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ABSTRACT

This annual report describes the accomplishments of the Office of Science Information Service toward meeting its goal of closing the gap between the information needs of scientists now being served and those needs which must be met in the future. Program emphasis was placed on information systems development, operational support for services and publications, research in information science and evolution of a framework for planning, coordination and cooperation, and activities toward support of these objectives are described. A budget summary and a list of members on the Science Information Council are appended. (AB)

Office of SCIENCE INFORMATION SERVICE

ANNUAL REPORT

Fiscal Year 1970

NATIONAL SCIENCE FOUNDATION

Washington, D.C. 20550

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Washington, D. C. 20550

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Office of Science Information Service

Burton W. Adkinson

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Annual Report
of the
OFFICE OF SCIENCE INFORMATION SERVICE
for
Fiscal Year 1970

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 the 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 in chemistry, physics, 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 produced by professional societies, government agencies, and commercial organizations;

(3) Short-term deficit support to ongoing information activities, including translations;

(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 $12.4 million for science information activities.

SIGNIFICANT DEVELOPMENTS

The discipline-oriented system based in the American Chemical Society (ACS) began to emerge as an international information system for chemistry. ACS has made 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's computer system. Similar agreements are being discussed with other countries. Agreements for the distribution of the products of the chemical information system have been concluded with organizations in seven foreign countries. In the United States, the products are now distributed by commercial, industrial, and not-for-profit organizations as well as universities.

The university-centered systems supported by the Foundation have expanded their coverage of computer tape services to include the tapes from commercial organizations and mission-oriented services, as well as the discipline-oriented systems.

The Research Centers at Georgia Institute of Technology and Ohio State University have succeeded in attracting highly qualified graduate students from a wide variety of disciplines. Consequently, the centers were able to select the students they need for multi-disciplinary research and training.

A highlight of FY-70 accomplishments was the formation of the Association of Scientific Information Dissemination Centers (ASIDIC) as a community sponsored means for achieving intersystem coordination. The membership includes university, not-for-profit, and industrial organizations. The Association's purposes are to (1) promote applied technology of information storage and retrieval as related to large data bases; (2) share experience and information through meetings, seminars, and workshops; (3) recommend standards for data elements and codes; and (4) promote research and development for more efficient use of varied data bases.

PROGRAM EMPHASIS

Support provided by the Office of Science Information Service is oriented to four areas of program emphasis which closely interact and influence each other. The two information systems development programs--discipline-oriented and university-centered information systems--complement each other: University-centered systems provide the terminal environment and discipline-oriented systems the communication channels for an evolving world-wide science communication network. These two system development programs are supplemented by operational support for

services and publications, that is, transitional operational support as a necessary prelude and follow-on to investment in development. Support of research in information science cultivates the technological environment within which system growth must occur. Support of studies and organizational activities, both national and international, fosters the evolution of an institutional framework conducive to system growth through which planning, coordination, and cooperation is fostered.

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. During Fiscal Year 1970, 25 grants or contracts were awarded.

Chemical Information System.-

Fiscal Year 1970 marked the end of five years of intensive development of an information system for chemistry. By the end of June 1970, the

American Chemical Society (ACS) had exceeded the five-year objectives as stated in the Office of Science and Technology planning document issued in October 1965.

In addition to the major achievements mentioned earlier, the number of substances in the Chemical Registry System has been increased to nearly 1.5 million substances with more than 1.75 million names and 3 million refe ences. The conversion of the file for CAS's Eighth Collective Index (1967 to 1971) in machine-readable form was 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 system.

Other Disciplines.-

NSF has supported studies in engineering to determine a feasible method of establishing a national system for engineering information. The latest study, made by the Tripartite Committee for a United Engineering Information Services, was not accepted by the engineering associations. The American Psychological Association has defined a program of system development and five disciplines--linguistics, earth sciences, life sciences, mathematics, and social sciences--are either in the process of defining their programs or are 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 sub-disciplinary 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 Grants project at the University of Washington.

Limited support for system development was continued at three university libraries--University of Chicago, Columbia University and Hamline University. The NSF-supported project at the University of Colorado to establish a centralized processing agency for the acquisition of library materials has been completed. The final report is not yet available but an earlier detailed report of this project has been published. ("Centralized Book Processing: A Feasibility Study Based on Colorado Academic Libraries," by E. Lawrence Leonard, Joan M. Maier, and Richard M. Dougherty," Meuchen, N. J., Scarecrow Press. 1969. 401 p. $10.00)

OPERATIONAL SUPPORT FOR SERVICES AND PUBLICATIONS

The Foundation continued its support of existing information systems and services at an operational level and extended its support of the transitional operation of developing systems in the major scientific disciplines. Altogether, support was provided for eight specialized bibliographies and indexing services and for the operation of systems in six disciplines - psychology, engineering, geology, physics, mathematics, and atmospheric sciences.

The American Geological Institute (AGI) received support for the operation of its computer-based geological reference file. AGI acquires the significant geological literature and stores the bibliographic data and index of the material on magnetic tape. Subsets of the data are sold to producers of geological information services. For example, the Geological Society of America uses the tapes for printing the Bibliography and Index of Geology. The tapes are used also to produce indexes for primary journals.

The American Mathematical Society continued to receive support for its Mathematical Offprint Service (MOS). MOS is a discipline-wide selective dissemination information service. Subscribers to MOS have their choice of several types of services. A subscriber to one type of service submits an interest profile and, on a monthly basis, receives offprints of greatest interest to him and descriptions of articles of lesser interest. At the present time, MOS covers about 200 journals and proceedings of symposia.

In the engineering field, Engineering Index, Inc. has concluded agreements with U. S. and foreign information centers on the use of COMPENDEX (Computerized Engineering Index). In addition, CITE (Current Information on Tapes for Engineers) and COMPENDEX have been made available to a commercial organization which will provide customized searches. The Institute of Electrical and Electronic Engineers, Inc. (IEEE) inaugurated a new tape service during the year, IEEE REFLECS (Retrieval from the Literature on Electronics and Computer Sciences). IEEE and the Institute of Electrical Engineers (IEE) of London have signed an agreement on the exchange of data bases on tape.

The Foundation's support of publications was rigorously reduced. Only three monographs were supported as opposed to twenty-two 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 (PL-480) with eight foreign contractors resulted in the translation and republication in English of foreign primary journals, patents and monographs from Russian, 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 PL-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 proto-type experimental systems. During fiscal year 1970, 13 grants were awarded for centers and projects of this type.

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 convential 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 Systems Meeting, Las Vegas, Nevada. 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 materials 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 Foundation continued its support of studies and projects designed to promote coordination, cooperation and planning in science information at the national and international levels.

The report submitted by the Committee on Scientific and Technical Communications (SATCOM) of the National Academy of Sciences and National Academy of Engineering has received wide review during the past year and

has stimulated worthwhile discussion in all types of organizations. Means of implementing some of the reports recommendations are presently being considered. In addition, a Task Group of SATCOM has prepared a report on the economics of primary publication which discusses the present situation of primary journals, recent trends and problems, and a perspective for general national policies. The report is to be published by the National Academy of Sciences in August or September of 1970.

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 of any one monolithic information service, cannot be provided by a single governmental or private organization but should interconnect 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 is being considered 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 Head of OSIS has continued also to participate in the International Council of Scientific Unions/UNESCO Joint Study Project, UNISIST, on a world-wide science information system.

Appendix A

BUDGET SUMMARY

SCIENCE INFORMATION ACTIVITIES, FY 1970

	No. of Awards	Actual FY 1970
SCIENCE INFORMATION ACTIVITIES	98*	$11,433,279
SYSTEM DEVELOPMENT AND IMPROVEMENT	32	5,957,740
Discipline-Oriented Systems	23	4,500,673
University-Centered Systems	9	1,457,067
INFORMATION SERVICES AND PUBLICATIONS	47*	4,279,455
Information Services	29*	1,898,134
Science Information Exchange	3	1,537,367
Translation	15	843,954
INFORMATION SCIENCE AND TECHNOLOGY	19	1,196,084
Centers and Projects	13	1,043,545
Management Studies	6	152,539

*Excludes 5 awards involving no OSIS funds: 4 projects supported with funds from other activity areas of the Foundation, and 1 project involving no cost.

Appendix B

NATIONAL SCIENCE FOUNDATION
Office of Science Information Service

SCIENCE INFORMATION COUNCIL

Membership List

June 30, 1970

	Category in which Appointed
Dr. Burton W. Adkinson Head, Office of Science Information Service National Science Foundation Washington, D. C. 20550	Ex Officio
* Mr. Herbert S. Bailey, Jr. Director Princeton University Press Princeton, New Jersey 08550	Librarian-Documentalist
Dr. Carey Croneis Chancellor Rice University Houston, Texas 77001	Scientist
Dr. Martin M. Cummings Director, National Library of Medicine 8600 Rockville Pike Bethesda, Maryland 20014	Ex Officio
Dr. Victor J. Danilov Publisher Industrial Research Inc. Industrial Research Building Beverly Shores, Indiana 46301	Librarian-Documentalist
Dr. Bowen C. Dees President The Franklin Institute 20th & Benjamin Franklin Parkway Philadelphia, Pa. 19103	Layman

* Chairman

	Category in which Appointed
Mr. John W. Murdock Associate Manager Department of Economics and Information Research Battelle Memorial Institute 505 King Avenue Columbus, Ohio 43201	Librarian-Documentalist
Dr. Byron Riegel Director Chemical Research and Development Searle & Company P. O. Box 5110 Chicago, Illinois 60680	Scientist
Mr. John Sherrod Director, National Agricultural Library U. S. Department of Agriculture Beltsville, Maryland 20705	Ex Officio
Dr. John C. Weaver President University of Missouri Columbia, Missouri 65201	Layman
Mr. Leo Weins President The H. W. Wilson Company 950 University Avenue Bronx, New York 10452	Librarian-Documentalist
Dr. F. Karl Willenbrock Provost Faculty of Engineering and Applied Sciences State University of New York Buffalo, New York 14214	Layman

	Category in which Appointed
Dr. Amitai W. Etzioni Chairman Department of Sociology Columbia University New York, New York 10027	Scientist
Dr. Herman H. Fussler Director University of Chicago Library University of Chicago 1116 East 59th Street Chicago, Illinois 60637	Librarian-Documentalist
Dr. Robert E. Gordon Professor of Biology Associate Dean College of Science University of Notre Dame Notre Dame, Indiana 46556	Scientist
Dr. Clifford Grobstein Vice Chancellor for Health Sciences and Dean of the School of Medicine University of California, San Diego P. O. Box 109 La Jolla, California 92037	Scientist
Dr. H. William Koch Director American Institute of Physics 335 E. 45th Street New York, New York 10017	Scientist
Dr. J. C. R. Licklider Professor of Electrical Engineering Director of Project MAC Massachusetts Institute of Technology 545 Technology Square Cambridge, Massachusetts 02138	Librarian-Documentalist
Dr. L. Quincy Mumford The Librarian of Congress Washington, D. C. 20540	Ex Officio