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A GUIDE TO INFORMATION TOOLS, METHODS, AND RESOURCES IN SCIENCE AND ENGINEERING.

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This guide is a recapitulation of the substantive content of a one-and-a-half day course which was given before three groups of Federal scientists and engineers. The purpose of the course was to train and inform working scientists and engineers as to the most direct and efficient means of seeking and acquiring information. A problem-solving approach is taken, in which the type of information or information problem is discussed and then the means or tools for locating or solving it are presented. Chapters presented in this way are about sources of information about information, and information about on-going research and development results, current or recent research and development results, and past research and development results. Also included are descriptions of some of the nation's major literature and information resources, a presentation of methods of organizing personal index files to provide means of retrieving useful documents later, and a discussion of the major potential effects of the scientist and engineer on information tools and mechanisms. Appendices deal with the methods of gaining access to security classified documents; discuss ways and conditions for acquiring other types of government documents, such as patents and congressional documents; and present an annotated bibliography of fifteen items for further reading in information technology. (CM)

HERNER & COMPANY

Progress through effective use of information

A GUIDE TO INFORMATION

TOOLS, METHODS, AND RESOURCES

IN SCIENCE AND ENGINEERING

A GUIDE TO INFORMATION

TOOLS, METHODS, AND RESOURCES

IN SCIENCE AND ENGINEERING

Prepared by
Saul Herner

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July 1968

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[DRAFT]
July 12, 1968

PREFACE

This guide is a recapitulation of the substantive content of a one-and-a-half day course which was given before three groups of Federal scientists and engineers during the Fall of 1967. The course was developed under the sponsorship of the Panel on Education and Training of the Committee on Scientific and Technical Information (COSATI), with financial support from the U. S. Office of Education. Its purpose was to train and inform working scientists and engineers as to the most direct and efficient means of seeking and acquiring work-related information.

The impetus for the course was the recognition of the growing need for working scientists and engineers to share and participate in the existing and emerging information tools and mechanisms, and to avail themselves of the opportunities afforded by the newer approaches to information collection, organization, and dissemination. A further, related purpose of the course was to facilitate the fullest possible participation of the working scientist and engineer in the evolution of information services and mechanisms which are likely to have a greater and greater effect on their professional activities. Consciously or unconsciously, as a result of the increasing mechanization of the information flow process, the scientific and engineering user of information services and systems is having a greater and greater effect on what they do for him and how they do it. However, in order to make these services and systems as beneficial as possible, it is necessary to understand their nature.

In developing the course syllabus, we tried to avoid the conventional compendium or compilation approach which, all too frequently, results in a mere recitation of a bibliography of information tools; instead, we elected to use a functional or problem-solving approach, in which we first discuss the type of information or information problem and then describe the most efficient means or tools for locating or solving it. Thus, the chapters are given to discussions of sources of information about information, information about ongoing research and development, current or recent R&D results, and past R&D results.

Following the chapter on past research results, we depart from our functional or problem-oriented approach in a chapter describing major exemplary libraries and literature collections in the United States. The purpose of this chapter is to acquaint the reader with some of the nation's major literature and information resources and, in so doing, to complement the functional or problem-oriented chapters, which deal primarily, although not exclusively, with specific tools and techniques rather than institutional repositories.

The chapter following is given to methods of organizing personal index files, to provide means of organizing or "tagging" useful documents for later search, once located and acquired. The last chapter is given to a discussion of the major potential effects of the scientist and engineer on information tools and mechanisms, and vice versa. This is followed by appendices dealing with methods of gaining access to security classified documents issued by, or under the aegis of, the various defense oriented departments and agencies of the Government, methods and conditions for

acquiring certain other types of Government documents, and with suggestions for further reading in information technology and its present and potential products and services.

One final caveat is in order. It is near impossible in a single course, or a single book, to do justice to the information resources of the entire range of science and technology. One can only hope, at best, to highlight some of the most prominent ones. On the other hand, through the use of the directories and guidance services described, particularly in the first chapter, it should be possible to track down the most effective sources of practically every type of information that the scientist or engineer is likely to require in support of his work. Additionally, owing to the increasingly interdisciplinary nature of science and technology, particularly in their applied or mission-oriented aspects, there are few major information tools or facilities which, regardless of their official titles, deal exclusively with narrow subject areas; most deal with a broad variety of subjects and serve wide audiences. Thus, a general knowledge of the major information tools and resources, can be extremely valuable to the scientist or engineer, regardless of his specific field or activity.

While ultimately responsible for the form and content of this guide, I am deeply indebted to many people for advice and assistance in its preparation. Most prominent among these are: Dr. Lee G. Burchinal, Director, Division of Information Technology and Dissemination, U. S. Office of Education, and Chairman, COSATI Panel on Education and Training; the other members of the Panel; the U. S. Civil Service Commission Office of Career

Development, which furnished not only guidance in the development of the course syllabus but also classroom facilities for the conduct of the course; Melvin Weinstock, who prepared the lectures and chapters on principal resource collections in the United States, and the organization of personal index files; and John P. Knable II, who assisted in the preparation of the descriptions of the tools, facilities, and resources that constitute the bulk of this guide. Last, but certainly not least, I am indebted to the scientists and engineers who attended the three sessions of the course, and whose frank comments and criticisms are closely reflected in the structure and content of the course and this guide.

Washington, D.C.
July 12, 1968

ADDENDUM NO. 1

Chapter 2

Insert:

FAST ANNOUNCEMENT SERVICE (FAS). Irregular. U. S. Department of Commerce, Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151. $5.00 per year.

A selective announcement bulletin, FAS consists of one or two page sheets noting new acquisitions at the Clearinghouse. Any or all of the 57 subject categories may be received by subscription; frequency of FAS depends on the number of reports received at the Clearinghouse. More than 5000 U. S. Government-sponsored (unclassified) R&D reports are noted annually with brief, newsy annotations. No indexes.

Chapter 4

Insert:

BIBLIOGRAPHY OF AGRICULTURE. U. S. National Agricultural Library, 1942-. V. 1. Monthly. Available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. $19.00/year.

Cites over 100,000 references per year in world literature in the fields of plant science; soils; forestry; animal industry; entomology; agricultural engineering products and economics; and food and human nutrition. Arranged in a subject classified order, it contains monthly author indexes and cumulates annually, personal and corporate author and subject indexes. Also includes an annual cumulation of translations received in the National Agricultural Library.

METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS. Boston, Mass. American Meteorological Society, 1950-. Monthly. $90.00/year.

Over 11,000 abstracts and bibliographic references a year are noted from all world literature in the fields of meteorology, oceanography, hydrology, geophysics and astrophysics. Arranged by subject, with Universal Decimal Classification numbers provided. Author, subject, geographical, and journal indexes are published monthly and annually.

PHYSICS ABSTRACTS (Science Abstracts. Section A). London, Institution of Electrical Engineers, 1898-. Monthly. £6.

A classified subject arrangement, by the Universal Decimal Classification, of over 15,000 abstracts of world literature in the fields of physics, nuclear physics, physical chemistry, geophysics and biophysics. Individual issues contain author indexes and subject and author indexes appear annually.

1

INFORMATION ABOUT INFORMATION

Traditionally, in considering formal sources of information in science and technology, one thinks of three types of media: primary (papers, monographs, and reports discussing the results of original research and development undertakings), secondary (textbooks, review publications, abstracting and indexing publications, and similar descriptive,and occasionally critical, compendia of primary publications), and tertiary (descriptive compendia of primary and secondary sources of information). This chapter deals with the major tertiary sources of information which have been, or can be, of use to the working scientist and engineer. Many of these have been around for a long time, being traditional library tools; others are of more recent origin, reflecting a growing awareness and concern for the need of improved means of directing the working scientist and engineer to the most expeditious primary or secondary sources of work-related information from an ever burgeoning array of possibilities.

The National Referral Center for Science and Technology and its several published compendia constitute perhaps the most prominent reflection of the recognition of the need for rapid and efficient means for directing the scientist and engineer to the most likely sources of required information. Dealing primarily with institutional sources of information, such as specialized information centers and libraries, the Referral Center is essentially complementary to the other tertiary sources discussed in this chapter, in that they deal primarily (although certainly not exclusively)

with written and published media. Taken as a whole, the tertiary sources described in this chapter deal with practically every form in which scientific and technical information is communicated or acquired.

AMERICAN BOOK PUBLISHING RECORD (BPR). New York, R. R. Bowker Co., 1960-. Monthly. $15.50/year.

A monthly cumulation of announcements of books newly published, taken from the Weekly Record listings of Publishers' Weekly (See p.10). Bibliographic information is taken from author entry and descriptive information supplied by the Library of Congress. Price and, in some cases, descriptive annotations are added. Arrangement is in Dewey Decimal Classification order with author and title indexes at the end of each issue.

AMERICAN LIBRARY DIRECTORY. A classified list of libraries in the United States and Canada with personnel and statistical data, plus a selected list of libraries around the world, 25th edition. Compiled biennially by Eleanor F. Steiner-Prag. New York, R. R. Bowker Co., 1967. Biennial. $25.00.

A guide to public, university and college, special, medical, law, etc., libraries of the United States and Canada. Elementary and secondary school libraries are omitted. Arrangement is geographical by state and city and within each location by name of library. Entries contain: name and address, telephone numbers, personnel (names of key people), number of volumes, expenditures, subject interests, and special collections. Also included are lists of: public library extension agencies, school library agencies, library schools and training courses, U. S. Armed Forces libraries overseas, U. S. Information Centers, and an international library directory arranged by country. Indexes to regional libraries and educational institutions and to special libraries are provided.

AMERICAN SCIENTIFIC BOOKS 1964-1965. A basic selection of scientific, technical, and medical books as entered in the American Book Publishing Record. Edited by Phyllis B. Steckler. New York, R. R. Bowker Co., 1965. Annual. $8.00.

An annual cumulation of entries from the scientific, technical, and medical sections of the American Book Publishing Record (See p.2), covering the period April 1964 to March 1965. Subject arrangement by the Dewey Decimal Classification. Author and title indexes. Bibliographic information is taken from information supplied by the Library of Congress. Price and, in some cases, descriptive annotations are added.

ASH, LEE and LORENZ, DENIS. Subject Collections; a guide to special book collections and subject emphases as reported by university, college, public, and special libraries in the United States and Canada. 3rd edition. New York, R. R. Bowker Co., 1967. $20.95.

A compilation of about 35,000 references to special collections or library emphases on special subject interests. Alphabetical arrangement by subject, including personal names as subjects. Subject headings are based on the ninth edition of "Sears List of Subject Headings." Listing under each heading is alphabetical by state, then city, then name of library. Entries include: name of library, name of librarian and/or special collection, address, number of volumes, annual budget, notes on scope and type of material in collection.

BOOKS IN PRINT (BIP). An author-title-series index to the Publishers' Trade List Annual. Edited by Sarah L. Prakken. New York, R. R. Bowker Co. Annual. 2 v. Vol. 1 - Authors; Vol. 2 - Titles and Publishers. $21.85.

An annual index to books currently available from 1600 American publishers. Arrangement is in two sequences: (1) Author; (2) Title. Entries in "Author" sequence include: author, co-author, title, price, publisher, and year of publication. Entries in the "Title" listing include: title, author, price, and publisher. Thus, more complete bibliographic information is usually found in the "Author" volume. Alphabetical listing of American publishers appears at the end of the "Title" volume. BIP covers paperbacks as well as hardbound books.

BRITISH UNION CATALOG OF PERIODICALS (BUCOP). A record of the periodicals of the world, from the seventeenth century to the present day, in British libraries. New York, Academic; London, Butterworths, 1955-8. 4 v. $128.00.

A union list of serials received in participating British libraries which began publication in or after 1960, changed title, began a new series, or ceased. Entries include: title, publisher, place, date and volume number of beginning publication, bibliographical notes, and holdings in participating libraries. Supplements British Union Catalog of Periodicals.

CUMULATIVE BOOK INDEX. A world list of books in the English language. New York, H. W. Wilson Co., 1898-. Monthly, except July and August. Sold on service basis (prices based on sizes of library collections).

An author, title, and subject index in one alphabet to books published in English throughout the world. Coverage of Great Britain, Canada, and the United States occupies the main part of each issue, while a check list in the front covers books published in English in other countries of the world. Author entries include name, birth and death dates where known, title and subtitle, collation, price, publication year, publisher, and Library of Congress card number.

DIRECTORY OF DEPARTMENT OF DEFENSE INFORMATION ANALYSIS CENTERS. Washington, D.C., Office of Naval Research, 1965. Distribution made by issuing office.

Lists information analysis centers supported wholly or in part by Department of Defense funds. These centers emphasize the provision of technical information as opposed to citations or documents. Arrangement is alphabetical by name of center. Entries include: name of center, address, name of director, name of cognizant DoD official, mission of the center, and subject coverage. These centers are primarily for the use of the DoD community, including its contractors.

DIRECTORY OF INFORMATION RESOURCES IN THE UNITED STATES. Washington, D.C., Library of Congress, National Referral Center for Science and Technology, 1965-. Irregular.

- Physical sciences, biological sciences engineering. 1965. $2.25, from U. S. Government Printing Office.

- Social sciences. 1965. $1.50, from U. S. Government Printing Office.

- Water. 1966. $1.50 from U. S. Government Printing Office.

- Federal Government. $2.75 from U. S. Government Printing Office.

A series of directories of information resources in various subject fields. Resources included are: libraries and bibliographic services, centralized information centers capable of providing processed and evaluated data, professional societies and other organizations through which contact can be made with specialists, industrial firms willing to extend their services beyond their own organization, Government agencies, and other resources which make scientific and technical information available in some form. Each directory, in its foreword, makes more specific general statements regarding the types of information resources it lists. Entries include: name of resource; address and telephone number; areas of interest; holdings; publications; information services; other services; facilities (where applicable). Format varies slightly from one directory to another. Arrangement is alphabetical by name of resource. Subject indexes are provided in each directory and the last three include organization indexes.

DIRECTORY OF SPECIAL LIBRARIES AND INFORMATION CENTERS. 2nd edition. Edited by Anthony T. Kruzas. Detroit, Michigan, Gale Research, 1968. $25.00.

A listing of a wide variety of special libraries and information facilities in the United States and Canada. Arrangement is alphabetical by name of library. Types of library included are:

- Subject divisions, departmental and professional libraries in colleges and universities.

- Subject divisions of large public library systems.

- Company libraries.

- Federal, state, and municipal governmental libraries.

- Libraries supported by nonprofit organizations, associations, institutions and societies.

- Information centers which fall into the categories noted above but which usually cover a narrower subject field and which offer analyzed and evaluated data in response to specific requests.

Entries include: name of sponsoring organization, name of library or information center, address, name of head of library or information center, telephone number, date founded, size of staff, subject emphasis, special collections, size of holdings, number of serial titles taken, services provided and limitations thereon, serial publications issued by the library or information center, unique or unusual indexes locally prepared or maintained, and names of principal staff. Appended to the volume are lists of U. S. Information Service libraries, U. S. Regional Libraries for the Blind, libraries of the United Nations and related intergovernmental agencies, U. S. Geological Survey Public Inquiry Offices, U. S. Commerce Department Field Offices, ERIC Clearinghouses, DoD Information Analysis Centers, National Standard Reference Data System data centers, USAEC Specialized Information and Data Centers, National Library of Medicine MEDLARS Search Centers, NASA Regional Dissemination Centers, and U. S. Coast and Geodetic Survey Regional Offices.

DIRECTORY OF USAEC SPECIALIZED INFORMATION AND DATA CENTERS. Bethesda, Md., U. S. Atomic Energy Commission, Division of Technical Information, 1967. Distribution made by issuing office.

A listing of specialized information and data centers supported wholly or in part by the USAEC. These centers provide, for the most part, technical data of various kinds as opposed to references or citations. Arrangement is alphabetical by name of the center. Entries give: name and address of center, sponsor, year started, scope, services provided by the center, number and type of staff, and user qualifications.

INTERDOK. Directory of published proceedings. White Plains, N. Y., Interdok Corporation.

Series SEMT: Science/Engineering/Medicine/Technology, 1966-. Monthly. $48.00/year.

Series SSH: Social Science/Humanities, 1968-. Quarterly. $45.00/year.

Lists proceedings of conferences, meetings, seminars, symposia, congresses. Proceedings are in chronological sequence by meeting date. Each entry gives place of meeting, name, sponsor, name and address of publisher and the price. Editor, location and subject/sponsor indexes. Volumes are cumulated annually in the same format and are available separately.

KLEIN, BERNARD. Guide to American directories. 7th edition. New York, McGraw-Hill, 1968. $25.00.

Lists directories published by business and reference book publishers, magazines, trade associations, chambers of commerce, and city, state, and Federal governments. Arranged in about 415 subject categories. Entries include: name of directory, frequency of publication, name and address of publisher, and price. Indexed by directory name.

LIBRARY JOURNAL (LJ). New York, R. R. Bowker Co., 1876-. v. 1-. Semimonthly. $10.00/year.

A journal edited for the library community and containing, in addition to articles and other features, a "Books to Come" section with information on new books to be published. Scientific, technical, medical, and business books are listed three times a year and the listing covers the ensuing four to six months. Other types of books are covered in other LJ issues. Arrangement is by subjects and entries include: author, title, descriptive annotation, expected publication date, publisher, and price. Every issue of LJ has a book review section which reviews scientific and technical books as well as others likely to be of general interest rather than those for the specialist.

LIBRARY OF CONGRESS CATALOG, BOOKS: SUBJECTS. A cumulative list of works represented by Library of Congress printed cards. Washington, D.C., Library of Congress. Quarterly, with annual and quinquennial cumulations. Annual subscription for 1968, $250.00, from: Card Division, Library of Congress, Bldg. 159, Navy Yard Annex, Washington, D.C. 20541.

A continuing and cumulative subject bibliography of recent works currently received and cataloged by the Library of Congress and by other libraries contributing to its joint cataloging program, insofar as these works are represented by LC printed cards. Entries are included for books, pamphlets, maps, atlases, periodicals, and other serials. Descriptive notes are eliminated from the entries.

NATIONAL DIRECTORY OF NEWSLETTERS AND REPORTING SERVICES. A reference guide to national, international, and selected foreign newsletters, information services, financial services, association bulletins, training and educational services. Detroit, Michigan, Gale Research, 1966. $20.00.

Contains information on 1566 newsletters and reporting services which meet rather elaborate criteria for inclusion. Broad subject arrangement in 12 categories. Each entry includes: title, publisher, address, editor's name, subjects covered, frequency of publication, subscription rate, and year founded. Title, publisher, and subject indexes.

NATIONAL REFERRAL CENTER FOR SCIENCE AND TECHNOLOGY. Fifth Floor, Library of Congress Annex, Second Street and Independence Avenue, S.E., Washington, D.C. 20540. Mailing Address: National Referral Center for Science and Technology, Library of Congress, Washington, D.C. 20540. Telephone: (202) 967-8265.

Purpose and Function: The Center "provides a single place to which anyone with an interest in science and technology may turn for advice on where and how to obtain information on specific topics." The Center does not itself provide technical detail or bibliographic services, but rather refers the requestor to those who can.

Information Services: Answers inquiries in the physical, biological, and social sciences; engineering; and related technical areas. Provides names, addresses, telephone numbers, and brief descriptions of appropriate information resources. Resources utilized include: professional societies, university research bureaus and institutes, Federal and state agencies, industrial laboratories (if willing to share specialized knowledge outside of their own organization), museum specimen collections, testing stations, individual experts, and more traditional sources such as technical libraries, information and document centers, and abstracting and indexing services. Queries to the Center should include a precise statement of the specific information desired, a statement of the resources already consulted, and a statement of the requestor's special qualifications, if any. Requests may be made in person, by letter, or by telephone. Services of the Center are free.

Publications:* Directory of Information Resources in the United States:

* For a detailed description of these publications, see p.4.

- Physical sciences, biological sciences, engineering (1965)

- Social sciences (1965)

- Water (1966)

- Federal government, with a supplement of government-sponsored information resources (1967).

THE NATIONAL UNION CATALOG (NUC). A cumulative author list representing Library of Congress printed cards and titles reported by other American libraries. Washington, D.C., Library of Congress. Monthly, except March, June, September, with quarterly, annual, and quinquennial cumulations. $500.00 for 1968 from: Card Division, Library of Congress, Bldg. 159, Navy Yard Annex, Washington, D.C. 20541.

An author list of works cataloged by the Library of Congress and by the libraries contributing to its cooperative cataloging program during the period of its coverage. Also includes entries for monographic publications issued in 1956 and after, reported by about 950 North American libraries and not represented by LC printed cards. NUC contains entries for books, pamphlets, maps, atlases, periodicals, and other serials. Entries are essentially reproductions of LC catalog cards with entries from other libraries typed into a consistent format.

NEW SERIAL TITLES. Union list of serials commencing publication after December 31, 1949. Washington, D.C., Library of Congress, 1953-. Monthly, with annual cumulation. $115.00/year from: Card Division, Library of Congress, Bldg. 159, Navy Yard Annex, Washington, D.C 20541.

A union list (directory of titles and the libraries that receive them) of serials received in more than 600 participating libraries. Entries include: title, name of issuing body, place of publication, and issues owned, noted in terms of inclusive periodical issue numbers and dates.

NEW SERIAL TITLES 1950-1960. Supplement to the Union List of Serials, 3rd edition. Washington, D.C., Library of Congress, 1961. 2 v. Out of print.

A cumulation of New Serial Titles for the period indicated. Alphabetical title arrangement using the form of entry prescribed by the A.L.A. Cataloging Rules (2nd edition, 1949). For details see New Serial Titles below.

NEW SERIAL TITLES. Supplement to the Union List of Serials, 3rd edition. 1961-1965 Cumulation. New York, Bowker-Arno, 1966. 3 v. $38.35.

A five year cumulation of New Serial Titles for 1961-1965. Alphabetical title arrangement using the form of entry prescribed by the A.L.A. Cataloging Rules (2nd edition, 1949). Volume 3 is a listing of changes in titles for the period of the cumulation.

PUBLISHERS' WEEKLY. The book industry journal. New York, R. R. Bowker Co., 1872-. $15.00/year.

A weekly journal containing news and feature articles relating to the book trade and a "Weekly Record" section listing books published in the United States during the previous week. Bibliographic information presented for each work is that found in the author entries and descriptive cataloging of the Library of Congress with the addition of the price and occasional descriptive annotations. Last issues of January and August contain publishers' advertisements of books to come in Spring and Fall, respectively. There are title and author indexes to these advertisements. Index entries include: title, author, price, publisher, and expected publication date.

SCHMECKEBIER, LAURENCE F. Government publications and their use, by Laurence F. Schmeckebier and Roy B. Eastin. Washington, D.C., The Brookings Institution, 1961. $6.00.

"The purpose of this volume is to describe the basic guides to government publications, to indicate the uses and limitations of available indexes, catalogs, and bibliographies, to explain the systems of numbering and methods of titling, to call attention to certain outstanding compilations or series of publications, and to indicate how the publications may be obtained." A very useful work providing the type of information noted above, particularly with reference to Federal and state laws, congressional publications, Federal and state consti-

tutions, Presidential Papers, foreign affairs, maps, periodicals, etc. Some parts of the book dealing with technical publications are dated in some details, but the bulk of the book is descriptive of current practice.

SCIENTIFIC MEETINGS AND CONFERENCES. Ottawa, National Research Council of Canada, Scientific Liaison Office. Tri-annually. From Scientific Liaison Office, National Research Council of Canada, Sussex Drive, Ottawa, Canada. Distribution made by issuing office.

A list of upcoming meetings and conferences in the physical, biological, mathematical, and medical sciences and engineering. Chronologically arranged by meeting date for about three years in advance. Entries include: date(s), name of meeting, address for information, location. Subject index provided.

SPECIALIZED SCIENCE INFORMATION SERVICES IN THE UNITED STATES. A directory of selected specialized information services in the physical and biological sciences. Washington, D.C., National Science Foundation, Office of Science Information Service, 1961. Out of print.

Descriptions of information service activities of 427 different organizations or projects in the United States arranged alphabetically within 25 broad subject categories. Only those activities which provide some degree of service beyond their own organization and which provide a continuing service beyond the publication of a periodical are included. Entries contain: name of service, address and telephone number, scope, user qualifications required, type of materials in collection, information services, and prices for publications and/or services. Indexing is by subject and organization name in one alphabet.

STANDARD PERIODICAL DIRECTORY. 2nd edition (1967). New York, Oxbridge Publishing Co., 1964-. Annual. $25.00.

A guide to 39,000 periodicals published in the United States and Canada, including newsletters, house organs, government publications, advisory services, etc., which are not normally covered in other directories. Entries arranged in 222 subject categories. Each entry contains: title, source, editorial description, year started, frequency of publication, price, subscriber qualifications

(if any), circulation, and advertising rate. Subject cross index, title index, and edge index to subject categories.

STANDARD PERIODICAL DIRECTORY. Semi-Annual Supplement. New York, Oxbridge Publishing Co., 1967. Included in price of Standard Periodical Directory.

Supplements annual editions of main work (above). Entries arranged by subject category. Each contains title, source, year started, frequency of publication, price, and circulation. Coverage of periodicals by major abstracting and indexing services is also included, when applicable.

ULRICH'S INTERNATIONAL PERIODICALS DIRECTORY. A classified guide to a selected list of current periodicals, foreign and domestic. 12th edition, edited by Marietta Chicorel. New York, R. R. Bowker Co., 1967-68. 2 v. Vol. 1 - Scientific, technical, medical; Vol. 2 - Arts, humanities, business, and social sciences. V. 1, $15.00; V. 2, $15.00.

A worldwide listing of periodicals, including: title, date of inception, frequency of publication, price, publisher, circulation, and coverage by major abstracting and indexing services. Classified arrangement in broad subject areas subdivided into more specific ones. Title and subject index in one alphabet. Also includes list of cessations since last edition.

UNION LIST OF SERIALS IN LIBRARIES OF THE UNITED STATES AND CANADA. 3rd edition. Edited by Edna Brown Titus. New York, H. W. Wilson Co., 1965. 5 v. $120.00.

A directory of 156,449 serial titles held by 956 libraries in the United States and Canada. Alphabetical title arrangement. Entries include: title, place, date started, volume numbering, name changes, and library holdings. The basic source of information on the location of journal subscriptions and holdings in libraries.

U. S. LIBRARY OF CONGRESS. SCIENCE AND TECHNOLOGY DIVISION. A guide to the world's abstracting and indexing services in science and technology. Washington, D.C., 1963. (National Federation of Science Abstracting and Indexing Services. Report No. 102.) Out of print.

A guide to "continuing bibliographical services aiding in the documentation of the scientific and technical literature of the world." Main section contains listing of the services by title. Each entry shows complete bibliographic information as well as information on scope, arrangement, indexes, source, price, etc. Also included are an arrangement of short titles by subject, a listing of services by country of origin, and an alphabetical subject index.

WINCHELL, CONSTANCE M. Guide to reference books. 8th edition. Chicago, American Library Assn., 1967. $15.00.

An annotated listing of about 7500 works of general reference in all fields. Entries arranged in five parts, i.e., Part A, General Reference Works; Part B, The Humanities; Part C, Social Sciences; Part D, History and Area Studies; Part E, Pure and Applied Sciences. Within each part, entries for each subject are arranged by type of work, i.e., Guides and Manuals; Bibliographies; etc. Extensive author, title, and subject indexes in one alphabet.

WORLD LIST OF FUTURE INTERNATIONAL MEETINGS. Washington, D.C., Library of Congress, 1959-. Bimonthly. $6.00/year, from the U. S. Government Printing Office.

A listing of international (bodies in which three or more countries are represented) meetings for ensuing three years. Two parts: Part 1 - Science, technology, agriculture, medicine; Part 2 - Social, cultural, commercial, humanistic. Entries include: name of meeting, location, date(s), address for information. Chronological arrangement within each part. Combined subject, sponsor, geographical location index to both parts.

WORLD LIST OF SCIENTIFIC PERIODICALS PUBLISHED IN THE YEARS 1900-1960. 4th edition. Washington, D.C., Butterworth's, 1963. 3 v. $84.00

An alphabetical listing by title of about 60,000 scientific periodicals published during the period indicated. Entry is by first word, not an article, in the title and includes: complete title, place of publication, title abbreviation, and British library holdings. Supplemented by supplements to the British Union Catalog of Periodicals. (See p.3).

WORLD MEETINGS, UNITED STATES AND CANADA. A two-year registry of future medical, scientific, technical meetings. New Hartford, N.Y., TMIS, 1963-. Quarterly. $25.00/year from TMIS, 22 Imperial Drive, New Hartford, N. Y. 13413.

A guide to upcoming medical, scientific, and technical meetings to be held in the United States and Canada. Divided into two main sections: (1) Data section, and (2) Index section. The Data section entries give: name, headquarters, and date(s) of meeting; sponsor; contact for general information; technical content of meeting; estimated attendance and restrictions thereon; abstract and paper deadline and contact for more information; information on publication of papers; information on exhibits. Arrangement is chronological by quarters. Five indexes: date of meeting, keyword, deadline for paper or abstract, location, sponsor.

2

INFORMATION ON ONGOING RESEARCH AND DEVELOPMENT

This chapter, contrasted with the preceding one, deals with information on R&D activities which are currently operational, and on which no final reports of results have been issued in published form.

With the increasing dynamicism of science and technology, the need for bridging the time gap between concurrent research and development and the ultimate reporting of results has become increasingly recognized. The publications and services described in this chapter are a reflection of this growing recognition and need.

In general, the publications and services dealing with ongoing research take four distinct forms. The first, illustrated by the correspondence sections of Nature and Science, and by Physical Review Letters, consists of letters or announcements prepared, as a rule, by the principal investigators of the projects involved. The second type, illustrated by the new publication, Accounts of Chemical Research, consists of reviews of research trends in a given field. The third, illustrated by Nuclear Science Abstracts, deals, among other media, with progress reports on ongoing research projects. The fourth, illustrated by the Science Information Exchange and the Division of Research Grants of the National Institutes of Health, are essentially repositories of descriptions of ongoing R&D projects to which questions can be addressed. The Division of Research Grants, in common with a number of other similar activities in other agencies, also issues and distributes annual and interim compendia of project descriptions.

Following are major illustrative publications and services dealing with information on ongoing research:

ACCOUNTS OF CHEMICAL RESEARCH. Easton, Pa., American Chemical Society, 1968-. Monthly. ACS members, gratis; non-members, $10.00.

Contains accounts of research in areas of chemistry under active investigation. "Most articles are written by scientists personally contributing to the area reviewed." Four or five articles in each issue.

CLEARINGHOUSE ANNOUNCEMENTS IN SCIENCE AND TECHNOLOGY (CAST). Springfield, Va., Clearinghouse for Federal Scientific and Technical Information, 1968-. Bimonthly. $5.00 ($6.25 foreign) for first category and $5.00 ($6.25 foreign) for each additional two or fewer categories.

CAST is a service which announces new reports of Government-sponsored R&D and translations in 46 information categories on a biweekly basis. Included are progress reports on ongoing projects. Format is that of U. S. Government Research and Development Reports (USGRDR) (See p.22). Subscribers may subscribe to as many or as few of the fields as they wish.

COMMERCE BUSINESS DAILY. A daily list of U. S. Government procurement invitations, subcontracting leads, contract awards, sales of surplus property and foreign business opportunities. Chicago, Ill., U. S. Department of Commerce, Office of Field Services, 1950-. Daily, Monday through Friday, except on Federal holidays. $15.00/year from Superintendent of Documents, U. S. Government Printing Office.

A listing of U. S. Government procurement invitations, etc. (see above), arranged by: services, supplies, equipment and materiel, and foreign business opportunities. Listings of new R&D contract awards are included from time to time. Not indexed.

DIRECTORY OF GRADUATE RESEARCH 1967. Washington, D.C., American Chemical Society. Biennial. $5.00.

A directory of research being carried on by faculty members in colleges and universities in the United States and Canada, offering advanced degrees in any or all of the following fields: chemistry, biochemistry, chemical engineering, pharmaceutical and/or medicinal chemistry. Arrangement is alphabetical by name of institution in the four major sections given above. Several faculty members and the chairmen of the listed departments are given along with the research interests of each and a list of the papers they have published since the last issue of the Directory. Instructional staff (name) index only. Subject searches using this volume would be impractical.

NASA RESEARCH AND TECHNOLOGY PROGRAM FLASH INDEX. Washington, D.C., National Aeronautics and Space Administration, Office of Advanced Research and Technology, 1964-. Annual. Distribution made by Issuing Office.

A listing by title of NASA Work Units (NASA Form 1122), describing current NASA supported R&D, arranged in five sequences: alphabetical by keywords with one or more Work Units under each word; by major program number; by supporting research and technology (SRT) subprogram; by installation; and by program number order of the technical contacts for information about a particular Work Unit. Requests for copies of Work Units from Government agencies are filled by the NASA Office of Advanced Research and Technology. Requestors outside of the Government may obtain copies of Work Units from the Science Information Exchange (See). Work Units are one page forms containing short resumes of research and development projects in progress and other relevant information such as contract number, level of funding, name(s) of principal investigator(s), starting and ending dates, descriptors, etc.

NATURE (London). A weekly journal of science. London, Macmillan (Journals) Ltd., 1869-. Weekly. $39.00/year.

Contains numerous short accounts of current research in all of the sciences. There are also longer articles of a scientific nature as well as discussions of public policy and current events as they relate to science. Reviews of current scientific books are included.

NUCLEAR SCIENCE ABSTRACTS (NSA). Washington, D.C., United States Atomic Energy Commission, Division of Technical Information, 1948-. v.1-. Semimonthly. $30.00/year from the Superintendent of Documents, U. S. Government Printing Office.

A comprehensive abstracting and indexing coverage of the international literature on nuclear science and technology. Covered are: scientific and technical reports of the U. S. Atomic Energy Commission and its contractors; reports from other Government agencies, and of other governments, universities, industrial and research organizations; patents; books; and worldwide journal literature. The reports include progress reports on current projects. Arrangement is by broad subject category, broken down into more specific subcategories. Included in each issue are corporate author, personal author, subject, and report number indexes. Cumulative indexes are sold separately (See p.41).

PHYSICAL REVIEW LETTERS. New York, American Physical Society, 1958-. Weekly. $15.00/year.

Contains "short communications dealing with important new discoveries or topics of high current interest in rapidly changing fields of research, and abstracts of articles to be published in future issues of The Physical Review." Letters and abstracts in separate sections. Each letter has an abstract. Table of contents - no indexes.

RESEARCH CONTRACTS AND SUPPLEMENTARY AGREEMENTS, Bethesda, Md., U. S. Department of Health, Education, and Welfare, Public Health Service, National Institutes of Health, Research Contracts Section. Quarterly. Distribution made by the Research Contracts Section.

A listing by state and by foreign country of the research contracts and supplementary agreements executed during the period covered by the report. Gives name of contractor, scope of work, name of sponsoring organization (usually an NIH institute), and dollar amount of contract.

RESEARCH CONTRACTS IN THE LIFE SCIENCES. Germantown, Md., U. S. Atomic Energy Commission, Division of Biology and Medicine. Annual. Distribution made by the issuing office.

The body of this publication consists of a detailed listing of off-site contracts of the Division of Biology and Medicine of the U. S. Atomic Energy Commission arranged alphabetically by institution in 18 subject categories and subcategories. Each entry gives name and address of contractor, AEC contract number, name(s) of principal investigator(s), title of contract, cumulative amount and period funded, and current level of support. Also included are an alphabetical index by institution, a summary of contracts by state, listing institutions within each state, and a general summary of current fiscal year costs by program category and by type of institution. A summary of on-site contracts by total costs for each AEC laboratory is also given.

RESEARCH CONTRACTS IN THE PHYSICAL SCIENCES. Germantown, Md., U. S. Atomic Energy Commission, Division of Research. Annual. Distribution made by the issuing office.

A listing of contract research projects supported by the AEC Headquarters Division of Research, arranged alphabetically within several broad subject areas. Given are name and address of contractor, name(s) of principal investigator(s), short descriptive title of the research, and the level of support during the most recent funding period. Also included are: a list of major AEC research centers with their level of support for the current fiscal year, a summary of off-site contracts by type of organization and subject area, a summary of new proposals received and actions taken, and a summary, by state, of numbers of contracts awarded and amounts of money involved.

RESEARCH GRANTS AND AWARDS, U. S. PUBLIC HEALTH SERVICE. Announced during (Month and year). Bethesda, Md., U. S. Department of Health, Education, and Welfare, Public Health Service, National Institutes of Health, Division of Research Grants. Monthly. Distribution made by issuing office.

Contains four sections, each arranged alphabetically by state. These are: Research Grants, Fellowship Awards, Research Career Development Awards, and International Fellowship Program. Each entry gives name of institution, grantee, title of grant or award, dollar amount. Overall dollar summaries by granting institution are included.

RESEARCH GRANTS INDEX. Washington, D.C. U. S. Department of Health, Education, and Welfare, Public Health Service, 1961-. Annual. 2 v. Volume 1 - Index Section. Volume 2 - Grant Number List and Bibliography; General Research Areas; Alphabetical List of Investigators. $10.00/set from Superintendent of Documents, U. S. Government Printing Office.

An index to research grants and contracts of the Bureau of State Services and National Institutes of Health of the U. S. Public Health Service. Volume 1 is an alphabetical arrangement, by subject heading, of research grants and contracts. Volume 2 has three sections: a listing of research grants and contracts by PHS project number; a categorization of projects by general research areas; and an alphabetical listing of investigators. Detailed description of format given in front of Volume 1.

RESEARCH IN EDUCATION. Washington, D.C. U. S. Department of Health, Education, and Welfare, Educational Resources Information Center (ERIC), 1966-. Monthly. $11.00/year, from the Superintendent of Documents, U. S. Government Printing Office.

Abstracts and indexes significant and timely research materials collected by the 18 ERIC Clearinghouses. Covered are reports of work sponsored by the Bureau of Research, U. S. Office of Education, as well as reports deriving from other relevant research. Arranged in two main sections: Report Resumes, and Project Resumes. Each is indexed by author or investigator, performing institution, and subject. Report section covers reports that have been published and are available. Project section gives synopses of new projects started. Arrangement of abstracts in Report section is by cognizant clearinghouse; in Project section, it is random. Each entry includes:

Report Section	Project Section
- ERIC accession number (ED 000 000)	- ERIC accession number (EP 000 000)
- Title of report	- Title of research project
- Author(s)	- Investigator(s)
- Report number (originator's)	- Institutional source
- Contract or grant number	- Bureau number (Bureau of Research)
- Price *	- Contract or grant number
- Descriptors	- Descriptors
- OE program code	- Start and end dates of project
- Institutional source	- OE program code
- Publication date	- Proposal date
- Informative abstract	- Informative abstract
- Abstractor's initials	- Abstractor's initials

*NOTE: Reports abstracted are available from ERIC Document Reproduction Service (EDRS) in hard copy or microfiche at varying prices. Ordering details in each issue.

SCIENCE. Washington, D.C., American Association for the Advancement of Science, 1880-. Weekly. $8.50/year.

Contains numerous short accounts of current research in all of the sciences as well as a smaller number of longer articles. Also contains articles relating to science and public policy and other science-related matters. Reviews of current scientific books are included.

SCIENCE INFORMATION EXCHANGE (SIE). 300 Madison National Bank Bldg., 1730 M Street, N.W., Washington, D.C. 20036, Telephone: (202) 381-5511.

Purpose and Function: The Exchange is a clearinghouse for information on research in progress from all available sources, Government, industry, and private. It covers the fields of biology, medicine, sociology, psychology, agriculture, and the physical sciences. It complements the services of technical libraries and documentation centers by providing information about research in progress between the time a project is proposed or started and the time results are made available in published form.

Holdings: Several hundred thousand "Notice of Research Project" forms. These are single page documents which include the following information: name of granting agency, names and addresses of principal and associate investigators, location of the work, title, a 200-word summary of technical detail, and level of effort. DoD provides information on its projects extracted on magnetic tape from their Work Unit Data Bank while NASA provides copies of its "Research and Technology Resume" (Form 1122) for its projects.

Information Services: Provides research investigators associated with recognized institutions with information on who is currently working on a specific problem. In response to inquiries stating the specific research or problem on which information is desired, the Exchange will forward pertinent "Notices of Research Projects." Conversely, information on current research may be furnished to the Exchange by organizations that support research and by individual investigators who wish to register their current projects. Services are currently provided free of charge.

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS (STAR). A semi-monthly abstract journal with indexes. Washington, D.C. National Aeronautics and Space Administration, 1963-. V. 1-. Semi-monthly. $33.00/year from the Superintendent of Documents, U. S. Government Printing Office.

Comprehensive abstracting and indexing journal covering worldwide report literature on the science and technology of space and aeronautics. This includes progress reports on ongoing projects. Bibliographic citations and abstracts arranged in 34 subject categories. Guide to subject categories with scope of each is given in the front of each issue. Subject, personal author, corporate source, report/accession number, and accession/report number indexes, bound at the end of each issue. No periodical literature is abstracted in STAR. The related journal literature is covered in International Aerospace Abstracts (See p.40).

NOTE: Cumulative indexes to STAR are sold separately (See p.42).

CLASSIFIED SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS (C-STAR). Washington, D.C., National Aeronautics and Space Administration, 1963-. v. 1-. Semi-monthly. Free to qualified users.

Classified version of STAR having the same format but containing about 40% of the number of entries appearing in STAR. Classified CONFIDENTIAL and available only to users with appropriate security clearance.

TECHNICAL ABSTRACT BULLETIN (TAB). Alexandria, Va., Defense Documentation Center, 1953-. Semi-monthly. Free to qualified users.

Abstracts and announces classified and unclassified/limited distribution documents produced by the Department of Defense and its contractors and acquired by the Defense Documentation Center. These include progress reports on ongoing R&D projects. Arranged in 22 subject fields which are broken down into subfields called groups. Indexes are not included in individual issues of TAB. Indexing function is performed by a separate publication entitled Technical Abstract Bulletin Indexes (See p.42). TAB is classified CONFIDENTIAL and is only available to D.D.C. users authorized to receive classified documents.

U. S. GOVERNMENT RESEARCH AND DEVELOPMENT REPORTS (USGRDR). A semi-monthly abstract journal. Springfield, Va., Clearinghouse for Federal Scientific and Technical Information, 1946-. v. 1-. Semi-monthly. $30.00/year.

Abstracting and announcement bulletin of reports, including progress reports, offered for sale by the Clearinghouse as well as those pre-

pared under Government auspices, but published in the journal literature. Abstracts are arranged in 22 major subject fields, each of which is divided into subfields called "groups." A guide to the subject field structure appears in the front of each issue. Indexes are not included in the individual issues of USGRDR. The indexing function is performed by a separate publication entitled U. S. Government Research and Development Reports Index, which is sold separately (See p.43). A "Report Locator List" in the back of each issue locates abstracts within the issue if accession number is known. "Research Highlights" section has abstracts of recent reports judged to be of high current industrial interest.

3

CURRENT OR RECENT RESEARCH AND DEVELOPMENT RESULTS

This chapter, as contrasted with the previous one, deals with keys to published results of research and development of relatively recent origin. The word "relatively" should, perhaps, be emphasized here, since there are generally significant time lags between the end of a piece of research and development, its being written up and submitted for publication, and its actual publication. Perhaps the most extreme example of this time lag is in the case of R&D work which is announced in the form of patents, where there is generally an interval of several years between application and issuance. In regard to patents, one can only say that for the bulk of the scientific and technical community, the newly issued patent will frequently constitute the first formal announcement and description of the results of an R&D activity.

There have traditionally been formal and informal means of communicating and obtaining relatively current R&D results, outside of the conventional publication media with their attending time lag problems. Prominent among these is the meeting program and papers delivered at meetings. Hearing a paper delivered or obtaining a copy of it at or near the time of delivery can frequently speed up the acquisition of R&D results by as much as a year, and in some cases more. There are also other tools and devices, many of them newly developed and based on computer techniques, for shortening the announcement time interval, particularly between the publication of

a paper in a journal and its listing or review in the conventional abstracting and indexing publications, which have their own time lags, frequently extending up to a year after the original publication of cited items.

Mention has also been made of Nature, Physical Review Letters, Science, and Research in Education in their role as vehicles for the announcement of new or ongoing R&D projects. These, as well as other media, such as newsletters, also serve in the rapid announcement of new R&D results, frequently in advance of formal publication. The American Psychological Association has instituted an experimental program for announcing papers accepted for publication in APA journals, to permit the reader to make direct contact with the author, rather than wait for publication. The American Society of Mechanical Engineers has, for years, had a system of preprint sales of papers to be presented at its meetings. The Society of Automotive Engineers has taken a slightly different tack, making rapid announcement of accepted papers and disseminating them on request, only as separates.

Such publications as the Clearinghouse Announcements in Science and Technology (CAST), Nuclear Science Abstracts, Research in Education, Scientific and Technical Aerospace Reports (STAR), and U. S. Government Research and Development Reports, described in detail in the previous chapter on ongoing research, are also important media of current or recent R&D results, in that they cover unpublished progress and final reports on government-sponsored projects. The significance of these publications is heightened by the fact that the reports they cover, like papers presented at meetings, are available far in advance of formal publication. In many, if not most, cases, the un-

published research report is the only form in which results are presented.

The discussion and descriptions that follow deal with some other of the important media for bridging the gap between original publication and conventional abstracting and indexing.

With the exception of Current Chemical Papers, the Monthly Catalog of U. S. Government Publications, NASA Tech Briefs, and the Official Gazette of the U. S. Patent Office, the secondary publications and services treated in this chapter incorporate advanced or innovative approaches to information dissemination. One of the more sophisticated of these newer approaches is Selective Dissemination of Information (SDI), illustrated here by ASCA III (Automatic Subject Citation Alert), a commercially available service. SDI is a system in which the interests and activities of scientists and engineers are "indexed" in the same language or by the same vocabulary as are documents coming into an information center or library. As documents are indexed, the index entries are put in machine-readable form, and read into a computer which matches the entries against those by which participating scientists or engineers have been "indexed." Where matches occur between the contents of documents and the computer-stored "interest profiles" of the scientists or engineers, notifications are printed out automatically for forwarding to the appropriate persons. SDI has the double advantage of being rapid and highly specific in regard to the activities and interests of the recipient personnel.

Some of the other services described in this chapter incorporate new formatting procedures made possible through the manipulation of data by computers. One prominent example of such computer formatting is the

permutation index, sometimes known as "keyword-in-context" or KWIC, or "keyword-out-of-context" or KWOC. Permutation indexes are based on the substantive (search) words in the titles of publications. An index entry is automatically produced for each substantive word in a title. The substantive words are arranged alphabetically, along with words from other titles, and are printed out, with the titles to which they belong, to produce an index requiring no (or a minimum of) human intervention in its preparation. The advantages of this type of index are its speed, simplicity, and economy of production. Its prime disadvantage is the fact that the index entries are dependent on the wording of titles, which can sometimes be misleading. Biological Abstracts Subjects in Context (BASIC), Bioresearch Index, Chemical-Biological Activities (CBAC), and Chemical Titles, among others, utilize the permutation principle of indexing.

Current Contents and Marine Science Contents are illustrative of still another approach to awareness of current or recent research results, consisting of bound reproductions of the tables of contents of current issues of selected major publications in the fields they cover (life sciences, physical sciences, and chemical sciences in the case of Current Contents; marine biology and related subjects in the case of Marine Science Contents). Tables of contents media share, along with permutation indexes, the problem of dependence on titles. But they are simple and rapid to compile and reproduce.

Finally, while not described by specific title in this chapter, mention must be made of newsletters, which are becoming increasingly important secondary media of announcements of new or ongoing projects and R&D results.

Serving as "news" media, newsletters emphasize currency in their coverage, and can be extremely informative sources. The National Directory of Newsletters and Reporting Services, described in Chapter 1, lists newsletters in practically every field of science and technology.

Further information regarding the bulk of the available current awareness services can be obtained from the Standard Periodical Directory and Ulrich's International Periodicals Directory, both described in Chapter 1.

ASCA III (Automatic Subject Citation Alert). Philadelphia, Pa., Institute for Scientific Information (ISI). Weekly. ($100.00/year min.

A weekly alerting and Selective Dissemination of Information (SDI) service based on articles in more than 1800 key scientific and technical journals. Those wishing to use the service submit, on a form provided, an interest profile prepared in accordance with instructions provided by ISI. This profile provides certain indexing points such as words, word stems, phrases, publishing authors or organizations, journals, cited works, and cited authors which can be used by a computer to scan the current literature for items which match the interest profile previously submitted. A printout of those citations found in the computer search which meet the criteria as established in the profile is sent weekly to each subscriber. Charges for the ASCA III service are a function of the number and type of search terms specified with a minimum charge of $100.00 for a year's service. Profile forms and complete instructions for completing them are available on request from ISI.

BASIC (Biological Abstracts Subjects in Context). Key to the world's biosciences research. Philadelphia, Pa., BioSciences Information Service of Biological Abstracts, 1962-. v. 38-. Semi-monthly. $15.00/year.

A separately published keyword-in-context (permuted) title index to articles abstracted in each issue of Biological Abstracts (BA). Titles deficient in meaning are editorially enriched with significant words. Each entry refers user to an abstract number in BA.

BIORESEARCH INDEX. Philadelphia, Pa. BioSciences Information Service of Biological Abstracts, 1967--. v. 1-. Monthly. $75.00/year.

An indexing publication covering biologically related material not covered in Biological Abstracts. Consists of a permuted expanded title index, a bibliography section arranged by journal, containing titles, authors and initial paging, an author index, and "Biosystematic" and CROSS indexes similar to those found in Biological Abstracts. Basically a supplementary service extending the coverage of BA.

CHEMICAL-BIOLOGICAL ACTIVITIES (CBAC). An index to current literature on the biological activity of organic compounds. Easton, Pa. Chemical Abstracts Service of the American Chemical Society, 1965-. Biweekly. $1100.00/year; $100.00/year personal subscriptions, without indexes.

Chemical Biological Activities (CBAC) is a computer-produced index to current literature on the biological activity of organic compounds. About 585 journals are covered. CBAC includes a Digest Section and five indexes; Keyword-in-Context, Molecular Formula, Registry Number-Faceted Number, Faceted Number-Registry Number, and Author indexes. Directions for the use of the faceted number system are given in the front of each issue. Papers covered in the Digest Section are grouped by journal titles which are arranged alphabetically by title codes. Entries include title of paper, author, journal reference, research site, and digests of the articles. Also included are structural formulae, CAS Registry numbers, and a special faceted number for cross-referencing related compounds. The keyword-in-context index is based on keywords found in the article titles and digests.

CHEMICAL TITLES. Current author and keyword indexes from selected chemical journals. Easton, Pa., American Chemical Society, Chemical Abstracts Service, 1960-. Biweekly. $50.00/year; $25.00/year to ACS members.

A keyword-in-context (KWIC) index of titles of papers selected from about 650 journals. Consists of three sections: Keyword-in-context index; Bibliography; Author Index. Each title in KWIC index and author selections has a reference code which leads to the bibliography section where complete citations are given. Entries in bibliography

section are arranged under the titles of the journals in which they appear so that this section actually contains tables of contents of the journal issues covered.

CURRENT CHEMICAL PAPERS. A classified world list of new papers in pure chemistry. London, The Chemical Society, 1954-. Monthly. $35.00/year.

A listing of bibliographic citations to papers in pure chemistry grouped in 13 subject categories. Arrangement within categories is roughly classified by subject covered. Citations include title, author(s), journal title, year, volume, number, and paging. No indexes.

CURRENT CONTENTS. Philadelphia, Pa. Institute for Scientific Information, 1958-. Weekly.

- Life Sciences. 1958-. v. 1-. $100.00/year; $60.00/year to nonprofit organizations.

- Physical Sciences. 1961-. v. 1-. $100.00/year; $60.00/year to universities only.

- Chemical Sciences. 1967-. v. 1-. $100.00/year to all subscribers.

Reproduces tables of contents of several hundred journals in each of the fields noted above. For convenience in writing for reprints, an author index giving the addresses of authors of most articles is given at the end of each issue.

MARINE SCIENCE CONTENTS TABLES. Rome, Food and Agriculture Organization of the United Nations, Biological Data Section, Fishery Resources and Exploitation Division, v. 1-. 1966-. Monthly. Free from: Distribution and Sales Section, Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, Rome, Italy.

A monthly periodical reproducing the tables of contents of core journals in marine science. Fifty journals are covered. Not

indexed. However, the name and address of publisher, frequency of publication, subscription rate, current volume number, issue number, date, and language(s) of publication are given for each journal having a title page reproduced in the particular issue.

MONTHLY CATALOG, UNITED STATES GOVERNMENT PUBLICATIONS. Washington, D. C., U. S. Government Printing Office, 1895-. Monthly. $4.50/year from the Superintendent of Documents, U. S. Government Printing Office.

"A current bibliography of publications issued by all branches of the government, including both Congressional and departmental publications." Entries arranged alphabetically by issuing agency. Entries include: title, author, date, paging, price, availability, etc. Monthly indexes in each issue and annual index in December issue. February issue contains Directory of United States Government Periodicals and Subscriptions.

NASA TECH BRIEFS. Washington, D.C., National Aeronautics and Space Administration, Technology Utilization Division. Irregular. Available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, as follows:

Electrical (Electronic)	$6.00/year
Energy Sources	$2.50/year
Materials (Chemistry)	$5.00/year
Life Sciences	$2.50/year
Mechanical	$6.00/year
Computer and Programs	$6.00/year
All Categories	$20.00/year
All Briefs published before 1968	$70.00

"NASA Tech Briefs" are one or two-page bulletins concerning individual innovations. Each Brief describes the innovation briefly, using line drawings where necessary and furnishes name of persons or organization to contact for more information.

OFFICIAL GAZETTE OF THE UNITED STATES PATENT OFFICE. Washington, D.C., U. S. Patent Office, 1872-. Weekly. $67.00/year from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402.

A publication of the U. S. Patent Office giving official notices, condition of patent applications, decisions in patent cases, patent suits, and in the main section, abstracts of patents granted in the week covered. Sections of design patents and trademarks are also included. Arrangement of the patent abstracts section is by type of patent, i.e., general and mechanical, chemical, and electrical. Indexes of patentees, design patentees, and trademark registrants are included. Trademarks section is available separately at $12.00/year.

PLASTICS INDUSTRY NOTES. Columbus, Ohio. Chemical Abstracts Service of the American Chemical Society. 1967-. Weekly. $225.00/year.

"....a weekly abstracting and indexing service of information for decision makers in polymer-based industry and other organizations." Thirty trade journals and newspapers are covered. Abstracts consist of excerpts taken from the publications covered and arranged into 12 sections: Production/Consumption; Prices; Marketing/Sales; Plant Engineering; New Products/Uses; Corporate Transactions/ Finance/Industrial Relations; Government Action; Licensing/Patent Actions; State-of-the-Art Surveys; Management Changes; Safety. Important names and subject words in the abstracts are capitalized and these are incorporated into a "Keyword Subject" index at the end of each issue.

POLYMER SCIENCE AND TECHNOLOGY (POST).

POST-J - Guides to the journal and report literature.
POST-P - Guides to the patent literature.

Easton, Pa., Chemical Abstracts Service of the American Chemical Society, 1967-. Biweekly. POST-J, $1200/year, $100.00/year personal; POST-P, $1000.00/year, $100.00/year personal; POST-J&P, $2100.00/year, $175.00/year personal.

A computer-produced guide to the current journal and Government report literature (POST-J) and patent (POST-P) literature of polymer chemistry, chemical engineering and technology. POST-J contains a digest section and four indexes: Keyword Subject Index, CA Keyword

Index, Molecular Formula Index, and Author Index. POST-P is in the same basic arrangement, with the addition of a Numerical Patent Index and Patent Concordance, but without the CA Keyword Index. Entries in the digest section of POST-J contain complete bibliographic citations with author affiliations where known and informative digests of the articles covered. Entries in the digest section of POST-P include names of patentees and asignees as well as granting and application dates and patent number and title. Informative digests of the patents are included. Keyword subject indexes to both POST-P and J utilize terms appearing in the original document with enrichment as necessary. Molecular Formula Indexes are arranged alphabetically by formula and give compound name and CA Registry number as well as number of Digest in which compound is mentioned. CA Keyword Index gives keywords and abstract numbers of related material (biopolymers) in current issues of Chemical Abstracts which would be of interest to users of POST-J. Numerical Patent Index in POST-P lists patents numerically by country of origin. Patent Concordance lists by country those patents currently received which correspond to patents already abstracted in POST-P or CA. These patents are not analyzed again but are entered in the concordance with reference to the previous equivalent patent. Indexes are cumulated semiannually.

PAST RESEARCH AND DEVELOPMENT RESULTS

In this chapter we deal with tools which are primarily retrospective in nature, being designed for searches of the literature of the recent or more distant past. In speaking of retrospective searching tools, as in the case of tools for becoming aware of recent or current research results, it is necessary to emphasize the word "primarily," since for many people and in many situations the tools designed for retrospective awareness actually serve as alerting or announcement vehicles, despite the fact that the materials covered are relatively old. However, for the most part, the tools dealt with in this chapter can be categorized as archival rather than current in nature and function.

Two factors, one intentional and one circumstantial, go to make this so. The first characteristic -- the intentional one -- is the cumulative nature of most retrospective tools. Most consist of, or include, cumulative indexes which increase in value as searching tools as the numbers of publications covered increase. This unification of large numbers of items into single indexes is obtained at the expense of timeliness. Thus, we trade off currency for comprehensiveness and searching convenience.

The circumstantial characteristic that goes to make many of the tools discussed in this chapter archival rather than current in nature, is the fact that they contain abstracts. As noted in the previous chapter, an important problem and shortcoming of abstracting publications is the time lag between the original appearance of a published item and its announcement

in the form of an abstract. This is largely due to the fact that the preparation and editing of an abstract -- particularly a detailed or informative abstract -- is time-consuming and expensive. Many abstracting publications get around this through the use of author abstracts. However, many of the larger abstracting and indexing publications eschew this approach, either for copyright reasons or because of very high abstracting standards. And so, in the latter case at least, we are trading off speed for quality.

While, for the most part, the searching tools described in this chapter are made up of conventional indexes, several are, or incorporate, advanced or unconventional techniques or principles. Perhaps most illustrative of these newer approaches is the Science Citation Index, which, starting with a representative cross section of early publications in the fields it covers, lists all subsequent publications that cited the earlier ones, all those that cited the subsequent ones, etc., thus permitting extremely rapid, thorough, and selective searches for related papers on specified subjects.

Another avant-garde type of searching tool is represented by the Uniterm Index to Chemical Patents, which consists of duplicate listings of index terms and, under each, the numbers of the patents that pertain to them. This duplicate listing, in bound form, facilitates multiple subject or coordinate searches, which are performed by comparing two or more terms for common patent numbers.

Still another advanced approach is illustrated by Electrical and Electronics Abstracts, the Engineering Index Plastics Section, and Pandex, all of which, in addition to printed indexes, offer indexes on magnetic tape for computer searching on the subscriber's premises.

Returning to the more conventional searching media, mention should be made of the review publication, which, while not specifically described by individual titles in this chapter, is represented in practically every major field of science and technology. The review publication (Annual Reviews, Progress in, Advances in, etc.) bear a vague resemblance to the Science Citation Index, in that both are designed to bring together related papers on presumably topical subjects. The review publication carries the concept a step further by analyzing, synthesizing, and, in some cases, criticizing the contents of the published items it covers. In a sense, a review paper is a highly structured form of the annotated bibliography. As such, it is one of the more important of the available searching tools. A fairly complete listing of the major review publications can be obtained from the Standard Periodical Directory and Ulrich's International Periodicals Directory, both described in the first chapter of this book. Review papers on specific subjects may be identified via searches of the major abstracting and indexing services.

APPLIED SCIENCE AND TECHNOLOGY INDEX. New York, H. W. Wilson Co., 1913-. Monthly. Sold on service basis (price based on size of library collection).

A subject index to about 200 major periodicals in applied science and engineering. Monthly issues are cumulated annually. This publication gives only bibliographic citations in a detailed subject arrangement. No author entries or other indexes are included.

BIOLOGICAL ABSTRACTS (BA). Philadelphia, Pa., BioSciences Information Service of Biological Abstracts, 1926-. Semimonthly. $600.00/year list; $480.00/year to educational and nonprofit organizations and individuals. Price includes BASIC and Bioresearch Index. (See pp. 28-9).

A classified subject arrangement of abstracts of literature in the biosciences. Each entry includes a bibliographic citation and an abstract. Author, Biosystematic, and CROSS indexes to each issue. Biosystematic index lists relevant abstract numbers in taxonomic categories; CROSS index lists them in subject categories in such a way that manual indexing may be done. (They are arranged in columns by units digit of the abstract number.) Subject indexing is provided by BASIC, a separate publication.

BUSINESS PERIODICALS INDEX. New York, H. W. Wilson Co., 1958-. Monthly. Sold on service basis (price based on size of library collection).

A subject index to about 180 major periodicals in the field of business, including accounting, advertising, banking and finance, public administration, labor and management, etc. Monthly issues are cumulated annually. This publication gives only bibliographic citations in a detailed subject arrangement. No author entries or indexes are included.

CHEMICAL ABSTRACTS (CA). Key to the world's chemical literature. Columbus, Ohio, Chemical Abstracts Service of the American Chemical Society. V. 1-. 1907-. Semimonthly. $1550.00/year; $1050.00/year to educational institutions.

An abstracting publication which aims to publish abstracts of all technical papers of chemical interest appearing in the world's chemical literature. Arrangement is by subject in five broad groupings: biochemistry, organic chemistry, macromolecular chemistry, applied chemistry and chemical engineering, and physical and analytical chemistry. Any two consecutive issues of CA will contain abstracts in all of these sections. Sections are also sold separately. Each issue contains "Keyword," "Numerical Patent," "Patent Concordance," and "Author" indexes. Chemical Abstracts is issued in two volumes a year, each one having cumulated Author, Subject, Molecular Formula, HAIC (Hetero-Atom-in-Context), Ring System, Numerical Patent, and Patent Concordance indexes. Descriptions of these indexes and instructions for their use are given in

the beginning of each volume. Collective indexes (five-year cumulations) are sold separately. CA is available on microfilm as a complete set or as a current subscription, or both.

DATRIX (Direct Access to Reference Information; a Xerox service). Ann Arbor, Michigan, University Microfilms. $5.00 for first ten or less references; 10¢ each for each additional reference.

A computer-produced index to the file of doctoral dissertations published since 1938 in American universities and maintained at University Microfilms. The data base is divided into three major sections; Chemistry/Life Sciences, Engineering/Physical Sciences, Humanities/Social Sciences. A list of keywords used to index theses in each of these areas is provided the user who selects keywords which best describe the object of his search and combines them into a logical statement in accordance with instructions given in the front of each of the keyword list booklets. Upon receipt of the search request, a computer search of the data base is made and a list of the theses meeting the requirements of the search statement is returned to the requestor. Forms for requests and appropriate keyword lists are provided on request by University Microfilms.

DISSERTATION ABSTRACTS. A. The Humanities and Social Sciences. B. The Sciences and Engineering. Ann Arbor, Michigan, University Microfilms, Inc. 1938-. Monthly. Section A, $45.00/year; Section B, $45.00/year; Sections A and B, $75.00/year.

A monthly compilation of abstracts of doctoral dissertations submitted to University Microfilms, Inc., by more than 160 cooperating institutions in the United States, arranged in broad subject categories. Identical subject and author indexes to parts A and B, are included in each part. Indexes are cumulated annually.

ELECTRICAL AND ELECTRONICS ABSTRACTS. An INSPEC publication. London, Institution of Electrical Engineers, 1903-. Monthly. Available from Engineering Index, Inc., 346 East 47th Street, New York, N. Y. $120.00/year.

A monthly abstracting bulletin in a subject arrangement in 30 chapters which are broken down into a total of 210 subchapters or categories. Each entry contains, in addition to an abstract, the complete title, author, and bibliographic citation. Each issue contains a chapter code index which is simply the table of contents in an alphabetical arrangement. Also included are author, book, and conference indexes. A list of journals indexed for the first time is also appended. Semi-annual cumulated author and subject indexes are provided.

A magnetic tape service is also available covering the electrical/electronics literature. Users of this service receive monthly tapes which include for each reference: deep index terms, subject headings, "notation of content" or title, and complete bibliographic citations. Abstracts of all documents accompany each tape on printed cards. Software and documentation is provided where necessary. Costs range from $1600.00/year to $2000.00/year, depending on subscriber's in-house capabilities and requirements.

ENGINEERING INDEX. New York, Engineering Index, Inc., 1885-. Monthly. $350.00/year; $250.00/year to educational and nonprofit institutions.

An annotated index to about 2000 technical periodicals and other material received and retained in the Engineering Societies Library. Patents are excluded. Arrangement is alphabetical by subject with an author index in each issue. Annual cumulated volumes are issued which contain the entries in the monthly issues. Coverage of the periodicals indexed is selective.

ENGINEERING INDEX CARD SERVICE. New York, Engineering Index, 1928-. Prices vary depending on subject categories ordered.

A service which provides abstracts of documents indexed for Engineering Index on cards. Subscribers may receive cards in any or all of 249 subject divisions available. Subscribers to less than all divisions receive their cards weekly. Subscribers to all 249 divisions receive cards daily. The subscription cost for each division is different, with the rate for all 249 divisions being $1500.00/year; $750.00/year to educational institutions and public libraries. A complete schedule of rates for the various divisions is available from Engineering Index, Inc., 345 West 47th Street, New York, N. Y. 10017.

ENGINEERING INDEX PLASTICS SECTION. New York, Engineering Index, Inc. Monthly. $25.00/year to Society of Plastics Engineers members; $150.00/year to educational and nonprofit institutions; $250.00/year to profit making organizations.

A monthly abstracting service providing coverage of about 350 journals in the field of plastics. Each monthly issue consists of an abstract section and an index section containing both author and subject indexes. Abstracts are arranged in 23 subject categories. Subject index is arranged alphabetically by terms based on those in the Thesaurus of Engineering Terms published by the Engineers Joint Council. Under each term are document entries comprising a document number and a "notation of content" (NOC) which may be the document title or a version of it more indicative of the contents of the article. Author index has only author surname and document number. Subject and author indexes are cumulated annually.

A monthly magnetic tape service covering the plastics engineering field is available. Each monthly tape covers about 500 documents and is accompanied, when necessary, by software and documentation. Each reference on the tape contains deep index terms, subject headings, "notation of content" or title, and complete bibliographic citation. Costs vary from $1400.00/year to $1800.00/year, depending on subscriber in-house capabilities and requirements.

INTERNATIONAL AEROSPACE ABSTRACTS (IAA). Phillipsburgh, N. J. Technical Information Service, American Institute of Aeronautics and Astronautics, 1961-. Semimonthly. $25.00/year from Technical Information Service, American Institute of Aeronautics and Astronautics, Inc., 750 Third Ave., New York, N. Y. 10017.

Abstracting and indexing journal providing worldwide coverage of the open aerospace literature including scientific and trade journals, books, and meeting papers. Bibliographic citations and abstracts are arranged in 34 subject categories. Guide to these and scope of each is given in the front of each issue. Subject, personal author, corporate source, report/accession number, and accession/report number indexes are bound at the end of each issue and are cumulated quarterly, semiannually, and annually. IAA complements Scientific and Technical Aerospace Reports (STAR) (see p.42). Availability of items abstracted varies; complete availability information is given in each issue.

MATHEMATICAL REVIEWS. Providence, R.I., American Mathematical Society, 1940-. Monthly. $180.00/year.

An abstracting publication of mathematics arranged in broad subject areas. Citations and critical abstracts are of sufficient length and detail to summarize and evaluate the contents of the items covered. Some abstracts are in languages other than English. Author index in each issue. Mathematical Reviews is issued in two volumes a year with an index issue at the end of each volume. This is mainly a cumulated author index giving titles as well as author names. Also included are a list of journals abstracted in the volume and a list of subject headings under which articles were classified in the volume covered.

NUCLEAR SCIENCE ABSTRACTS (Cumulative indexes). Washington, D.C., United States Atomic Energy Commission, Division of Technical Information, 1948-. v. 1-. $22.00/year, from the Superintendent of Documents, U. S. Government Printing Office.

Quarterly, semi-annual, and annual cumulation of corporate author, personal author, subject, and report number indexes. Longer cumulations available separately as noted in the front of each issue of NSA. (See p.18).

PANDEX. New York, Pandex, Inc. $460.00/year for microfiche service. Quarterly. $6500.00/year for magnetic tape service. Weekly.

PANDEX is an indexing service covering the fields of science, technology, and medicine as reported in 2100 journals and 6000 English language books a year. The index is issued in two parts, a subject index and an author index. The author index gives first authors with cross references to secondary authors. Main author entries provide secondary authors, title, journal coden (abbreviated title for machine coding), volume number, issue (if a weekly), and starting page. Secondary author entries give journal title and article paging only. Entries in subject index provide full title, primary author, journal coden, volume, issue (if a weekly), and starting page. When provided on magnetic tape, a basic printout program and Selective Dissemination of Information (SDI) program are furnished for use on the user's equipment.

SCIENCE CITATION INDEX (SCI). An international interdisciplinary index to the literature of science and technology. Philadelphia, Pa., Institute for Scientific Information, 1963-. Quarterly, with annual cumulations. $1250.00/year to hospitals, medical schools, colleges and universities; $1950.00/year to all others.

An index of cited papers and the sources which cite them. Arranged in two main sequences: Citation Index and Source Index. The Citation Index portion lists by first author those papers that are cited by other authors in the list of about 1600 journals that are covered. Each entry shows cited author, citing author, publication year of cited article, name of publication, year of citing article, volume number, and page. Also included in the Citation Index, but in separate sections are a "Corporate Index" arranged by corporate name and a "Cited Patent" section arranged by patent number. The Source Index gives complete bibliographical citations arranged by author for citing authors listed in the Citation Index. Detailed instructions for use of SCI are included in each issue.

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS (STAR). Cumulative indexes. Washington, D.C., National Aeronautics and Space Administration, 1963-. v. 1-. Three quarterly issues and an annual cumulation. $30.00/year from the Superintendent of Documents, U. S. Government Printing Office.

Cumulated indexes to STAR. Contains subject, personal author, corporate source, contract number, report/accession number, and accession/report number indexes. Contract number index is not contained in individual issues of STAR (See p.21).

TECHNICAL ABSTRACT BULLETIN INDEXES. Alexandria, Va., Defense Documentation Center, 1953-. Semimonthly, with quarterly and annual cumulations. Free to DDC users.

Indexes to Technical Abstract Bulletin (TAB). Include corporate author-monitoring agency, subject, personal author, contract number, report number, and release authority indexes. Unclassified, but only available to those qualified to receive TAB, which bears CONFIDENTIAL security classification. The cumulations are, however, available to all DDC users. (See p.22).

TRANSLATIONS REGISTER-INDEX. Special Libraries Association Translations Center. Chicago, Illinois, Special Libraries Association, 1967-. V. 1-. $30.00/year from SLA Translations Center, John Crerar Library, 35 West 33rd Street, Chicago, Illinois 60616.

A semimonthly journal which announces and indexes all translations currently collected by the SLA Translations Center. Newly received translations are recorded in 22 main subject categories arranged by COSATI classification and terminology. Included are a journal citation index which lists translations by journal in which the original article appeared. Also included are a list of translated patents arranged by country of origin and lists of translated conference papers and monographs. Index sections cumulate quarterly for all entries to date in a volume.

U. S. GOVERNMENT RESEARCH AND DEVELOPMENT REPORTS INDEX. Springfield, Va., Clearinghouse for Federal Scientific and Technical Information, 1965-. Semimonthly. $22.00/year from the Clearinghouse.

Indexes individual issues of U. S. Government Research and Development Reports. Provides subject, personal author, corporate author, contract number, and accession/report number indexes. It is planned to publish three quarterly and an annual cumulated index for 1968. Continuance of this is dependent on the success of the 1968 venture. (See p.22).

UNITERM INDEX TO U. S. CHEMICAL AND CHEMICALLY RELATED PATENTS. Washington, D.C., IFI/Plenum Data Corporation. Bimonthly, continuously cumulated. $1950.00/year.

The Uniterm Index analyzes, edits, classifies, and cross indexes all U. S. chemical and chemically related patents issued from 1950 to date. It consists of two duplicate alphabetical listings of indexing terms (Uniterms) arranged side-by-side in a special binder. Ranged in columns by units digit under each term are the code numbers of the patents to which the term applies. Major Terms, i.e., those applying to ten or more patents, and Minor Terms, i.e., those applying to less than ten patents, are in separate sequences within each main section. "Patentee," "Assignee," and "Code Number-Patent Number" indexes are included, but not in duplicate. A reproduction from the Official Gazette of the U. S. Patent Office of abstracts of the patents indexed is provided with each issue.

5

MAJOR AMERICAN LIBRARIES AND RESOURCE COLLECTIONS

Having dealt with the functional aspects of information tools and services thus far, we now turn in this chapter to descriptions of some of the major information collections and library resources, both inside and outside of the Federal Government. The institutions described encompass practically every field and aspect of science and technology and all of the major forms or media of formal information conveyance.

The descriptions are divided into two parts. The first deals with eleven major library and information systems and programs conducted by the Federal Government. These are, for the most part, national in character, and constitute focal points or nuclei of country-wide information networks.

The second part of the compendium deals with other major library and information resources, primarily outside of the purview of the Federal Government.

As in the case of the tools and services discussed in the previous chapter, the information facilities and resources described in this chapter have been selected for illustrative purposes, rather than on the basis of exhaustiveness. Further and more detailed information regarding library and information facilities in the United States may be obtained from the descriptions in Chapter 1, dealing with information about information, or what places or tools to turn to when one doesn't know where to look for a given type of information.

CLEARINGHOUSE FOR FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION (CFSTI). 5285 Port Royal Road, Springfield, Va.
Mailing address: CLEARINGHOUSE for Federal Scientific and Technical Information, Springfield, Va. 22151.
Telephone: (703) 321-8500

Purpose and Function: Announcement and dissemination of reports describing the results of research performed under Government contract in the fields of defense, space, atomic energy, and other national programs.

Holdings: About 500,000 unclassified/unlimited Government-sponsored scientific and technical reports including those produced by the Department of Defense laboratories and contractors.

Information Services: Reference and inquiry services to the general public, including inquiries on document availability and searches for documents in specific areas of interest. Abstracting and indexing services are provided through issue of the publications noted below. Reports and translations announced in these publications are sold at the price of $3.00 for hard copy and $0.65 per document for microfiche. Documents not available from the Clearinghouse are so noted.

Publications:
- U. S. Government Research and Development Reports (See p.22).
- U. S. Government Research and Development Reports Index (See p.43).
- Fast Announcement Service (See Addendum No. 1)
- Clearinghouse Announcements in Science and Technology (CAST) (See p.16).

DEFENSE DOCUMENTATION CENTER (DDC). Cameron Station, Alexandria, Va. 22314. Telephone: (202) 974-7067.

Purpose and Function: The Defense Documentation Center (DDC) is the central depository for documents generated by the research, development, test, and evaluation activities of the Department of Defense, its contractors, subcontractors, and grantees. The Center also operates, for the military departments, a work unit data bank containing information on research in progress and other data banks containing information on contractor performance evaluations, contractor cost reductions, research and development facilities, and a special joint NASA/DoD data bank for aerospace life sciences.

Information Services: Provides copies of documents in its collections without charge to all executive Government agencies and to their contractors and grantees approved for DDC services for specified fees; prepares computer-produced bibliographies of abstracts in response to user requests; furnishes in 24 hours bibliographies, of AD numbers only, in response to teletype requests (Rapid Response Bibliography (RRB) service); furnishes information to military departments on research and development in progress through Research and Technology Work Unit Information System (unclassified portions of this are made available to others through Science Information Exchange) (See).

Publications: Technical Abstract Bulletin (See p.22).
Technical Abstract Bulletin Indexes (See p.42).

NOTE: A more detailed description of DDC and its functions will be found in: Rea, Robert H. "Programs and Services of the Defense Documentation Center," Defense Industry Bulletin, 4 (4), April 1968.

EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC). Central ERIC, U. S. Office of Education, 400 Maryland Avenue, S.W., Washington, D.C. 20202. Telephone: (202) 963-5275.

Purpose and Function: ERIC is a nationwide information network comprising Central ERIC and 18 clearinghouses specializing in specific substantive areas of education. Each Clearinghouse selects and acquires research and research-related materials in its subject area. These are then supplied to Central ERIC for announcement in Research in Education (see p.20), for availability through the ERIC Document Reproduction Service, and for computer storage and retrieval. The clearinghouses currently in operation are:

- ERIC Clearinghouse on Educational Media and Technology, Institute for Communication Research, Stanford University, Stanford, California 94305.
- ERIC Clearinghouse on Junior Colleges, University of California at Los Angeles, 405 Hilgard Avenue, Los Angeles, California 90024.
- ERIC Clearinghouse on Linguistics, Center for Applied Linguistics, 1717 Massachusetts Avenue, N.W., Washington, D.C. 20036.
- ERIC Clearinghouse on Exceptional Children, Council for Exceptional Children, National Education Association, 1201 16th Street, N.W., Washington, D.C. 20036.
- ERIC Clearinghouse on the Teaching of English, National Council of Teachers of English, 508 South Sixth Street, Champaign, Ill. 61820.
- ERIC Clearinghouse on Early Childhood Education, University of Illinois, 805 West Pennsylvania, Urbana, Illinois 61801.

- ERIC Clearinghouse on Reading, Indiana University, 204 Pine Hall, Bloomington, Indiana 47401.
- ERIC Clearinghouse on Counseling and Personnel Services, University of Michigan, Ann Arbor, Michigan 48104.
- ERIC Clearinghouse on Library and Information Sciences, Center for Documentation Information Retrieval, University of Minnesota, Minneapolis, Minnesota 55455.
- ERIC Clearinghouse on Rural Education and Small Schools, Box AP, University Park Branch, New Mexico State University, Las Cruces, New Mexico 88001.
- ERIC Clearinghouse on the Disadvantaged, Yeshiva University, 55 Fifth Avenue, New York, N. Y. 10003.
- ERIC Clearinghouse on School Personnel, City University of New York, 33 West 42nd Street, New York, N. Y. 10036.
- ERIC Clearinghouse on the Teaching of Foreign Languages, Modern Language Assn. of America, 62 Fifth Avenue, New York, N. Y. 10011.
- ERIC CLearinghouse on Adult Education, Syracuse University, 107 Roney Lane, Syracuse, N. Y. 13210.
- ERIC Clearinghouse on Science Education, Ohio State University, 1460 West Lane Avenue, Columbus, Ohio 43221.
- ERIC Clearinghouse on Vocational and Technical Education, Ohio State University, 980 Kinnear Road, Columbus, Ohio 43212.
- ERIC Clearinghouse on Educational Administration, University of Oregon, Eugene, Oregon 97403.
- ERIC Clearinghouse on Educational Facilities, University of Wisconsin, 606 State Street, Madison, Wisconsin 53703.

Information Services: All of the ERIC clearinghouses provide some or all of the services listed below:

Answer inquiries
Make referrals
Provide: - reference services
- searching services
- abstracting services
- indexing services
- consultation services
Prepare bibliographies
Allow on-site use of the collections.

Publications: Research in Education (See p.20).

Many of the clearinghouses have their own periodic or aperiodic publications which may be identified by application to them.

LIBRARY OF CONGRESS SCIENCE AND TECHNOLOGY DIVISION. Library of Congress, Annex Building, Fifth Floor, Study Room 103, Washington, D.C. 20540. Mailing Address: Library of Congress, Science and Technology Division, Second and Independence Aves., SE, Washington, D.C., 20540. Telephone: (202) 967-8089.

Purpose and Function: The Division was established to act as a central point in the Library of Congress for reference, bibliographic, and consultative services in all fields of science and technology, with the exception of clinical medicine and technical agriculture. All languages are covered. Its services are available to individuals and firms, and the Science Reading Room is open to the general public.

Holdings: Over one and one-half million volumes, including textbooks, monographs, technical reports, encyclopedias, selected periodicals, and other reference materials of the specialized fields of science and technology.

Information Services: Answers reference questions, performs brief literature searches, compiles subject bibliographies on request, and offers advisory services. Will perform comprehensive literature searches at an hourly fee, in conjunction with the Clearinghouse for Federal Scientific and Technical Information of the Department of Commerce. Main portion of staff engaged in bibliographic activities as contracted by various governmental agencies, including the National Aeronautics and Space Administration, U. S. Army, and National Science Foundation.

Publications:
- Directory of Information Resources in the United States (See p.4).
- Guide to the World's Abstracting and Indexing Services in Science and Technology (See p.13).
- Aerospace Medicine and Biology. A continuing bibliography with indexes. Monthly. Available from Clearinghouse for Federal Scientific and Technical Information (CFSTI) as NASA-SP-7011 and supplements, at $1.00 an issue. Yearly cumulative subject, corporate source, and personal author indexes, $5.00. Free to NASA offices and contractors, U. S. Government agencies, and organizations working in direct support of NASA, from National Aeronautics and Space Administration, Code USS-AD, Washington, D.C. 20546.
- Astronautics and Aeronautics. A chronology on science, technology, and policy. 1964-. Monthly. Available to qualified requestors from NASA Historical Staff, Office of Assistant Administrator for Policy Analysis (EPH), National Aeronautics and Space Administration, Washington, D.C. 20546.
- Bibliography on Snow, Ice, and Frozen Ground. v. 1-. 1951-. Annual. Available from CFSTI - $3.00 hard copy, $0.65 microfiche.

NOTE: The Science and Technology Division has from time to time published a large number of bibliographies, directories, and other reference tools. These are listed with appropriate availability information in Library of Congress Publications in Print, March 1968. This publication is available free on request to: Office of the Secretary, Library of Congress. It has a detailed subject index.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA). Washington, D.C. 20546.

Purpose and Function: The National Aeronautics and Space Administration investigates and solves problems of flight within and outside the earth's atmosphere. It develops, constructs, tests, and operates aerospace vehicles for research and exploration in cooperation with the scientific community and industry and coordinates its efforts with other nations engaged in space activities for peaceful purposes.

Information Services: Through its Scientific and Technical Information Division, it maintains NASA report collections at 11 Federal Regional Technical Report Centers; prepares demand bibliographies for NASA personnel, contractors, and grantees from material abstracted in Scientific and Technical Aerospace Reports (STAR); and publishes STAR as well as several other technical report series (see below). Technology Utilization Division answers inquiries regarding technological innovations, sponsors meetings and symposia, arranges conferences at appropriate NASA field installations to discuss applications of NASA research and development results to specific problems, and sponsors Regional Dissemination Centers which provide computerized searching services to industry on a fee basis.

Publications: In addition to STAR (see p.21), the Scientific and Technical Information Division disseminates the following technical publication series of the Agency:

- Technical Reports (NASA TR-R-)
  Scientific and technical information considered important, complete, and a lasting contribution to existing knowledge.

- Technical Notes (NASA TN-D-)
  Information of less scope, but still important as a contribution to knowledge.

- Technical Memoranda (NASA TM-X-)
  Information which receives limited distribution because of its preliminary or classified nature.

- Technical Translations (NASA TT-F-)
  Information originally published in a foreign language, but considered sufficiently valuable to NASA's work to merit distribution in English.

- Contractor Reports (NASA CR-)
  Technical information generated in the course of a NASA contract and released under NASA auspices.

- Special Publications (NASA SP-)
  Conference proceedings, monographs, literature surveys, continuing bibliographies, Technology Utilization Reports, Technology Surveys.

NATIONAL AGRICULTURAL LIBRARY (NAL). U. S. Department of Agriculture, Room 1052, South Building, 14th Street and Independence Ave., S.W., Washington, D.C. Mailing Address: U. S. Department of Agriculture, Washington, D.C. 20250. Telephone: (202) 388-3434.

Purpose and Function: The mission of the Library is to acquire publications in the field of agriculture and related sciences of chemistry, biology, animal husbandry, apiculture, veterinary medicine, soils and fertilizers, rural sociology, and economic aspects of agricultural products. It makes its services available to persons working in the agricultural field and to the general public.

Holdings: Over a million and a quarter volumes on agriculture and related sciences.

Information Services: Answers reference questions and performs brief literature searches, compiles subject bibliographies at irregular intervals to meet the needs of agricultural research workers, produces Bibliography of Agriculture (see below), provides on-site use of its collections during normal weekday working hours.

Publications: With the exception of the National Agricultural Library Catalog, the publicaitons noted below may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 at the prices indicated. The source for the Catalog is Rowman and Littlefield, 84 Fifth Avenue, New York, N. Y. 10011.

- Bibliography of Agriculture. $14.00/year. Monthly index of all important books and periodical articles on agriculture and the allied sciences received in the NAL.

- Pesticides Documentation Bulletin. $12.00/year. A biweekly index to the literature on pests and their control and the impact on the economy and man's total environment.

- National Agricultural Library Catalog. $72.00/year. A monthly listing of all publications added to the Library collection during the previous month.

NATIONAL LIBRARY OF MEDICINE (NLM). 8600 Rockville Pike, Bethesda, Md. 20854. Telephone: (301) 656-4084.

Purpose and Function: The National Library of Medicine (NLM) collects, organizes, and makes available biomedical information to practitioners, investigators, and educators. It also carries out extramural programs designed to strengthen existing medical library services in the United States and to develop new ones.

Holdings: 315,000 monographs, 310,000 bound journal volumes, 285,000 theses, 168,000 pamphlets, 4,500 reels of microfilm, 60,000 portraits and illustrations. Material is added at the rate of approximately 90,000 items a year.

Information Services: Answers telephone inquiries requiring a brief search, provides to other libraries interlibrary loan and photocopies of material not readily available locally, makes collections available for on-site use weekends and evenings as well as normal weekday hours, provides demand bibliographies on specialized subjects produced by the Library's computer-based Medical Literature Analysis and Retrieval System (MEDLARS) in response to requests from individual professionals and groups in the health field, produces approximately 30 continuing bibliographies in specialized fields of biomedicine.

Publications: The publications noted below can be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402, at the prices indicated.

- Index Medicus. $40.00/year. A monthly bibliographic listing of references to current articles from approximately 2400 of the world's biomedical journals. Each issue contains subject and name indexes, and a separate Bibliography of Medical Reviews.

- Cumulated Index Medicus. $40.00/year. A cumulation in one author volume and three subject volumes of the articles cited in twelve monthly issues of Index Medicus.

- NLM Current Catalog. $15.00/year. A biweekly author and title listing of publications cataloged by the NLM during the past two weeks and also a subject listing of

the publications cataloged. Quarterly and annual cumulations.

- Bibliography of Medical Translations. $4.50/year. Semimonthly guide to the location of available translations from the foreign language biomedical literature.

- Bibliography of Medical Reviews. Prices vary. Annual cumulation of current review articles cited in monthly Index Medicus, listed by subject.

- Medical Subject Headings (MeSH). $2.50. Subject headings used in Index Medicus, arranged alphabetically with cross references and in categorized lists.

- List of Journals Indexed in INDEX MEDICUS. $0.75. Contains four separate listings of journals indexed for Index Medicus; Title, Title abbreviation, Subject, Geographical Location.

- The National Library of Medicine Classification: A Scheme for the Shelf Arrangement of Books in the Field of Medicine and its Related Sciences. 3rd edition, 1964. $2.00.

- Biomedical Serials, 1950-1960. $3.00. A list of 8939 titles of substantive biomedical serials which NLM holds in issues of the time period named.

Single copies of demand bibliographies which have been produced are available without charge from the Library.

NATIONAL STANDARD REFERENCE DATA SYSTEM (NSRDS). National Bureau of Standards, Gaithersburg, Maryland. Mailing Address: National Standard Reference Data System, National Bureau of Standards, Washington, D.C., 20234. Telephone: (301) 921-2583.

Purpose and Function: "The NSRDS is a government-wide effort to give to the technical community of the United States optimum access to the quantitative data of physical science, critically evaluated and compiled for convenience.... The general objective of the system is to coordinate and integrate existing data evaluation and compilation activities into a systematic, comprehensive program, supplementing and expanding technical coverage when necessary, establishing and maintaining standards for the output of participating groups and providing mechanisms for dissemination of the output as required."

Information Services: Through 28 specialized Information and Data Centers in the United States and through its publications, the NSRDS provides compilations of critically evaluated property data to the technical community. Inquiries to a Center may result in four kinds of action being taken: (1) Referral of the question to another organization or individual; (2) Provision of a list of citations; (3) Provision of copies of literature cited in (2); and (4) Furnishing of technical data along with explanations, etc., as necessary. Publications of the NBS Office of Standard Reference Data, which coordinates the NSRDS, supplement those of the various technical data centers in the areas of reference data in general and in those areas which cut across the lines of several data centers or fall between them.

Publications: Principal among the publications of the NSRDS is the "National Standard Reference Data Series" (NSRDS-NBS-), which consists of compilations produced at NBS as well as those of more general interest such as state-of-the-art reports, lists of compilations of standard reference data, and reports on classification, indexing, mechanization and other topics of interest to data compilers and users. Through March of 1968 there were 36 other publications of the NSRDS of which 15 were in its own series and the rest in other NBS report series or series employed by data centers located outside of the Bureau.

U. S. ATOMIC ENERGY COMMISSION (USAEC). Germantown, Maryland.
Mailing Address: U. S. Atomic Energy Commission, Washington, D.C. 20545.

Purpose and Function: The Atomic Energy Commission is the agency of the United States Government responsible for the development of atomic energy for defense as well as for peace.

Information Services: Maintains about 184 depository libraries throughout the United States and around the world. Each contains a comprehensive collection of USAEC reports and other publications, including bibliographies, conference papers and proceedings, translations, catalogs and indexes of engineering materials, a complete file of Nuclear Science Abstracts, and the Technical Progress Reviews. Also maintained are 28 Specialized Information and Data Centers which provide to qualified users critically evaluated and analyzed data on various aspects of nuclear science and technology. The USAEC also has an active publication program (see below).

Publications:
- Nuclear Science Abstracts (see p.41). Semimonthly.
- Technical Progress Review series*
  - Isotopes and Radiation Technology. Quarterly.
  - Nuclear Safety. Quarterly.
  - Power Reactor Technology. Quarterly.

- Reactor Fuel Processing. Quarterly.
- Reactor Materials. Quarterly.

- Miscellaneous booklets and pamphlets. For a complete listing of these as well as other miscellaneous material, see "What's available in the atomic energy literature," TID 4550. (latest rev.).

* Each title in this series available from the Superintendent of Documents, U. S. Government Printing Office, at $2.00/year.

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Buffalo, New York 14221
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6

ORGANIZATION OF PERSONAL INDEX FILES

Up until this point we have dealt with methods of acquiring, or locating or identifying the most likely sources of, needed information. In this chapter, we deal with methods of organizing personal files to facilitate the searching and retrospective retrieval of useful publications once they are identified and acquired.

In discussing personal files and filing methods, we shall be dealing with two general types: the document file, in which the physical object which is stored and searched is the document itself, and what might be termed the surrogate type of file, in which a representation of the document or its contents is stored and searched.

Document Files

Perhaps the most common form of organization and storage of personal files are the physical documents themselves, arranged by personal or corporate author (corporate meaning by the name of the organization that performed the research or development effort). This type of physical arrangement is generally reflective of one of the primary ways in which people search document files. While much is made of subject searches and searching tools (as indeed it was in the preceding chapters), it develops, upon analysis, that most people become aware of useful publications through references cited in things they read and through personal recommendations. Thus, for

a high percentage of situations and applications, author arrangements of documents will suffice.

There are, of course, situations where the author, and particularly the personal author, is subordinated. A prime example of this is the unpublished research report, emanating primarily from government-sponsored research and development. Here the most prominent form of citation is the report number, and the most frequent method of physical arrangement is by report number. Again, the physical arrangement of documents is reflective of the primary method by which the file is invoked.

Another form of document storage which has proved useful in various types of applications is the so-called collectanea approach. Here each page in a document is indexed by as many terms as are deemed appropriate, and the page is reproduced by xerography or some other photoduplicating procedure in as many copies as there are index terms applied to the page. The copies are then filed under each of the index terms assigned to the page, with appropriate identification as to the document from which the page came. This arrangement permits very rapid subject searches, which can be "multi-dimensional," in that the searcher, in pulling a page from a desired subject category in the file, knows not only that it deals with that subject but also all the other subjects that it deals with. Thus, we get into what is known as coordinate or multi-subject searching.

Naturally, in order to ensure accuracy and consistency in the assignment of indexing terms to pages, it is necessary to use some sort of indexing or vocabulary authority. Major examples of such indexing or vocabulary authorities are the EJC Thesaurus, which covers most of the major fields and

subfields of engineering, and the Thesaurus of DDC Descriptors, which covers all of the fields involved in Department of Defense research, development, and engineering activities.1/,2/ The DDC Thesaurus is to be supplanted shortly by the Thesaurus of Engineering and Scientific Terms.3/

Returning to the collectanea approach to document filing, there is one obvious drawback which should be borne in mind. This is the matter of file maintenance and space consumption. While the collectanea type of file makes for rapid subject searches, it is extremely space consuming and difficult to maintain, requiring considerable housekeeping. The housekeeping requirements have tended to discourage many individuals and organizations from using the collectanea approach. Another discouraging problem is the cost of reproducing copies of pages. Where indexing is detailed or exhaustive, this cost can be prohibitive. A further complication is the fact that it is frequently necessary to maintain a file of the whole documents from which the copied pages were taken, since the information on a given page may not give the full context of the information it contains. Thus, while, from the viewpoint of speed, the collectanea approach is attractive, it does have serious drawbacks.

There is one other common method of arranging document files. This is by subject classes, as in most conventional libraries. There are three major subject classification systems presently in use. These are the Library

1/ Thesaurus of Engineering Terms: A list of engineering terms and their relationships for use in vocabulary control in indexing and retrieving engineering information. 1st ed. New York, Engineers Joint Council, May 1964.

2/ Thesaurus of DDC Descriptors: Arlington,Va., Defense Documentation Center, June 1, 1966. AD632 600 (out-of-print). Also had assorted supplements.

3/ Thesaurus of Engineering and Scientific Terms (TEST): Compiled under the auspices of the Office of Naval Research. Expected date of publication: Summer 1968. To be distributed by the Clearinghouse for Federal Scientific and Technical Information and the Engineers Joint Council (jointly), for $19.50 soft cover and $25.00 hard bound.

of Congress Subject Classification, the Dewey Decimal Classification, and the Universal Decimal Classification. From the viewpoint of comprehensiveness and specificity, the Universal Decimal Classification, which is actually an expansion of the Dewey Decimal Classification, is probably most satisfactory for personal files. However, the application of the Universal Decimal Classification and other classification systems involves considerable effort. It also has the further shortcoming of being uni-dimensional, in that, while a document may deal with several subjects, it can only be filed in a single place. We can, of course, get around this through the use of the collectanea approach. But this is a very expensive and space consuming solution.

Surrogate Files

We can also get around the fact that we are limited as to where to locate a single document in a collection through the use of surrogate files. The most common example of this type of file is the library card catalog, which, if fully understood and used efficiently, can be a relatively sophisticated retrieval device. The library catalog card is an example of what is known as a "unit record." Each card contains all of the descriptive information about a publication, including authors and subjects under which it was indexed. This feature makes possible multi-subject or coordinate searches. Given a multi-subject search situation, the searcher looks under the most important of the subjects in which he is interested. In so doing, he becomes aware of what publications are available under this primary subject, and also what other subjects these publications deal with (Figure 1).

Another example of the unit record type of surrogate file is the

Abstracting and Indexing Services.

Klempner, Irving M

Diffusion of abstracting and indexing services for government-sponsored research by Irving M. Klempner. Metuchen, N. J., Scarecrow Press, 1968.

319 p. illus. 22 cm.

Bibliography: p. 302-311.

1. Abstracting and indexing services. 2. Science—Abstracting and indexing. 3. Technology—Abstracting and indexing. I. Title.

Z695.9.K55 029 67-12065

Library of Congress [75-2]

Figure 1. Conventional library catalog card, with index entries at the bottom.

marginal punched card (Figure 2). The marginal punched card, also known as the edge-notched punched card, provides space for a total document description. The subject content of documents is represented in the form of punched codes on the periphery of the card. In the illustrated example (Figure 2), there are two basic means of representing coded subjects. One is by direct coding or punching, in which each punch on the card represents a specific subject. The second is via the "7, 4, 2, 1" code, which permits twenty-two subject classes and fourteen (the sum of 7, 4, 2 and 1) subclasses within each, making a total of 308 discrete subjects. Single subject searches are performed by "needling," with an ice pick-like device, those holes or combinations of holes representing the desired subject. Multi-subject searches are performed by re-needling the cards which have dropped out of the file on the first needling, etc.

There is a wide variety of types of marginal punched cards and coding schemes. These are discussed in detail in Bourne's Methods of Information Handling, listed in the Appendix on Suggestions for Further Reading.

The primary shortcoming of marginal punched cards for personal files, aside from the mechanical details of needling and the limitation of the number of available subject codes, is the fact that searches through files of more than 300 cards are generally physically cumbersome. Where files exceed this number, searches have to be done in two or more stages, which can be time consuming.

Inverted Indexes

One very successful device for getting around the mechanical limitations

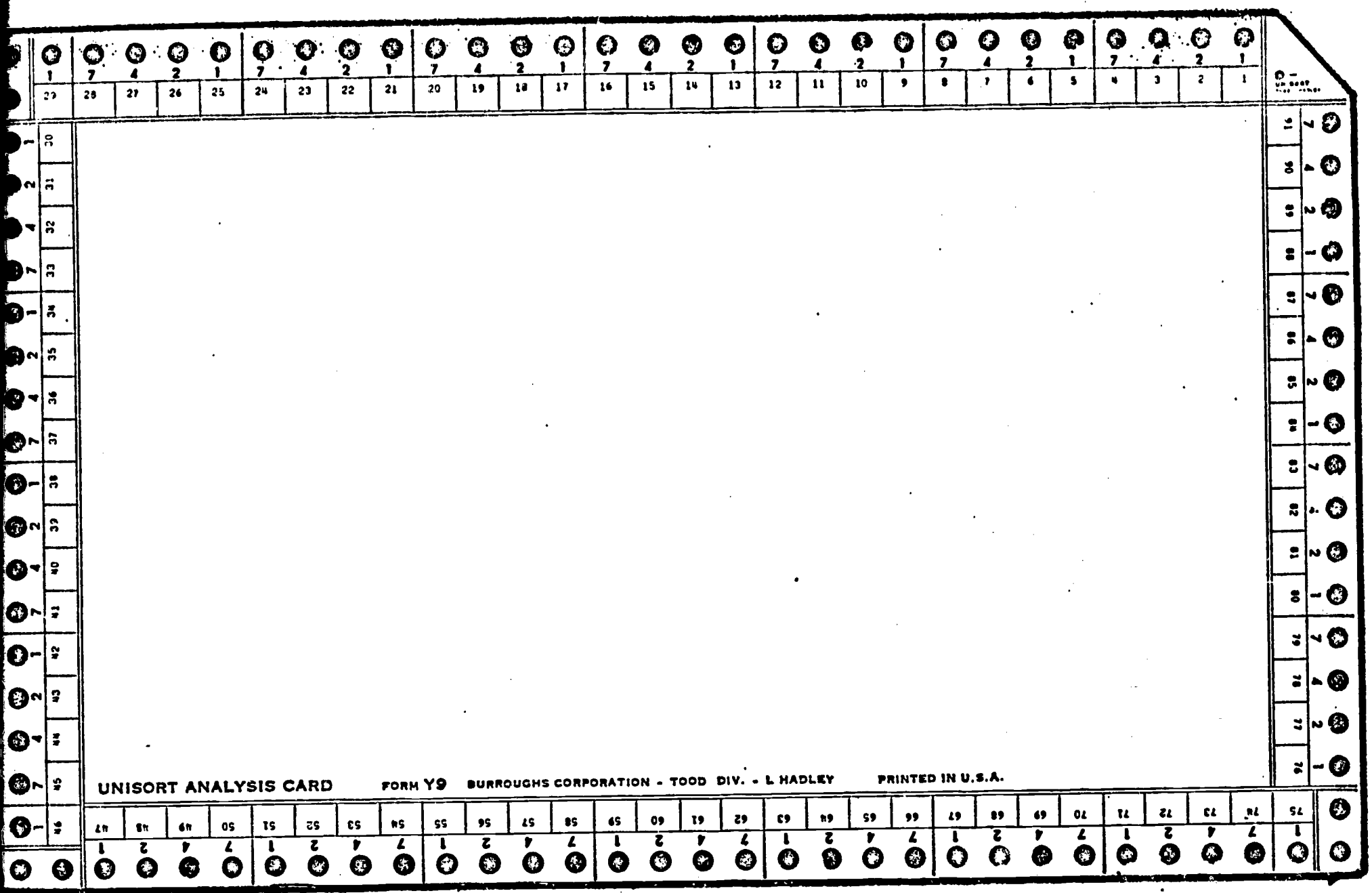

Figure 2. One example of a commercially available marginal or edge-notched card, in which the descriptive information is typed in the center and the subject codes are punched in the periphery.

of the unit record type of index, particularly where multiple subject or coordinate searches are involved, is the "inverted index." Figure 3 is an example of one form of such an index. It works on the "terminal digit" principle. One card is dedicated to each subject in the index file. Each time a new document is brought into the system, it is assigned a discrete document number which is posted on the cards for each of the subjects under which it is indexed. The document number is posted in the column coinciding with its terminal digit. Multi-subject or coordinate searches are performed by pulling the cards for the subjects desired, and searching for common numbers among the cards. This matching of numbers is facilitated via the terminal digit arrangement, since a given document number will always appear in the same column on every subject card on which it is posted.

The obvious advantages of the type of inverted index such as that represented in Figure 3 are its simplicity, economy, and amenability to growth. New subjects or subject cards can be added to the file as required, and there is theoretically no limit to the number of document numbers that can be posted on a given subject card, since "annex" cards can always be added.

A somewhat more sophisticated, but less flexible, version of the inverted index is what is known as the peek-a-boo or optical coincidence card. One example of this type of card, very suitable for personal files, is the Port-a-Punch, developed by the International Business Machines Corporation (Figure 4). The Port-a-Punch card is a conventional IBM card with 480 pre-scored positions, each representing a document number. As in the case of the inverted index depicted in Figure 3, a card is dedicated to

Annealing

	1	2	3	4	5	6	7	8	9
)	21	12	23	14	35	26	17	38	29
)	61	42	33	44	65	76	47	88	39
)	91		103	114	85	126	97	118	99
)	101			554	105	176	137	428	239
	301			594		246		468	
				614		486			
						876			
						936			

Figure 3. Coordinate index card, developed by Mortimer Taube, and originally called a Uniterm card.

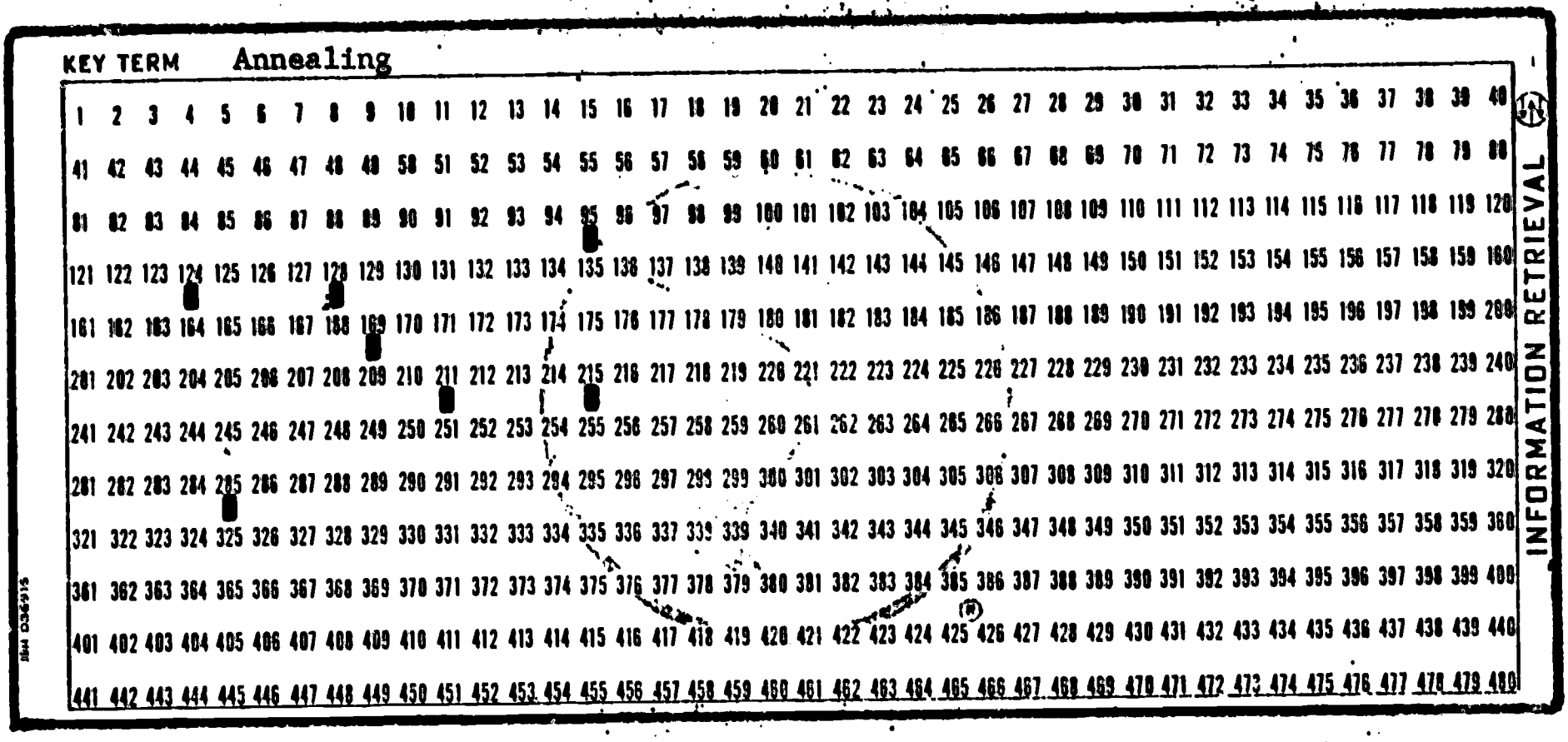

Figure 4. Port-a-Punch card, an example of a simple, manually operated peek-a-boo or optical coincidence system.

each indexing term. When a new document is brought into the system, a discrete number is assigned to it, the cards for the subjects under which it has been indexed are removed from the file, and the document number is punched in the appropriate position on each of the cards. The fact that each of the 480 positions are pre-scored facilitates the punching process, which can be performed with a pencil point. Single subject searches are performed by pulling the appropriate card, holding it up to a light source, and reading off the documents whose numbers have been punched. Multiple subject searches are performed by pulling the appropriate subject cards, laying them on one another, holding them up to a light source, and reading off the document numbers that have been punched on all the subject cards withdrawn from the file and thus show through.

The greatest limitation of the Port-a-Punch and similar pre-scored optical coincidence cards is the number of documents they can accommodate. In the case of Port-a-Punch, this number is 480. In another commercially available version of this type of card, called Find-It, the number is 400. It is possible to get around this limitation by adding successive decks of subject cards. But this means the same search must be duplicated two or more times when the number of documents in the collection exceeds 480 or, in the case of Find-It, 400.

Bourne, in Methods of Information Handling, describes two other commercially available peek-a-boo systems with greater document capacity than Port-a-Punch or Find-It. These are Omnidex, which attains a capacity of 20,000 documents through the use of 500 dedicated document numbers and 40 subfile numbers on the same card, and Termatrex, which attains a

capacity of 10,000 through the use of a larger card and by placing the holes somewhat closer together. Both are somewhat more complex and expensive to operate, Omnidex requiring subfile and document number punching and searching, and Termatrex requiring a special precision drill for punching.

Computerized Personal Files

One other possible means of organizing personal files, albeit experimental at this point, is worthy of mention, primarily because of its potential impact on the subject. This is the production of personal files by computer. While seemingly contradictory, computer-produced personal indexes, from the results of several projects, are beginning to appear not only technically feasible but quite serviceable in many situations.

One notable project in this area, performed by Jahoda and his colleagues at Florida State University, appears to establish (1) that acceptable personal index files can be created and maintained via computer techniques, and (2) that they can be effective retrieval tools (at least as effective as those produced by human indexers). 4/,5/

The substance of the Jahoda experiment was as follows:

Analyses were made of the titles contained in the personal files maintained by 12 members of the scientific and engineering faculties at Florida State. Analyses were also made of (1) the substantive words contained in

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4/ Jahoda, G., Ronald D. Hutchins, & Robert R. Galford. Characteristics and Use of Personal Indexes Maintained by Scientists and Engineers in One University. American Documentation, 17 (April 1966) 71-75.

5/ Jahoda, G., Ronald D. Hutchins, & D. M. Miller. Analysis of Case Histories of Personal Index Use. In: Black, Donald V. (Ed.)."Progress in Information Science and Technology. Proceedings of the American Documentation Institute; 1966 Annual Meeting, October 3-7, 1966, Santa Monica, California." Adrianne Press (Woodland Hills, Calif.) p. 245-254.

several hundred recorded reference questions actually put to the specimen personal files by their owners, and (2) the logical or semantic relationship of these words to one another.

Matching the semantic content and arrangement of the document titles and the reference questions, Jahoda and his colleagues found such a high degree of coincidence that they concluded, with seeming validity, that one could produce, through the computer-based permutation techniques discussed in an earlier chapter, Keyword-in-Context type of indexes, based on document titles alone, which would be strongly responsive to the apparent reference needs of users and maintainers of personal files.

Obviously, the Jahoda results have to be considered preliminary and tentative at this point. However, should they prove generally valid and applicable, they could have a profound effect on the kind and degree of personal file maintenance. They could also, incidentally, curb the apprehensions of many (including this writer) regarding the quality and utility of indexes based on titles.

There is one other interesting example of the computerization of personal files that should be mentioned. This is the computer production and updating of coordinate indexing cards such as illustrated in Figure 3. An early experiment in this area, since gone operational, was conducted at the Douglas Aircraft Company, where a coordinate index card file was created, duplicated in multiple copies, distributed to all of the Company's branch libraries, and is updated and redistributed to the libraries on a regular basis.6/

6/ Koriagin, G. W. "Library Information Retrieval Program." Engineering Paper No. 1269. Santa Monica, Calif.: Douglas Aircraft Company, Inc., Missiles and Space Systems Engineering, February 1962, 22 pp.

The posting of document numbers via computer, as opposed to manually, is very fast, and has an extremely high level of accuracy. This, combined with the high speed printing capability of computers, makes this method of producing coordinate index files very advantageous. It has obvious application to personal files.

RELATIONSHIP OF THE SCIENTIST AND ENGINEER TO HIS INFORMATION TOOLS AND MECHANISMS

In this chapter, we deal with how the user affects the information system or mechanism, and vice versa. More and more, as communication devices become more sophisticated and more ornate, the ultimate user or information seeker is forced to interact with the system as he never did before. As will be demonstrated in the following paragraphs, this interaction may be conscious or unconscious, intentional or unintentional. But, in any event, it is there and it should be understood.

Computer-User Relations

With the advent of the computer and its growing role in the processing of information, what a scientist or engineer writes and how he writes it is having an increasingly important effect on the content and serviceability of information systems. For instance, permutation indexes such as Keyword-in-Context, are wholly dependent on the titling of publications. If a title is vague or not truly descriptive of the contents of a publication, that publication will be lost for searching or retrieval purposes in bibliographic tools that are based on permuted indexing methods.

There are a number of other computer-based indexing techniques which can have as great, or perhaps an even greater effect, on the bibliographic treatment of writing as permutation indexing. The other systems are based

on texts rather than titles. Here the general procedure is to read texts, either in whole or abstract form, into the computer, via punched cards, punched paper tape, character recognition devices, or other means, and have the substantive words in the text automatically matched against a standardized vocabulary of index terms into which they are translated for subsequent searching. Obviously, in a situation of this kind, the accuracy and consistency of the indexing is wholly dependent on writing styles. Lack of clarity, excessive redundancy, and other writing blemishes can have a profoundly negative effect on the outcome and ultimate usefulness of this type of automatic indexing.

Another information tool or technique which has become viable as a result of the computer is the citation index, which, as noted earlier, starts with a representative cross section of early publications in the field, lists all subsequent publications that cited the earlier ones, all those that cited the subsequent ones, etc. Most writers (including this one) tend to be very incomplete and inconsistent in the preparation of reference citations. In bibliographic tools dependent on citations, this can have a very deleterious effect. Incidentally, references cited in publications constitute one of the major means by which the average scientist or engineer becomes aware of useful publications. This being the case, we do a profound disservice to our scientific and technical colleagues by citing publications incompletely or incorrectly.

Turning to the other side of the computer coin, the characteristic of computers that makes them very powerful searching tools is their ability to negotiate highly complex search questions, involving large numbers of concepts

and a broad variety of logical relationships among them. How well the requestor of a search is able to make use of these capabilities is wholly dependent on how well he is able to express what it is that he wants searched. Here again, we have, in the more advanced computer retrieval systems, the situation where the computer has to translate through matches the words in the question against the words in its stored index file. Thus, the more clear and simply expressed the query statement, the higher probability of a successful search. In a totally human search procedure, it is, of course, possible for the searcher to correct and compensate for inadequacies in the expression of a search topic. However, this option is not available in totally computerized search situations, and a greater onus falls upon the originator of the search request.

Closely related to the subject of searches and the wording of search requests, is that of Selective Dissemination of Information (SDI), illustrated earlier by the Automatic Subject Citation Alert (ASCA III). As previously noted, the SDI process consists of matching the index terms applied to documents coming into a system against the indexed descriptions of interests and activities of persons who are notified when there is a coincidence between the contents of a document and those of their interest profiles. The degree of matching accuracy and precision is dependent on two basic factors: how well each document is analyzed and indexed, and how well each recipient of the SDI service describes his interests, activities, and types of documents in which he is interested. Thus, in a sense, an SDI service is really a continuing bibliographic search activity, and once again it falls very much to the requestor to communicate clearly and efficiently with the system, if satisfactory results are to be obtained.

Non-computer Communications

Leaving the subject of the interdependence of the computer-based information system and its user, we now turn to the non-computer aspect of system-user interdependence. In the foregoing chapters, we have discussed and described a number of national information clearinghouses. For instance, we discussed, in the chapter on Information About Information, the National Referral Center for Science and Technology; in the chapter on Ongoing Research, we discussed the Science Information Exchange; in the chapters on Current and Past R&D Results, we discussed the Clearinghouse for Federal Scientific and Technical Information and the Defense Documentation Center.

All of these agencies are totally dependent on the cooperation of the scientific and technical community for their input, and the degree of cooperation of this community ultimately determines the overall effectiveness of these agencies as collectors and disseminators of information. Unfortunately, this required cooperation is not as readily forthcoming as it should be. Organizations such as the National Referral Center, which collects the bulk of its descriptions of information services and functions via questionnaires, suffer from the fact that individuals and institutions are reluctant to complete and return questionnaires. As a result, the files of the Center are incomplete and the person addressing a query to the Center is likely to get an incomplete answer. Theoretically, the Science Information Exchange is supposed to receive a description of every unclassified scientific and technical R&D project supported by the Federal Government. Again, the Exchange receives only a fraction of these descriptions, with the inevitable result that the person who wants to know what projects are being conducted or supported

in a given subject area will only get a fractional answer. The same is true of the Clearinghouse for Federal Scientific and Technical Information and the Defense Documentation Center, which are charged with collecting and announcing reports and other publications resulting from government-R&D activities.

Thus, a significant proportion of the information generated through the funding of the Federal Government is lost not only to the overall scientific and technical community, but also to the government itself. The obvious solution to this dilemma is for the scientist and engineer to bear in mind that, more and more, in order to <u>get</u> from the available information mechanisms he is going to have to <u>give</u> to them. There is no way around it.

APPENDIX 1

METHODS OF OBTAINING CERTAIN TYPES OF GOVERNMENT DOCUMENTS

Security Classified Material

The Department of Defense, National Aeronautics and Space Administration, Atomic Energy Commission, and certain other agencies to a lesser degree, are the major sponsors of work that is classified for reasons of national security.

Before classified information can be made available: (1) the person(s) to receive it must be cleared; (2) the facility where the classified material will be received, stored, and used must be cleared; and (3) there must be a "need to know" the information in connection with the work being performed. All of the pertinent regulations covering the handling of classified information, security clearances for facilities and individuals, control of areas, visitor control, subcontractor and vendor relations, consultants, etc., etc., are covered in the Department of Defense Industrial Security Manual (Superintendent of Documents, U. S. Government Printing Office, $1.50).

Specific instructions for registering for classified services from the Defense Documentation Center are contained in, Registration for Scientific and Technical Information Services of the Department of Defense, DSAM4185.3, January 1968. Similar procedures are employed by the National Aeronautics and Space Administration and are described in a small kit containing a cover sheet of general information and samples of user registration and facility clearance forms, a sample document request form, and a brochure describing

NASA scientific and technical publications and how to use them. This is available from the Scientific and Technical Information Division. Provisions of the"DoD Industrial Security Manual" also apply to NASA.

The Atomic Energy Commission has its own clearance procedures and rules and regulations for handling classified material. These are contained in the AEC Manual, Vol. 2000, Security. The Manual is an internal working document which gives detailed procedures covering all phases of AEC operations. It is available for inspection at the AEC Public Document Room in Washington, D.C., and at field offices, but is not sold or furnished to persons outside of the AEC or its contractors. However, the three basic criteria of personal clearance, facility clearance, and "need to know" still apply.

A unique feature of the AEC is its Access Permit Program which is described in Questions and Answers on U. S. Atomic Energy Commission Access Permits, TID-4558 (4th Rev.), available from the AEC Division of Industrial Participation. Parts of the "Code of Federal Regulations, Title 10 Chapter 1 - United States Atomic Energy Commission" (GPO - $1.00) applicable to Access Permits are:

Part 10 - Criteria and Procedures for Determining Eligibility for Access to Restricted Data or Defense Information

Part 25 - Permits for Access to Restricted Data

Part 26 - Dissemination of and Access to Certain Private Restricted Data

Part 95 - Safeguarding of Restricted Data

An Access Permit authorizes "the holder, after he has obtained appropriate facility approval and personnel access authorizations, to obtain Restricted Data useful for civilian applications in his business, trade, or profession. Information on weapons and other military applications is excluded." This means that a person need not be an AEC contractor to receive certain classes of classified information provided he meets other requirements which are detailed in TID-4558 cited above.

Patents

Patents are an important source of information about technical innovation. Abstracts of patents issued each week are printed in the Official Gazette, United States Patent Office (see p. 32). Copies of newly issued patents themselves are available on subscription from the U. S. Patent Office in any of the subject categories or sub-categories set out in the Manual of Classification, U. S. Patent Office (Superintendent of Documents, U. S. Government Printing Office, $11.00). Copies of patents previously issued in a particular category or sub-category are also available and for these it is possible to specify a time period to be covered, if desired. The foregoing applies to U. S. Patents only. Foreign as well as U. S. patents may also be ordered by number from the Patent Office. U. S. patents on 16 mm microfilm may be ordered from the Clearinghouse for Federal Scientific and Technical Information (see p. 45) for the years 1963 to the present; however, these may not be ordered by category but rather all the patents in one of the three groups into which the Official Gazette is arranged may be specified; i.e., General and Mechanical, Electrical, and Chemical. Cost of a year's current patents on microfilm is $600 for General and Mechanical, $400 for

Electrical, and $300 for Chemical, and all groups for $895. Costs of past year's patents in this form vary. Lockboxes in the Patent Office building to which daily deliveries are made are available for the convenience of those local individuals who frequently order patents. Because payment must normally accompany orders for patents, deposit accounts may be maintained with the Patent Office. Correspondence regarding patent matters should be directed to: Commissioner of Patents, U. S. Patent Office, Washington, D.C. 20231.

Congressional Documents

Single copies of Senate and House Documents and Bills, at least for the current session, are usually available from the Senate and House Document Rooms. They may be picked up in person or may be requested by letter. Telephone requests are not honored. When requesting by letter, the Document Rooms request that self-addressed mailing labels accompany the request. When a Bill has passed both Houses and becomes law it is published in the slip laws and the statutes at large. Slip laws, except in rare cases, are available individually from the Superintendent of Documents. House and Senate Committee Reports (Committee Prints), Hearings, etc., are, in many cases, available from the Committee originating them, often in multiple copies, however, availability varies from committee to committee. Some Committee Prints are available from the Superintendent of Documents. Most Congressional publications of all kinds are announced in the Monthly Catalog of U. S. Government Publications (see p. 31). An excellent discussion of Government documents of all kinds is contained in Schmekebier, Laurence F. and Roy B. Eastin, Government Publications and Their Use. Washington, D.C., Brookings Institution, 1961.(see p.10)

Deposit Accounts

A number of information disseminating organizations, both governmental and non-governmental, which require payment to accompany orders for their services, allow users to maintain deposit accounts. A deposit account customer can make prepayment for services which are charged against the account. Most organizations require a minimum balance to establish and maintain the account. Statements of account balances are rendered in ways which differ from agency to agency. An advantage of having a deposit account is that,in many cases, orders may be placed by telephone, which results in faster service. Some organizations with which deposit accounts can be established are:

Library of Congress Photoduplication Service
Library of Congress Card Division
Clearinghouse for Federal Scientific and Technical Information
Superintendent of Documents, U. S. Government Printing Office
U. S. Patent Office
John Crerar Library (photoduplication service)
New York Public Library (photoduplication service)
Engineering Societies Library (photoduplication service).

APPENDIX 2

SUGGESTIONS FOR FURTHER READING

Annual Review of Information Science and Technology - N.Y., Interscience, 1966-. Vol. 1-1966; Vol. 2 - 1967.

An annual review of progress in major areas of concern to information scientists with chapters written by authorities in their fields. A useful aid in keeping up with progress in the rapidly changing documentation field.

Becker, Joseph & Robert M. Hayes, Information Storage and Retrieval: Tools Elements, Theories, N. Y., Wiley, 1963.

A standard work on tools used in retrieval systems as well as a comprehensive treatment of theory and elements of system design.

Bourne, Charles P., Methods of Information Handling, N. Y., Wiley, 1963.

A standard text covering general aspects of the information problem, indexing, classification, coding, capabilities of many kinds of information handling equipments, computer systems, and microfilm equipment. A very useful book though the sections dealing with specific items of equipment are becoming dated.

Current Research and Development in Scientific Documentation (CRDSD). No. 14. Washington, D.C., National Science Foundation, Office of Science Information Service, 1966. Irregular. Available from Superintendent of Documents, U. S. Government Printing Office @ $2.00.

A comprehensive, thoroughly indexed, compilation of descriptions of current research projects in documentation and related fields; worldwide in scope.

Fairthorne, Robert A., Towards Information Retrieval. London, Butterworth, 1961.

A witty and closely reasoned treatise examining the theoretical foundations of information retrieval theory and library science written by one of the pioneer theoreticians in the field.

Fry, Bernard & Foster Mohrhardt, Guides to Information Sources in Science and Technology. Volume 1. Space Science & Technology, N. Y., Wiley, 1963.

A comprehensive guide to the literature of space science and technology covering specialized information centers, reference books, pertinent publications in specific subject areas, and a large amount of other useful information.

Kent, Allen, Textbook on Mechanized Information Retrieval, 2nd ed., New York, Wiley, 1966.

A text covering search methods, coding systems, and systems design as well as capabilities of specific pieces of equipment. A supplementary section with material for classroom use is appended.

Lancaster, F.W., Elements of Information Retrieval, N.Y., Wiley (in preparation).

A very lucid discussion of the intellectual, as opposed to the mechanical, aspects of information retrieval, with a very useful chapter on methods of addressing questions to information systems.

Loosjes, Th. P., On Documentation of Scientific Literature, Hamden, Conn., Archon Books, 1967.

Discusses documentation in its various aspects such as bibliographic control of periodical and monographic literature, search techniques, thesauri, instructions, types of retrieval systems and choice of retrieval system.

Meadow, Charles T., The Analysis of Information Systems: A Programmer's Introduction to Information Retrieval. N. Y., Wiley, 1966.

A recent text on the design of information handling systems with emphasis on computer implementation. Deals with indexing and the organization of files for optimum retrieval of information.

Nonconventional Scientific and Technical Information Systems in Current Use. No. 4. Washington, D.C., National Science Foundation, 1966. Irregular. Available from Superintendent of Documents, U. S. Government Printing Office @ $1.75.

A well indexed compilation of descriptions of operating advanced manual and mechanized scientific and technical information systems in current use in the United States.

Perry, James W. & Allen Kent, Documentation and Information Retrieval; An Introduction to Basic Principles and Cost Analysis. Wiley, 1957.

A monograph presenting a mathematical model of an information retrieval system and a detailed cost analysis of its operation. An older work interesting for its analytical approach and cost analysis.

Scheele, Martin, Punch-card Methods in Research and Documentation; with special reference to Biology. N. Y., Interscience, 1962.

Deals with application of punched cards to documentation. Describes in detail machine-readable and edge-notched cards. The second part of the book deals with general precepts in the application of punched card documentation and the third section deals with specific examples of applications to research. The book has a biological bias (as noted in the title) and the style is rather heavy.

Vickery, B.C., On Retrieval System Theory, 2nd ed., London, Butterworth, 1965.

A ..."unified presentation of the whole problem of information retrieval treating the subject on general theoretical lines." Description of documents, descriptor languages, file organization and coding, search strategy, system evaluation, etc. are covered.

Williams, William F., Principles of Automated Information Retrieval. Elmhurst, Ill., Business Pr., 1965.

Covers systems planning, documentation, abstracting, indexing, coding, storage, retrieval, vocabulary control, and types of data processing equipment available. A useful and reasonably current text with review questions at end of each chapter.