

country might assemble at 8 o'clock each Monday morning (before the regular work day starts) in a company conference room, and review the latest developments in their field on large screen TV—from a program which was broadcast while they were asleep.

Meanwhile, what about magazines? Our technological society keeps getting more complex, and publication costs keep rising. Commercial magazine publishers face a considerable challenge. We believe successful magazines will have to concentrate on those areas of technical information which are most efficiently disseminated by publications. This means eliminating many types of information now appearing in publications. Publishers

must find ways to shorten the lead-time between the occurrence of an important technical development and the time it appears in the magazine. Possibly most important, they will have to develop new journalistic techniques—writing style, format, and the use of graphics—to shorten reading time, and at the same time increase understanding for the reader.

As technology grows more complex and as the rate of technological obsolescence quickens, effective technical communication will become even more important. I sincerely believe that the competitive system which motivates our commercial technical publications will be the most important force driving us to meet this challenge.

## The Federal Government and U. S. Scientific Information\*

By BURTON W. ADKINSON

Office of Science Information Service, National Science Foundation, Washington, D. C.

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**GENERAL SCOPE OF THE FEDERAL GOVERNMENT'S ROLE.** The U. S. Federal Government, through its own activities and through contracts and grants, today is both one of the principal producers and stimulators and one of the largest users of scientific information. The following facts indicate something of the scope of the Federal Government's activities in scientific information: In fiscal year 1960, over 60% of the scientific research and development in the United States was financed by the Federal Government, and one of the principal products of all research and development is scientific information. Thirty-seven Federal agencies have significant scientific information activities. Of approximately 450 specialized scientific information centers in the United States, as identified by the Battelle Memorial Institute, some 200 receive direct or indirect Federal support. The last issue of the National Science Foundation's publication, *Research and Development in Scientific Documentation*, describes 171 projects in scientific documentation under way in the United States of which 120, or 70%, are supported in whole or part by the Federal Government.

**CHARACTER OF THE FEDERAL GOVERNMENT'S ACTIVITIES.** The major emphasis of Government agencies in this field has been, and should continue to be, on the support of information activities which contribute to the accomplishment of the particular missions of these agencies. However, each agency has been established to perform a needed public service, and its information efforts are bound to have an effect on the general information picture, just as scientific information from non-governmental sources contributes to the accomplishment of strictly Federal purposes. Beyond this, however, the Federal Government has a major responsibility for the maintenance of an effective U. S. technical information system because today scientific research and development play so important a role in the nation's over-all welfare.

In its own operations, the Government has been principally involved in scientific information (1) as an operator of information systems and (2) as a user of services and equipment.

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As an operator of information systems, the Government contributes to a variety of non-Federal needs for scientific information. Examples of these non-Federal services include:

A series of bulletins called *Scientific Information Activities of Federal Agencies* is being issued by the National Science Foundation. Numbers published to date are:

1. Department of Agriculture (NSF 58-27)
2. Office of Naval Research (NSF 59-19)
3. Department of Commerce I, covering Office of Technical Services, Bureau of the Census, Bureau of Public Roads, and Patent Office (NSF 59-58)
4. Government Printing Office (NSF 60-9)
5. Tennessee Valley Authority (NSF 60-44)
6. National Science Foundation (NSF 60-56)
7. Department of Commerce II, covering Weather Bureau, Coast and Geodetic Survey, Maritime Administration, Business and Defense Services Administration, Office of Business Economics, and Bureau of Foreign Commerce (NSF 60-58)
8. Department of Commerce III, covering National Bureau of Standards (NSF 60-59)
9. Federal Communications Commission (NSF 61-12)
10. Veterans Administration (NSF 61-22)

These bulletins are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

As a service to libraries and scientific information centers, the Library of Congress systematically supplies catalog cards on publications, including those on scientific and technological subjects. Its publication *New Serial Titles* during the past five years has provided a listing of approximately 16,500 new serial titles per year of which at least a third have been in the fields of science and technology, including agriculture and medicine. This listing is important for indicating the existence of new research areas and the world-wide status of scientific research. The Library also issues the *Monthly Index of Russian Accessions* which lists thousands of Soviet publications, over 50% of which concern science and technology.

As a service to agriculture and allied fields, the Department of Agriculture publishes numerous reports, bulletins, surveys, and compendia of various kinds. Among the best

known are the *Yearbook of Agriculture* and the *Bibliography of Agriculture*. The latter, which is issued by the Department library, is an index to the world's literature on agriculture and related sciences. Special bibliographies also are prepared as the occasion arises.

As a service to medicine, the National Library of Medicine performs the task of keeping organized and available more than 1 million volumes on medical and related scientific subjects. In 1960 this library received and cataloged more than 125,000 medical articles and books. It publishes and distributes an annual catalog of medical books, a monthly index to medical literature under the title *Index Medicus*, and current bibliographies on medical subjects; it also answers specific bibliographic inquiries on medical subjects received from all parts of the world.

As a service to atomic energy research organizations, the U. S. Atomic Energy Commission provides a coordinated, comprehensive information system, extending from the production of reports on subjects related to atomic energy to direct service to users. In 1960, its *Nuclear Science Abstracts* covered over 26,000 articles, books, reports, monographs and other material.

As a service to the business and the scientific community, the Department of Commerce conducts a wide range of scientific information activities. Its Patent Office has several million patents on file which are excellent sources of scientific and technical information. The Department's Office of Technical Services acts as the operating agency for announcing and making generally available the unrestricted scientific research reports of a number of Government agencies, including those issued by the Department of Defense, the Atomic Energy Commission, the National Aeronautics and Space Administration, and their contractors.

As a user of information services, the Government has a profound influence on the development of more effective techniques for the dissemination of scientific information. The sheer enormity of its tasks which require access to technical information necessitates the development of effective systems for handling bibliographic materials and the application of mechanization to these systems on as large a scale as can be made efficient and practicable. The by-product of this effort can have significant advantages for private applications in the scientific information field. For example, Government needs for automatic data processing have resulted in its providing funds for developmental costs of equipment which is now available for other purposes.

This same process now appears to be taking place in the mechanical translation field where the practical payoff is too far in the future for substantial commercial funds to be available for extensive basic research. However, such research is prerequisite to the development of practical machines for automatic translation. Also, the principles established as the basis for mechanized translation systems are certain to have important applications in the mechanization of the storage and retrieval of scientific information.

**GOVERNMENT'S PRESENT AND FUTURE ROLE.** In the general field of scientific information, the Government's role during the past four to five years has become increasingly dynamic. This is the result of the pressing necessity to extend and speed up scientific research and development in the United States. All branches of the Government have come to recognize that the effective

dissemination of scientific information plays a key role in scientific achievement. This recognition is exemplified by the following two actions, one Legislative and one Executive, which were taken in 1958: 1. The National Defense Education Act of that year directed the National Science Foundation to

"provide or arrange for the provision of, indexing, abstracting, translating, and other services leading to more effective dissemination of scientific information; and undertake programs to develop new or improved methods, including mechanized systems, for making scientific information available."

2. Executive Order 10521, as amended, directed the Foundation to

"provide leadership in the effective coordination of the scientific information activities of the Federal Government with a view to improving the availability and dissemination of scientific information."

Under these mandates a six-point program has been developed by the National Science Foundation for improving the dissemination of scientific information, particularly among U. S. scientists and engineers.

First, improvement in policy making, program planning, and coordination in scientific information activities is being fostered both within and between Government agencies. For example, the individual institutes within the National Institutes of Health are now making plans to co-operate more closely to prevent overlap in information efforts and also to derive the increased benefits possible through coordination. As another example, a number of agencies which support scientific research are cooperating to coordinate information on where and by whom research is conducted; this is being accomplished through the Science Information Exchange located at the Smithsonian Institution. This program is an extension of the one formerly conducted by the Bio-Sciences Information Exchange.

Second, a sizable research and study program is being supported looking toward the development of new and better methods of processing, disseminating, storing, and retrieving scientific information. At present this phase of the work is concerned principally with three areas: information needs of scientists, mechanization of storage and retrieval, and mechanical translation. In this activity, the Foundation's principal interest to date has been in basic research investigations which will increase fundamental knowledge of the problems involved rather than in the development of particular devices and systems.

Universities and related scientific organizations also have a prime responsibility for insuring that research programs leading to better documentation methods and mechanization are adequately fostered. Universities always have been active supporters of basic research, and their programs should include research in scientific documentation. It is only by phasing in new and more efficient ways of handling information that the country can hope to keep up with the inevitable growth of scientific information in the future.

Third, scientific societies are being encouraged and supported by the Federal Government in assuming greater responsibility for the effective dissemination of scientific information within their own disciplines. Examples include the following:

The American Chemical Society's Chemical Abstracts Service has been aided in its study of new techniques for applying mechanization to the information retrieval problem. Also, support has been provided to develop a mechanized system for handling formulas and to initiate an automatically prepared permuted index of titles of chemical papers.

The American Institute of Biological Sciences has established a communications project for the purpose of examining in detail the basic needs of biologists for scientific information and the best means of satisfying these needs.

The American Institute of Physics is engaged in a similar study, and the American Mathematics Society has several projects underway for improving communication among mathematicians, including the systematic exchange of publications with the Soviet Union.

Temporary assistance is provided for the initiation of needed new primary journals and to enable existing journals and abstracting and indexing services to expand coverage, eliminate backlogs, update indexes, and the like.

Major support is given for the translation into English and the publication of a number of Russian scientific journals and monographs and of certain significant Japanese and Chinese materials.

On the general problems associated with publication of research information by scientific societies, studies are being made of the best means of channeling an appropriate fraction of the research dollar into the support of (1) primary and secondary journals and (2) abstracting and indexing services. One approach to the first objective is the page charge which long has been used effectively by some scientific societies; many Federal agencies have paid such charges for a number of years, and efforts are underway to make this practice standard for the Government as a whole. The possibility of an article charge to support abstracting is being carefully explored.

Fourth, closer cooperation and coordination is being fostered among Government agencies having like or similar scientific information programs. Examples include the following:

The Department of Defense, the U. S. Atomic Energy Commission, the National Aeronautics and Space Administration, the Office of Technical Services of the Department of Commerce, and the National Science Foundation are working together to bring about better dissemination of the information contained in research reports which does not readily and promptly get into conventional publication channels.

In the field of mechanical translation, an Interagency Committee on Mechanical Translation Research, chaired by the National Science Foundation, has been established to coordinate progress in this field.

The Office of Technical Services, the Special Libraries Association, the National Science Foundation, and military and intelligence agencies are cooperating in making translations of foreign scientific literature more readily available.

An interdepartmental committee is operating to coordi-

nate efforts to acquire difficult-to-obtain foreign materials. This committee includes representatives from the Library of Congress, the Department of Agriculture, the National Library of Medicine, the Department of State, the U. S. Atomic Energy Commission, the National Aeronautics and Space Administration, and intelligence and military agencies.

Fifth, better coordination is being fostered in American participation in international organizations that are oriented to documentation activities. Formerly, there were often situations where the U. S. viewpoint was not adequately represented or a national position had not been well thought out. To remedy this situation, the National Academy of Sciences-National Research Council, with the support of the National Science Foundation, is taking responsibility for organizing and coordinating the U. S. National Committee to the International Federation of Documentation which is one of the key international bodies in the documentation field. Also coordination and the exchange of ideas is being fostered with such organizations as the International Council of Scientific Unions and UNESCO. In August of 1961, the National Science Foundation organized a Section of Scientific Information at the 10th Pacific Science Congress. This was the first time that this subject was included as a section at these Congresses.

Sixth, action is being undertaken to stimulate effective educational and training programs in scientific documentation. Because this is a relatively new field there is a shortage of individuals who have been trained specifically in it, and there are far too few educational facilities for giving such training. This deficiency must be remedied if scientific documentation activities are to be staffed adequately in the future. Also, the training of scientists to take advantage of the scientific literature of their own disciplines has been grossly inadequate, leading to ineffectiveness and inefficiencies that the nation can ill afford. Universities and related scientific organizations have a prime responsibility for insuring that both scientists and information specialists are adequately trained in scientific documentation.

In conclusion, it is stressed that the dissemination of scientific information must be recognized as an integral part of research and development. Unless such information is adequately disseminated and used, the advance of knowledge is unnecessarily hindered and the resources going into research will be wasted.

Maximum progress in this complex area will result only if there is effective cooperation among all those concerned with scientific research and development. No one individual or no one organization can have the final solution for all problems in scientific information. At the same time, where problems do exist, or are anticipated and are not being worked upon, some kind of positive action must be taken if scientific research and development are not to be retarded. The Federal Government is attempting to identify some of these problems and, where it seems appropriate for it to act, is fostering efforts looking toward their solution.