

Science information, as an integral part of the research and development process, must be easily accessible to scientists and engineers if science and technology are to make progress in improvement of the quality of man's physical and social environment. The Foundation's science information programs are directed toward ensuring that adequate information systems and services are available to the scientist and engineer. The long-term goal of the Foundation's Office of Science Information Service and its programs is to close the gap between the information needs of scientists now being served and those needs which must be met in the future as science and technology progress.

In pursuit of this goal the following major objectives have been set:

1. Investment in information system development for physics, chemistry, and other areas of science;
2. Aid to major universities to develop mechanisms which effectively serve research and education with present and new information products and services, including machine-readable tapes which are produced by professional societies, government agencies, and commercial organizations;
3. Short-term support to ongoing information activities, including translations, which are not yet self-sustaining;
4. Continued support of research and advanced development on science information problems; and
5. Fostering of cooperation, coordination and standardization among the various components of the present science communications complex which will lead to national and international networks of information services.

In fiscal year 1970, the Foundation awarded 104 grants and contracts and obligated \$11.4 million for science information activities.

INFORMATION SYSTEMS DEVELOPMENT

The information systems development program was initiated in response to the needs of scientists and engineers for modernized information systems. The costs of developing modern computerized systems while simultaneously supporting existing services exceeds the financial resources of the scientific community. Therefore, to insure an adequate flow of information in the future, the Foundation has undertaken to provide support for the development of modernized systems.

Discipline-Oriented Science Information Activities

Support is being provided for the development of discipline-oriented science information systems in nine disciplines.

Chemical Information System.—Fiscal year 1970 marked the end of 5 years of intensive development of an information system for chemistry. By the end of June 1970, the American Chemical Society (ACS) had exceeded the 5-year objectives as stated in the Office of Science and Technology planning document issued in October 1965. Some of the major achievements during fiscal year 1970 were:

1. The American Chemical Society has concluded agreements with the West German Chemical Society and the Chemical Society of London for the processing of the primary publications of their respective countries for direct input into Chemical Abstracts Service (CAS) computer system. Similar agreements are being discussed with two other countries.

2. Agreements have been concluded with organizations in seven foreign countries for the utilization

of the computer tapes produced by the CAS system.

3. In the United States, the computer tapes are being used by commercial, industrial, and not-for-profit organizations as well as universities and Government agencies to provide scientists with a variety of services.

4. The Chemical Registry System now contains nearly 1.5 million substances with more than 1.75 million names and 3 million references.

5. The conversion of the file for CAS's Eighth Collective Index (1967 to 1971) to machine-readable form continued and the funding provided in fiscal year 1970 should be sufficient to complete this project.

The use of the CAS system has emphasized the need for better cooperation between the major abstracting and indexing services in order to avoid excessive duplication. Accordingly, CAS, Biological Abstracts, and Engineering Index, Inc. have undertaken a joint study to determine the areas of overlapping coverage and, if possible, to develop a plan to reduce the duplication of effort and effect operating economies.

National Information System for Physics.—The American Institute of Physics (AIP) continued its creation of a computerized file of the primary physics literature. The file contains the following items for each journal article: (1) bibliographic information—journal, volume, page, article title, author, and author's location; (2) abstract of article; (3) indexing information; and (4) citations of the article to other literature. About half of the world's primary physics literature is being entered into the file.

Four different services are either available or in the process of being made available. They consist of a magnetic tape service which covers the monthly additions to the file, a

current awareness journal entitled *Current Physics Titles*, a series of bibliographies in special areas of physics, and the production of indexes to the various AIP journals.

The computer tapes produced by AIP are being used in a number of pilot operations which provide feedback information which will be used to improve the efficiency of the system.

Other Disciplines.—In the engineering sciences, indexes to electrical and electronics literature for both manual and automated usage have been developed. The American Psychological Association has defined a program of system development. The five remaining disciplines—linguistics, environmental sciences, life sciences, mathematics, and social sciences—are either in the process of defining their programs or in the preliminary study stage.

University-Centered Information Systems

The immediate objectives of support for university-centered information systems are threefold: (1) to meet the information requirements of academic scientists and the students they are training; (2) to establish "retail" campus-based terminals to accept the "wholesale" machine-readable tapes from the society-based, discipline-oriented systems, as well as the mission and problem-oriented products from Federal and private sources; and (3) to support the development of major nodes for the emerging national science information system.

During fiscal year 1970, the Foundation supported the development of discipline-oriented information service centers at six universities. Three of the centers—University of Georgia, University of Pittsburgh, and the Illinois Institute of Technology Research Institute—were originally established to develop systems to provide service for

the tapes produced by CAS, but have now expanded their operations to cover tapes from commercial and mission-oriented systems. These centers together with other centers using tapes from Chemical Abstracts Service (CAS) and from other tape processors have formed the Association of Scientific Information Dissemination Centers (ASIDIC). A similar organization of distribution centers has been formed in Europe and is known as the European Association of Scientific Information Dissemination Centers (EUSIDIC). Both organizations include commercial and industrial organizations in addition to universities and other not-for-profit organizations.

Two other centers—University of Arizona and University of Washington—are concerned with the development of systems for the acquisition, processing, and distribution of interdisciplinary or subdisciplinary information. The University of Arizona is developing an Arid Lands Information System and is exploring the feasibility of establishing a worldwide arid lands information network with other institutions in the United States which are processing similar material and with institutions in Israel and Australia. The University of Washington continued to work on the development of a computerized data bank of the information in the U.N. Treaty Series and is investigating the extension of the system to cover maritime laws of interest to the Sea Grant project at the University of Washington.

OPERATIONAL SUPPORT FOR SERVICES AND PUBLICATIONS

The Foundation continued its support of existing information systems and services at an operational level, and extended its temporary

support for the operation of developing systems in the major scientific disciplines. Altogether, support was provided for the operation of systems in six disciplines—psychology, engineering, geology, physics, mathematics, and atmospheric sciences. In addition support was provided for eight specialized bibliographies and indexing services.

The Foundation's support of publications was rigorously reduced. Only three monographs were supported as opposed to 22 in the previous year. Only one journal, one conference proceedings, and one critical review received support. Support was continued for the translation of 20 current primary journals by U.S. professional societies.

The science information activities conducted under the Agricultural Trade Development and Assistance Act of 1954 (Public Law-480) with eight foreign contractors resulted in the translation and republication in English of foreign primary journals, patents and monographs from Rus-

sian, East European, Japanese, and other languages; the preparation of abstracts; the compilation of annotated bibliographies, and the preparation of guides to foreign scientific institutions and information services. The combined activities of the Public Law-480 projects and the society-sponsored translation journals provided the scientific community with approximately 100,000 pages of foreign scientific and technological literature.

RESEARCH AND DEVELOPMENT

Support was provided for projects undertaken by individual research workers, research conducted by investigators associated with science information research centers, and the development of prototype experimental systems.

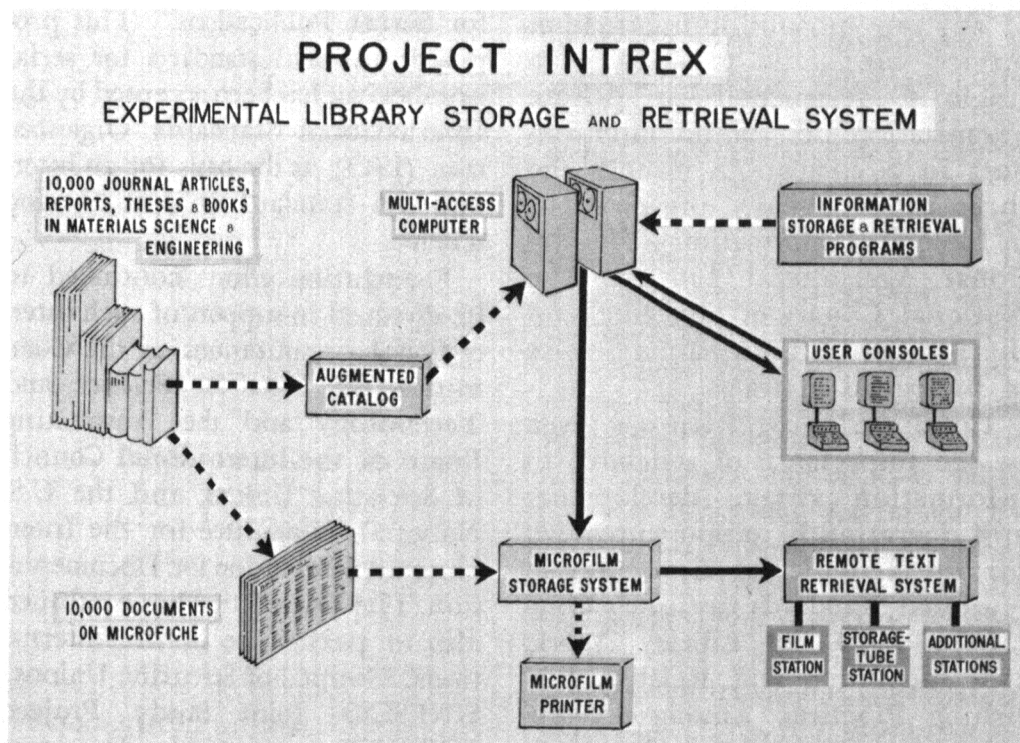
Cornell University has been doing research on procedures for the automation of indexing, classification, and construction of retrieval

tools for indexers. These procedures and their effectiveness are being tested by comparison of manual and automatic processing of textual material.

Project INTREX at the Massachusetts Institute of Technology (MIT) has been studying the utilization of digital computers, communication systems and microphotography to enhance the effectiveness of the library as an information transfer center. During the past year, the remodeling of the Engineering Library at MIT provided INTREX with an opportunity to compare the conventional library services with the new information transfer techniques. INTREX terminals are being intermingled with bookstacks and study carrels in a variety of arrangements to determine the preferences of the users.

The Alfred P. Sloan School of Management at MIT has been studying how scientific and technical information passes from one person to another in industrial organizations. It was found that in any organization a few key people called "technological gatekeepers" are relied upon to provide information to other people. These key people read the professional literature and maintain close liaison with the experts in their fields. The extension of the "gatekeeper" concept to information transfer on an international scale is now being studied.

The Science Information Research Center at the Georgia Institute of Technology demonstrated its newly developed audiographic learning system at the 1970 International System Meeting, Las Vegas, Nev. The system provides access via telephone to a modular body of indexed, graphically supported, narrative presentations for a student controlled study. The existing facility is capable of supporting several telephone-connected student stations and providing each with random accessibility to learning ma-



(Photo MIT)

terials or scientific information stored on computer-controlled tape recorders.

The Ohio State University Science Information Research Center reported that work on molecular cybernetics has led to the hypothesis that DNA stores programs or algorithms rather than "blueprint" or descriptive information. This suggests that the bridge between molecular and developmental biology is to be sought along lines similar to those developed for pattern recognition. Substantial progress has also been made on the theory of how people process information.

PLANNING, COORDINATION, AND COOPERATION

The Office of Science Information Service continued to support studies and organizational activities and to provide assistance of a planning, coordinative, and cooperative nature to enhance science communication at the national and international levels.

During the year attention was given by the Committee on Scientific and Technical Communication (SATCOM) to the problem of determining the most appropriate planning and coordinating mechanism for the science communication complex. A SATCOM Task Group on the Economics of Primary Publication also prepared a study report on the present situation of primary journals, recent trends and problems, and a perspective for general national policies.

The Committee on Biological Sciences Information (COBSI), under sponsorship of the National Academy of Sciences-National Research Council, issued a report on *Information Handling in the Life Sciences*. The report concludes that the U.S. information system for the biological sciences, in the absence



INTREX augmented catalog console at MIT. (Photo MIT)

of any one monolithic information service, cannot be provided by a single Governmental or private organization but should inter-connect in a compatible manner the three existing major organizations in biological information—The National Agricultural Library, The National Library of Medicine, and the Biosciences Information Service of Biological Abstracts.

Continued recognition was given to the importance of standards to information system development and operation by support provided for the activities of the American National Standards Institute's Committee Z-39 on Library Work, Documentation and Related Publishing Practices. Among accomplishments of Z-39 during the year is a "Standard Identification Number

for Serial Publications." This proposed national standard for serial numbering has been accepted by the International Standards Organization (ISO) as the basis for an international standard serial numbering scheme.

Foundation efforts continued to be directed in support of such international organizations as the Committee on Data for Science and Technology and the Abstracting Board of the International Council of Scientific Unions, and the U.S. National Committee for the International Federation for Documentation. The Foundation has continued also to participate in the International Council of Scientific Unions/UNESCO Joint Study Project, UNISIST, on a worldwide science information system.