, but it also provided the means which greatly assisted in their control. The computer was first applied to the development and maintenance of indexes of documents, allowing for greater depth of indexing and more comprehensive retrieval of information locked in documents. The use of the computer in this manner is still quite new, but there seems to be little doubt that it will one day replace the card catalog as we know it today.

Although slow in being applied to indexing, the use of the computer has not stopped at this point in the information transfer process. Like the book, the computer is becoming a medium of information transfer itself. In the United States there are over 200 well-established data-handling centers and perhaps a greater number of management information systems. In these centers the computer provides storage of and access to recorded, but in many cases unpublished, information. Although management information systems are restricted in their use by their corporate settings, data systems are accessible to many people who desire the information and have a legitimate need for it. The development of management information systems and data-handling systems can be attributed to the very existence of the computer and, comcomitantly, the desire to develop better and more efficient means of handling information.

The reasons given here for the rapid development of the various extra-library systems now in operation outside of the formal library network constitute only those reasons considered to be of major significance.

III. Characteristics of Extra-Library Information Services

From the foregoing synopsis of the types of extra-library information systems and reasons for their development, several broad generalizations can be made about their characteristics. Although many of their functions are similar to those of traditional libraries, the services provided by extra-library information systems differ in many respects.

In the main, extra-library information services place greater emphasis on information than on documents. Although documents comprise a major part of their store and are the major source of their information, extra-library information services attempt to index to a much greater depth the information contained in the documents. To achieve this end practically all information systems have adopted open-ended classifications schemes in order to avoid the restraints imposed by the hierarchical schemes of the Dewey Decimal and Library of Congress systems. The newer schemes permit more intensive indexing of the information and more comprehensive retrieval of information contained in documents.

Extra-library information services are more active disseminators of information. They work toward getting the information into the hands of those who can use it. Document-handling systems such as Defense Documentation Center, the Clearinghouse for Federal Scientific and Technical Information, and the NASA system send to their users on a regular and frequent basis a bibliographic listing that includes abstracts of their new acquisitions. Other systems have alerting techniques such as Selective Dissemination of Information (SDI) to keep their customers informed of articles and reports of interest to them. The underlying commitment of these systems is to get the information into use by making their customers aware of its existence.

Another distinguishing characteristic of extra-library information services is that their collections maintain file integrity. They achieve this by selling (or giving) to their customers copies of the documents in either hardcopy or microform. This practice is in marked contrast to that of libraries which lend their materials and require that they be returned.

Such a procedure eliminates the problems of follow-up for the return of documents and prevents the slow erosion of a library's collection due to loss of or failure to return documents. An important added advantage of allowing the user to keep the materials sent to him is that it tends to develop specialized collections in his private files.

For extra-library information services, the book is a minor rather than a major medium of information transfer. Information systems deal primarily with technical reports, journals, symposium and convention papers, maps, drawings, and other types of printed material which can be easily duplicated for dissemination. The volume of these kinds of documents is probably as great as, if not greater than, the volume of published books. To effectively accommodate this mass of printed material in its diversity of forms, extra-library information systems had to be developed to store and retrieve it if these kinds of documents were to be made accessible to the public.

The use of these forms indicates the kind of information they convey. The specific attribute of the information is currency or up-to-dateness and extra-library information services concentrate on making available to their customers information that has this quality. Consequently, the life span of active usage for this up-to-date information is relatively short and therefore its high usage rate drops off drastically after several months or years. At this point extra-library information systems establish criteria by which the information that has a low usage rate or has lost its current value can be purged from the active files and placed in an inactive archival file. Extra-library services assume as one of their main responsibilities the job of collecting and maintaining this kind of information. This responsibility denotes one of their chief characteristics.

It follows then that extra-library information services emphasize the organization of information for current and specialized usages rather than stressing long-term future utility of the information. The indexing and classification schemes employed by these services reflect this emphasis. The use of subject-matter specialists for indexing purposes adds greater weight to this emphasis and also greater competence in the center's area of specialization. It has almost become standard practice for extra-library information services to employ subject-matter specialists and then train them in the field of information science.

The way in which extra-library information services are structured and the nature of the information they contain dictate and are dictated by the type of clientele they service. In general, the users have immediate and pragmatic applications for the information they require. The customers who use these services therefore have a vital interest in state-of-the-art reports, progress reports, and position papers; facts of all kinds, such as chemical compounds and their properties, number of voters or welfare recipients, etc.; and figures or statistics of all kinds, such as building starts, opinion polls, etc.

It must be emphasized that all of these characteristics are of a general nature and therefore it is difficult to apply all of them to any one extra-library information service. Nor are they completely exclusive vis-a-vis libraries. There is one characteristic, however, that is almost universally true of extra-library information systems--one that points out in a very forceful way the characteristics already mentioned. To extra-library information services the reading room is not an essential part of their operation. Its de-emphasis makes obvious the type of services extra-library information systems render and how they must operate. It points out the different way in which a book is regarded in contrast to a paper-bound document and it also indicates the different way in which they are treated.

IV. Services Offered to Users of Extra-Library Information Services

Probably the most important service that extra-library information services offer the user is access to information unavailable in libraries. An excellent example of such a service is the Science Information Exchange (see Exhibit J). At present there is no other organization which offers such comprehensive coverage of research in progress. All of the document-handling centers in the Federal Government also constitute a reservoir of information unavailable in libraries. By concentrating on a specific subject area, extra-library information services become the most comprehensive source for specialized information. This is the case for such

information services as the Mechanical Properties Data Center. (See Exhibit I)

A second service or advantage offered the user of extra-library information services is convenience. A person using these services does not have to leave his office either to order or pick-up the materials he desires. These steps are accomplished by mail or telephone and, in some cases, electronically through a computer console and a display screen. Many of these services provide their customers with an index to new materials received by the center. This index, consisting of abstracts of documents, simultaneously provides the user with a permanent record of the documents available to him from the center, a handy catalog for selecting and ordering documents, and a means of keeping abreast of current research. The Technical Abstracts Bulletin from the Defense Documentation Center is a good example of such a service. Selective Dissemination of Information (SDI) is another well-known technique providing the user a convenient means of keeping abreast of the papers in his field. (See Exhibits E and H) Through these techniques, extra-library information services extend their services to the offices of their customers.

Manipulation of information is a distinct and work-saving advantage certain information services offer their customers. Since these services store their information on computer tape, the answer to a query can be tailored to meet the parameters set forth by the individual. This kind of manipulation is done on a regular basis by the Science Information Exchange. Other information systems providing this service are the individual systems belonging to the Council for Social Science Data Archives. The Bureau of the Census will also offer this kind of service as part of the 1970 Census. (See Exhibit B) A few examples of requests requiring computer manipulation may help to illustrate the point. If a person wanted the opinions expressed about a particular subject by individuals living within a specified area during a certain period, he could get this information from the data centers which store the computerized results of the Harris or Gallup polls. If one wanted to know the number of patients treated in U. S. hospitals for a particular disease in five western states and the types of treatment given, he could obtain this information from the Commission on Professional and Hospital Activities, sponsored by the American College of Physicians and the American Hospital Association. In these instances the original information is coded and stored on computer tape. The computer

then manipulates the information to fit the specified parameters of the requestor such as the number of states, the type of disease, etc. Because these services are now relatively expensive, they are not in widespread use. However, they should become in the next few years an important additional resource for research work, since they provide a means to find and use information and to derive new data from previously unrelated sources.

The ability of extra-library information services to provide the most current information available is one of their most important qualities. As was discussed in the previous section, these extra-library services achieve this by storing, retrieving and disseminating the latest documents that contain up-to-date information considered valuable to their clientele. Moreover, they concentrate on keeping the time between submission of a report and its entry into the system as short as possible. Generally, it takes from four to six weeks for most of the Federal Government document-handling systems to accomplish this step. In contrast, it takes a much longer period of time for a book to be published and reach the shelves of libraries. These efforts by extra-library information systems are slowly gaining the confidence of the public as the best sources for current information, while, at the same time, clarifying the distinct advantage of the traditional library as the best source for information of long-term or permanent value.

Like the library establishment, extra-library information services have large general collections covering a variety of subjects (e. g., the Clearinghouse for Federal Scientific and Technical Information, the National Referral Center and the Science Information Exchange) and also many specialized services covering comprehensively a small subject area of interest. These specialized extra-library information services may, in some cases, differ in name only from special libraries, but where they incorporate many of the characteristics of extra-library information services, they must be considered as belonging to that category. The benefits offered users of these specialized extra-library information services parallel those of the special library but with the added advantages of those services mentioned above.

V. Libraries and Extra-Library Information Services

A. A Reassessment of the Division

The term extra-library creates a dichotomy which in many ways is unfortunate. It places in juxtaposition to the traditional library all of the other information services. On the one side is the library establishment composed of the Library of Congress and all of the other research, special, university, public, industrial, and government libraries; on the other side are the document-handling systems, referral centers, clearinghouses, data systems and information analysis centers.

This dichotomy is particularly unfortunate to the degree that it suggests that libraries and extra-library information services are in competition with each other or that extra-library information services are in some way a threat to the continued existence and growth of traditional libraries. Moreover, the dichotomy clouds the fact that libraries and extra-library services are, in all liklihood, more complimentary than competitive. It is probably much more practical to view extra-library information services as services that compliment those of traditional libraries.

The dichotomy is unfortunate in a more fundamental sense. Because there is no clear-cut basis for distinction, the foundation upon which the division rests is practically non-existent. Moreover, the dichotomy tends to obscure the primary difference between the two media now in use for transfering information.

The context in which to clarify these ambiguities has as its basis the two media employed today to transfer information. The first medium used for this purpose is the printed page; the second is the electronics medium. Of primary concern here are the organizations that have the basic function of storing or archiving of information in anticipation of later use, regardless of the transfer medium they employ. Within this context, those systems that handle information stored in documents are libraries and many of the systems (specifically document-handling systems and indexing and abstracting services) now considered to be in the extra-library information service category. For these systems, the printed

page constitutes the means by which information is transferred from the generator to the reader. The goal of these organizations, therefore, is to facilitate this process of transfer.

The information systems that are attempting to develop and use the electronics medium to achieve the same goal are principally data-handling centers, management information systems and teaching machines. One might argue that even these systems have as their product a computer printout which is, for all practical purposes, a document. One might also argue that their input is derived from documents. But in the majority of cases the output of these systems is unique and tailor-made for the requestors. The output or answer could just as easily have been received on a display screen. The receipt of the information would depend on the length of the answer and the use the requestor wanted to make of it.

As for the input, an increasing number of systems are getting their information directly from the source rather than waiting for the information to be published, then using the published document as the source of input. This shows that such a step can be bypassed although the information may eventually appear in published form.

Recognition of these two modes of transfering information establishes a clear-cut distinction between libraries and extra-library information services.

B. The Computer and the Transfer of Information

In the majority of cases today where the computer is being applied to the information transfer process, it is being used to enhance the storage and transfer of documents. The use of the computer permits greater flexibility and depth of indexing of documents. Computers also enhance the flow of documents when they are applied to the housekeeping functions of libraries. Using computers in this way tends to make documents a more viable medium of information transfer. But according to Marshall McLuhan, when a new medium comes into being we initially attempt to make it increase the utility of the old medium it is offsetting. The application of computers to libraries would tend to substantiate this view.

Undoubtedly, such efforts are enhancing the utility of all kinds of printed materials and therefore should be encouraged.

But the question remains as to the position of the computer as a medium of information transfer in its own right. How should the computer be used? If it is in fact a new medium of information transfer, what are the consequences in relation to our libraries? A look at how the computer is being applied to the information transfer process outside of the library should help to provide at least some partial answers to these questions.

Today, there are over 40,000 computer installations in the United States, each one processing millions of bits of information. More specifically, there are over two hundred data centers, covering practically every discipline, which are storing and retrieving information electronically. This number does not include the hundreds of corporate management information systems or the one thousand commercial data processing service centers throughout the United States. All of these activities are capturing to a greater degree the computer's real potential in the field of information processing and transfer. When the practice of sitting down before a computer console, interrogating the system, and receiving an answer on a display screen becomes a more widespread practice, the computer will no doubt be considered at that time a medium of information transfer in its own right.

In a broad sense what we are witnessing today is the first step leading toward the development of such a system. The first step in this process is logically the collection of data in computerized form. The number of data centers collecting information and storing it on computer tape has grown from two or three in 1950 to over 200 today. The Chemical Information System, National Oceanographic Data Center, National Standard Reference Data Program, National Earth Science Data Center, National Water Data Program, the Cancer Chemotherapy Data Center, and the member organizations of the Council for Social Science Data Archives are some of the more obvious efforts in which the computer is being employed as an electronic medium of storage, retrieval and dissemination.

These efforts derive their data from many sources but the literature is still their main source. When viewed as the first step in creating an electronic information system the process is naturally one of converting

the old records into the new computerized from. This, of course, is a massive job and one that will take a considerable amount of time and manpower.

It should be made clear that only certain types of information are amenable to this process. The kinds of information that are most suitable are facts and statistics of all kinds. The computer has already been shown to be a more flexible means of storing and retrieving this kind of information than is the printed page. Conceptual information, on the other hand, is better suited to the document as a means for storage and dissemination. Dr. Harold Lasswell of Yale University, in an article in the Saturday Review stated that "The computer revolution has suddenly removed age-old limitations on the processing of information, including the linkage of data with competing theories of explanation."* This statement goes a long way in explaining why people in many fields of interest are converting existing data into computerized form. And it explains why there is so much interest in gathering new data for computer processing.

What are the consequences of such developments for our libraries? There are two rather immediate ones although they are not as yet large enough to be measured. These consequences, however, will become more obvious as electronic information systems develop stronger bases and therefore become more broadly useful. First, people will use these data systems to get specific information rather than turn to the library for reference material. For example, a social scientist can receive today an up-to-date biographical sketch of an east European leader from the Archive on Political Elites in Eastern Europe at the University of Pittsburgh, thereby saving himself the trouble of gathering together a sketch of his own from library materials. Other examples can be given using other fields where data systems already exist such as law enforcement, history (old voting and census records), and engineering. If library users place less reliance on handbooks and contemporary reference documents containing a high degree of factual information and greater reliance on data centers containing the same information in a more up-to-date and comprehensive form, it will certainly relieve libraries of the time-consuming task of answering specific questions requiring factual answers.

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* Lasswell, Harold D. "Do We Need Social Observatories?", Saturday Review, August 5, 1967, pp. 49-52

The second consequence has to do with the acquisition of data by these centers. Some data, primarily in the scientific and technological fields, is being transmitted directly to the data centers for storage and retrieval. Sending one's initial findings directly to a data center cuts down, at least to some degree, the reporting of such information in a printed form. To the degree this occurs, the document-handling burden of libraries is lessened.

VI. What Extra-Library Information Services Offer Libraries

This paper endeavors to clarify the role of extra-library information services for the National Advisory Commission on Libraries; first in the context of the assignment and second, in the context developed in the preceding two sections. In considering what extra-library information services offer to the library, each context will be dealt with separately, starting with the generally accepted one provided for this assignment. Libraries might profit most from the experience document-handling systems have had in automating various functions of their operation. Bibliographic control is well established in libraries, and document-handling systems have not added appreciably to this function. However, where they have added a new aspect in bibliographic control (e.g. greater flexibility) it would appear wise for libraries to consider its inclusion into their system.

Extra-library information services have placed considerable emphasis on the problem of subject-matter control, as reflected in the development and use of open-ended classification schemes, greater depth of subject indexing, and the use of subject-matter specialists. It would appear that many of these developments could be superimposed on the existing structure of library classification and indexing schemes as libraries begin to automate their present practices.

Extra-library information systems offer a growing number of back-up resources to which librarians can turn to get information for their customers. Special librarians, for the most part, are aware of and use the extra-library information systems within their own specialty. But in those areas where librarians lack familiarity with extra-library

information services, greater reliance on the National Referral Center, Science Information Exchange and other like services could measurably enhance their effectiveness in relation to their customers. An awareness of the numerous information systems available can be of great help to users, to libraries, and also to extra-library information services. It would help the extra-library information services to know more about the size and type of clientele they wish to serve. More importantly, it would help to develop a more viable and close-knit network between libraries and the extra-library services.

What do extra-library information services utilizing the electronic medium of information transfer offer the traditional library? The long run implications for the library are impossible to foresee. In the immediate future, however, there are several. First, electronic information transfer services will help to clarify the kinds of information best suited for each medium. This process of clarification will help the libraries in their selection of new materials. Documents containing unevaluated data or data that has been entered into a data center could receive a lower order of priority. This kind of policy would be especially applicable if the library had a rapid means of access to the data centers.

Second, traditional libraries should consider the prospects of placing within their establishment terminal equipment connected to data centers. By adding terminal equipment, libraries could offer their customers a new and rapid service unavailable to most people today. So situated, the library would continue to perform its historic role as an institution providing access to the total resources of human knowledge.

VII. Recommendations

1. It is recommended that libraries and extra-library information services be considered as integral parts of the total information transfer process.

Extra-library information services should be included in any discussion or deliberation concerning the present status of American libraries. Omission would only lead to greater division between libraries and extra-library services. Recommendations of the Commission should help to

draw these two branches together into a close-knit working relationship. This could be done in the allocation of funds, in the establishment of standards, or even in the development of library statistics.

2. It is recommended that the professional library associations develop an easy and efficient method to keep librarians informed of existing and new extra-library information services.

Like the inter-library loan system extra-library information services should be regarded as back-up resources for the librarian. An easily up-dated reference tool could initially serve this purpose. With such a tool librarians could familiarize themselves in the use of these extra-library services. Using these services librarians could develop better working arrangements with them, gain better knowledge of the breadth and depth of the subject area they cover and learn in greater detail the types of services they offer. This knowledge could then be passed on to the library's users.

3. It is recommended that the professional library associations investigate the possibilities of acquiring terminal equipment connected to one or more of the extra-library information services.

Such a step could first be done on an experimental basis with those extra-library services that have a high degree of automation. University and special libraries are excellent candidates for terminal equipment tied to systems that cover scientific subjects or certain areas in the social sciences. Municipal libraries could investigate the possibilities of having a terminal connected to their city's urban data center. Information concerning such possibilities should be developed by either the library associations or through Federal Government agencies.

4. It is recommended that a study be conducted to ascertain the feasibility of applying to libraries the indexing concepts and automated file search methods now used in extra-library document-handling systems.

To date, the application of computers in library operations has differed significantly from their application in extra-library document-handling systems. This difference is largely attributable to the manner in which indexes to the document collection are constructed, maintained, and searched.

Library indexing assigns documents to a pre-determined position in a classification scheme. The resulting index codes are difficult to process by computer; it is especially difficult to up-date such indexes. Automated up-dating and searching of indexes is facilitated by serially assigned accession numbers and concept coordination search procedures such as are currently used in extra-library document-handling systems. The potential utility of these methods should be studied and tested. Study should include consideration of hybrid configurations embodying the coordinated search capability, yet retaining the shelving convention of current library operations.

A Word about the Exhibits

The Exhibits presented in the following section are included to provide the reader a detailed discription of twelve extra-library information services. With these twelve examples, we have attempted to show the diversity found among extra-library information services. They also act as documentation for the ideas presented in the preceding section. The reader will find references to the Exhibits in the body of the text. Hopefully, the inclusion of these Exhibits helps the reader to gain more substantive understanding of extra-library information services.

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SECTION II

EXHIBIT DESCRIPTIONS OF SELECTED EXTRA-LIBRARY SERVICES

EXHIBIT A .... CHEMICAL PROPULSION INFORMATION AGENCY
To judge by the criterion that it has been a key information clearinghouse for the rocketry community almost from the day it began, CPIA is one of the outstandingly successful special information services.

EXHIBIT B .... BUREAU OF THE CENSUS INFORMATION
The Census is adopting a more active dissemination stance for the 1970 Census data, partly in response to the greater computational flexibility of computer tape.

EXHIBIT C .... CHEMICAL ABSTRACTS SERVICE
The Chemical Abstracts Service is past the mid-point of a 10-year program ofconversion to a computer-based operation which will permit a significant advance of its service range.

EXHIBIT D .... EDUCATIONAL RESOURCE INFORMATION CENTER (ERIC)
ERIC's charter spans indexing-abstracting, document service, and the state-of-the-art appraisals of educational activity. Eighteen clearinghouses, a current awareness publication, and a reproduction service are now operational.

EXHIBIT E .... INSTITUTE FOR SCIENTIFIC INFORMATION
The Institute for Scientific Information has created a significant commercial enterprise based on journal paper citations of important resource documents and a computerized inventory.

EXHIBIT F .... THOMAS MICROCATALOGUES
Thomas Microcatalogues, another commercial enterprise, unbinds an elephantine industrial catalogue with the aid of microfiche.

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EXHIBIT G .... COMPUSTAT, Standard & Poor's Corporation
COMPUSTAT shows what computers can do for financial analysts.

EXHIBIT H .... DODGE REPORTS, SWEET'S CATALOGUES, SHEPARD'S CITATIONS
McGraw-Hill moves the computer into various roles in its report services and catalogs.

EXHIBIT I .... MECHANICAL PROPERTIES DATA CENTER
The Mechanical Properties Data Center is one of the Defense Department's services that displays an important class of information independently of the publication context in which it might have previously been buried.

EXHIBIT J .... SCIENCE INFORMATION EXCHANGE
The Science Information Exchange discloses ongoing research activity, ordinarily two or more years earlier than it is visible through reports or publications.

EXHIBIT K .... SCIENCE TEACHING CENTER
The Science Teaching Center is a demonstration facility equipped with many of the new products that aid the science teacher.

EXHIBIT L .... AUDIO-VISUAL MATERIALS CENTER
The Audio-Visual Materials Center shows a view, at county-school-system level, of the budget, specialized skills, and operating practices associated with an important new tool in education.

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EXHIBIT A

CHEMICAL PROPULSION INFORMATION AGENCY

Introduction

The Chemical Propulsion Information Agency, organized in 1946 as the Solid Propellant Information Agency, currently serves the information needs of liquid-propellant and solid-propellant rocket developers. Since both the science and technology of modern rocketry in this country have been developed largely since World War II, CPIA's subject coverage ranges from research advances in the supporting sciences to engineering design data and specialized rocket testing facilities.

CPIA covers and serves all Federally funded activities that are technically involved with rocket propulsion. Dissemination of much of the information of the field is still subject to military security constraints. As an extra-library information service, CPIA performs a number of discrete though related operations. In its scope, it may typify better than any of the other exhibits in this paper the various special information activities one would expect to encounter in a major program activity in which professional specialists contribute important working functions.

CPIA's mission includes:

-- Acquiring and organizing information and data.

-- Disseminating the information through meetings, briefings, consultation, and publications.

-- Servicing technical inquiries from scientists, engineers, and managers.

-- Providing technical support to the Interagency Chemical Rocket Propulsion Group, and to ICRPG technical Working Groups.

A flow-chart summary of the CPIA operational complex follows this page.

Staffing and Subject Coverage

Thirteen professionals and nineteen support personnel comprise the current working staff of the agency. The participation of the ICRPG

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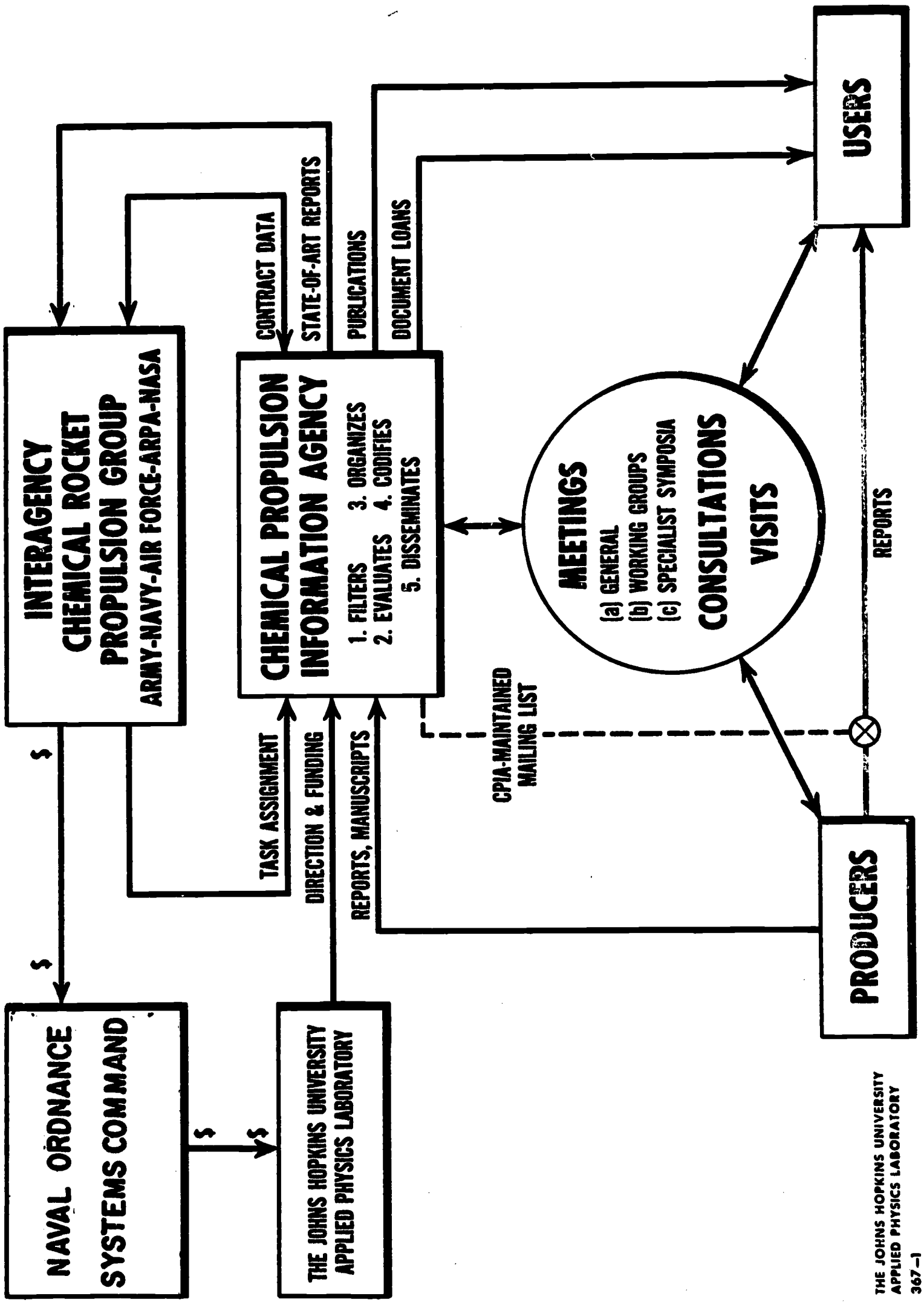
CHEMICAL PROPULSION INFORMATION AGENCY



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Working Groups in the information activities operated by CPIA represents a very substantial additional element of professional manpower, involving over 400 technical specialists in the Federal agencies and contractor organizations. The estimated time devoted annually by these specialists in attending and preparation for committee meetings is equivalent to an additional ten man-years of activity.

The scientific and technical range of CPIA's subject coverage is suggested by the titles and special publications of the following Working Groups that are currently active:

- Analytical Chemistry (Analytical Chemistry Handbook)
- Design Automation (Compilation of Scientific Computer Programs, Computer Program Deficiency Areas)
- Hazards (Static Testing with Toxic Exhausts)
- Liquid Propellant Combustion Instability
- Mechanical Behavior (ICRPG Solid Propellant Mechanical Behavior Manual)
- Solid Propellant Combustion
- Static Testing (Static Test Safety Manual, Current Solid Propellant Static Test Facilities)
- Thermochemistry

Publications

The publications produced directly by the CPIA staff generally go to about 500 to 600 "subscribers" -- principally Federal agencies and contractors. The publication products include a semi-monthly newsletter, an abstract publication, and several loose-leaf manuals. They are described briefly below:

The Chemical Propulsion Abstracts is an indexed publication containing abstracts of reports on U. S. Government-sponsored research and development programs in chemical propulsion. Abstracts of United Kingdom and Canadian reports are also included.

These abstracts cover design, research, test, and evaluation of solid and liquid propellants and the propulsion hardware.

Issues are distributed twenty times per year in loose-leaf form to provide the reader with a resume of current developments in the chemical propulsion field. Bound volumes, superseding the loose-leaf editions, are issued periodically.

The Chemical Propulsion Newsletter covers significant developments in the entire area of chemical propulsion.

The Liquid Propellant Manual is a compilation of the properties of liquid propellants and is intended to provide a survey of the physicochemical characteristics and performance of selected propellants and promising propellant candidates. Revisions are issued at frequencies dependent upon the receipt of new data.

The Liquid Propellant Engine Manual contains descriptions of engines which are now in use or have been operated in a flight-weight configuration. In addition, engine data for systems in an advanced stage of development in a current space or missile program are included. Performance values, design innovations, and engine parameters are tabulated. New units are published as the data becomes available.

The Rocket Motor Manual contains general descriptions of solid propellant rocket motors used or designed for use as missile boosters or sustainers, as primary or auxiliary propulsion for research or space vehicles, or as aircraft JATO devices. Principal weights and dimensions, ballistic performance, component details, and drawings of the motors are included.

The Solid Propellant Manual includes data on physical, chemical, and ballistic properties of both Service-accepted and experimental solid propellant formulations. Additions to the manual are made on a continuing basis, the frequency of issue depending upon the receipt of data from solid propellant manufacturers.

Military security criteria must be met in carrying out this substantial publication activity. CPIA maintains a mailing list system in which the authority for receipt is monitored: the list has become one of the prime vehicles serving similar "access control" requirements in the rocket community.

Informal Information Transfer

A tradition of active field visits on the part of CPIA staff members dates from the first years of operation. Most major and many minor facilities are visited each year by one or more of the staff to gain first-hand familiarity with local activities, to establish personal contacts among investigators, and to obtain specific information unavailable by conventional reporting practices. Assistance in maintaining currency of the loose-leaf technical manuals is a part of the visit tradition. Telephone queries and personal visits to the CPIA offices are also warmly encouraged.

In the early years of the Agency, the annual 3-day technical meetings it organized and conducted probably were the most influential state-of-the-art dissemination activity serving the rocketry community. In the late '40's and early '50's, there were so many common development problems that the exchanges among the attending 600 to 700 key professionals of the community often resulted, in effect, in advancement of the art forum sessions, within the formal meeting structure or at informal sessions. By the late '50's, an increasingly maturing and commercially specializing technology was being identified by some long-term attendees as the probable cause for a measurable decline in the unusually open and productive communication pattern of the first decade.

Since about 1963, the professional staff has performed state-of-the-art evaluation functions in addition to providing information services. This service, which assists program managers to decide what further developments in rocketry best merit support, has simultaneously improved the general readiness of the community to provide timely information of good quality to CPIA professionals.

Internal Information System Mechanics

Until the last few years, CPIA employed principally traditional manual information processing techniques. A 5-year planning document prepared in 1964 stated:

> "The Chemical Propulsion Information Agency has followed machine retrieval studies but has not used machine retrieval for its files because the amount of information and the specificity of index terms for machine searches has not been adequate and competitive with manual searches. It is believed that the situation has changed sufficiently to warrant consideration of machine retrieval soon."

The CPIA collection had grown to approximately 30,000 documents by that date. These were indexed, the indexes using the standard chemical nomenclature for significant compositions in the work reported. The Applied Physics Laboratory, CPIA's housing organization, then had in operation a computer-based information retrieval system, which stored program and bibliographic data plus descriptors and abstract texts. The APL system was used by about eight other industrial and university organizations across the county.

The planning document discussed the machine-processing potentials that were achievable if the computer index tapes and microfiche copies of NASA-funded reports could be provided and an Army Chemical Typewriter purchased. (This special typewriter is capable of typing chemical structure formulas and automatically transferring the information onto magnetic tape). Upon their acquisition, the document went on to say that CPIA would then:

> "...be able to utilize immediately the APL capability for computer searching...(and)...a wealth of raw information to perform its analysis function...to convert its files for machine retrieval...but the first priority must be given to developing a capability for machine search, and screening information being currently generated by DOD research and development effort."

In a 1966 report, some of the network implications of the 1964 report had become operational reality. The NASA tapes were being used by the APL computer center to serve both CPIA and the APL Document Library. CPIA was feeding structural formulas on unusual compounds developed in propellant research to the Army Chemical Information and Data System at Frankford Arsenal. The formulas were particularly useful as test specimens for the CIDS retrieval system. The report commented "the chemical typewriter and the CIDS program hold great promise as a mechanized, time-saving combination which will improve our ability to provide in-depth indexes, informative abstracts, and retrospective searches to the chemical propulsion industry."

The report also stated that a current-awareness bibliography was being provided monthly from the Defense Documentation Center, and that "bibliographies on specific subjects are frequently requested also, but it has been found that although automatic retrieval is a useful tool, knowledgeable technical information analysts are required to remove extraneous material before the useful portion is passed on to the investigator."

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EXHIBIT B

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BUREAU OF THE CENSUS INFORMATION

The Bureau of the Census is partly responsible for the mechanical handling of statistical material, and for much of the basic work leading to punch card approaches and computerization. In the last part of the 19th Century, discovering that hand tabulation of the Census could no longer be completed in a single decade, the Bureau commissioned an engineer, Hollerith, to devise a system of mechanical tabulation. The result of his effort was the electrical-sensing machine utilizing punched cards now globally distributed by International Business Machines Corporation. This method was used through the Census of 1950 quite satisfactorally. In 1960 a new method was devised, and has since been refined and will be used in 1970. This system provides for a form to be used by enumerators which employs the use of positional marks on the form which are then photographed on microfilm and transferred directly to electronic tape by a machine called FOSDIC, specially invented for the use of the Census by the Bureau of Standards. This method avoids the use of punch cards, and basic census tabulations are prepared from the FOSDIC tape by standard computers.

In 1970, Census tabulations will be published for basic returns, but much additional detail will be stored on the tape and made available to users through a rather elaborate system which has been arranged and which may well form a pattern for handling large-scale collections of data of this kind. The system includes the following items:

Documentation Central Office. This office will provide service to users of the taped data. It has already been set up and is operating in a small way with data relating to the New Haven test census, which has already been taken to resolve problems associated with the 1970 census.

Dictionary of Universe Definitions. This is the essential basis for classifying and using census data. The book is now in a second draft, and a third working draft will be ready for a 1968 "dress rehearsal" census.

A Universe Index Code System. This code will provide numeric tags for the definitions mentioned above.

Analytic Programs for Area Comparisons. This will be a software system which will go directly from the tally tapes to the calculated products desired by the user. One example is a plan for producing English-language press releases of the 1970 returns which will be printed out and addressed, ready for mailing to 5,000 newspapers throughout the country. Thus, 1970 returns can be made available during 1970 both for fresh information locally, and for the use of demographers in planning further studies.

Visual Displays. Experiments are being made with cathode ray tube and plotter making techniques to provide reports of certain data on maps.

Indicator Analyses. Efforts are directed toward indexing and quantifying various population aspects such as poverty, housing, segregation, air pollution, school loads, dependency, etc. This will provide comparisons between areas.

Data Processing Sub-centers. Sub-centers are being considered. One has been established at Stanford University, and both the problems and the advantages are being explored.

Data Access Descriptions. A series of leaflets are designed to educate users in how to use the computer-based Census information store and how to order tabulations.

Special Project Reports. Census data will be organized in ways to make it more readily available than heretofore. The Bureau is relying on the experience with the 1960 Census returns for guidance in this respect.

Data Needs Clearinghouse. The clearinghouse will attempt to organize and encourage feedback from users. This will help in planning programs for other users.

Laboratories. The Census plans to establish two laboratories. They are a Census Data Access Laboratory and a Census Data Use Laboratory. The Data Needs Clearinghouse will help mesh the work of these labs.

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EXHIBIT C

CHEMICAL ABSTRACTS SERVICE

Chemical Abstracts began operation in 1907 as an abstract-index publication covering the world's chemical literature. It has maintained that comprehensive objective over the 60 years that have followed. By 1967, the coverage of new papers and patents had grown to a quarter-million items annually; and the "store" of abstracts accumulated in the system approximated four million items. Chemically significant information is estimated to appear in 30 per cent of the world's technical journals, and in 15 per cent of all currently appearing scientific and technical papers.

Terminology Control

Essential to the chemical literature is the terminology of chemical identity. An estimated 50,000 to 100,000 new compounds are now being reported annually in the technical literature. The total of known compounds is believed to be in the neighborhood of four million.

Despite this enormous proliferation, over the years the evolving nomenclature of chemical identity--the special language of chemistry--has succeeded in retaining its original high level of phenomenological expressiveness. Chemists can still employ words and numbers that communicate to their peers virtually as much of the knowledge of atomic composition and molecular structure as their research has succeeded in identifying in the laboratory. An alternate graphical language also has been established. It is an equally successful "language", which employs two-dimensional symbolic structural representation of molecules (that thereby can be depicted in journals, books, and on classroom blackboards), whose characteristics may be considerably more than two-dimensional in nature.

The nomenclature rules of chemistry (i.e., the vocabulary and grammar of this discipline language) are established and managed by interested chemists. These individuals, typically, create committees in national and international scientific organizations in order to secure such customary institutional amenities as publicity within the chemical community, professional peer acceptance for their endeavors, convenient meeting arrangements and, to some minor extent, secretariat services. The most substantive support for chemical nomenclature management undoubtedly comes, however, from the combination of the individual "off-hours" labor of these interested professionals, plus the approved or bootlegged use of the work-day and the support resources they

command in the office, laboratory, or classroom where they are employed. Chemical Abstracts employs chemists who are nomenclature specialists, most particularly to meet the editorial needs in indexing. They are viewed as respected colleagues by other chemical nomenclature specialists and are often the first called when a chemist is seeking guidance in naming a new compound.

When a new compound is identified its creator may or may not propose a name for it in his publication manuscript. Before the paper is indexed by Chemical Abstracts, however, nomenclature compatible with the systematic language of chemistry usually has been established for the compound.

This description considerably oversimplifies the full involvement of Chemical Abstracts as a "key to the world's chemical literature". However, it should be sufficient to show that CAS is both an intensively and extensively significant participant in the bibliographic and nomenclatural activities of this major scientific discipline. Librarians, in particular, may find a helpful comparison with the 7.5 million volumes at Harvard, the largest university library in the country, with the 4 million documents whose chemical content is identifiable, in the CAS system, through an average of 11 index entries per abstract. And while CA's budget and personnel statistics should be recognized as only the visible portion of the professional activity supporting the CAS output, it may be of some interest to state that its current budget is approximately $12.5 million, its staff numbers nearly 1,000, and it additionally uses a volunteer corps of nearly 3,500 scientist-abstractors and section editors.

Computer-Based Processing Innovations

Beginning in 1959, a serious effort got under way to develop computer and photocopy technology that would advance the existing information-dissemination capabilities of Chemical Abstracts, and improve its operational performance. It has taken two principal directions, toward

Computer-assisted, photo-printout, bibliographic operations, and

Computer-manipulatable use of chemical-identity terms (including atoms, molecular fragments, molecular classes, whole molecules and commercial and "lay" terminology) to identify relevant documents recorded in the system.

The following excerpts from an excellent 60th anniversary pamphlet from CAS are particularly illuminating summary descriptions of the progress made through April 1967:

Bibliographic Operations*

In 1959, CAS, with assistance from the National Science Foundation, embarked on an intensive program of research on the application of modern data-processing technology to the handling of chemical and chemical engineering information. This work was also supported, in part, in its later stages by the National Institutes of Health and the Department of Defense. Its earliest result was the introduction of the world's first computer-produced periodical, Chemical Titles, in 1961.

By 1965, this research had yielded some powerful techniques, and CAS embarked on a five-year program to implement an operating computer-based information system by 1969. What is emerging is an integrated man-machine system that can produce a variety of information tools, both printed publications and machine-searchable files, from a single human processing of current chemical knowledge.

In the new system, information selected and prepared by chemists - titles and abstracts of technical papers, reports, and patents - are encoded into machine language on magnetic tape through a keyboarding process. The CAS computers are then programmed to select and organize this material into the appropriate form for publication and to compose pages for printing through a computer-driven device. Thus the usual multiple keyboarding operations of the traditional publishing process are replaced by a single handling of the information, a virtually unlimited number of publications and services can be derived from a single input without further human manipulation, and the magnetic tape record used to produce the publications can be rapidly and economically searched by computer to locate specific data of interest.

The end of 1966 marked the midpoint in this five-year transition, and a significant portion of the system was in operation. The machine-manipulation data store now contains some 500,000 titles processed for CT since 1961, plus about 24,000 whole digests processed for CBAC since 1965. These computer files and accompanying search programs are available on a subscription basis. Computers are also helping to speed preparation of CA indexes and to maintain document acquisition and assignment records.

During 1967, all titles and bibliographic data in the 1967 CA issues - some 240,000 bibliographic items - and the 1967 CA issue and volume indexes will be recorded on tape for computer searching, as will an additional 50,000 whole abstracts. The mechanical printers currently used for composing CAS computer-based services will be replaced in 1967 by a new computer-driven photocomposing unit capable of

*CAS TODAY: Facts and Figures about Chemical Abstracts Service. 60th Anniversary Edition. American Chemical Society (1967).

composing both textual and diagrammatic material at a rate of 2,000 to 3,000 characters per second with a quality equivalent to that of typeset pages.

Over the next two years, more and more of the CAS information-processing operations will be phased into the computer system. By mid-1969, Chemical Abstracts itself will be produced through this system, and the entire body of current information handled by CAS will go into computer-manipulable form...

The Chemical Compound Registry

Any information system that would serve the community of chemists and chemical engineers must necessarily include an effective mechanism for manipulating chemical compound data. Information on the nature and properties of compounds comprises perhaps as much as 85 percent of man's total store of chemical knowledge. There are now upwards of four million known chemical compounds, and some 100,000 new compounds are reported in the literature each year. Many potentially valuable correlations between structural features and chemical and physical properties require the manipulation of vast amounts of data - more than can be handled effectively by human analysis - and machine processing is necessary.

The CAS system provides such a capability through the Chemical Compound Registry, a computer-based file which ties together information on the structures, names, and bibliographic references for all chemical compounds indexed by CAS. The Registry provides both a means for uniquely identifying these compounds and a computer-based mechanism for rapidly retrieving available information on specific compounds or families of compounds.

The process of registering a compound - entering it into the Registry System - involves the assignment of a unique "address", the Registry Number. The basis for assigning this number is a unique and unambiguous machine-language representation of the compound's two-dimensional structural diagram plus a full stereochemical description. The Registry Number is then used as the basis for organizing files of related data, such as the compound's known names and references to the literature which describes its characteristics, properties, and uses.

Because the registration of a compound is based on a machine-language description of its structure, the Registry provides a data base that can be machine-searched for compounds that contain any particular structural feature or structural fragment of interest. To accomplish such searches, CAS has developed a special set of computer programs - the Substructure Search System - for efficiently searching the structure files at various levels of specificity.

The Registry has been under development at CAS since 1961 with substantial financial support from the National Science Foundation, the National Institutes of Health, the Department of Defense, the Food and Drug Administration, and the National Library of Medicine. Techniques and program are complete for the registration of fully defined compounds, including salts and coordination compounds, and mixtures. Techniques for registration of polymers and partially defined structures are in advanced stages of development. The system also includes provisions through which a proprietary compound can be registered and its owner alerted to related published data passing through the system while the proprietary data themselves are carefully protected from unauthorized access.

As of April 1967, the Registry files covered nearly 600,000 compounds. All compounds indexed for Chemical Abstracts since January 1965 have been registered, along with the contents of several special collections of compound data, and compounds new to the file are being registered at a rate of approximately 4,000 per week. The substructure Search System was demonstrated publicly for the first time in 1966 and is currently being reprogrammed for an IBM 360 system.

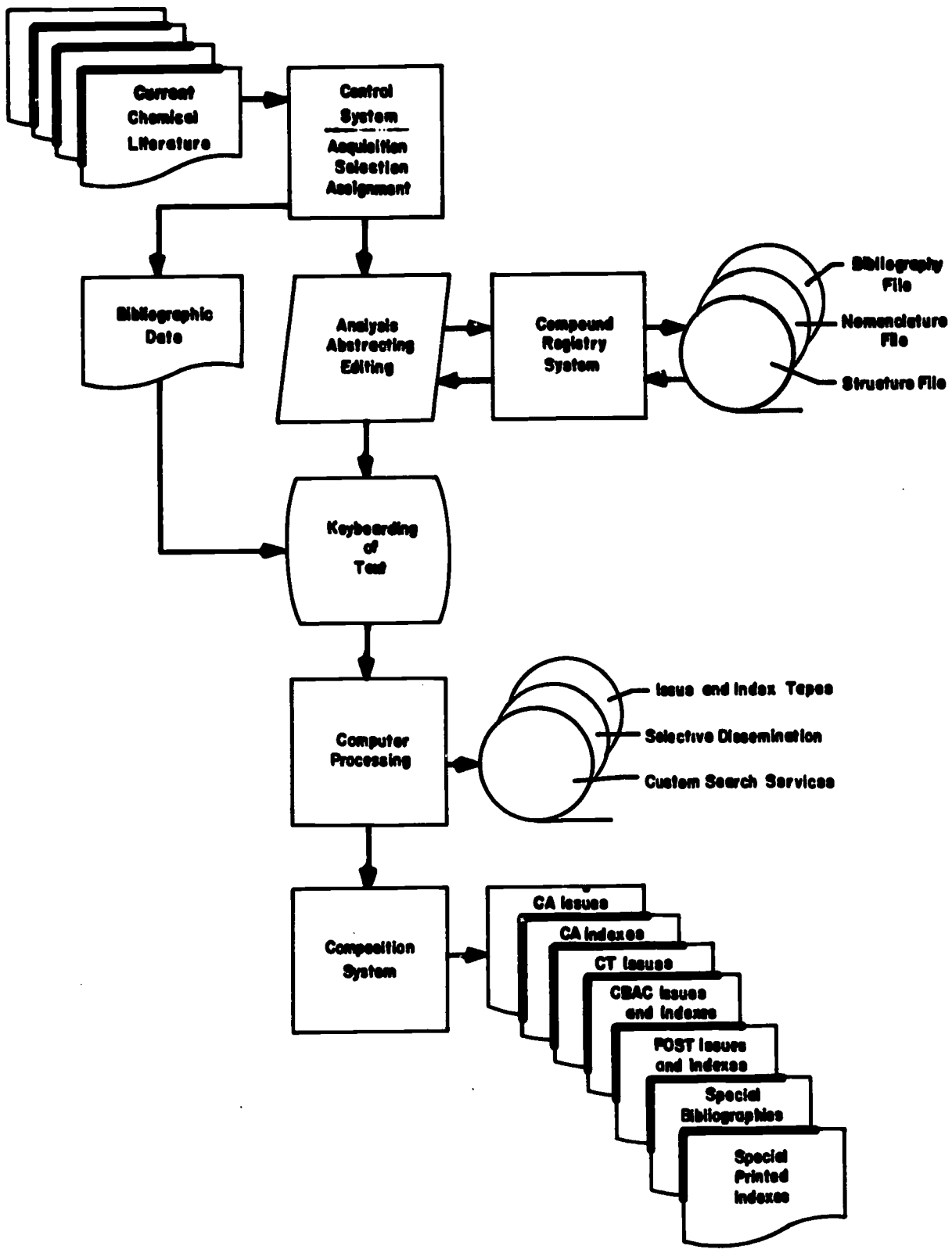
In related projects, CAS is maintaining a separate Registry of compounds involved in the Cancer Chemotherapy Program for the National Cancer Institute and developing a special data base of synonyms for the names of compounds associated with foodstuffs, drugs, pesticides, cosmetics, and other health-and-medicine-related substances for the National Library of Medicine and the Food and Drug Administration. This latter file will experimentally interlink the NLM's Medical Literature Analysis and Retrieval System (MEDLARS), the FDA's regulatory information files, and the CAS Registry System.

The Registry System obviously has wide potential as an alerting and information-retrieval tool. Pilot services based on the Registry will be available in 1968. The full potential of the system will be realized only as imaginative scientists and engineers identify information needs within their own programs that the Registry can fill...

System Design and Process Technology

The processing flowsheet for the CAS Unified Information-Handling System (attached) provides a summarizing view of the intended future capability of Chemical Abstracts. The processing chart, and the series of photographs reviewing the CAS Chemical Compound Registry provide some feel for the mechanical facilities and operational arts required (in addition to the primary technical-intellectual operations) for the computer-based mode under development.

FLOWCHART OF CAS UNIFIED INFORMATION-HANDLING SYSTEM



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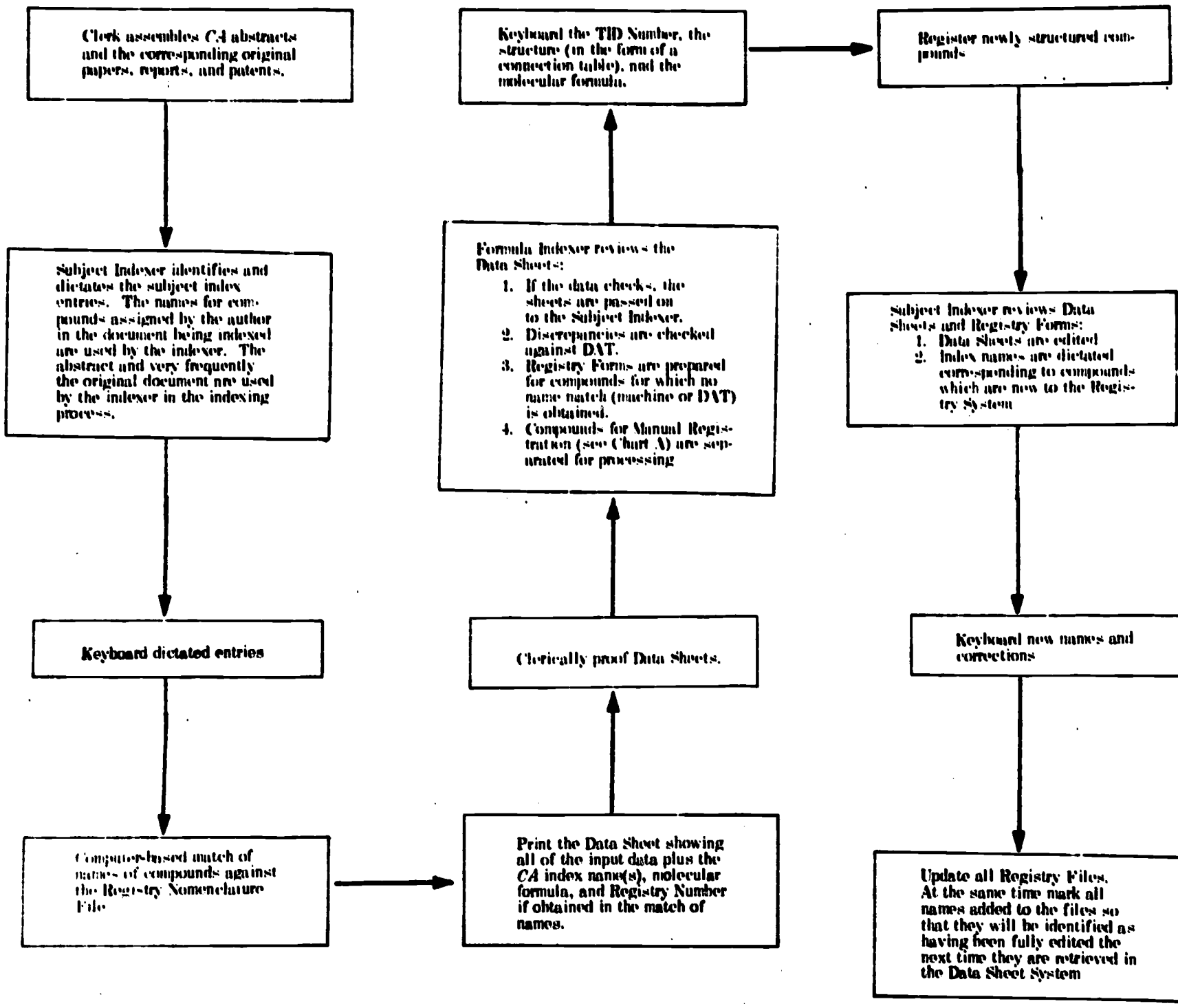
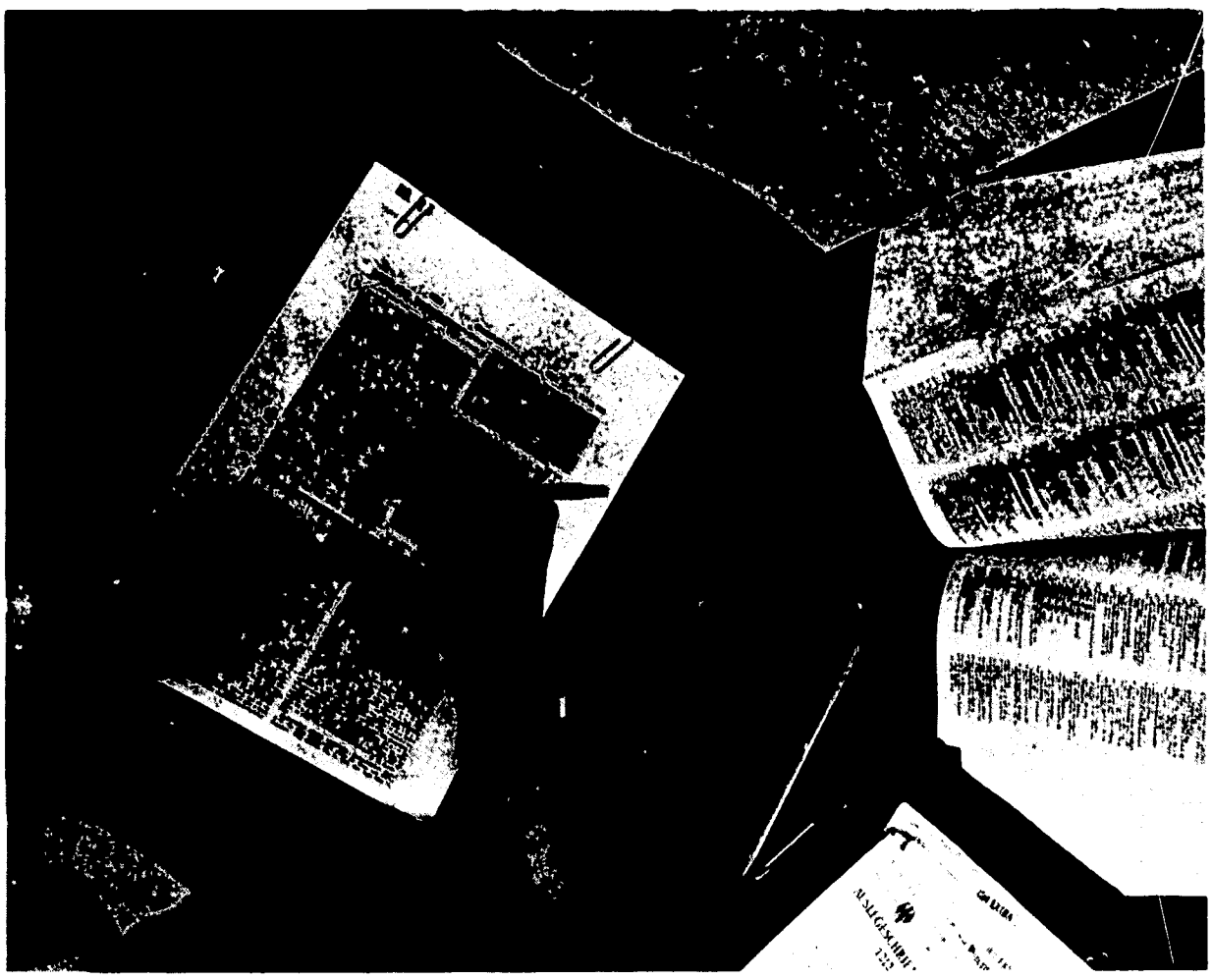
FLOWCHART OF CHEMICAL COMPOUND REGISTRY SYSTEM

Flow Sheet for Compounds Selected from Biochemical, Industrial, and Physical Sections of Chemical Abstracts

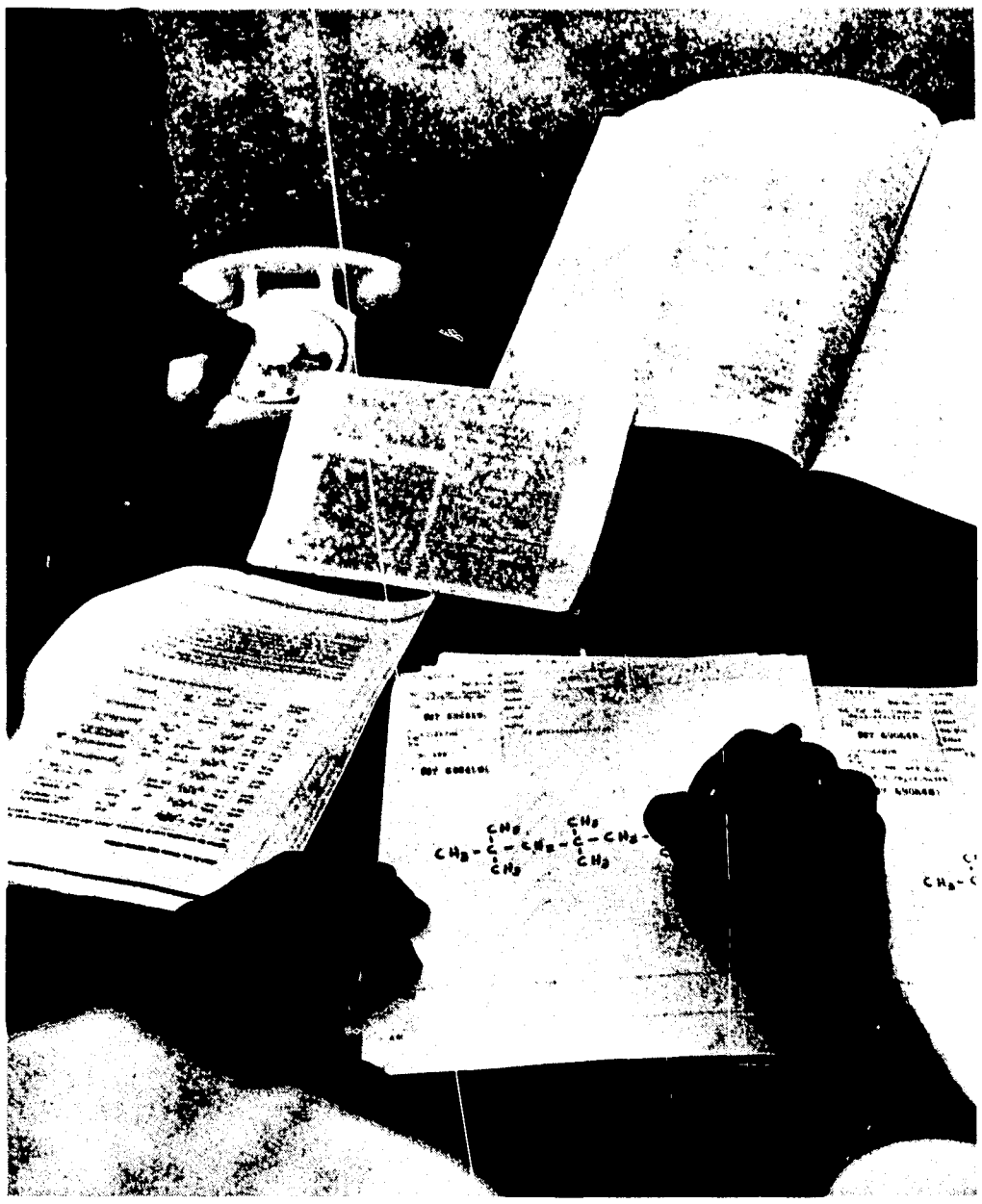
The registration operation is a batch process, with batches based on the organization of material in CA. The subject material indexed by the processes illustrated on this flow chart deals mainly with nonstructural data. The compounds described are most often well known and are associated with trivial names in the documents being indexed. Thus, after a compound has been selected for inclusion in an index entry, the author's name for the compound is automatically matched against the file to try to retrieve the CA index name(s) and the associated Registry Number for the compound. If the index name is retrieved, the corresponding connection table must already be on file. If the index name cannot be retrieved by machine or by use of a DAT, then the structure of the compound must be drawn and registered. Thus, the procedure illustrated here eliminates the need to redraw and rename the structures for all of those compounds which respond to the name-match technique.





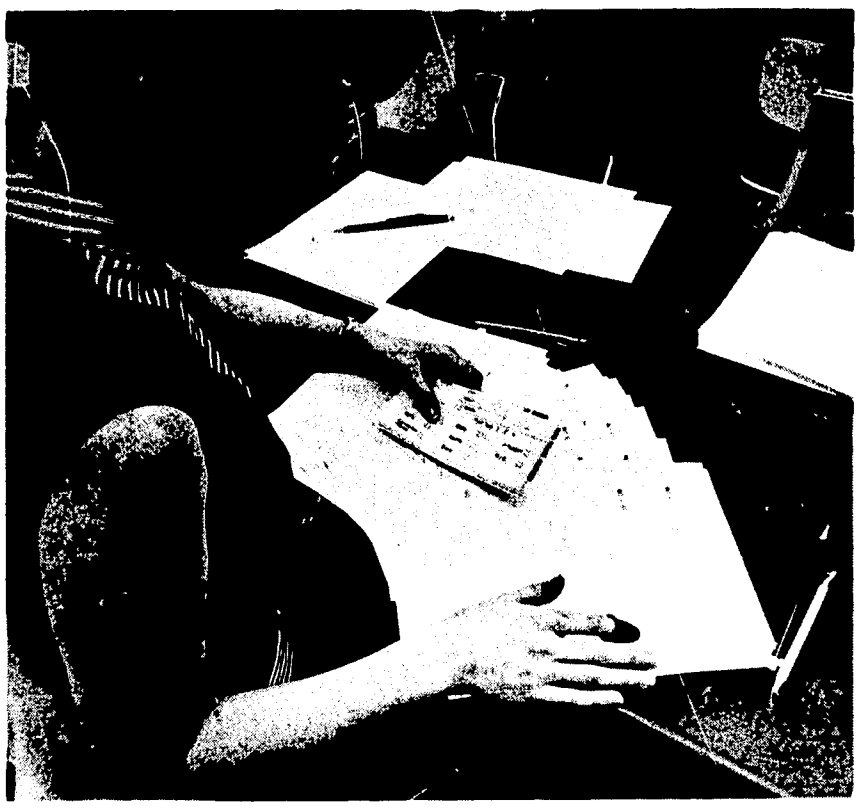
1.
From the abstract and original document, the formula indexer selects compounds for the synthetic organic sections of Chemical Abstracts. These compounds will be indexed and subsequently registered.

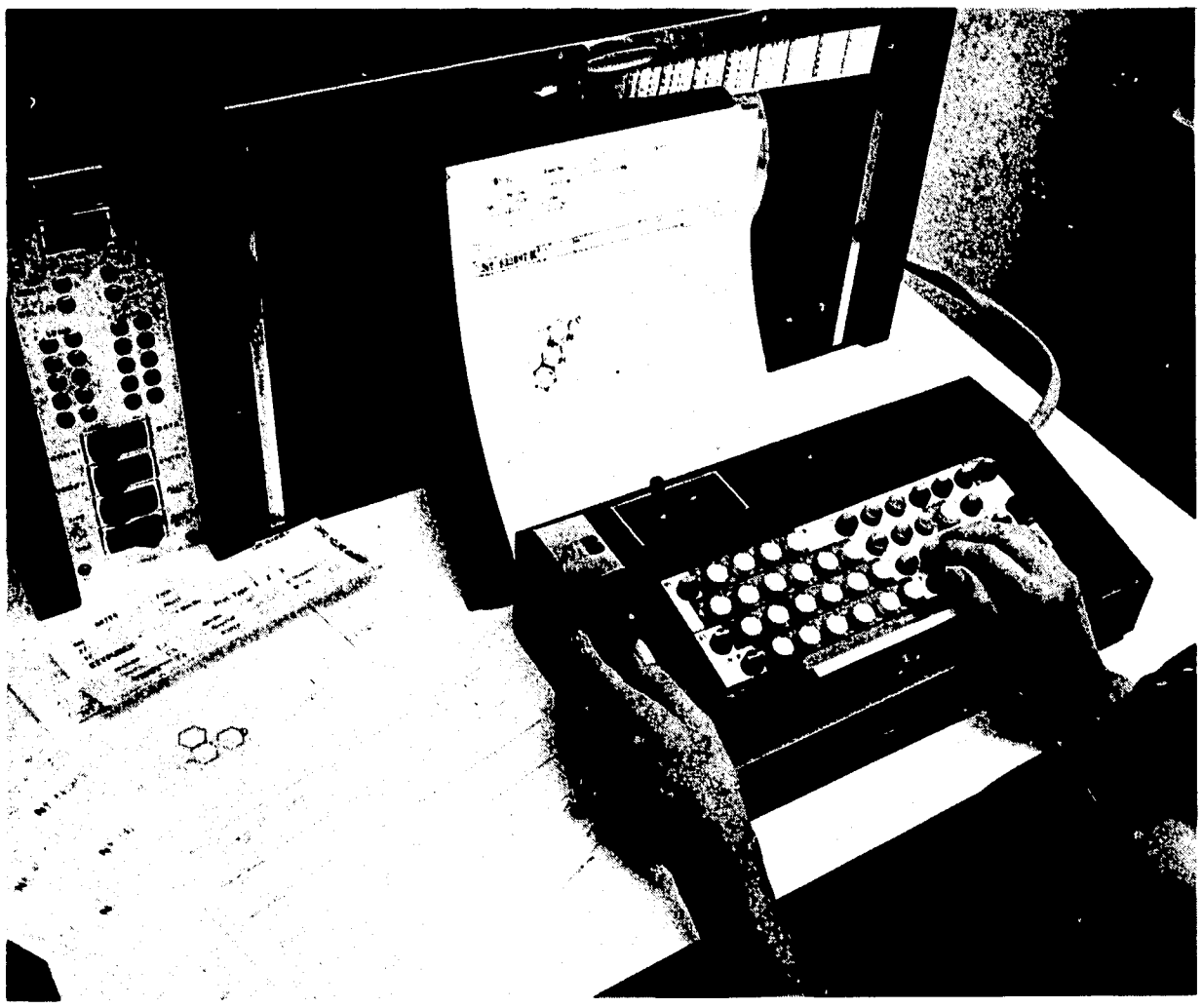
2.
Using the marked abstract, Temporary Identification (TID) Numbers are simultaneously keyboarded, via the Mohawk 1181 data recorder, onto the registry form and magnetic tape along with the reference and name(s) of the compounds as supplied by the author of the article.



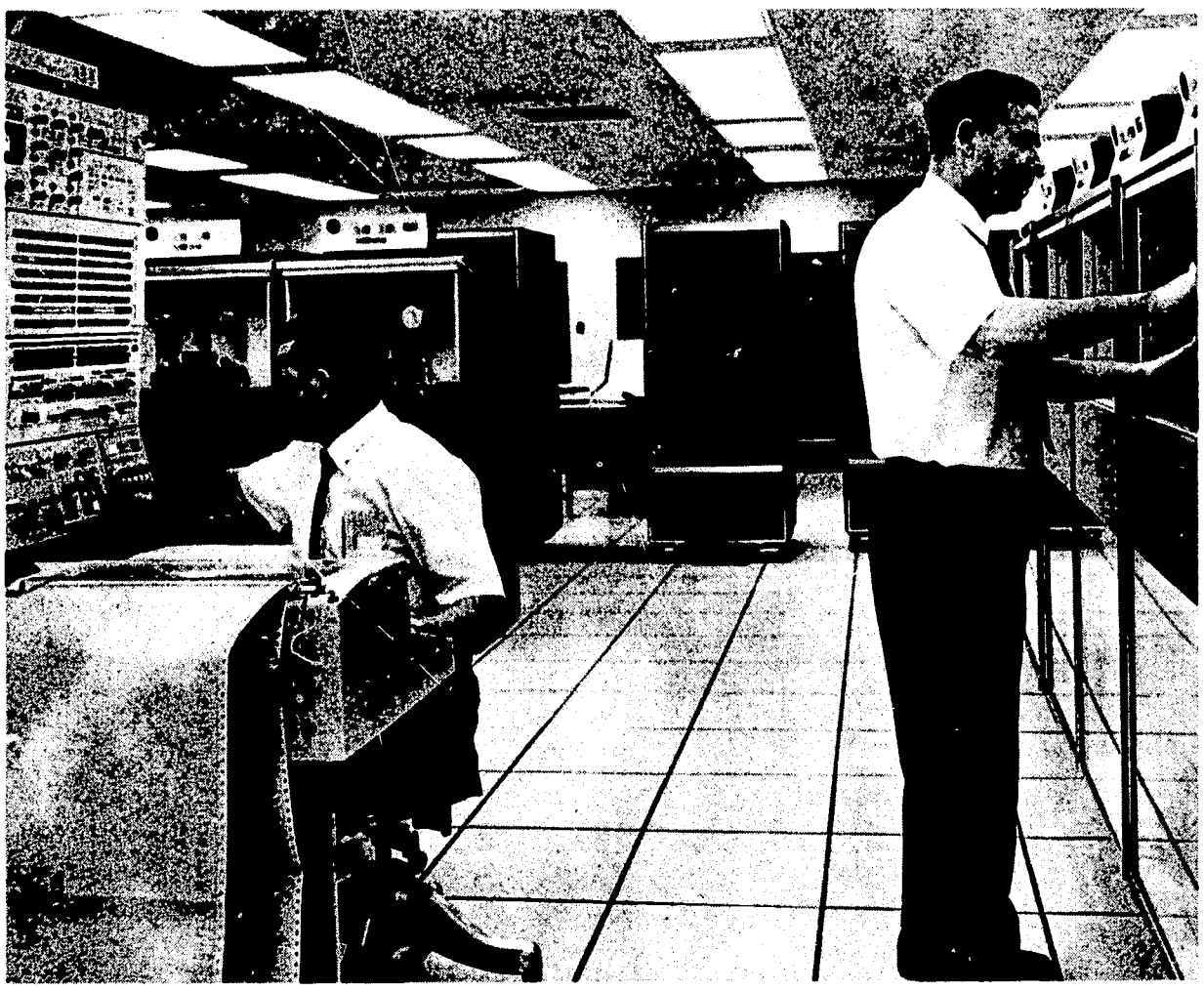
3.
The formula indexer reviews the registry form, draws the structure, and calculates the molecuformula, or retrieves the registry number from a Desktop Analysis Tool (DAT).

4.
Registry forms are batched (put in TID order and identified by source) to facilitate entry into the computer system.





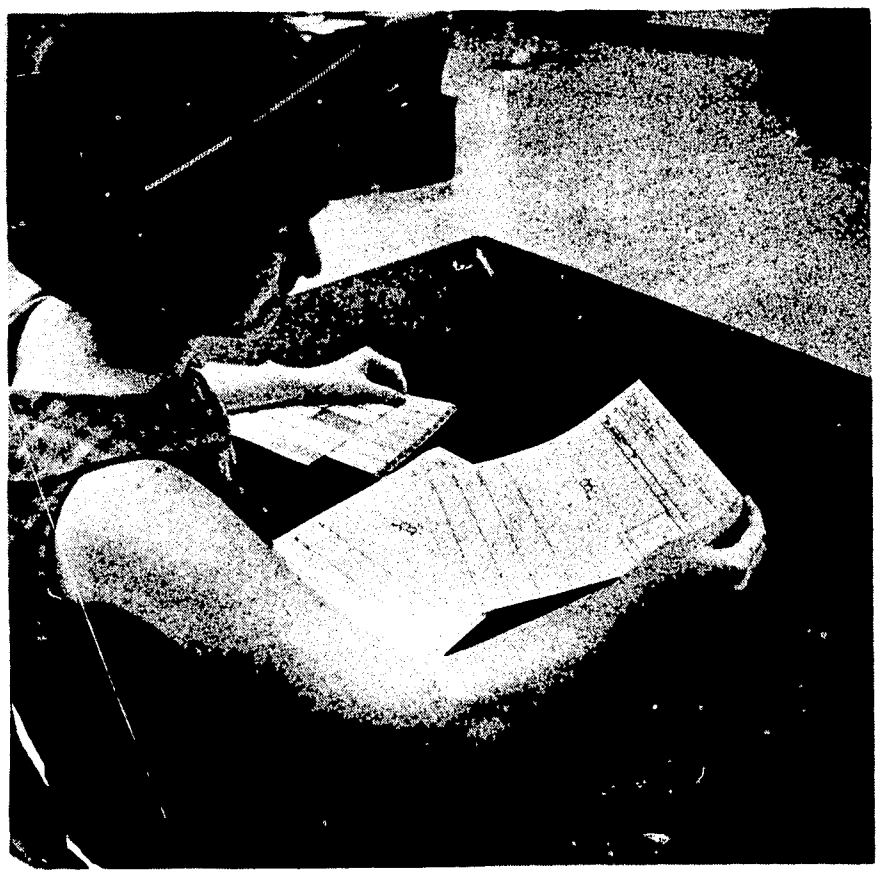
5.
TID numbers, structures (in the form of connection tables), and molecular formulas are keyboarded directly onto magnetic tape by means of the Mohawk 1101 Data Recorder.

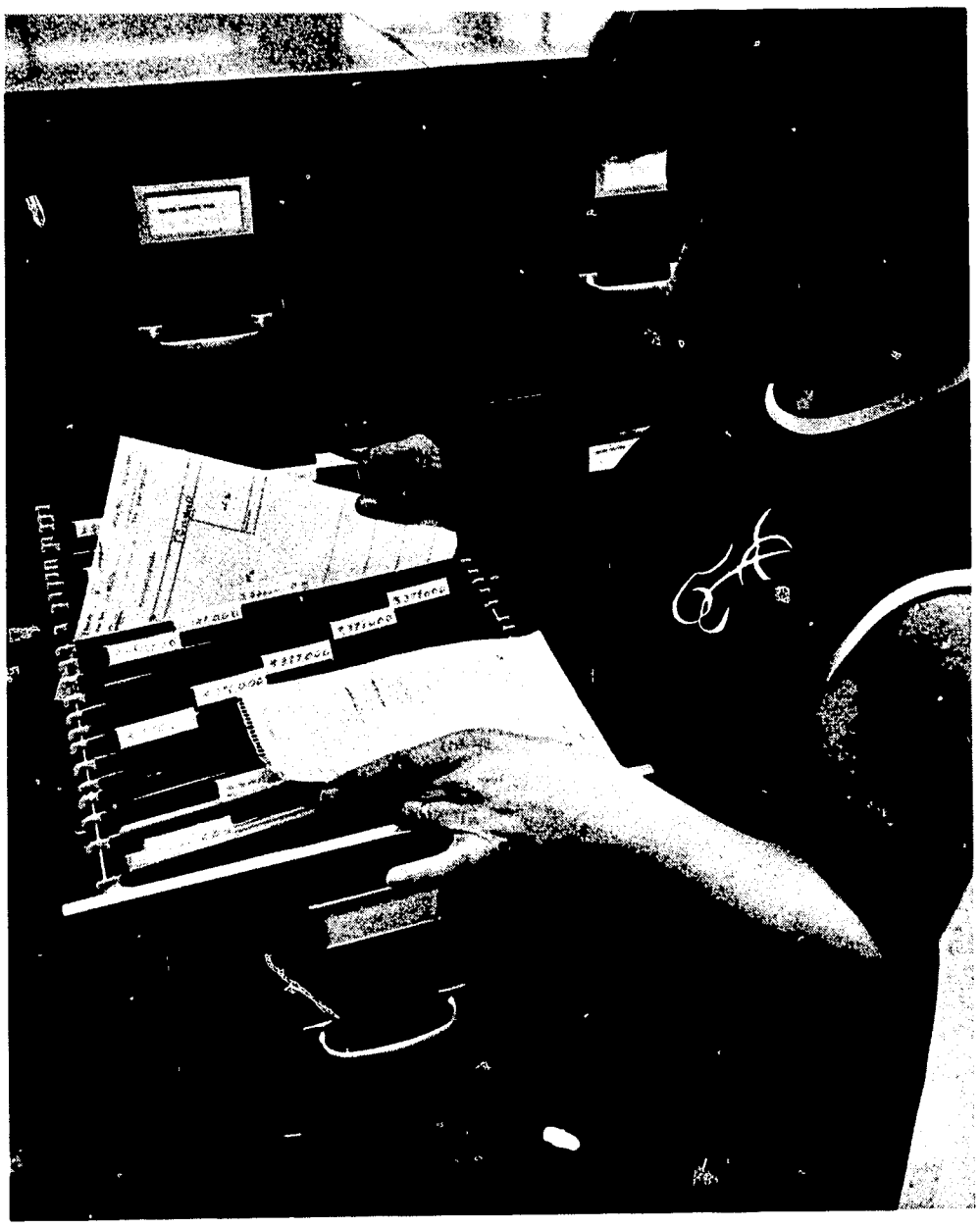


6.
Using the IBM 360 system, the compounds are registered. This step includes editing connection tables and resolving and correcting any errors, generating and numerical ordering of unique connection tables, merging of the files, applying registry numbers to names and references, and updating bibliography and nomenclature files.

7.
Periodically, Desktop Analysis Tools are prepared for use in processing compounds.

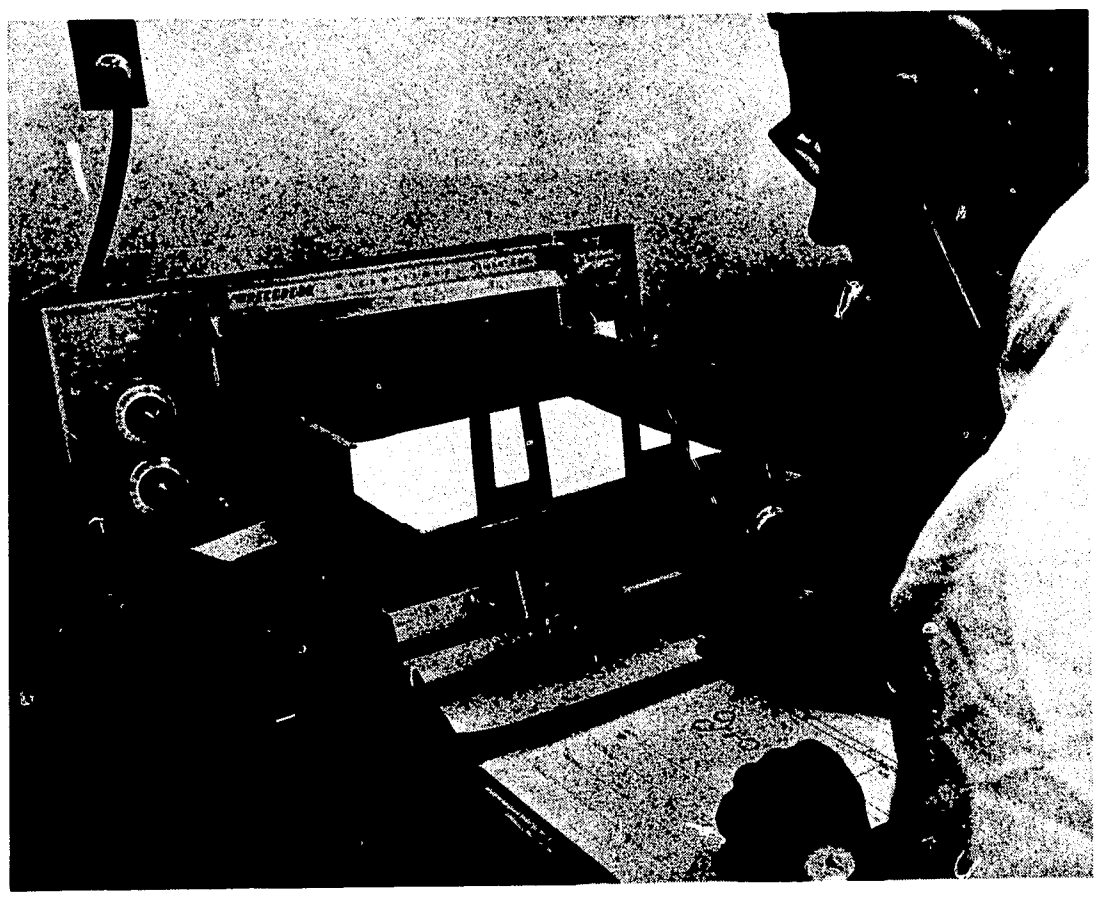
8.
Gummed registry number labels are applied to registry forms for those compounds new to the system.





9.
A master file of registry forms is manually maintained by registry number.

10.
Registry forms are microfilmed.



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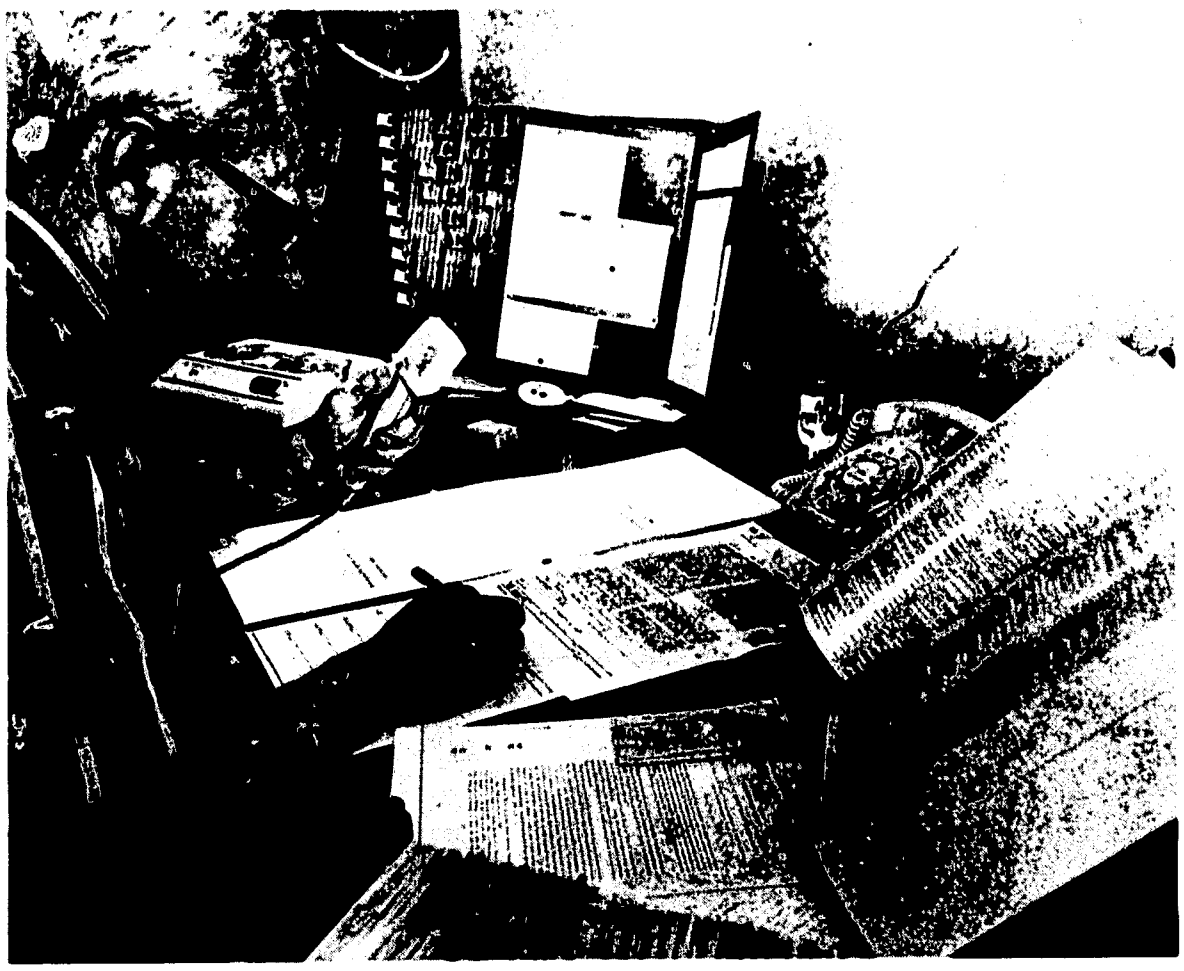
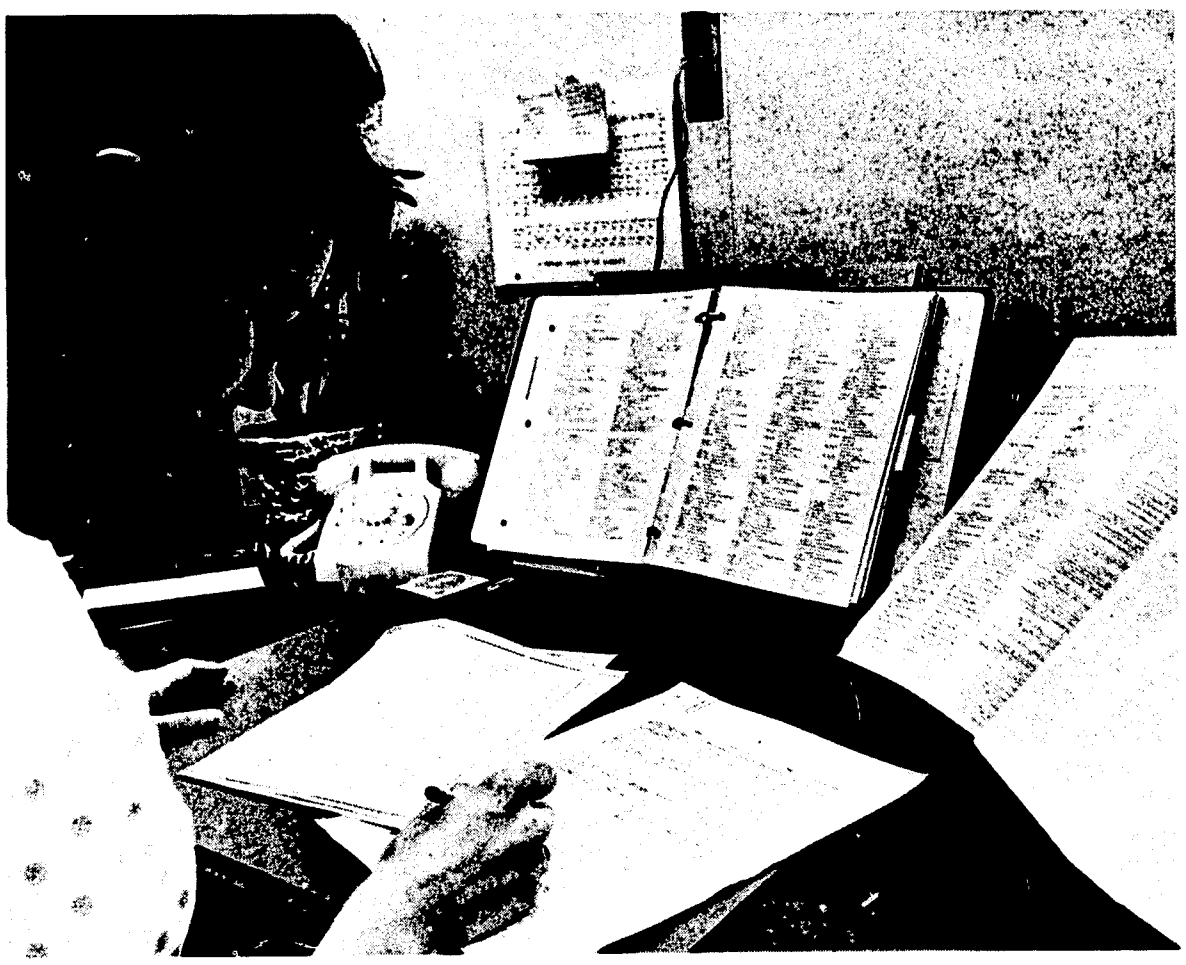
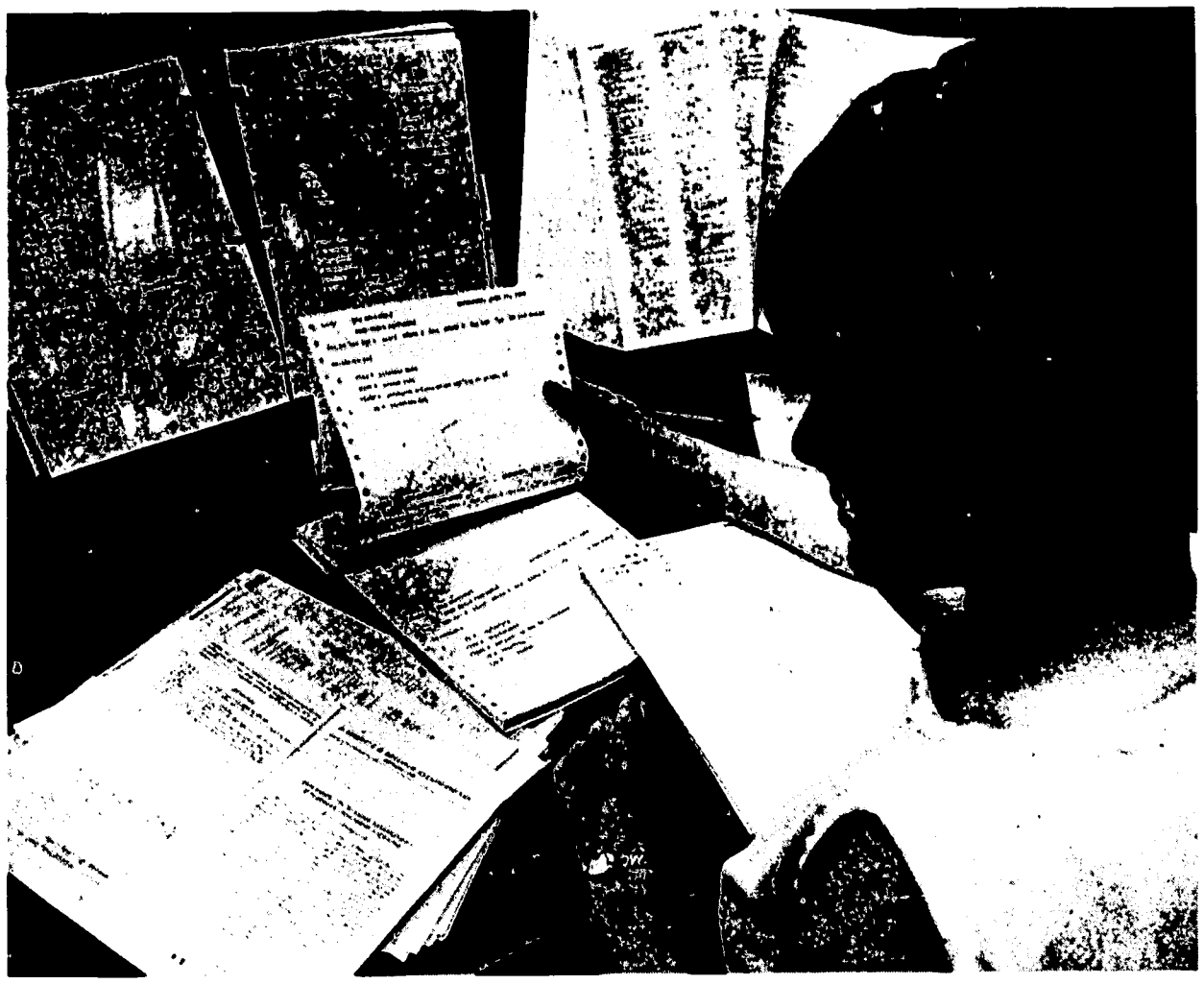


11.
For compounds selected from the synthetic organic sections of Chemical Abstracts, computer-generated data sheets are edited by the subject indexer, based on the registry form and marked abstract. Index names of compounds new to the registry system are determined and dictated.



12.
Using the abstract and the original document, the subject indexer identifies and dictates subject index entries for compounds selected from biochemical, industrial and physical sections of Chemical Abstracts. Dictated entries are keyboarded, using a Mohawk 1181 Data Recorder (See Illustration #2) for a computer-based name match against the registry nomenclature file.



13.
The data sheets, resulting from name match and showing all of the input data plus the CA index names, molecular formula and registry number (if obtained by name match), are reviewed by the formula indexer. Registry forms are prepared for compounds for which no name match is obtained.

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EXHIBIT D

EDUCATIONAL RESOURCE INFORMATION CENTER

The central coordinating office of the Educational Resource (formerly Research) Information Center (Central ERIC) is a unit of the Division of Information Technology and Dissemination of the Bureau of Research within the U. S. Office of Education. It is a central coordinating office since ERIC, in reality, is not a center but a concerted network of specialized centers, directed from the Office of Education and funded by various National Education Acts. (It s current annual budget is approximately 3 1/2 million dollars.)

ERIC is a national information system dedicated to the progress of education through the dissemination of educational research results, research-related materials, and other information about other resources that would be used in developing more effective educational programs. It is designed to be useful to all professional personnel in education --teachers, administrators, and researchers.

Since ERIC only began operation in 1966, many of its intended programs are still in the process of being implemented. Further, some intended services such as state-of-the-art reviews and annotated or selective bibliographies, etc., are by their nature contingent upon the prior development of comprehensive literature resources and will develop operationally as these resources have been organized and accumulated.

Decentralized Design

The most striking feature of ERIC is its decentralization. It is currently composed of eighteen separate clearinghouses, each, on the most basic level, assuming responsibility for monitoring, acquiring, evaluating, abstracting and indexing the literature in a defined subject area. (A list of current clearinghouses follows this page.) Their independent efforts are then channeled into Central ERIC in a prescribed manner.

Such intellectual decentralization was chosen on the judgement that it provided a number of benefits. Specialized research literature intrinsically demands the indexing and abstracting skill of subject specialists. Central ERIC, in locating and establishing clearinghouses, has in many instances gained the participation of an already existing center of research, thereby availing itself of an already existing corps of subject specialists. Further, subject specialists have not been "pirated" from their needed research roles in their respective institutions to be lodged in a central center--perhaps to grow too remote thereafter from the real information needs of the users in their subject area. And, lastly, as new

CURRENT ERIC CLEARINGHOUSES

Clearinghouse on Counseling and Personnel Services
University of Michigan, Ann Arbor, Michigan

Clearinghouse on the Disadvantaged
Yeshiva University, New York, New York

Clearinghouse on Educational Administration
University of Oregon, Eugene, Oregon

Clearinghouse on the Teaching of Foreign Languages
Modern Language Association of American, New York, New York

Library for Adult and Continuing Education
Syracuse University, Syracuse, New York

Clearinghouse on Vocational and Technical Education
Ohio State University, Columbus, Ohio

Clearinghouse on Teaching in English
National Council of Teachers of English, Champaign, Illinois

Clearinghouse on Library and Information Sciences
University of Minnesota, Minneapolis, Minnesota

Clearinghouse on Educational Media and Technology
Institute for Communication Research, Stanford University

Clearinghouse on Educational Facilities
University of Wisconsin, Madison, Wisconsin

Clearinghouse on Early Childhood
University of Illinois, Urbana, Illinois

Clearinghouse on Exceptional Children
Council for Exceptional Children, National Education Association

Clearinghouse on Junior Colleges
University of California at Los Angeles, California

CURRENT ERIC CLEARINGHOUSES (Cont'd)

Clearinghouse on Linguistics and Uncommonly Taught Foreign Languages
Center for Applied Linguistics, Washington, D. C.

Clearinghouse on Reading
Indiana University, Bloomington, Indiana

Clearinghouse on Rural Education and Small Schools
New Mexico State University, University Park, New Mexico

Clearinghouse on School Personnel
City University of New York, New York, New York

Clearinghouse on Science Education
Ohio State University, Columbus, Ohio

areas and centers of research develop (educational research now goes on in areas never thought about 10 years ago) so can ERIC's coverage, as the decentralization provides an open-ended capacity to incorporate new subject areas and new centers of research.

Those processing steps that can be performed most efficiently by a centralized activity--for example, the merging of indexing and abstracting records created by the clearinghouses and the reproduction of documents for distribution--have been contracted to central servicing activities.

The Clearinghouses

The eighteen clearinghouses are at present in different stages of development and are, of course, of varying institutional natures. Some have been so recently recognized and integrated into ERIC that they are in the initial process of staffing, obtaining equipment, and acquiring relevant literature. Some of the clearinghouses had long established document collections when they joined ERIC--others have just been started.

Each clearinghouse has a basic literature coverage and monitoring responsibility. If the clearinghouse specialists determine that a report is of sufficient value to be disseminated through ERIC, the document is abstracted and then indexed according to the ERIC code, or thesaurus. A Panel on Educational Terminology has been established within ERIC to develop and maintain a thesaurus of educational terms for this indexing operation. There are presently about 3200 terms in the thesaurus of ERIC descriptors. These are hierarchically arranged into broader, narrower, and related terms.

The bibliographic entry, the indexing terms, and an indicative abstract of the document developed by the clearinghouse are recorded on a standard ERIC resume form by means of a typewriter that simultaneously generates a punched paper tape. The form, one copy of the paper tape (a duplicate of which is retained in the individual clearinghouse) and a copy of the document are sent to a central processor.

The first target in collecting literature comprised documents that were difficult to obtain or become aware of, so called "fugitive" materials. These included unpublished report literature, speeches, meeting presentations, etc. ERIC is currently expanding its literature coverage to the published journal literature, but is incorporating first those articles not included in the coverage of existing index-abstract services such as Psychological Abstracts or Sociological Abstracts.

The clearinghouses are not meant to function solely as literature searching, indexing and abstracting nodes for ERIC, however. As these centers of resources and expertise develop, ERIC expects to place greater emphasis on state-of-the-art reports, critical reviews, and highly selective and specialized bibliographies--products more typical of information analysis centers than of abstracting-indexing services. These products will not only serve the select professional segment to which a particular clearinghouse is allied, but the community at large.

Data Processing

Under a service contract, North American Aviation, Inc. serves as a central data processor for ERIC. From Central ERIC, the punched paper tape records of input documents are sent to North American. From these records, North American prepares a printout, monthly listing which is photographed, reproduced and sold through subscription by the Government Printing Office. This publication is titled Research In Education (RIE). Until the clearinghouses have become sufficiently operational, Central ERIC has concentrated attention on covering new project announcements and final reports of projects sponsored by the U. S. Office of Education. In the near future, the best and most timely of all documents found will be announced through RIE. Research In Education provides extensive information about each report and project. Indexes cross-reference the subjects, investigators, etc., for the activities and reports. To increase their value as research tools, the indexes will be cumulated and published separately at the end of each year.

Document Services

Research In Education, specialized bibliographies, indexes, critical reviews, etc., will all furnish knowledge of existing literature. A companion services to this--the furnishing of actual copies of the documents--is provided by ERIC Document Reproduction Service (EDRS), which sells for a nominal price microfiche or hardcopy reproductions of all reports cited in RIE. This service is currently performed, under contract, by Bell and Howell Company in Cleveland, Ohio.

Interfaces with Other Information Services

The ERIC system is an entity in itself and is not a part of any overall larger information system. The ERIC management is acutely aware, however, of other information dissemination patterns related to is sphere and is developing working linkages with them. For example, such a cooperative interface with another information service is described and supported in a standard introductory pamphlet for ERIC:

"Since the ERIC clearinghouses by no means cover all of the fields or subject areas of education, some documents you would like to have included in the ERIC system will not fit within the scope of any of the existing clearinghouses. However, another related information system, Phi Delta Kappa's School Research Information Service (SRIS), is interested in receiving copies of all research and other innovative educational materials developed recently by local school systems and school study councils, Arrangements are being developed to ensure that any materials received by SRIS that are within the subject areas of the ERIC clearinghouses will be forwarded to them."*

Another such interface is seen in the case of the ERIC Clearinghouse on Exceptional Children, under the Council for Exceptional Children, in Washington, D. C. The grant under which this clearinghouse was established provided only for its participation in the ERIC program as an information center, but also for its servicing as the communications center for the handicapped children instructional materials centers network, and as the interlinkage between the two networks, as described in the following quotation from the clearinghouse's newsletter:

"The IMC's (Instructional Materials Centers) have been established in cooperation with the U. S. Office of Education as resource centers for teachers and other school personnel engaged in educational programs for handicapped children. The centers collect instructional materials and aids such as braille books, test kits, tapes, and recording devices, evaluate their effectiveness, and make them available to local schools. The centers also plan to engage in research and development aimed at devising improved teaching materials for the handicapped.

"The Clearinghouse on Exceptional Children functions as a communications center for the IMC network and hopefully will provide the link to the ERIC network information about materials collected by the various materials centers will be processed through the Clearinghouse. The Clearinghouse will assume considerable responsibility for dissemination of this information to the field and the prevention of overlap of abstracting among the centers."**

* Burchinal, Lee G. ERIC . . and the Need to Know. U. S. Office of Education.

** Clearinghouse on Exceptional Children, Volume 1, No. 1, March 1967, pp. 1 and 2.

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EXHIBIT E

INSTITUTE FOR SCIENTIFIC INFORMATION

The Institute for Scientific Information, Inc., is one of many organizations which have developed as extra-library information services in response to the demand and need for control over the expanding volume of scientific and technical information. The ISI response has included many extra-library information dissemination products and programs. One of the major products of the ISI operation is the Science Citation Index.

Fundamental to a citation index is the assumption that the author of a paper can and does locate and use other papers relevant to the subject matter of his own, and then cites them as formal citations or references when he publishes. This being the case, the author has simultaneously "indexed" his paper and the papers he cites as being interrelated in content. A citation index is an index, not of subjects but of papers authors had cited as significantly related. Researchers have long taken advantage of this indexing by locating all the references cited in a useful paper, and then locating the references of those papers, and so on, when performing literature searches on a topic. Such searching, it should be noted, proceeds backward in time, as papers only cite other preceding papers. Searches forward in time - that is the location of papers which have cited an article of interest rather than being cited by it - are possible through the use of a citation index. Science Citation Index lists the reference (cited) author and his work, and then lists under this "ancestral" work all source (citing) authors and papers, which have referred to that same work in the journals governed by the Index volume being consulted. Each of the author's cited works, accompanied by its cited authors, is arranged chronologically. Source or citing authors are limited chronologically to the calendar year (via journal publication dates) and to the source journals being covered. (In the 1966 Science Citation Index, all the articles cited in the 1966 issues of 1,573 source journals were covered and entered.) Cited authors and articles are unlimited, either in date of publication or journal source.

The development of the Science Citation Index involves information handling on a massive scale. The 1966 Science Citation Index covered 1,573 source journals to yield 273,870 source journal items (articles), which in turn yielded 3,074,006 citations to earlier publications. To cope with the storage and arrangement of this mass of data, a largely automated system is used. Relevant citations are entered onto Hollerith punch cards (1 card per article/citation). These cards are then eventually read onto magnetic tapes. Automatic routines arrange the citations in proper sequence, aid in standardization of journal title abbreviations,

error detections, etc. Final copy for the Science Citation Index is a direct computer printout from these magnetic tapes, which is then photographically reduced in size and printed.

One great advantage of the citation index is the relatively low technical knowledge or involvement required to input data, once standard formats and procedures have been developed. With the burden of subject-content indexing removed, the system coder or clerk need only understand the basic bibliographic referencing rules. This fact allows in part the tremendous quantity of coverage in the Science Citation Index, which is a major asset of the Index.

Other Uses for Science Citation Index Data Files

The Science Citation Index is not the only output obtained from these data files at ISI. Operating from the same data base is ASCA (Automatic Subject Citation Alert), a current awareness service responding in a customized manner to the searching profile submitted by a user, to alert him to current articles of relevance to his search or interest.

ISI also provides a searching service of the Science Citation Index files for individuals and organizations desiring a Science Citation Index search done on request.

A Permuterm Index is also available from this data file which not only is a standard permuted title index to the articles covered, but also provides for concept coordination among these terms.

The Institute for Scientific Information is further offering to scientific and technical information centers the total content of the SCI data files on magnetic tapes. This information can then be used by the specialized center for many purposes. Among them are:

Input for selective alerting publications
Selective Dissemination of Information services
Input for KWIC, KWOC indexes, etc.
Retrospective searching (Author Indexes, Title Indexes, Journal Indexes)

Complete computer programs for the IBM 1401/7074 and IBM 360 are available without charge to purchasers of these magentic tapes. These programs comprise a system for the selective dissemination of information based on the specified interests of individuals within the user group.

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EXHIBIT F

THOMAS MICROCATALOGUES

The Thomas Publication Company has been famous for a great many years for the publication of the Thomas Registry which contains, by now, something over 10,000 pages of information on products with supporting catalogue pages. Material is classified in 75,000 categories, and every known manufacturer in the U.S. is listed.

Thomas commenced the microfiche operation some five years ago. Now the Catalogues have been put on microfiche and are being marketed in that form. The microfiche system is based on a 4 x 6 sheet of translucent photo film which reduces the catalogue pages by a ratio of 19 to 1. Thus, 72 full-sized pages can be reproduced on a single "fiche". The Thomas size is consistent with other standardized fiches now in use by various U.S. government agencies.

In order to use the system, the subscriber needs the Thomas Product Index which provides codes for 21,000 product designations. It is a book of some 350 pages. The microfiches are numbered, and the product index refers the user to the fiche number, row and frame on which information about the product may be found.

The basic package, therefore, is the Index and the Catalogue. The subscriber, therefore, buys a Micro-catalogue on an annual basis plus as many printed Index books as he needs. This service costs $350. , including a mid-year supplement and a microfilm reader. The renewal cost is $205. per year.

Advantages of the system are its small storage space, rapid retrieval, and easy updating and supplementation.

There are some disadvantages. Readers for microfiche have been much improved in recent years, but the image is still not as sharp as that found on a page of printed type. This is not a stumbling block for this kind of use, since eye strain is not likely to result from the process of examining a few items and taking notes for purposes of ordering. Also, microfiche are more likely to be lost or mislaid, or injured in use than microfilm, but here again, the annual re-issue and the availability of substitute fiches for nominal cost (50 cents each) cover that problem.

The Microfiche edition is now in its sixth year, and is an established success. Users find it easier to handle than the hardcover publication.

Typically, a large firm may have a single file of the catalogue, but a number of indexes in various parts of its premises. Thus, the engineer can learn whether the desired product is reported by consulting the index, then go to the catalogue for the detailed information. The collection may be had either in positive or negative form, and adequate machinery for printing enlarged copies of either is in process.

In addition to the Thomas Register and Microcatalogues the Company produces a number of other microfiche products. A specialized service in the field of transistor product information is maintained and updated quarterly. A collection of some 40,000 pages of information on plastics technology collected by the Picatinny Arsenal is available. The Transactions of the American Society of Automotive Engineers for 1966 may be purchased, as well as a collection of 1965 papers. The SAE handbook of some 100,000 pages and the 30,000 pages of U.S.A. Standards can be purchased on microfiche. Several other collections of standards, drawings and specifications from government agencies are either available or in the planning stage.

The Thomas program is dealing in most cases with transitory materials which must be updated or replaced frequently. So long as the product is satisfactory to users, and it seems to be, it has distinct advantages over hard cover handling of the material. When one considers the cost of shelving as many hard cover books as would be required, regardless of the costs of manufacturing, the savings involved in the use of the fiches seem impressive. The fiches arrive, of course, already "shelved". The contents are classified and accompanied by an index which replaces the standard library classification system. Thomas Publication management thinks there will be many other applications for the system, especially in situations where the material changes frequently.

EXHIBIT G

COMPUSTAT

Standard & Poor's Corporation, which has operated an investment service and a statistical service for many years, began to computerize some of its operations four or five years ago. The use of computers in this industry has arrived fairly late. The problem has been to produce information in consistent, machine-readable form. Standard & Poor's began experimentally by collecting data on 45 firms. In order to handle material by machine, it was found necessary to write a book of definitions which now comprises some 250 pages. This document has been reviewed by many individuals and organizations, including the Securities and Exchange Commission.

The Company now has data on 2,000 companies. By 1970 they expect to have computerized material on every publicly-owned company in the United States. They are covering industrials and utilities as well as insurance companies, banks, and other financial institutions. Customers for this service are mainly banks and investment services. At the moment only about 75 firms buy this service; the total number may be 125 to 150 potential customers. The service is expensive; subscription for the first year costs $27,000 and something like $12,000 each subsequent year.

COMPUSTAT has organized the balance sheet, income statement, and certain other selected statistical information on the companies covered for each year back to 1946, and has put the information into magnetic tape packages that can be read and processed by computers. This means that most of the financial analysis made on the firms covered can be done by machines, and the wearisome process of manipulating figures and computing ratios and percentages is removed from the analysis operations.

COMPUSTAT refers to this collection as a series of "library information." These are, however, packages of computerized material. A basic library contains annual data on 900 industrial companies, including the 425 companies that make up Standard & Poor's Industrial Stock Index. Other tapes include 100 leading utilities and 900 industrial companies for which information is provided on a quarterly basis. The material covers a period of 20 quarters. The tapes are, or can be, made compatible with any computer arrangement available to the customer. Material for any individual company includes data on 60 separate items. Information on utilities covering 61 separate items is given. The following are examples of the basic information provided:

Industrial Companies

Cash and Equivalent	Capital expenditures
Receivables	Price -- High, Low, Close

Industrial Companies (cont'd)

Inventories	Nonrecurring Expense
Current Assets	Net Income
Sales	Dividends Per Share

Utilities

Gross Plant	Maintenance
Common Stock and Surplus	Flow Thru Tax Savings
Mortgage Debt	Peak Load
Reserve for Deferred Taxes	Customers
Cost of Gas Purchased	Sales in KWH and MFC -- Resid., Commercial, Total

Standard & Poor's has prepared a Statistics Computer Center which many subscribers use. As tapes are updated weekly they are automatically available to such subscribers, and on special request for any other customer. Notice of each updating is sent to COMPUSTAT customers.

In addition to their services to companies, Standard & Poor's has contributed its tapes to some 30 major universities having graduate business schools. Already a considerable amount of graduate research based on these tapes is occurring. Material is also used in undergraduate teaching for experience in computer operation.

The company is beginning to develop remote inputs and "on-line timesharing" of their computer center.

The corporation data books are now being produced with the use of punch-paper tapes; magnetic tapes are used for daily stock reports and other materials.

Standard & Poor's computer installation is very impressive, and supplements a very extensive financial library that has been collected over a period of many years. In their handling of financial portfolios and in the production of company analyses for other purposes, a battery of analysts draws on both the library and computer material.

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DODGE REPORTS, SWEET'S CATALOGUES, SHEPARD'S CITATIONS

Dodge Reports

The Dodge Reports provide information on construction projects for the use of prospective bidders and contractors. The service is provided through 19 information centers which collect data on construction projects and issue reports to subscribers who have an interest in them. Subscribers indicate their areas of interest (profiles) which are coded, and information on projects is coded in the same way. The interests of each subscriber are compared with the profile of each project, and summary statements of the project are sent to appropriate subscribers. The statements are mimeographed on 4" x 6" slips and daily mailings are made as the information comes in. Samples of the slips follow this page.

Dodge Reports are bought by over some 40 thousand subscribers. The gross income each year for this service is something over $16 million. It will be noted that the reports contain only factual data, although in some cases the facts reported may be only rumors. For example, a report that a local school is operating on a two shift basis may be sent out to alert subscribers to a possible future project. Data on each construction project are constantly updated. A whole series of reports is typically the history of a construction project. Rapid communication is the rule. Subscribers receive reports within 24 hours of the time of acquisition of the information.

The system provides approximately 10 million reports per year. However each subscriber gets only a small percentage of these; the system is designed to reduce the amount of information reviewed by the subscriber.

As soon as information comes into the Center, a stencil is cut which provides the basis for the information slips circulated by the service. These are coded and, as noted above, the "profiles" are matched with the profiles furnished by the subscriber. This is done electronically. IBM cards have been used and further mechanization is in progress. Ten centers have already installed IBM 1130 computers.

The Centers also provide services to builders. Subscribers may review blueprints of construction projects in the Center. This saves the architect and general contractor (who supply much of the information) from dealing with individual requests from subcontractors.

In addition to supplying individual reports to subscribers, the system yields statistics on the use of the various materials or the activities of various architects and general contractors and on the dollar value of construction projects in different states and metropolitan areas.

AUG 23 1962/ 3 NY 29-99#169 320D
1ST REPT 7-5-62

KNITTING MILLS MHS
WANAQUE MIDVALE NJ (PASSAIC CO)
ADDL BIDDER ON G C-OWNER TAKING BIDS ON G C
(INVITATION ONLY) DUE AUG 30TH AT 4PM
OWNER - VALLEY KNITTING MILLS INC-SAM & IRVING
PILZER (IN CHG) 207 RINGWOOD AVE MIDVALE NJ
(TEMPLE 5-3226)
ARCHT - HERBERT F NECKER 2 W ALLENDALE AVE
ALLENDALE NJ
ENGR (CONSLTG) - GEORGE J BROWN 144 BELLE AVE
MAYWOOD NJ
CB EXT WALLS & BACKUP-PREFAB ALUM & STN TRIM-
1 STY & NO BASMT-14,500 SQ FT-STL SKEL-CONC
SLAB FLR CONSTN-ON STL BEAMS-STL RF DECK-INCL
CB FDN-SPKRS-CONC WALKWAY-ASPH PARKING &
LOADING AREA
G C INCLS ALL TRADES
PLANS & SPECS FROM OWNER DEP $50 CERT CK
ADDL BIDDER ON G C
BERT THOMAS AITKEN CONST CO 442 POMPTON RD &
PO BOX 798 WAYNE NJ DESIRES BIDS DUE AUG 24TH
BIDDERS ON G C PREV REPT
CAROL CONSTN CO 156A BOONTON RD WAYNE NJ
WENY BROS & STORMS CO MCLEAN BLVD AT 9TH AVE
COLIN CONSTN CO INC 37 MIDLAND AVE (BOTH)PATERSON
NJ
GUNDERSEN CONST CORP PO BOX 193 OAKLAND NJ
JET CONSTN CO 299 KEARNY AVE KEARNY NJ
COSMOPOLITAN CONST CO 16 GLEN RD VERONA NJ

AUG 23 1962/ 4-0 NY 16 #173 222A
1ST REPT 8-17-62

TELEVISION STUDIO (ALTS FROM STORE) $100,000
NEWARK NJ (ESSEX CO) 1020 BROAD ST
G C AWARDED - WORK STARTS SHORTLY
OWNER - EDUCATIONAL BROADCASTING CORP C/O CHANNEL
13 WNDT-G EDWARD HAMILTON (IN CHG) 1657 BROAD-
WAY NYC (581-6000)
ARCHT-ROGER E GOODWIN ASSOC 106 MARKET ST SUNBURY
PA
ENGR(STRUCL-PLBG-HTG-VENTG-ELEC) - BY ARCHT
INCL REMOD STORE INTO BROADCASTING STUDIO-ELEC
WK-ELECTRONIC WK-PLBG ALTS-PARTNS-ACOUST TREAT-
MENT-COMPOSITION-CONC & CARPET FLRG
G C - JOHN LONRY INC 52 VANDERBILT AVE NYC (MURRAY
HILL 5-5050)
G C INCLS ALL TRADES

Sweet's Catalogues

Sweet's Catalogues are supplied to architects whose activities, as reflected in the statistics from the Dodge Reports, qualify them for the service. The catalogues are architects' handbooks and provide information from manufacturers of construction materials. The catalogue provides data on the size, types and costs of material for each item. The pages included in the catalogues may be supplied by the manufacturers from the regular printed materials. In some cases, Sweet's Catalogues undertakes, for a fee, to write the descriptive material included. The Information Centers mentioned above are beginning to provide a new service: contractors may inspect micro-film copies of blueprints, which may be scanned on a magnifying tape.

This service is naturally very useful to architects and encourages them to provide information for the Dodge Reports on projects on which they are involved. However, the architects are not the sole sources of information. News reports and other sources are constantly reviewed.

Shepard's Citations

Shepard's Citations is another service provided by McGraw-Hill. The ordinary lawyer's library contains a series of law reports such as those published by the American Law Reports or West's. When a lawyer prepares a case he examines these reports to learn which are the governing decisions in the case he has under contract. After he has outlined his argument he checks Shepard's Citations for changes since the published compendia were assembled. Shepard's reviews legal decisions currently with a staff of some 20 lawyers located in Colorado Springs, Colorado. These decisions are then quoted according to the official reports for the state in which the basic decision is numbered. The subsequent decisions related to each number are listed under it. The listings also provide a descriptive title for each case number. The entries also provide a series of codes indicating whether the case listed in Shepard's agrees with or parallels the leading case or whether it overrules or questions the case.

Shepard's gets information by subscribing to all legal publications. For example, West's now sends advance galleys to Shepard's.

Shepard's plans computerizing its operations and has recently requested bids on appropriate computers.

MECHANICAL PROPERTIES DATA CENTER

The Mechanical Properties Data Center is designed and operated by the Technical Information Systems division of Belfour Stulen, Inc. in Traverse City, Michigan, for the Air Force. The Center is one of a coordinated program of Air Force Materials Information Centers. Its subject coverage is accordingly interfaced with other activities within the larger program.

The Mechanical Properties Data Center (MPDC) is one which originated with a distinct information rationale--namely:

> "The basic problem, to facilitate the use of existing knowledge, has basically not become more complex, just larger. The proffered solutions, and there are many, employ variations or combinations of two fundamental concepts. These are, to store and retrieve documents, or to extract, store and retrieve the pertinent numbers, facts and ideas from documents. Herein lies the distinction between Document Centers and Data Centers. Document Centers are libraries, Data Centers are organizations designed to extract, store, operate on, and present merged information." *

Starting with such a definition, the Mechanical Properties Data Center has bent its considerable system design efforts toward developing automatic data center capabilities in extra-library information

System Mechanics

The MPDC data processing system is built around an IBM 1440 Computer, incorporating magnetic disk packs. Also used are logarithmic and linear X-Y plotters, as well as general peripheral equipment for data processing. The total system is designed, to the extent possible, to store and retrieve the actual data reported in the documents, along with the associated information needed to make the data meaningful. In the realm of mechanical properties of materials, data particularly amenable to such treatment are the results of standardized tests, such as fatigue, tension, compression, bending, fracture, toughness, etc. Punched card formats have been developed

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*F. L. Stulen, "Mechanical Properties Data Center Design and Operation," Belfour Engineering Co., Suttons Bay, Michigan., TDR No. ASD-63-566, Part I, May 1963, p. 1. (AD 414 396)

for the most effective data storage for each type of test. On each card is then entered the test results of a single specimen undergoing that test. Therefore, a single IBM card records all necessary information for a given specimen tested in a particular type of test. One document may yield detail on as many as 1,000 specimens and a variety of tests. Auxiliary cards are prepared to include additional detail on chemical composition and heat treatment, and intermediate test values, and to annotate the test and its coding as required. These are strictly auxiliary and their use is optional. This punched card data file is called the Detail Data File. Cards are arranged by major material type, then by specific material, then by test type. On the magnetic disk packs of the computer the code file for access to and manipulation of the Detail Data File is maintained, as is the source document reference list for the Detail Data File.

With this data system, the results of tests on a specific material can be automatically plotted or tabulated in comparison with each other to give to the inquiring user all the data recorded in the system on the material and property of interest to him. Thus, the MPDC performs the most valuable service of extracting from the literature and displaying the precise information often lost to the engineer in need due simply to the bulk of the literature. As of May 1967, the MPDC data files held approximately 600,000 test records on over 4,000 alloys which constituted approximately 30 million addressable units of information. It is estimated that this data represents approximately $60 million worth of materials test programs.

The MPDC holds as one of its explicit missions the continued development of such automated data handling techniques and services. However, in order to serve its primary mission of furnishing materials information to scientists and engineers, the center still makes use of conventional document handling methods for supplemental references. All useful materials information does not lend itself as readily to processing and manipulating as do the precisely described numerical results of standardized tests. Valuable information on processes, failure mechanics, test techniques, etc., which is not numerical, is of course still most useful and should be made available. To accommodate this information, the Center has a punched card indexing system based on descriptors pertaining to properties, materials, environment, processes, etc., that identifies documents containing important non-numeric information, and numeric data not yet incorporated in the data storage file.

Supported by these two information files, MPDC responses to information requests may include a data tabulation or graphic display (with references to sources of the data), and/or references to documents containing relevant information, and/or actual copies of relevant documents or their relevant sections. MPDC estimates that data printouts are furnished as partial response, at least, to 80% of those requests properly directed to it. This percentage response will grow with the growth of the Detail Data File.

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EXHIBIT J

SCIENCE INFORMATION EXCHANGE

The Science Information Exchange (SIE) of the Smithsonian Institution (funded by the National Science Foundation) is a clearinghouse for information on scientific research activity currently in progress. It was established in 1949 by Federal research agencies in order to facilitate the prompt exchange of information about their current research activities. The mission of SIE is to furnish research directors, administrators and individual investigators with up-to-date information about who is currently working on what problems or projects, where, and with what support. Its services are available to all responsible requestors.

SIE, in this manner, documents the 1 - to 3 - year period between the time that an investigator plans and starts his experimental work to the time the results finally appear in the technical literature. Documentation and control of this period is crucial both in the administration and conduct of research -- to prevent unintentional duplication in sponsorship or technical approach and to encourage and make possible cooperation between allied research efforts.

SIE accumulates, uses and distributes a non-library artifact -- one which has been developed and expanded for the reporting of on-going research. It is the "Notice of Research Project" (NRP). The NRP is a standard one-page record which includes six items of information:

(1) The name of the agency that supports the work,
(2) The names and addresses of principal or associated investigators,
(3) The location of the laboratory doing the work,
(4) A short title,
(5) 200-word summary of the technical detail,
(6) Level of effort, including dates.

NRP's (and their functional twins such as the DOD Form 1498) are reporting forms increasingly required by government sponsors at the commencement of a research project. Supplied by contractors or researchers doing the work, these NRP's are fed to SIE for incorporation into their files. This operation constitutes a large-scale cooperative effort among all government research agencies.

System Mechanics

The computerized files within SIE have been developed for the purpose of manipulating NRP identification elements as informatively as possible in regard to

the above items of information. Through this capability SIE performs a function analagous to "document retrieval" -- the retrieved artifact, however, being the NRP. A further purpose in the construction of the files is information retrieval for purposes other than "document retrieval" -- i.e., other than that of locating relevant NRP's. This type of information retrieval involves various printouts of information for their statistical or directory value alone.

All NRP information is extracted and entered into the index tapes except the 200-word summary: subject indexing descriptors substitute for this. A series of independent, multiple entry, open-ended, hierachical subject indexes permits each NRP to be indexed thoroughly. Over 20,000 descriptors of "topics" are in use for this indexing, in several hundred biological and physical sciences indexes. These indexes undergo continual revision.

Staffing

Indexing and vocabulary control of the above nature requires a sound knowledge of the discipline in question. Therefore, SIE's staff includes 55 subject specialist-indexers for the subject coding of NRP's. Also included on the SIE staff are 12 system managers and technicians and 90 clerical and support staff members. The entire operation has an annual budget of approximately $2 million.

SIE Services

As stated earlier, SIE was established to document the existence of research activity in the 1 - to 3 - year period between the time an investigator plans and starts his experimental work to the time the results appear in the technical literature. Its mission is, overall, the conservation of energy of the individual researcher and of the larger, administered research program. Services and products of the SIE range from answering a request involving a single NRP description to the preparation of catalogs covering large subject fields for printing and distribution.

The former is a "document retrieval" service as are the following services offered by SIE: NRP Subject Retrieval is the retrieval of all NRP's (current research descriptions) relevant to a subject area specified by the requestor. This service supplies the individual research (or government administrator) with the technical descriptions, research investigators, locations, sponsorship, etc., of all on-going research relevant to the subject of interest to him. NRP Name Retrieval supplies the requestor with all the NRP's associated with a given investigator. NRP Accession Number Retrieval furnishes government agencies all NRP's identified as in their purview by their respective contract numbers.

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Other information services offered by SIE involve the compilation of specified elements of the computer tape indices. These services are primarily used by research program directors and administrators of the Federal Government: The Subject Field Catalog identifies all NRP's related to a broad subject field. The Agency Program Catalog is similar to the subject field catalog, except that it identifies only the NRP's from a given agency. The Administrative Compilation is a computer printout table of data or list showing the number of NRP's and/or dollars involved, sorted or grouped by source, location, and/or other groups, but exclusive of subject matter. The Subject-Administrative Compilation is like the Administrative Compilation except that it includes subject classification as a grouping parameter.

As a library is only as good as its collection, so too SIE is only as good as its collection of NRP's -- both in terms of their completeness of coverage and their quality of content. The past few years have seen great expansion of SIE's files covering the Federal research establishment and greater joint utility therefrom. SIE now registers more than 100,000 NRP's and answers over 55,000 inquiries each year. Answers range from computer printouts of index elements to customized sets of NRP's (about half each of the information and document services as described above). Only partly included in SIE's files are research project NRP's describing activities funded by private industry, institutes, foundations and universities. Greater representation of private research activity is actively solicited.

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EXHIBIT K

SCIENCE TEACHING CENTER

Introduction

The Science Teaching Center, located at the University of Maryland, serves as a specialized information center on science and mathematics curriculum developments. The Center disseminates information in two major ways:

(1) Externally by means of a) an annual publication titled Report of the International Clearinghouse on Science and Mathematics Curriculum Developments, and b) reviews for the National Science Teachers Association of the latest in science teaching materials, published in The Science Teacher and Science and Children.

(2) Internally, by means of facilities and equipment current to the curriculum developments available in the Center for display, experiment and observation. Graduate and undergraduate courses in science education taught by the Center's staff employ these materials regularly.

The Center's Clearinghouse is funded by the American Association for the Advancement of Science under a National Science Foundation grant, while the National Science Teachers Association sponsors the review activities. Other in-house facilities and research support are suppled by the University of Maryland.

The staff of the Center consists of seven full time professionals, five graduate assistants, three secretaries, and approximately sixty outside personnel to assist in reviewing books, films, and equipment. The center is used by local teachers, University of Maryland staff members and visitors from all over the world interested in the Center's operations.

The Center is located in the University of Maryland Education Building and consists of six offices, 2 classroom size laboratories, a large library resource room, a materials and file room, two storage and preparation rooms, a research project room, a photographic dark room, a large seminar room and various conference rooms and classrooms shared with the Education Department.

Functions and Facilities of the Science Teaching Center

A. International Clearinghouse for Science and Mathematics Curriculum Developments

The original Clearinghouse operations began in 1962, and remained national in scope until 1965 when it became apparent that because of increasing overseas interest and activities in science and math curriculum developments, international cooperation was necessary. In 1967, approximately 350-400 current project descriptions were published in the Center's annual report and 10,000 copies produced. The majority of these were distributed by mail to school systems and well-known educators nationally and internationally in the fields of science and math. The demand for each Annual Report has far exceeded the supply even though the number printed goes up by thousands each year.

B. Curriculum Projects and Resource Library

Detailed reports and descriptions of current science and mathematics projects are maintained in one of the Centers special libraries for reference. These are important for the staff members in determining what equipment and materials need to be ordered for review and experimental purposes. Also available are samples of most of the science textbooks used at all levels in schools nationally, many textbooks used in other countries, and current periodicals.

C. Science Laboratories

Fully equipped classroom-type laboratories are established with the latest science equipment available and University teachers to explain the use of the equipment. Student teachers from the University are expected to try out this equipment in their science methods courses and their student teaching experience.

D. Audio-Visual Facilities

The latest films and audio-visual equipment used in science teaching are available, and the Center will later feature some of the most recent technological developments in science education including closed-circuit television, a sample audio-tutorial set-up and provision for eventual connection to a computer facility.

E. Review and Consulting Services

Not only does the Center function in disseminating information about the current projects in science and mathematics curriculum developments, but also in reviewing, evaluating and testing theories, teaching techniques, equipment, and books related to this area of knowledge. The Center's in-house staff is unable to fulfill this function alone and, consequently, approximately sixty outside specialists assist in this operation. The review results are published in the National Science Teachers Association's two periodicals, The Science Teacher (primarily for secondary school teachers) and Science and Children (for elementary teachers).

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EXHIBIT L

AUDIO-VISUAL MATERIALS CENTER

Introduction

The development of new and better audio-visual equipment and expansion of its use in schools has enabled teachers to utilize a vast amount of resources in varied forms. Expanded use of tape recorders and head phones has brought to education the new idea of "listening stations" whereby a teacher can either prepare his own lesson in advance or obtain a tape prepared elsewhere and have 8 to 10 students listening while the teacher works with another group. Development of the optical projector and its use by schools as an educational tool has created a need for a substantial program for the preparation and supply of visual matter. Easier to manipulate film and filmstrip projectors has increased the educational usage of this media as well.

Materials Handling

In Maryland, the Prince George's County School System has seen the need for an Audio-Visual Materials Center for the organization and handling of these materials so that schools can:

1. recognize what materials are available to them, and
2. know how the materials can be readily obtained for use.

The Center serves 150 elementary schools, 46 secondary schools, and 4 special education schools under a $3.00 per pupil allotment established by the County Commissioners. A full-time staff of 11 carries out the materials processing and circulation. The processing of materials requires various operations.

1. New material needs to be reviewed and screened (such as previewing new film releases, etc.). A "team" of teachers work part-time to serve this need.
2. Once screened, material recommended for purchase is budgeted and ordered.
3. Newly purchased material is added to a list of available materials and sent to all the schools. Summary cards are sent also.
4. Master tapes, transparencies and slides are reproduced in the center and given to the schools free of charge, as requested.

5. All films and tapes loaned to the schools are checked for possible damage, and necessary repairs are made, following each use.

The Center circulates its materials by means of a "pony" which consists of six trucks that deliver and pick-up from the schools daily. The Center's holdings currently include 2,202 original film titles, 109 overhead transparency titles, 64 filmstrip sets, 59 sets of slides, 544 records, 20 filmstrips with accompanying tapes, and 849 tape recordings. These are either circulated or duplicated for use. Since many of the inexpensive materials, such as slides, tapes, transparencies, and charts are now reproduced within the center at low cost, the individual schools are in the process of building up their own resource supply. As an example of this, in the summer of 1967, the Center reproduced over 52,000 transparencies for the independent school collections.

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RETRIEVAL TERMS

600 Information Systems, Data Systems, Information Transfer
601 Libraries
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604 Document-handling systems
605 Media
606

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607 National Advisory Commission on Libraries

ABSTRACT

800 This paper discusses three types of extra-library information services:
801 Document-handling systems, data-handling systems, and information
802 analysis centers. It gives reasons for the development of extra-library
803 information services and enumerates the characteristics of these serv-
804 ices. What extra-library services offer the user and what they offer the
805 traditional library is discussed. One section is devoted to a discussion
806 of media, the document and the electronics medium, employed in trans-
807 ferring information. The role of the computer with regard to both of
808 these media is developed. Recommendations and examples of several
809 extra-library information services are presented.
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