

1. THE GOVERNMENT MAKES PLANS

by William T. Knox

In discussing information-system development, I feel, in a way, like a missionary. I don't mean in the sense of propagating the faith some of us have that progress in science and technology can result from better information handling. I mean, rather, in advocating a partnership of the government and the private sector in fashioning the tools—the information systems—that will meet our present and future needs. I stress the word *partnership* because I sincerely believe that although *federal*-information-system improvement is a vital ingredient, the larger need is *national*-information-system improvement. In this positive sense, then, I describe myself as a missionary seeking to convert your curiosity into interest and your interest into action. Without your participation in the planning and execution of national systems, progress will continue to be slower than it need be.

In a nutshell, we who are studying the problem for the federal government are convinced that in your professional and in the public interest every physicist has a role to play in the development of national systems for scientific and technical information.

I am chairman of one of the committees of the Federal Council for Science and Technology, the Committee on Scientific and Technical Information, commonly called "COSATI." Let me give you a word picture of what COSATI does and how the COSATI Task Group on National Systems for Scientific and Technical Information is proceeding. I will tell you about some problems we face and trends we must consider. I will outline some of the actions undertaken and some being planned by the government. I will highlight to you my interest that organizations such as the American Institute of Physics and its member societies must participate in the program of developing a national system and that the stakes are high for us as a nation as well as for physicists as individuals. You are invited to join in a dialogue—to make your thoughts known.

What is an information system?

Now, I have been referring to information systems and perhaps we need a definition. Information systems, as I use the term, refers to that large, somewhat amorphous complex under the general heading of scientific and technical information activities. I think "systems" is a better concept, because it is through a series of related systematic functions that information is transferred to promote the progress of science and technology.

Too often there has appeared to be an emphasis on scientific and technical information systems without relating them to the cause the systems serve, the reason for their existence—the progress of science and technology.

President Kennedy focused on the real issue when he said, "One of the major opportunities for enhancing the effectiveness of our national scientific and technical effort, and the efficiency of government management of research and development lies in the improvement of our ability to communicate information about current research efforts and the results of past efforts. Strong science and technology is a national necessity and adequate communication is a prerequisite for strong science and technology."

Arising out of that basic declaration of opportunity and purpose, those federal government organizations concerned with overall plans and pol-



The author, a research chemist and corporate-planning manager for Esso Research and Engineering, is on leave to the President's Office of Science and Technology, where he is concerned with information-system development. This article is adapted from a speech delivered recently before representatives of Corporate Associates of the American Institute of Physics and is, in essence, the material presented last summer to the Subcommittee on Science, Research, and Development of the House Committee on Science and Astronautics. Congressman Daddario (D-Conn.) is chairman.

icies for research and development have for some years been working on specific programs to improve scientific-information systems. That effort is now greater than ever before.

The government effort

The Federal Council for Science and Technology is the overall advisory and coordinating mechanism for activities within the executive branch of the federal government for science and technology. I also assist Dr. Donald F. Hornig, the President's Special Assistant for Science and Technology and Director of the Office of Science and Technology. OST advises and assists the President in overall coordination, planning, and evaluation of federal programs in science and technology. COSATI is the principal mechanism for obtaining individual agency views and reaching agency consensus on desirable activities and programs of the federal government with respect to information systems for science and technology. The Office of Science and Technology provides an executive device for implementing the recommendations of COSATI.

Let me first outline the scope of COSATI's concerns. They are very broad because they are related to all scientific and engineering disciplines and to all of technology. The breadth of problems being studied by COSATI can be understood better by considering the work areas of its panels:

Operational techniques and systems. This panel is concerned with acquisition, accession, abstracting, indexing, announcement, distribution, terminology control, equipment compatibility and convertibility, wholesale and retail resources, specialized information centers, libraries, and depositories. This is our "workhorse" panel, charged with improving the quality of performance and coordination of current and near future federal agency programs.

Information sciences technology. The missions assigned to this panel are to make recommendations for orderly development of information-sciences technology and orderly transition from current to improved systems. "Orderly development" means avoiding unnecessary duplication of agency research and development efforts and identifying gaps in those efforts.

Education and training. This panel helps us look for improved education and training of information specialists and means for increasing their supply. It will also recommend programs to help educate scientists and engineers and managers in the use of information resources and systems.

International information activities. This country needs information produced by scientists and engineers in other countries. In these days of plans for computerized information systems serving an international community, it is important to have a panel to help coordinate federal-agency activities to set standards for systems, to recommend international exchange policy and procedure and to improve the many translation programs carried on in and out of government.

Also under consideration are other panels dealing with the problems associated with production



ILLUSTRATIONS BY HELEN HERMAN

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and use of information and with relations between federal and nonfederal information activities.

COSATI's concerns thus embrace not only systems that actually transfer documents and information from one user to another. They also embrace (a) initial publication processes and producers of information, (b) user groups with their varying information needs, (c) education and training of information-system operators, and (d) producer-user groups of modern information systems. Information systems also have their own large research and development programs.

The size of the federal-government program is not easy to determine. The reason is that it is difficult to make a distinction between some information activities and the research or engineering activities of which they are an integral and essential part. To all scientists and engineers information transfer is an inseparable part of their

science and engineering. Recognizing, however, the difficulties in separating information services from other aspects of research and development, COSATI has developed some very rough budget estimates for information programs of executive-branch agencies for fiscal year 1966, as follows:

<i>Activity</i>	<i>Cost (\$ millions)</i>
Publication and distribution	130
Bibliographic and reference service	80
R&D information sciences and systems	60
Symposia and technical meetings	40
Information centers	20
Management and training	20
Audio and visual media	10
Budget issues	10
Translations	5
Support publications	5
Total	380

These numbers are rounded. They are estimated obligations, not expenditures.

Actions by federal agencies

A number of actions have been taken by federal agencies to improve information systems as a result of COSATI studies and recommendations. Some of these are

1. a uniform policy to guide federal agencies on financial help to nonprofit, nongovernment scientific publications. This is the so-called "page-charge" policy, whereby federal agencies pay certain costs of publication if requested by the publishers

2. a standard for microforms of technical reports. We call these "microfiche," and we look for this new standard to create a new, large market and thus lower unit costs

3. a uniform method for identifying federal reports. This is called "descriptive cataloging," and the technique is of particular help to those people who have to store and retrieve reports

4. finally, a subject-category list to be used throughout the federal government for the announcement of reports. This will make it easier for users of federal reports to locate information.

These COSATI actions do not have the glamor of a space walk, but they are very significant actions in bringing about better coordination of federal and nonfederal information activities. We will have to follow their implementation and modify and correct them when necessary. We are also working hard on other standards and policies.

In addition to the above-mentioned actions whereby individual agencies and nongovernment

organizations have been enabled to make their own information systems more effective and more efficient as components of the total national network, COSATI has been the mechanism by which, or with whose endorsement, several new organizations have been created to carry out special functions of the national network. These new central organizations are

1. the Clearinghouse for Federal Scientific and Technical Information
2. the Science Information Exchange
3. the National Referral Center for Science and Technology
4. the National Standard Reference Data System

An overall national complex

About a year ago, following several suggestions from committees of the Congress that the executive branch exercise stronger, more aggressive leadership in this area, an interdepartmental COSATI task group began to develop the conceptual framework for a plan to improve the overall complex of scientific and technical information activities in the United States.

To develop a realistic conceptual framework, one had to consider activities inside and outside the federal establishment because nonfederal and federal activities are mutually dependent on one another, and much federal money goes directly or indirectly in support of these activities (and vice versa, of course). Very early in the deliberations of the COSATI task group, we recognized the importance of continuing dialogues with representatives of various nongovernment components of the information-system complex.

Accordingly we have already participated in a number of special meetings held to present the task group's preliminary thinking regarding a *concept* toward which US information systems could develop. These meetings have been held with top-level representatives of scientific and engineering professional societies, industrial and trade associations, the technical and business press, and library groups.

Although there are many other areas of interest, the task group has focused its efforts so far on formalized communications mechanisms, primarily document-handling mechanisms. In part this emphasis is due to the relatively organized subsystem of document-handling activities, compared to the less structured nondocument systems for information transfer. The task group has been assisted by a study team from the System Development

Corp., and the first report became publicly available recently.

What have we developed so far? First, we have concluded that the far-flung, widespread nature of the information system can be roughly conceived as in part analogous to the telephone network, which is a mechanism for connecting people who want to know or to talk with other people who either have the desired information or are willing

does not mean federal *operation* of the document-handling system but only federal *responsibility* for ensuring an effective system.

Apparently we need several libraries at the national level, handling *documents* in such fields as medicine, agriculture, engineering, earth sciences, physical sciences, behavioral sciences, etc. Each of these libraries would be concerned with acquiring all the pertinent literature in its field, cataloging



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to listen. The telephone network is a mechanism completely at the service of its users, and one needs only an elementary knowledge to be able to use it. The telephone operates on a real-time basis, however, and this is a big difference from information systems, which in part transfer knowledge acquired some years ago to today's users.

Partly to recognize this difference in user need and partly because of the different functions and types of people involved, we have, in our preliminary thinking, divided the body of the national network of information systems into two parts: first, a complex of library systems (document-oriented, as are traditional libraries) and second, a complex of information evaluation and retrieval systems (information-oriented).

A copy of each significant document

A basic proposition has been put forth by the task group for further consideration within the government: namely, that the federal government has responsibility for ensuring accessibility within the United States of a copy of all significant worldwide literature in science and technology. This

or indexing it, announcing the availability of the literature, and providing copies if requested. These would be structured, operated, and administered to meet some standard system requirements or specifications, but they would not necessarily be operated by the government. Each national library would be the responsibility of a federal agency with primary mission responsibilities in its field of interest, such as the National Library of Medicine, which responds to the mission of the Department of Health, Education and Welfare. Coordination and compatibility among the libraries would be a primary goal from the beginning, and a question for early decision is the mechanism for bringing about this coordination.

Because of the size of our population and the diversity of demands made on libraries for documents, ranging from help to the teenage student to the needs of the lay adult to the needs of small and large business and the professions, the rest of the library network will be essentially retailers of documents. Other library systems (federal, college and university, public, specialized, industry, institutes, schools, etc.) would, as now, look to the

national libraries for loan of documents, catalogs, etc., as may be appropriate, and would, in turn, provide some of the input to those libraries. But their main role would be to serve those users who will be satisfied with documents.

Evaluation and retrieval

The other part of the system—the complex of evaluation and retrieval systems—would consist of those activities of government agencies, universities, industries, and societies (professional, scientific, and trade) that are concerned with providing information, as opposed to documents, to specific audiences directly concerned with science and technology. Elements of this system would be expected to

1. provide secondary current awareness, such as abstracts bulletins;
2. analyze and evaluate information, not only the information contained in documents but that information just developed and still unpublished;
3. facilitate searching of the literature through deep indexing and other means;



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4. retrieve specific information on request, that is, answer on-the-spot questions.

These activities are normally much more closely identified with the research and development programs and the scientific disciplines than are the document-oriented activities centered on li-

braries. They require scientific and technical orientation and competence of the participating personnel. Here, too, we need an improved mechanism for bringing about the desired coordination of effort, and here especially the government needs the advice, assistance, and active involvement of nongovernmental groups. The task group will begin active study of this part of the national network very soon.

We look forward to continued progress in interagency coordination and to increasingly productive cooperation with the nongovernmental community.

Problems: money, men, management

There are, however, some difficult problems to be solved. For example, the advent of national computer-based information systems will raise new issues. Because of the federal government's deep involvement in the national effort in science and technology and its close relation to and financial support of the extensive nongovernmental activities in so much of the information network, the Congress will ultimately have to decide what parts

of the evolving modern information network are appropriately federal-government responsibilities and to what degree. As the report¹ of the President's Science Advisory Committee said, "Government involvement in scientific communication is going to grow, just as governmental involvement

in science and technology is growing. We must always seek to ensure on behalf of both the federal government and the technical community, that the federal information system remains adequate but does not overwhelm the existing nongovernment systems and that our government and nongovernment systems continue to develop into an effectively interwoven instrument that is always responsive to the changing needs of our science and technology."

Other difficult problems are the sources and mechanisms for financial support for the information network.

Federal-agency information services are usually subsidized by the general tax-paying public for the benefit of the service users. This is sometimes justified on the grounds of eliminating billing

the lack of adequate skilled manpower for the modernized information network and the lack of adequate information facilities on our college and university campuses, where the future users of the system are being trained.

But the problem demanding greatest attention at present is creating a permanent mechanism for ensuring the effective, efficient management of the vast, far-flung, almost incredibly complicated series of functions that together make up the national information network.

Let me mention a few possibilities for a central management mechanism. These are (a) a COMSAT-like corporation deeply involved in the actual operation of the information network with both governmental and private interests, (b) a new federal agency managing all agency science



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costs and collection of charges for many small items—sometimes on the grounds that more use is encouraged if the services are provided free, sometimes because it is judged to be for the general welfare. It is common experience that people associate value with cost to them, and in most cases people are willing to pay for something they really need. In the absence of a cost-controlling mechanism, an information service, like other services, is likely to become unwieldy and cumbersome and unresponsive to user needs. Such a situation could lead to overemphasis on the production or processing side and underemphasis on the true needs of the user, which is the marketing side. A mechanism by which users of an information service are made to pay some part of the costs for the service is a valuable control device. It also acts as a spur to the information-service managers.

There are other serious problems, too, such as

and technology information services much as the General Services Administration handles other services, (c) a new federal agency restricted to top-level planning and evaluation with existing agencies continuing to manage their internal information systems, (d) assignment of top-level planning and evaluation functions to an existing federal agency, and (e) a continuation of the present multifaceted management. These possibilities, and others, are now being examined closely by the COSATI task group and the System Development Corporation.

Reference

1. A. M. Weinberg et al, *Science, Government, and Information: The Responsibilities of the Technical Community and the Government in the Transfer of Information*, 10 Jan. 1963; available from Superintendent of Documents, Washington, D.C. 20402.