Interagency
1964

Information
Systems

[Correct name:
Task Force
on National
Systems for
Scientific &
Technical
Information]

Information
Systems

TF Memo

MEMORANDUM

THE WHITE HOUSE

WASHINGTON

December 12, 1966

MEMORANDUM FOR

Joseph A. Califano, Jr.

Subject: Task Force Report on National Systems for Scientific and Technical Information

As you requested in your August 31 memorandum, proposals for a national program for improved information systems in science and technology have been developed.

The full proposal contains background data, recommendations and a draft Presidential Statement and Executive Order. Alternative proposals are provided.

Dr. Haworth has reviewed the full proposal in detail and supports it.

Mr. Carey has read an earlier draft and agrees with the diagnosis of the problem and the general approach. However, he has not approved the specific proposals, nor the budgetary proposals.

The general concepts of the proposal, particularly the need for central policy planning and technical development activities, have been reviewed and endorsed by the Federal Council for Science and Technology.

Don Hornig

Donald F. Hornig
Special Assistant to the President
for Science and Technology

Attachments
a/s

TASK FORCE REPORT

ON

NATIONAL SYSTEMS

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

TASK FORCE REPORT ON NATIONAL SYSTEMS FOR SCIENTIFIC AND TECHNICAL INFORMATION

TABLE OF CONTENTS

I. The Importance of Information to Industrial Efficiency and to Research

To make productive use of research results and of technological advances, information must be communicated to users. These users include engineers in industry, medical practitioners and scientists in private and governmental laboratories. The design of new machines and processes depends heavily upon the easy availability of volumes of standard reference data on the properties of materials. The efficiency of research itself rests heavily upon effective interchange of information among investigators.

The significance of securing effective use of data is widely understood. That is why the Federal government invests about $400 million per year directly in activities designed to make scientific and technical information easily available. About another $600 million in Federal funds is spent indirectly for this purpose--mostly by contractors and scientists who spend Federal funds to purchase needed data. Provision of scientific

and technical information is the function of a large private industry composed of publishing houses, abstracting services, translating services and information services financed within companies. We estimate that more than $1 billion per year is spent for the product of this industry. There are some 600 abstracting and indexing services, some 6,500 scientific and technical journals, meetings and symposia by the thousands, 10,000 new books per year on science and technology, several hundred analysis and evaluation centers for specialized fields, and about 2,500 libraries concerned primarily with science and technology.

The system for handling data is based on essentially sound principles. It is decentralized and relies heavily upon private initiative to meet the specific needs of a large number of specialized users. The computer and other advanced technologies are widely used. To take an example from government, the National Library of Medicine operates a computerized system which classifies 18,000 citations to articles in 2,400 journals published in 40 languages. Each citation is classified under an average of three subject headings in a system containing 7,000 headings. Citations to articles in journals received by the 20th of any month are classified and published by the 10th of the following month, and distributed to physicians, and medical scientists. The citations are accumulated in the computer

and are available for quick search by machine. Many such systems of different size and with varying functions are operated by government and private agencies. (Appendix 1)

II. Problems and Deficiencies

In spite of its strengths, the system has serious weaknesses. The number of scientists, the volume of scientific findings and of technical data are growing rapidly. They double on roughly a ten-year cycle. The capacity of the system to handle data is falling behind our capacity to produce data. While the principle of decentralization is sound, it is accompanied by problems that are becoming more serious. There is a great deal of needless duplication--for example, multiple abstracting of the same scientific article. There are gaps, such as the failure to abstract findings in some fields. Costs are high and rising, whether measured in terms of consumption of the time of high grade talent or in terms of costs to the user. It is impossible for scientists and engineers to get information available in many systems by directing a question to a single system. They must waste time rephrasing their questions and seek information separately from a number of systems. The net consequence of these deficiencies is to create barriers to improved industrial efficiency, to innovation and to the effectiveness of research. The

potential gains from increased investments in the solution of such problems are high. We spend $22 billion per year on R&D, and every increase of one per cent in the efficiency of this process is worth $220 million per year.

Between 1962 and 1965, five White House or Executive Office advisory committees have pointed out what we are losing through inadequate information dissemination (Appendix 2). Vice President Humphrey issued forceful reports on the subject when he was a Senator. Pressure from Congress to improve the distribution of technical information continues.

OST has carried on an extensive planning effort over the past year through staff work and through contract. The Federal agencies have been involved in this planning through a Committee on Scientific and Technical Information. This Committee was the agent through which a comprehensive report on national information systems was prepared under contract with the System Development Corporation (Appendix 3). While we have not followed the detailed recommendations of this study, it has provided invaluable background information and ideas. This summary report is derived from the OST and the interagency effort, from all earlier studies and reports, and from discussions with BOB and NSF.

The Federal government has important and unique responsibilities in this field. In the first place, it sponsors about two-thirds of all R&D in the nation, and dissemination of information is an integral part of the R&D process. Second, the Federal agencies operate or finance directly an extensive array of information services which serve a wide variety of special purposes. These purposes include dissemination of the results of Federally financed R&D to non-governmental users, collection and classification of Federally financed research projects in progress and compilations of research findings in specialized fields. Third, the Federal government has a responsibility to increase the efficiency of research, development and industrial production by appropriate means when Federal and private actions are interrelated.

III. Objectives

Some primary objectives can be identified:

A. The quality and scope of information put into the system should be up-graded

1. The summary-review-abstracting function should be improved.

2. The quality and timeliness of standard reference data should be enhanced.

3. Gaps in the total system (such as the gaps in indexing services and the absence of a toxicological information service) should be filled.

4. Scientific manuscripts should be more rigorously screened before publication.

B. The links between users and the information systems should be tighter

1. Scientific and engineering groups should exert a larger degree of control over the content and format of data produced by information services.

2. Information systems should transfer data to the user more rapidly and conveniently.

C. Separate systems need to be linked together so that, ideally, the user can secure all relevant information from all systems by addressing a question to one system

D. A central point is required to define the indicated kind of long-range planning, coordination and research, and to undertake these tasks

The needs for linking systems together and for planning and coordination are analagous to the needs faced by the nation's telephone companies. As studies of the growth and distribution of population, economic growth and technical potential made clear the rapid growth of future demands, it was clear that manual operations would break down and that separate company operations alone could not provide a nation-wide telephone network. They had to be linked so that the separate companies would act as a

single system in serving the customer. For this, means of providing nation-wide long-range planning, coordination, standardization, engineering and basic communications research were needed. These are in principle the functions that have to be performed centrally to create an effective set of scientific and technical information systems. However, the problem is more complicated in the scientific and technical information field than in the telephone system because of the mixture of public and private activities and because the systems serve not a single purpose but many purposes.

E. The private efforts must be maintained and strengthened. Representatives of the private systems should participate fully in determining the policies to be followed in efforts to link all systems together more effectively

IV. Proposed Action

The essential aim of the proposal is to embark on a solid program to bring under tighter control the unsatisfactory state of Federal information services, and to make scientific and technical information a more effective instrument for increasing the efficiency of our national research and development activities and of our design, construction and production industries.

The instruments proposed for launching this program are an Executive Order and a Presidential statement. These are designed to establish the initiative of the President in this area, to energize the agencies, to enhance private-public cooperation, to ratify and emphasize needed shifts of emphasis in the activities of the Office of Science and Technology and the National Science Foundation, and to increase the attractiveness of the top Federal jobs in this area. Drafts of the Presidential statement (which might alternatively be in the form of a memorandum to the heads of departments and agencies or excerpted for inclusion in a speech), and of an Executive Order are attached (Attachment A and Attachment B).

The elements of the proposed program and the responsible agents are as follows:

A. Establish a technical systems design and standards development center in government (National Science Foundation)

1. Create and maintain the overall design for a network of information systems covering all areas of science and technology.

2. Design and carry out a program of research and development related to information systems.

3. Recommend and undertake to secure the adoption of means of increasing the quality of input to information systems, increasing their utility to users and of reducing inefficient duplication.

4. Design a program for increasing the production of information systems designers, builders and operators.

5. Stimulate and support the development of information systems for basic scientific disciplines, and for special fields not covered by other Federal agencies.

B. Create a mechanism for a dialogue between the Federal government and the private information activities (National Advisory Council on Information Systems)

Full participation of the important private sector in any comprehensive national effort is a prerequisite to success. Private and public activities must be effectively linked. For the necessary participation, a formally established forum is highly desirable, and this is the function of the proposed new National Advisory Council on Information Systems. It would contain both private and public members. It would advise and be chaired by the Director of the Office of Science and Technology.

C. Strengthen the coordination of information activities of the Federal agencies (Committee for Scientific and Technical Information)

This Committee now exists as a subgroup of the Federal Council for Science and Technology, and has worked effectively as a coordinating point for the activities of Federal agencies. Elevation of the group so that it would be directly advisory to the Director of the Office of Science and Technology is proposed.

D. Provide a nerve center for the entire system and a point for exercise of Presidential authority (Office of Science and Technology)

1. Assist the President by bringing about and guiding the evolution of a coherent network of rationally related information systems.

2. Develop general goals, priorities and policies for Federal information systems.

3. Resolve questions relating to agency roles and to basic standards for compatibility among their information systems.

4. Ensure that Federally developed information is made easily available to private users.

V. Funding

NSF--FY 1968

Additional funds and positions will be required for NSF in the FY 1968 budget if appreciable progress towards the objectives set in the Executive Order is to be made.

We recommend that 8 positions be added to the NSF staff at a cost of $200,000, and that $1.2 million be added to the NSF budget for contract studies of national information systems.

OST-FY 1968

OST will require four additional professional and supporting staff at a cost of $200,000 and $50,000 to cover the expenses of the new National Council on Information Systems.

The Future

If the proposed program is successful, additional expenditures in future years will be productive. The Executive Office expenditures should rise very little unless a decision is made to center substantially expanded management responsibilities in the Executive Office. This might come about if other preferable solutions do not work.

NSF activities would expand substantially in future years if the initial efforts are fruitful. NSF expenditures on the order of $30 million per year can be foreseen, but the rate at which this level might be approached cannot be predicted.

Attachment A

DRAFT STATEMENT BY THE PRESIDENT

Science and technology have built an enormous reservoir of information about the world we live in -- and the outer space we are exploring. Over the past three centuries, scientists have developed means of tapping into this reservoir, and for adding to it. But our nation's scientific and technical information system is in trouble. The traditional means of recording, classifying, storing and retrieving information are not adequate.

The use of this information to give us new products and to increase the efficiency of industrial production is being hampered.

The use of this information to plan and design new scientific experiments is made difficult, so that our $22 billion per year national research and development activities operate below peak efficiency.

We must press ahead. Our national defense, the health of our citizens, the strength and growth of our economy, the education of young and old, and the solution of many vexing national problems demand even more research and development. The problems of using the information produced through research are going to become more rather than less pressing.

We can foresee doubling of science information over the next 8 to 10 years. Between 1965 and 1975 as much will be published as has been published in all the years before. The number of scientists and engineers who need and use this vital information will also increase greatly. We expect 50% more of these users by the early 1970's.

The reservoir of information has to be exploited in new and imaginative ways. Fortunately, we now have the technical know-how to begin to build far more effective and efficient information systems. However, the problems involved are more than technical. The new computers and other technical advances are necessary, but they alone will not do the job.

We must avoid needless waste and duplication as the new systems are built. We must also preserve and stimulate to even better health the private, independent enterprises which today provide the bulk of information services in science and technology.

Five Presidential advisory committees have studied this problem and recommended that something be done. The Congress, through several of its committees, has urged that the Executive Branch act. Many private citizens and groups have also urged that the Federal Government exercise leadership.

We have kept the existing information services operating while a plan for action was being developed. Over the last two years, under the leadership of Dr. Hornig, my science advisor, such a plan has been devised. The time has now come to take action. We must begin the deliberate evolution of a more effective and more efficient information system in science and technology.

The basic assumption of this plan is that the Federal Government has an inescapable responsibility to ensure that there exists in this nation ready access to all the significant worldwide reservoir of information. But we do not propose a Federally-controlled or Federally-operated information system for all of science and technology. We propose instead relying to the fullest extent on the ingenuity and enterprise of the private, independent information services which now exist and which our citizens will undoubtedly create in the future.

What we are proposing is a way of bringing together in a concerted program the many different interests at stake. These include the scientists and engineers, the professional societies, the private publishers, the librarians, the computer and communications specialists, the university community, industrial research and development, and government agencies.

To this end, I am issuing an Executive Order which directs the following actions:

1. Establishment of a technical systems design and standards development center for government in the National Science Foundation.

2. Creation of a new mechanism -- the National Advisory Council on Information Systems -- for closer contact between the Federal Government and the private information activities.

3. Strengthening the coordination of the scientific and technical information activities of the Federal agencies through the Committee on Scientific and Technical Information.

4. Providing a nerve center and general guidance for the entire system through strengthening the Office of Science and Technology.

This set of actions will give us a more efficient national research and development program, and will contribute to the effectiveness of industrial production.

Attachment B

EXECUTIVE ORDER _____

Scientific and Technical Information

WHEREAS science and technology are essential resources for the security and welfare of the United States; and

WHEREAS the contributions of science and technology to security and welfare depend on the availability of scientific and technical information to users; and

WHEREAS despite large private and public expenditures the nation's capacity to produce scientific and technical data is outstripping our ability to make information available in a timely, efficient and economical manner:

NOW, THEREFORE, by virtue of the authority vested in me as President of the United States, it is hereby ordered as follows:

Section 1. Information Function of the National Science Foundation

Executive Order No. 10521 of March 17, 1954, as amended in March 1959 by Executive Order 10807, is hereby further amended by substituting for Section 10 thereof the following:

"Sec. 10. The National Science Foundation shall serve as the central point in the Federal government for operations which will:

"(a) Create and maintain the overall design for a network of information systems covering all areas of

science and technology, including the technical requirements for compatibility among information systems;

"(b) Design and carry out a program of research and development for aspects of information sciences and technology generally applicable to information systems, including the design and operation of prototype systems;

"(c) Recommend and take steps to secure the adoption of means to increase the quality of input to information systems, to increase the utility of information to users and reduce inefficient duplication of information activities;

"(d) Design, in cooperation with the Office of Education, a program for the education and training of information systems designers, builders and operators; and

"(e) Stimulate and support the development of information systems for basic scientific disciplines, and for special fields not covered by other Federal agencies."

Section 2. Establishment of the National Advisory Council on Information Systems

(a) There is hereby established the National Advisory Council on Information Systems, hereinafter referred to as the Council;

(b) The Director of the Office of Science and Technology shall be a member and serve as Chairman of the Council and the Director of the National Science Foundation shall serve as Vice Chairman;

(c) The Council shall be composed of 10 private members and 8 representatives of Federal departments and agencies. The 10 private members shall be appointed by the President and shall be chosen so as to represent the scientific, educational, communications and information communities. The 8 public members shall comprise one representative of each of the following named departments and agencies and each of them shall be designated by the head of his department or agency: Atomic Energy Commission, Department of Agriculture, Department of Commerce, Department of Defense, Department of Health, Education, and Welfare, Department of the Interior, National Science Foundation, Department of State, and the Department of Transportation;

(d) The Council shall advise the Director of the Office of Science and Technology on all matters pertinent to national problems in the area of scientific and technical information, and particularly on the functions of government and private information services.

Section 3. Committee for Scientific and Technical Information

(a) There is hereby established the Committee for Scientific and Technical Information, hereinafter referred to as the Committee;

(b) The Director of the Office of Science and Technology or his designee shall be a member and serve as Chairman of the Committee;

(c) The Committee shall be composed of representatives of Federal departments and agencies selected by the head of the department or agency from among those competent to speak for the agency. The departments or agencies represented on the Committee shall be the Departments of State, Defense, Interior, Agriculture, Commerce, Health, Education, and Welfare, and the Atomic Energy Commission, the Federal Aviation Agency, the National Aeronautics and Space Administration, and the National Science Foundation;

(d) The Committee shall serve as a primary instrument for interagency consideration of matters relating to the scientific and technical information policies and programs of the Federal agencies and for coordination of the activities of the agencies;

Section 4. Information Functions of the Office of Science and Technology

The Office of Science and Technology shall assist the President in carrying out the following responsibilities:

(a) Develop general goals, priorities and policies for Federal information systems;

(b) Resolve questions relating to such matters as the roles of the various Federal agencies and basic standards for compatibility among their information systems;

(c) Ensure that the Federal agencies make easily available to private users information developed through research and development conducted or financed by the government.

Section 5. Agency Cooperation

(a) Federal agencies shall cooperate with and assist the Office of Science and Technology and the National Science Foundation in the performance of these functions, to the extent permitted by law.

(b) Each executive department or agency listed in subsection (c) of Section 1 of this Order shall furnish necessary assistance for the National Advisory Council on Information Systems Policies as authorized by Section 214 of the Act of May 3, 1945, 59 Stat. 134 (31) U.S.C. 691.

LYNDON B. JOHNSON

THE WHITE HOUSE

_____ 1966

Appendix 1

A Sample of Information Systems Operated by Federal and Private Agencies

Note: The activities listed below are a small part of the total, but they indicate the scope and variety of the individual information systems operated by governmental and private agencies. The kinds of functions which these systems serve are:

(a) Provision of a central point where scientists may secure organized information on all research or on research supported or conducted by Federal agencies, relating to their fields of interest.

(b) Provision of organized information to those providing services to the civilian economy -- standard reference data to engineers and scientists; data on chemical compounds to chemists; organized information on medical literature to physicians; data to teachers on the results of research on education.

(c) Transfer of organized technical data to government agencies with specialized missions.

A. Federal

Agency and Program

Department of Commerce

- State Technical Services Information Program
- National Standard Reference Data System
- Clearinghouse for Federal Scientific and Technical Information
- Cryogenic Data Center
- Patent Information Program
- Center for Computer Science Technology
- National Meteorological Center

Health, Education, and Welfare

- National Library of Medicine Information Program
- National Clearinghouse for Mental Health
- Educational Research Information Center
- Toxicology Information Program

Agriculture

- National Agricultural Library Program
- Pesticides Information Center

Defense

- Defense Documentation Center
- Entomological Information Center

National Science Foundation

- Science Information Exchange
- National Referral Center

National Aeronautics and Space Administration

Scientific and Technical Information Program

Interior

Water Resources Information Center

Atomic Energy Commission

Isotopes Information Center

B. Academic

Activity	University
Chemical Propulsion Information Center	Johns Hopkins, APL
Human Engineering Info. & Analysis Serv.	Tufts
Power Information Center	University of Pennsylvania
Thermophysical Properties Research Center	Purdue
Biological Serial Record Center	Geo. Washington U.
Technical Information Center	Georgia Tech.
Water Resources Center Archives	University of California
Health Law Center	Pittsburgh U.
Brain Information Services	University of California
Neurosciences Research Center	Mass. Inst. of Tech.
Radiation Chemistry Data Center	Notre Dame

C. Non-Profit

Chemical Abstracts Service	American Chemical Society
Radiation Effects Information Center	Battelle
Remote Area Conflict Information Center	Battelle
Fused Salts Information Center	Sandia

D. Specialized Libraries

	Operator
Engineering Societies Library	United Engineering Trustees
Engineering Library	Mass. Inst. of Tech.
George David Birkhoff Library	Howard U.
The John Crerar Library	Chicago U.
Abrasives Library	Minnesota Mining & Mfg. Co.
Submarine Signal Operations Library	Raytheon

E. Private Industry

Electronic Properties Information Center	Hughes Aircraft
Air Force Machineability Data	Metcal Research Associates
Hercules Research Center	Hercules Powder Co.
Technical Information Center	Melpar
Baroid Division	National Lead Co., Houston
Technical Information Center	Westinghouse

F. State and Local Government

Capital Improvement Information System	Planning Dept., Wichita, Kans.
Education Data Processing System	Board of Education, Chicago
Community Renewal Information System	San Francisco
Land Use Information System	City Planning Department, Santa Clara County, Calif.
Transportation Information System	New York State
Community Renewal Information System	Washington State at Washington U. Urban Data Center
Education Information System	Department of Education, Dade County, Florida
Social Welfare Information System	Detroit, Michigan
Health Law Information System	Health Law Center, Pittsburgh U.
Metropolitan Data Centers	Planning Commissions and Departments in Tulsa, Denver, Forth Worth, Little Rock, Wichita

Note: During 1966 nearly all States have been granted funds by the Department of Commerce under the State Technical Services Act of 1965, for planning statewide or regional scientific and technological information centers.

Appendix 2

Reports to the President and the Executive Office on Scientific and Technical Information

1. President's Science Advisory Committee. Improving the Availability of Scientific and Technical Information in the United States, The White House, Dec. 1958 (The Baker Report)

2. President's Science Advisory Committee, Science, Government, and Information: The Responsibilities of the Technical Community and the Government in the Transfer of Information, The White House, January 1963 (The Weinberg Report)

3. Letter Report to the President's Science Adviser, by Panel on Scientific and Technical Communications, February 1965 (The Licklider Report)

4. Task Force Report to the President's Special Assistant for Science and Technology, Scientific and Technical Communication in the Government, April 1962 (The Crawford Report)

5. "Memorandum for the President on a National Library of Science System," Stafford L. Warren, 17 February 1964.

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Appendix 3

National Document-Handling Systems in Science and Technology

A study team has outlined the federal government's responsibilities and ways in which they can be met.

Launor F. Carter

Concern over the adequacy of this nation's document-handling and information system is far from new. Since World War II there have been at least 15 major proposals for the establishment of some sort of national system. Critics often point to the centralized Russian abstracting and announcing service VINITI (*1*) as a prototype we might well follow. Two recent reports, precursors to the study discussed in this article, have been given wide attention. In 1962 the "Crawford Report" (*2*), sponsored by the President's Science Advisor, advocated a major reorientation of organizational responsibilities for scientific and technical information within the federal government. The following year marked the appearance of the "Weinberg Report" (*3*), sponsored by the President's Science Advisory Committee. Although each of these reports received high-level governmental consideration, their recommendations were not widely adopted; rather, certain portions were incorporated into the existing structure. One innovation was the formation of the Committee on Scientific and Technical Information (COSATI) of the Federal Council for Science and Technology. The Director of the Office of Science and Technology asked COSATI to undertake a comprehensive study which would lead to the formulation of recommendations for a national document-handling system in science and technology. The results of the COSATI study, supported by a team from the System Development Corporation (SDC), are contained in an extensive report (*4*), the highlights of which are reviewed here.

The Problem

Each of the studies mentioned above views the problems of handling scientific and technical information and documents from a somewhat different point of view, largely because the problems have not been addressed as a single multifaceted problem. There are many different problems which, when summed, indicate that current practices and institutions need major revision. Among the problems which must be considered by a comprehensive design are the following:

1) Federal responsibility for scientific and technical documentation must be clarified and formalized. It is stated as a basic proposition that the federal government should be responsible for assuring the existence within the United States of at least one accessible copy of every significant publication in the worldwide scientific and technical literature. This has not heretofore been explicitly accepted as a responsibility of the federal government. As a result many government agencies are not oriented toward implementing such a policy, nor could they do so readily if the policy were formally adopted.

2) The number of users, and their requirements, are increasing. In 1960 there were 2,370,000 scientists, engineers, and technicians in the United States; it is estimated there will be 4,000,000 by 1970 (*5*). The documen-

The author is senior vice president of the System Development Corporation, Santa Monica, California.

tation requirements of these personnel differ substantially, depending on their work. Scientists and scholars require one kind of service, engineers a different kind, and managers of technical efforts a third kind. The present information and documentation system of libraries and information centers does not adequately meet current needs, and it will be even less able to cope with a large increase in users' requirements.

3) The number of publications is ever increasing—in fact, it doubles about every 15 years. One estimate places the number of technical documents published in 1961 at 658,000 and the number to be published in 1970 at 1,143,000. In 1964 the Library of Congress had over 43,000,000 items in its collection. This represents a growth of over 180 percent in the last 26 years. As the number of documents increases, it becomes more and more difficult for research libraries to cope with the problems of acquiring, cataloging, indexing, announcing, circulating, and storing them. Libraries react to these problems by becoming more specialized, restricting their clientele, or reducing their services. Clearly, a rationalized system for dealing with the increasing number of documents is needed (*6*).

4) Under the present system it is difficult for libraries and document centers to render high-quality services. It is hard to give exact figures to support this statement, but many separate pieces of evidence lead to this conclusion.

For instance, in 1965 Congress made a special appropriation of $5 million to the Library of Congress. Part of this will be used to finance an accelerated cataloging effort. Library of Congress catalog cards are used throughout the libraries of the nation, but their publication lag is becoming acute and they are covering a smaller proportion of the total number of documents.

The fact that many new mechanisms for information exchange are coming into use indicates that the traditional means of communication are inadequate. Large numbers of trips from center to center, informal publications, extensive use of preprints, and restricted symposiums are supplementing older and more public methods of communication.

Some libraries have large backlogs of books and other documents which they cannot process into their collections, and are restricting their services. For instance, more and more major university libraries are curtailing their services to nearby industrial organizations because of a lack of adequate library resources.

Studies of library users show a significant dissatisfaction with the present system and, at the same time, a serious lack of information about how to use the system. The user is turning to other sources or is not using libraries or information systems to the extent he should.

The number of people attracted to and trained for librarianship is much less than the demand, and the growth rate in the field is lower than that of the general professional work force.

The budgetary situation for most private research libraries is critical. Large private foundations and philanthropists are no longer supporting library operations, and municipal funds are in short supply.

In an uncoordinated fashion, many parts of the information and documentation system are depending on federal support. Direct subsidies, page charges, special grants, overhead allowances, special working agreements, and contracts all signal dependence on the federal government.

5) Technological innovations have not been utilized by libraries, which with few exceptions use virtually the same manual techniques today that they used 50 years ago. There are three basic causes for this situation. Most librarians and the traditions of librarianship are grounded in the humanities rather than in technology. As a result, many policy makers in libraries tend to be unsure of the potentials of modern technology. Another cause is the relative poverty of libraries. Usually libraries have barely been able to fund their current operations, let alone experiment with new techniques. The third cause is that automated techniques have not yet been developed for easy adaptation to many libraries. The development cost of adapting advanced technology to the problems of document and information centers will be high. So far, the federal government's efforts in this direction have been modest, but if we are to cope with increasing numbers of users and documents, new techniques must be developed and applied.

6) Long-range planning is needed. The present system is composed of many independent units: within the government, at universities, in professional societies, as private efforts, and in industry. Each of these units goes its separate way in terms of plans and resources. Each perceives its individual problems but may or may not be aware of the larger national problem (including problems of overlapping collections, duplicate cataloging, inadequate service to some groups of users, and so forth). There is no national long-range plan or planning body to provide cohesion in these separate efforts. In the past, *ad hoc* study groups or individual government officials have developed plans or suggested solutions to the problems, but these efforts have not led to any consistent action. Often, partial solutions—such as the establishment of the National Library of Medicine and the MEDLARS service it provides—represent the success of a particular group of users. But as the pressures of increasing numbers of users, increasing numbers of documents, and increasing potential of advanced technology continue to mount, the need for long-range planning becomes apparent (*7*).

Method of Studying the Problem

The initial approach in the study sponsored by COSATI was to follow three separate but related lines of endeavor. As a first step previous studies and proposals were reviewed. Congressional studies, reports by the President's Science Advisory Committee, reports from elsewhere within the government, and studies from private sources were collected and analyzed. A second area of investigation centered around studies of users' needs for scientific and technical information. Although over 450 such studies were identified, the SDC study team concentrated on 58 which seemed to be based on significant empirical data, in order to gain an understanding of users' own views of their needs. The third and most extensive effort was devoted to understanding the present scientific and technical information system. Of the large number of institutions in the federal government and in the nonfederal sector that render scientific and technical information services, 47 were visited. In addition, the legislative bases for existing services were reviewed and extensive statistical data were collected.

As a result of these studies (*8*) a series of basic propositions and system requirements was formulated. As the studies were progressing and the requirements were being defined, the team considered and developed ideas for several alternative systems which seemed capable of meeting a major portion of the requirements and which had some practical possibility of being implemented. Six alternative designs were developed and worked out in considerable detail. The designs were drawn from many sources, including previous proposals. Probably no one conception is completely original with the present effort, yet the characteristics enumerated, plus the spelling out of the details of conception and implementation, are a unique product of this study.

Basic Propositions and Requirements

In addition to the federal government's responsibility for assuring that at least one copy of every important scientific and technical publication is available in the United States, the most important principles developed were that the federal government is responsible for assuring that these publications, once acquired, are appropriately announced, processed, and made available to qualified individuals within the United States, and that proposed systems should be evolutionary, in that they should start with the present systems (libraries, information exchanges, and so forth) and evolve into forms which will be consistent with an overall plan. There must be flexibility to allow for new organizational and administrative arrangements.

While each principle needs discussion, an elaboration of the first and most fundamental proposition will give an appreciation of the import of these basic statements. The concept of federal responsibility for assuring the availability of all significant scientific and technical publications contains several ideas that need definition or qualification.

How does one determine whether or not a publication is significant? First of all, a document or a good abstract must be available from which a judgment can be made. If a document is not already available in the United States, then the judgment must be made elsewhere, probably by experts in the country of origin. Moreover, judgments of significance cannot be made in terms of current perception of possible relevance, since relevance is subject to periodic change. Rather, significance needs to be judged in terms of the soundness and professional character of the work reported. In the long run the system should aspire to having each published document available in the United States for evaluation by appropriate United States specialists. As a minimum effort we would want to include all published serials, documents from established monograph services, and books from established publishers. Occasional reports and pamphlets would be the last to be included. How soon this goal can be achieved depends on how important the scientific community thinks it is relative to competing goals and how willing Congress is to make funds available. (We may be closer to this goal than we realize. The open-literature holdings of the intelligence agencies are vast. It was beyond the scope of SDC's study to do so, but an investigation should be made of the extent to which unclassified holdings of these agencies could be made available to the civilian community.)

The federal government's "responsibility" implies that a system in the federal establishment will know what is available in the United States, not only in government depositories, but in private and university libraries. In other words, there must be a national union listing and an indexing of document holdings of major libraries. This will be a vast undertaking.

The concept of accessibility also needs elaboration. It implies that any document can be reached in an effective and timely manner by some yet-to-be-defined class of users.

What is meant by "scientific and technical" literature? There is no disagreement about including astronomy, mathematics, physics, chemistry, and biology, but what about the behaviorial and social sciences? The system should include these disciplines because of their increasing national importance and their rapid advances. In other words, psychology, sociology, cultural anthropology, political science, and economics fall within the definition of science and technology. How far do we go in such areas as industrial engineering, manufacturing technology, and management engineering? The system should include these areas. Its goal is to cover science and technology in the broad sense.

The number of basically different approaches that can be taken to the problem of document information is fairly limited. Four approaches were considered by the SDC team (although there are three variations on one idea). One emphasizes the need for an integrating and planning organization (Capping Agency) to formulate and implement national and federal policy, another emphasizes the establishment of defined responsibilities for the several federal departments and agencies, the third involves the centralization of all operating responsibility in one large federal or private organization, and the fourth features the slow evolution of the existing system. All of these can be given various interpretations and emphases, and they can be considered in several combinations.

The Capping Agency

The Capping Agency would be a new agency within the Executive Branch of government which would have overall directive and review authority relative to scientific and technical information and documentation. The proposed Capping Agency, called the Scientific and Technical Information Bureau, would not be an operating agency, but rather an overall executive or management agency dealing with information and document activities in the various departments and agencies of the federal government and related external groups. The Bureau would formulate policy and be responsible for the functions described below:

There are now several national libraries, and it is argued that several other national systems should be established. The Bureau should determine which are to be covered by which departments and agencies and should define the responsibilities of the various departments and agencies.

The Bureau should establish federal policy with respect to support for and cooperation with nongovernment libraries. As the federal information and documentation program becomes elaborated and standardized, it will affect nongovernment libraries. Some federal agencies may delegate part of their responsibilities to libraries or organizations outside the government. To the extent that major university libraries or private libraries support or back up federal interests, they

should be supported by federal funds.

There are some 300 major science and technology information centers throughout the country. Some of these are supported by the federal government, some are in private industry, and some are in universities. Their operation and services vary considerably, which is to be expected, but such variation is not in accord with any plan or systematic approach to information centers. Policy needs to be formulated regarding support and sponsorship of information centers, and this would be a function of the Bureau.

There are at present over 1200 libraries throughout the country which are depositories of government documents. The extent of their receipts and holdings varies considerably. Policy regarding distribution, processing, and support for these depositories needs to be developed.

At present many practices are being followed with respect to nongovernment scientific and technical publications. In the primary-publication field there is some direct subvention; there is often payment of page charges through research contracts. Similarly, among secondary publications, some abstracting publications receive a very substantial subsidy whereas other abstracting services receive none. Policy and funding patterns in this area need rationalization.

A primary method of communication, both formal and informal, among scientists is through the nondocumentary method of letters, visits, small meetings, symposiums, national meetings, and so forth. Federal policy relative to such activities varies. The whole area of nondocumentary communications needs extensive study, and development and implementation of policy.

Current figures on size of collections, use, budgets, and so forth are often unobtainable or incomplete and are rarely comparable from activity to activity. Reliable statistical information must be developed throughout the scientific and technical information and document area.

The Bureau should establish standards for information handling to be followed by all federal organizations that have responsibilities for information and documentation in science and technology. Performance standards concern such matters as completeness of coverage, speed of service, and nature and quality of services to users. Technical standards apply to such areas as cataloging, classification, bibliographies, micro-storage, and automation.

Presently the National Science Foundation has an important responsibility both for research in information science and for various science information activities. The establishment of the Bureau would change this situation relative to science information. However, it is anticipated that basic research in information science would remain a responsibility of NSF and enjoy the same status as any other major area of scientific research.

Broad guidance and encouragement are needed in the development of advanced technology for document handling. The Bureau should take an active role in fostering the application of advanced technology and automation techniques to government libraries and other information centers.

There is a shortage of information technologists and librarians trained in science and technology, and the situation will not improve under the current level of interest and support. Federal policy regarding the support of training of the necessary personnel needs to be stated, and funds must be made available for training purposes.

There are many more foreign than domestic serials and documents, although 60 percent of all documents are published in English. Extensive study of and policy for the acquisition and translation of the foreign documents are required.

Many scientists and engineers are uninformed about available services. The Bureau should publicize sources of information and services and should help in training users to use the available services effectively.

Information and documentation in science and technology represent a major federal expenditure, on the order of $200 million of direct expense annually. (Some estimates show this figure to be about $400 million.) In addition to normal review by the Bureau of the Budget, there should be an across-the-board funding review for the information and documentation activities.

As the agency responsible for the national information and documentation program, the Bureau should review all relevant Administration-developed legislative proposals. It should generate proposals where national policies are concerned.

The development of science and technology and the growing requirement for service indicate the need for continued planning. The Bureau would be responsible for developing long-range plans.

In addition to considering the functions that need to be performed, the COSATI study spells out in detail a suggested organization for the Scientific and Technical Information Bureau. Four major organizational divisions are indicated: a Systems Office, an External Policies and Support Office, a Technical Applications and Methods Office, and a Plans Office.

Finally, the placement of the Bureau needs consideration. Preferably, such activities would be performed in one of the existing agencies, but after considering the arguments for and against placing responsibility for them in the Office of Science and Technology, the National Science Foundation, the Bureau of the Budget, and the General Services Administration, it was concluded that a new organization in the Independent Offices and Establishments portion of the Executive Branch was needed. If OST or NSF were to have their missions broadened and their staffs expanded, the recommendation regarding placement should be reconsidered. The important point is that the various functions listed need to be performed. Whether a new agency is required, or whether the responsibilities of existing ones can be adequately expanded, is a question that needs to be examined by those most familiar with the broad organizational design for the Executive Branch of the government.

The Responsible Agent System

Under the Responsible Agent System a competent authority would designate a particular organization as the agent responsible for assuring the satisfactory performance of all tasks necessary to provide information services in a defined portion of the broad spectrum of science and technology. The organization would not necessarily perform all these tasks itself, but it would make sure that they were performed, if not by itself, by organizations elsewhere in the government or in the nonfederal sector.

The concept of Responsible Agent grew out of a suggestion in the Weinberg Report which pointed to the information functions being performed

by the Atomic Energy Commission and by the National Aeronautics and Space Administration in their respective fields. However, a detailed analysis of the applicability of the idea to other areas was not made and further support and implementation did not materialize. In SDC's study the applicability of the concept as related to national goals, responsibilities of government agencies, and reasonable groupings of scientific and technical areas is considered in depth.

The combination of the Capping Agency and the Responsible Agent concept was the system recommended by the SDC study team. However, the team considered several alternative systems to the extent of analyzing the general concept, developing an operating scheme, indicating a possible organization, defining functions to be performed, and developing the arguments in favor of and opposed to each of the alternatives. These alternatives were:

1) A New Federal Operating Agency. A new federal agency could be established to take over complete responsibility for information and documentation. The new agency would not only be responsible for policy but would also operate a national service.

2) A Government-Chartered Corporation. Most of the functions and operations to be performed under the New Operating Agency could also be performed by a special private corporation chartered by the government.

3) A National Library Administration in the Executive Branch of Government. It would be possible to amalgamate the major libraries now existing in the federal government. Because of the sizable collections and special status of the Library of Congress the S&T information and documentation problem might be solved by transferring the Library to the Executive Branch and enlarging and redefining the locus of operations and responsibilities of it and of the other major libraries and information services.

4) Strengthening of the Existing System. It can be argued that a somewhat adequate service is now being rendered and that the present system should be allowed to evolve much as it has in the past. The Office of Science and Technology might be strengthened, and small guiding groups in other existing agencies might be formed to achieve some additional coordination.

Evaluations

After the various alternatives were described, each was evaluated in terms of 43 design requirements developed earlier. Although the Capping Agency–Responsible Agent system ranked at the top of the evaluation, it was not markedly superior to the New Operating Agency, Government-Chartered Corporation, or National Library Administration as far as technical considerations were concerned. The evaluation concludes by saying:

> The New Operating Agency and the National Library Administration concepts both involve radical changes in operations and administration which are not consonant with our conception of the requirement for evolutionary development. The bases from which one could arrive at detailed specifications for a centralized operating system are as yet inadequate. Additionally, the National Library Administration concept requires the transfer of the Library of Congress to the Executive Branch, which would probably be politically difficult. Both concepts involve extensive transfers of responsibilities and central control of document-handling services.

The Government-Chartered Corporation is an attractive alternative because of its interfaces with the nonfederal sector, but it has the overriding weakness of infringing strongly on solely federal activities.

The option of simply strengthening the present system was not recommended, on the grounds that it was not currently satisfying many of the present requirements and the probability did not seem high that it would do so in the future.

The recommended design—the combination of Capping Agency and Responsible Agent—is evolutionary and represents the best solution for meeting the requirements. Furthermore, of all the designs considered, it provides the greatest degree of flexibility for adapting to changing requirements. Finally, since it requires the least change in existing operations, it would be the solution most acceptable to the organizations currently responsible for handling scientific and technical documents and information.

The Committee's Recommendations

The SDC study served as background material for the COSATI Task Group on National Systems. The recommendations of the Task Group were endorsed by COSATI, under the chairmanship of William T. Knox of the Office of Science and Technology, who subsequently presented them to the Federal Council for Science and Technology. The COSATI report (*9*) recommended that:

1) The Office of Science and Technology should accelerate its efforts on the overall planning, policy formulation, organization, coordination, and evaluation of the integrated *national* network of information and document-handling systems in science and technology, and should take appropriate steps to clarify areas of responsibility among the federal agencies involved.

2) The Office of Science and Technology, in collaboration with the Bureau of the Budget, federal departments, agencies, and other organizations involved in science and technology, should undertake at once (i) to develop a comprehensive, coordinated program for ensuring the acquisition, cataloging, and announcing of significant scientific and technical literature; (ii) to develop policies concerning the legislative bases for document and information services in or sponsored by the departments and agencies, and (iii) to propose or endorse legislation to enable departments and agencies to assume responsibility for ensuring effective information and document-handling services in agreed-upon areas of science and technology. The establishment of one or more national libraries in fields of science and technology in addition to medicine and agriculture, should be considered as elements of the integrated national network.

3) The Office of Science and Technology, in collaboration with appropriate federal agencies, should encourage the private sector to formulate document-handling plans and programs for its consideration (and for review by appropriate agencies) in the development of the integrated national network.

4) The Committee on Scientific and Technical Information should recommend action for the development of a coordinated plan and criteria for federal support of experiments in information technology, including prototype information systems designed to provide design data for the integrated national network.

Continuing tasks of high priority include the development of standard procedures for processing documents so that interagency exchange can be more efficient and comprehensive, the de-

velopment of guidelines for cost and budgetary analyses and control by agencies of their document and information services, the development of education and training curricula for the operators and users of the document and information systems, and the development of policies for acquisition, dissemination, and translation of unclassified foreign documents in science and technology and for the dissemination of federally produced information and data to foreign countries and organizations.

Summary

As a result of the studies described here and the COSATI recommendations, as well as briefings and discussions at many levels of government and with professional and industrial organizations, the Office of Science and Technology has a blueprint for action and support for forward movement in the handling of scientific and technical documents.

References and Notes

1. VINITI is an acronym derived from the English transliteration of the Russian name for the All-Union Institute of Scientific and Technical Information, Vsesoyuznyy Institut Nauchnoy i Tekhnicheskoy Informatsii. A description may be found in the SDC report cited below. For a critical Russian review of VINITI see V. S. Malov, Results of Check of Fulfillment of Resolution of Council of Ministers of USSR, "About measure for improvement of organization of scientific and technical information in this country," *Sci. Tech. Inform. (Selected Articles)* No. 6, (1964), Report FTD-MT-65-07, Foreign Technology Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio.
2. U.S. Department of Commerce, "Scientific and Technological Communication in the Government" (AD 295 545, Government Printing Office, Washington, 1962).
3. President's Science Advisory Committee, "Science, Government, and Information: The Responsibilities of the Technical Community and the Government in the Transfer of Information" (The White House, Washington, Jan. 1963).
4. L. F. Carter, G. Cantley, J. T. Rowell, L. Schultz, H. R. Seiden, E. Wallace, R. Watson, R. E. Wyllys, "Recommendations for National Document Handling Systems in Science and Technology" (TM-WD-213/001/00, System Development Corporation, Santa Monica, Calif., Sept. 1965. Available as PB 168 267 from Clearinghouse for Federal Scientific and Technical Information).
5. L. J. Carter, *Science* 151, 666 (1966).
6. It is often suggested that much of doubtful value is published and steps should be taken to reduce the amount published. It is easy to agree with this point but very hard to devise methods to reduce the amount of new material. The better journals have a very high rejection rate and new journals are started continuously. Government-required periodic reports further complicate the problem. An attack on this problem should be one of the first efforts of the Capping Agency discussed later.
7. In September President Johnson appointed a National Advisory Commission on Libraries to "evaluate policies, programs, and practices of public agencies and private organizations—and to recommend actions which might be taken by public and private groups to ensure an effective, efficient library system for the nation."
8. L. F. Carter *et al.* (*4*, vol. 2, 404 pp.) give the detailed findings of these studies. In addition, several technologically advanced systems are described and the present and probable near-future capability of the technical components needed for large automated systems are discussed.
9. Federal Council for Science and Technology, "Recommendations for National Document Handling Systems in Science and Technology" (Nov. 1965. Available as PB 168 267 from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va.).

NEWS AND COMMENT

Berkeley: New Crisis Breaks Out on California Campus

U Thant remarked recently of China that it is undergoing a nervous breakdown. The same diagnosis might be applied to the Berkeley campus of the University of California, by some measures the greatest, but by any measure the most havoc-ridden, of American institutions of higher learning.

Last week, 2 years after the Free Speech Movement (FSM) uprooted the *ancien régime* of Berkeley, the campus was again in chaos, the spark for the latest eruption being a protest against the presence of an on-campus recruiting table manned by Navy and Marine Corps officers. In the forefront of the protest was the banished hero of FSM, 23-year-old Mario Savio, returning to the scenes of old glory, like Napoleon from Elba. Savio, whose application for readmission to the university was recently denied (in a challenge of regulations barring political activity on campus by nonstudents, he conspicuously handed out leaflets while his application was pending), joined several other nonstudents in setting up an anti-military table near the military recruiters. When campus police ordered them to leave, on the grounds that nonstudents, with the exception of government representatives, are not permitted to set up tables on campus, they refused. A crowd gathered, a fight ensued, some 30 outside police—reportedly quite free with their clubs—were summoned by the administration, and Savio and nine others, among them three students, were arrested. Thereupon came mass meetings at which Savio was enthusiastically received when he called for a strike. This was followed by sit-ins and a boycott of classrooms, involving, according to various estimates, 3000 to 9000 of the university's 27,000 students. To the utter despair of the administration, which, in the wake of Ronald Reagan's million-vote victory, feels like Paris after the blitz but before the occupation, Berkeley was again conforming to its popular image as an enclave of tax-supported anarchy.

What happens next is beyond forecast, but, on the basis of a week of conversations at Berkeley just prior to this latest eruption, it is clear that the peace of Berkeley was indeed fragile and that, if the presence of the military recruiters had not provided the precipitating event, another would have served as well. For, 2 years after FSM, Berkeley still had not resolved the basic question of just what it is a university is supposed to be in this rich and turbulent society, and, all along, the tensions evoked by that question have been wrenching the innards of the university community. To which it should be added that, while 2 years of post-FSM skirmishing gave the campus administrators great expertise in crisis-management, it also rendered them so punchy that, just prior to last week, many of them readily expressed concern about the durability of their patience in the face of what they considered to be incessant provocation by a small group of ingeniously disruptive students and campus hangers-on. As Vice Chancellor Earl Cheit, who summoned the outside police in the absence of Chancellor Roger Heyns, put it 2 weeks ago "The administration

August 31, 1966

MEMORANDUM FOR

Dr. Donald F. Hornig
Special Assistant to the President
for Science and Technology

Re: Information System in Science and Technology

Your proposal for a National Information System in Science and Technology seems promising. Please attempt, in cooperation with the Bureau of the Budget and other interested agencies, to develop this idea and to submit a report to me by October 31, 1966. The report should contain the following information:

1. A short statement of the proposal.

2. A detailed statement of the problem giving rise to the proposal.

3. A statement of related on-going programs, including costs, the people whom the programs reach, and the inadequacies of the present programs.

4. A discussion of the proposal, with emphasis upon the pros and cons and the costs and benefits of implementation. (Of great importance here is a detailed statement of the arguments which can be advanced in support of the proposal and the factual back-up which is available.

5. A statement of the alternative proposals which were considered and the reasons for rejection thereof.

Joseph A. Califano, Jr.
Special Assistant to the President

Summary

MEMORANDUM

THE WHITE HOUSE

WASHINGTON

December 12, 1966

MEMORANDUM FOR

Joseph A. Califano, Jr.

Subject: Task Force Report on National Systems for Scientific and Technical Information

As you requested in your August 31 memorandum, proposals for a national program for improved information systems in science and technology have been developed.

The full proposal contains background data, recommendations and a draft Presidential Statement and Executive Order. Alternative proposals are provided.

Dr. Haworth has reviewed the full proposal in detail and supports it.

Mr. Carey has read an earlier draft and agrees with the diagnosis of the problem and the general approach. However, he has not approved the specific proposals, nor the budgetary proposals.

The general concepts of the proposal, particularly the need for central policy planning and technical development activities, have been reviewed and endorsed by the Federal Council for Science and Technology.

Don Hornig

Donald F. Hornig
Special Assistant to the President
for Science and Technology

Attachments
a/s

TASK FORCE REPORT

ON

NATIONAL SYSTEMS

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

TASK FORCE REPORT ON NATIONAL SYSTEMS FOR SCIENTIFIC AND TECHNICAL INFORMATION

TABLE OF CONTENTS

I. The Importance of Information to Industrial Efficiency and to Research

To make productive use of research results and of technological advances, information must be communicated to users. These users include engineers in industry, medical practitioners and scientists in private and governmental laboratories. The design of new machines and processes depends heavily upon the easy availability of volumes of standard reference data on the properties of materials. The efficiency of research itself rests heavily upon effective interchange of information among investigators.

The significance of securing effective use of data is widely understood. That is why the Federal government invests about $400 million per year directly in activities designed to make scientific and technical information easily available. About another $600 million in Federal funds is spent indirectly for this purpose--mostly by contractors and scientists who spend Federal funds to purchase needed data. Provision of scientific

and technical information is the function of a large private industry composed of publishing houses, abstracting services, translating services and information services financed within companies. We estimate that more than $1 billion per year is spent for the product of this industry. There are some 600 abstracting and indexing services, some 6,500 scientific and technical journals, meetings and symposia by the thousands, 10,000 new books per year on science and technology, several hundred analysis and evaluation centers for specialized fields, and about 2,500 libraries concerned primarily with science and technology.

The system for handling data is based on essentially sound principles. It is decentralized and relies heavily upon private initiative to meet the specific needs of a large number of specialized users. The computer and other advanced technologies are widely used. To take an example from government, the National Library of Medicine operates a computerized system which classifies 18,000 citations to articles in 2,400 journals published in 40 languages. Each citation is classified under an average of three subject headings in a system containing 7,000 headings. Citations to articles in journals received by the 20th of any month are classified and published by the 10th of the following month, and distributed to physicians, and medical scientists. The citations are accumulated in the computer

and are available for quick search by machine. Many such systems of different size and with varying functions are operated by government and private agencies. (Appendix 1)

II. Problems and Deficiencies

In spite of its strengths, the system has serious weaknesses. The number of scientists, the volume of scientific findings and of technical data are growing rapidly. They double on roughly a ten-year cycle. The capacity of the system to handle data is falling behind our capacity to produce data. While the principle of decentralization is sound, it is accompanied by problems that are becoming more serious. There is a great deal of needless duplication--for example, multiple abstracting of the same scientific article. There are gaps, such as the failure to abstract findings in some fields. Costs are high and rising, whether measured in terms of consumption of the time of high grade talent or in terms of costs to the user. It is impossible for scientists and engineers to get information available in many systems by directing a question to a single system. They must waste time rephrasing their questions and seek information separately from a number of systems. The net consequence of these deficiencies is to create barriers to improved industrial efficiency, to innovation and to the effectiveness of research. The

potential gains from increased investments in the solution of such problems are high. We spend $22 billion per year on R&D, and every increase of one per cent in the efficiency of this process is worth $220 million per year.

Between 1962 and 1965, five White House or Executive Office advisory committees have pointed out what we are losing through inadequate information dissemination (Appendix 2). Vice President Humphrey issued forceful reports on the subject when he was a Senator. Pressure from Congress to improve the distribution of technical information continues.

OST has carried on an extensive planning effort over the past year through staff work and through contract. The Federal agencies have been involved in this planning through a Committee on Scientific and Technical Information. This Committee was the agent through which a comprehensive report on national information systems was prepared under contract with the System Development Corporation (Appendix 3). While we have not followed the detailed recommendations of this study, it has provided invaluable background information and ideas. This summary report is derived from the OST and the interagency effort, from all earlier studies and reports, and from discussions with BOB and NSF.

The Federal government has important and unique responsibilities in this field. In the first place, it sponsors about two-thirds of all R&D in the nation, and dissemination of information is an integral part of the R&D process. Second, the Federal agencies operate or finance directly an extensive array of information services which serve a wide variety of special purposes. These purposes include dissemination of the results of Federally financed R&D to non-governmental users, collection and classification of Federally financed research projects in progress and compilations of research findings in specialized fields. Third, the Federal government has a responsibility to increase the efficiency of research, development and industrial production by appropriate means when Federal and private actions are interrelated.

III. Objectives

Some primary objectives can be identified:

A. The quality and scope of information put into the system should be up-graded

1. The summary-review-abstracting function should be improved.

2. The quality and timeliness of standard reference data should be enhanced.

3. Gaps in the total system (such as the gaps in indexing services and the absence of a toxicological information service) should be filled.

4. Scientific manuscripts should be more rigorously screened before publication.

B. The links between users and the information systems should be tighter

1. Scientific and engineering groups should exert a larger degree of control over the content and format of data produced by information services.

2. Information systems should transfer data to the user more rapidly and conveniently.

C. Separate systems need to be linked together so that, ideally, the user can secure all relevant information from all systems by addressing a question to one system

D. A central point is required to define the indicated kind of long-range planning, coordination and research, and to undertake these tasks

The needs for linking systems together and for planning and coordination are analagous to the needs faced by the nation's telephone companies. As studies of the growth and distribution of population, economic growth and technical potential made clear the rapid growth of future demands, it was clear that manual operations would break down and that separate company operations alone could not provide a nation-wide telephone network. They had to be linked so that the separate companies would act as a

single system in serving the customer. For this, means of providing nation-wide long-range planning, coordination, standardization, engineering and basic communications research were needed. These are in principle the functions that have to be performed centrally to create an effective set of scientific and technical information systems. However, the problem is more complicated in the scientific and technical information field than in the telephone system because of the mixture of public and private activities and because the systems serve not a single purpose but many purposes.

E. The private efforts must be maintained and strengthened. Representatives of the private systems should participate fully in determining the policies to be followed in efforts to link all systems together more effectively

IV. Proposed Action

The essential aim of the proposal is to embark on a solid program to bring under tighter control the unsatisfactory state of Federal information services, and to make scientific and technical information a more effective instrument for increasing the efficiency of our national research and development activities and of our design, construction and production industries.

The instruments proposed for launching this program are an Executive Order and a Presidential statement. These are designed to establish the initiative of the President in this area, to energize the agencies, to enhance private-public cooperation, to ratify and emphasize needed shifts of emphasis in the activities of the Office of Science and Technology and the National Science Foundation, and to increase the attractiveness of the top Federal jobs in this area. Drafts of the Presidential statement (which might alternatively be in the form of a memorandum to the heads of departments and agencies or excerpted for inclusion in a speech), and of an Executive Order are attached (Attachment A and Attachment B).

The elements of the proposed program and the responsible agents are as follows:

A. Establish a technical systems design and standards development center in government (National Science Foundation)

1. Create and maintain the overall design for a network of information systems covering all areas of science and technology.

2. Design and carry out a program of research and development related to information systems.

3. Recommend and undertake to secure the adoption of means of increasing the quality of input to information systems, increasing their utility to users and of reducing inefficient duplication.

4. Design a program for increasing the production of information systems designers, builders and operators.

5. Stimulate and support the development of information systems for basic scientific disciplines, and for special fields not covered by other Federal agencies.

B. Create a mechanism for a dialogue between the Federal government and the private information activities (National Advisory Council on Information Systems)

Full participation of the important private sector in any comprehensive national effort is a prerequisite to success. Private and public activities must be effectively linked. For the necessary participation, a formally established forum is highly desirable, and this is the function of the proposed new National Advisory Council on Information Systems. It would contain both private and public members. It would advise and be chaired by the Director of the Office of Science and Technology.

C. Strengthen the coordination of information activities of the Federal agencies (Committee for Scientific and Technical Information)

This Committee now exists as a subgroup of the Federal Council for Science and Technology, and has worked effectively as a coordinating point for the activities of Federal agencies. Elevation of the group so that it would be directly advisory to the Director of the Office of Science and Technology is proposed.

D. Provide a nerve center for the entire system and a point for exercise of Presidential authority (Office of Science and Technology)

1. Assist the President by bringing about and guiding the evolution of a coherent network of rationally related information systems.

2. Develop general goals, priorities and policies for Federal information systems.

3. Resolve questions relating to agency roles and to basic standards for compatibility among their information systems.

4. Ensure that Federally developed information is made easily available to private users.

V. Funding

NSF--FY 1968

Additional funds and positions will be required for NSF in the FY 1968 budget if appreciable progress towards the objectives set in the Executive Order is to be made.

We recommend that 8 positions be added to the NSF staff at a cost of $200,000, and that $1.2 million be added to the NSF budget for contract studies of national information systems.

OST-FY 1968

OST will require four additional professional and supporting staff at a cost of $200,000 and $50,000 to cover the expenses of the new National Council on Information Systems.

The Future

If the proposed program is successful, additional expenditures in future years will be productive. The Executive Office expenditures should rise very little unless a decision is made to center substantially expanded management responsibilities in the Executive Office. This might come about if other preferable solutions do not work.

NSF activities would expand substantially in future years if the initial efforts are fruitful. NSF expenditures on the order of $30 million per year can be foreseen, but the rate at which this level might be approached cannot be predicted.

Attachment A

DRAFT STATEMENT BY THE PRESIDENT

Science and technology have built an enormous reservoir of information about the world we live in -- and the outer space we are exploring. Over the past three centuries, scientists have developed means of tapping into this reservoir, and for adding to it. But our nation's scientific and technical information system is in trouble. The traditional means of recording, classifying, storing and retrieving information are not adequate.

The use of this information to give us new products and to increase the efficiency of industrial production is being hampered.

The use of this information to plan and design new scientific experiments is made difficult, so that our $22 billion per year national research and development activities operate below peak efficiency.

We must press ahead. Our national defense, the health of our citizens, the strength and growth of our economy, the education of young and old, and the solution of many vexing national problems demand even more research and development. The problems of using the information produced through research are going to become more rather than less pressing.

We can foresee doubling of science information over the next 8 to 10 years. Between 1965 and 1975 as much will be published as has been published in all the years before. The number of scientists and engineers who need and use this vital information will also increase greatly. We expect 50% more of these users by the early 1970's.

The reservoir of information has to be exploited in new and imaginative ways. Fortunately, we now have the technical know-how to begin to build far more effective and efficient information systems. However, the problems involved are more than technical. The new computers and other technical advances are necessary, but they alone will not do the job.

We must avoid needless waste and duplication as the new systems are built. We must also preserve and stimulate to even better health the private, independent enterprises which today provide the bulk of information services in science and technology.

Five Presidential advisory committees have studied this problem and recommended that something be done. The Congress, through several of its committees, has urged that the Executive Branch act. Many private citizens and groups have also urged that the Federal Government exercise leadership.

We have kept the existing information services operating while a plan for action was being developed. Over the last two years, under the leadership of Dr. Hornig, my science advisor, such a plan has been devised. The time has now come to take action. We must begin the deliberate evolution of a more effective and more efficient information system in science and technology.

The basic assumption of this plan is that the Federal Government has an inescapable responsibility to ensure that there exists in this nation ready access to all the significant worldwide reservoir of information. But we do not propose a Federally-controlled or Federally-operated information system for all of science and technology. We propose instead relying to the fullest extent on the ingenuity and enterprise of the private, independent information services which now exist and which our citizens will undoubtedly create in the future.

What we are proposing is a way of bringing together in a concerted program the many different interests at stake. These include the scientists and engineers, the professional societies, the private publishers, the librarians, the computer and communications specialists, the university community, industrial research and development, and government agencies.

To this end, I am issuing an Executive Order which directs the following actions:

1. Establishment of a technical systems design and standards development center for government in the National Science Foundation.

2. Creation of a new mechanism -- the National Advisory Council on Information Systems -- for closer contact between the Federal Government and the private information activities.

3. Strengthening the coordination of the scientific and technical information activities of the Federal agencies through the Committee on Scientific and Technical Information.

4. Providing a nerve center and general guidance for the entire system through strengthening the Office of Science and Technology.

This set of actions will give us a more efficient national research and development program, and will contribute to the effectiveness of industrial production.

Attachment B

EXECUTIVE ORDER _____

Scientific and Technical Information

WHEREAS science and technology are essential resources for the security and welfare of the United States; and

WHEREAS the contributions of science and technology to security and welfare depend on the availability of scientific and technical information to users; and

WHEREAS despite large private and public expenditures the nation's capacity to produce scientific and technical data is outstripping our ability to make information available in a timely, efficient and economical manner:

NOW, THEREFORE, by virtue of the authority vested in me as President of the United States, it is hereby ordered as follows:

Section 1. Information Function of the National Science Foundation

Executive Order No. 10521 of March 17, 1954, as amended in March 1959 by Executive Order 10807, is hereby further amended by substituting for Section 10 thereof the following:

"Sec. 10. The National Science Foundation shall serve as the central point in the Federal government for operations which will:

"(a) Create and maintain the overall design for a network of information systems covering all areas of

science and technology, including the technical requirements for compatibility among information systems;

"(b) Design and carry out a program of research and development for aspects of information sciences and technology generally applicable to information systems, including the design and operation of prototype systems;

"(c) Recommend and take steps to secure the adoption of means to increase the quality of input to information systems, to increase the utility of information to users and reduce inefficient duplication of information activities;

"(d) Design, in cooperation with the Office of Education, a program for the education and training of information systems designers, builders and operators; and

"(e) Stimulate and support the development of information systems for basic scientific disciplines, and for special fields not covered by other Federal agencies."

Section 2. Establishment of the National Advisory Council on Information Systems

(a) There is hereby established the National Advisory Council on Information Systems, hereinafter referred to as the Council;

(b) The Director of the Office of Science and Technology shall be a member and serve as Chairman of the Council and the Director of the National Science Foundation shall serve as Vice Chairman;

(c) The Council shall be composed of 10 private members and 8 representatives of Federal departments and agencies. The 10 private members shall be appointed by the President and shall be chosen so as to represent the scientific, educational, communications and information communities. The 8 public members shall comprise one representative of each of the following named departments and agencies and each of them shall be designated by the head of his department or agency: Atomic Energy Commission, Department of Agriculture, Department of Commerce, Department of Defense, Department of Health, Education, and Welfare, Department of the Interior, National Science Foundation, Department of State, and the Department of Transportation;

(d) The Council shall advise the Director of the Office of Science and Technology on all matters pertinent to national problems in the area of scientific and technical information, and particularly on the functions of government and private information services.

Section 3. Committee for Scientific and Technical Information

(a) There is hereby established the Committee for Scientific and Technical Information, hereinafter referred to as the Committee;

(b) The Director of the Office of Science and Technology or his designee shall be a member and serve as Chairman of the Committee;

(c) The Committee shall be composed of representatives of Federal departments and agencies selected by the head of the department or agency from among those competent to speak for the agency. The departments or agencies represented on the Committee shall be the Departments of State, Defense, Interior, Agriculture, Commerce, Health, Education, and Welfare, and the Atomic Energy Commission, the Federal Aviation Agency, the National Aeronautics and Space Administration, and the National Science Foundation;

(d) The Committee shall serve as a primary instrument for interagency consideration of matters relating to the scientific and technical information policies and programs of the Federal agencies and for coordination of the activities of the agencies.

Section 4. Information Functions of the Office of Science and Technology

The Office of Science and Technology shall assist the President in carrying out the following responsibilities:

(a) Develop general goals, priorities and policies for Federal information systems;

(b) Resolve questions relating to such matters as the roles of the various Federal agencies and basic standards for compatibility among their information systems;

(c) Ensure that the Federal agencies make easily available to private users information developed through research and development conducted or financed by the government.

Section 5. Agency Cooperation

(a) Federal agencies shall cooperate with and assist the Office of Science and Technology and the National Science Foundation in the performance of these functions, to the extent permitted by law.

(b) Each executive department or agency listed in subsection (c) of Section 1 of this Order shall furnish necessary assistance for the National Advisory Council on Information Systems Policies as authorized by Section 214 of the Act of May 3, 1945, 59 Stat. 134 (31) U.S.C. 691 .

LYNDON B. JOHNSON

THE WHITE HOUSE

_____ 1966

Appendix 1

A Sample of Information Systems Operated by Federal and Private Agencies

Note: The activities listed below are a small part of the total, but they indicate the scope and variety of the individual information systems operated by governmental and private agencies. The kinds of functions which these systems serve are:

(a) Provision of a central point where scientists may secure organized information on all research or on research supported or conducted by Federal agencies, relating to their fields of interest.

(b) Provision of organized information to those providing services to the civilian economy -- standard reference data to engineers and scientists; data on chemical compounds to chemists; organized information on medical literature to physicians; data to teachers on the results of research on education.

(c) Transfer of organized technical data to government agencies with specialized missions.

A. Federal

Agency and Program

Department of Commerce

- State Technical Services Information Program
- National Standard Reference Data System
- Clearinghouse for Federal Scientific and Technical Information
- Cryogenic Data Center
- Patent Information Program
- Center for Computer Science Technology
- National Meteorological Center

Health, Education, and Welfare

- National Library of Medicine Information Program
- National Clearinghouse for Mental Health
- Educational Research Information Center
- Toxicology Information Program

Agriculture

- National Agricultural Library Program
- Pesticides Information Center

Defense

- Defense Documentation Center
- Entomological Information Center

National Science Foundation

- Science Information Exchange
- National Referral Center

National Aeronautics and Space Administration

Scientific and Technical Information Program

Interior

Water Resources Information Center

Atomic Energy Commission

Isotopes Information Center

B. Academic

Activity	University
Chemical Propulsion Information Center	Johns Hopkins, APL
Human Engineering Info. & Analysis Serv.	Tufts
Power Information Center	University of Pennsylvania
Thermophysical Properties Research Center	Purdue
Biological Serial Record Center	Geo. Washington U.
Technical Information Center	Georgia Tech.
Water Resources Center Archives	University of California
Health Law Center	Pittsburgh U.
Brain Information Services	University of California
Neurosciences Research Center	Mass. Inst. of Tech.
Radiation Chemistry Data Center	Notre Dame

C. Non-Profit

Chemical Abstracts Service	American Chemical Society
Radiation Effects Information Center	Battelle
Remote Area Conflict Information Center	Battelle
Fused Salts Information Center	Sandia

D. Specialized Libraries

	Operator
Engineering Societies Library	United Engineering Trustees
Engineering Library	Mass. Inst. of Tech.
George David Birkhoff Library	Howard U.
The John Crerar Library	Chicago U.
Abrasives Library	Minnesota Mining & Mfg. Co.
Submarine Signal Operations Library	Raytheon

E. Private Industry

Electronic Properties Information Center	Hughes Aircraft
Air Force Machineability Data	Metcal Research Associates
Hercules Research Center	Hercules Powder Co.
Technical Information Center	Melpar
Baroid Division	National Lead Co., Houston
Technical Information Center	Westinghouse

F. State and Local Government

Capital Improvement Information System	Planning Dept., Wichita, Kans.
Education Data Processing System	Board of Education, Chicago
Community Renewal Information System	San Francisco
Land Use Information System	City Planning Department, Santa Clara County, Calif.
Transportation Information System	New York State
Community Renewal Information System	Washington State at Washington U. Urban Data Center
Education Information System	Department of Education, Dade County, Florida
Social Welfare Information System	Detroit, Michigan
Health Law Information System	Health Law Center, Pittsburgh U.
Metropolitan Data Centers	Planning Commissions and Departments in Tulsa, Denver, Forth Worth, Little Rock, Wichita

Note: During 1966 nearly all States have been granted funds by the Department of Commerce under the State Technical Services Act of 1965, for planning statewide or regional scientific and technological information centers.

Appendix 2

Reports to the President and the Executive Office on Scientific and Technical Information

1. President's Science Advisory Committee. Improving the Availability of Scientific and Technical Information in the United States, The White House, Dec. 1958 (The Baker Report)
2. President's Science Advisory Committee, Science, Government, and Information: The Responsibilities of the Technical Community and the Government in the Transfer of Information, The White House, January 1963 (The Weinberg Report)
3. Letter Report to the President's Science Adviser, by Panel on Scientific and Technical Communications, February 1965 (The Licklider Report)
4. Task Force Report to the President's Special Assistant for Science and Technology, Scientific and Technical Communication in the Government, April 1962 (The Crawford Report)
5. "Memorandum for the President on a National Library of Science System," Stafford L. Warren, 17 February 1964.

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Appendix 3

National Document-Handling Systems in Science and Technology

A study team has outlined the federal government's responsibilities and ways in which they can be met.

Launor F. Carter

Concern over the adequacy of this nation's document-handling and information system is far from new. Since World War II there have been at least 15 major proposals for the establishment of some sort of national system. Critics often point to the centralized Russian abstracting and announcing service VINITI (*1*) as a prototype we might well follow. Two recent reports, precursors to the study discussed in this article, have been given wide attention. In 1962 the "Crawford Report" (*2*), sponsored by the President's Science Advisor, advocated a major reorientation of organizational responsibilities for scientific and technical information within the federal government. The following year marked the appearance of the "Weinberg Report" (*3*), sponsored by the President's Science Advisory Committee. Although each of these reports received high-level governmental consideration, their recommendations were not widely adopted: rather, certain portions were incorporated into the existing structure. One innovation was the formation of the Committee on Scientific and Technical Information (COSATI) of the Federal Council for Science and Technology. The Director of the Office of Science and Technology asked COSATI to undertake a comprehensive study which would lead to the formulation of recommendations for a national document-handling system in science and technology. The results of the COSATI study, supported by a team from the System Development Corporation (SDC), are contained in an extensive report (*4*), the highlights of which are reviewed here.

The Problem

Each of the studies mentioned above views the problems of handling scientific and technical information and documents from a somewhat different point of view, largely because the problems have not been addressed as a single multifaceted problem. There are many different problems which, when summed, indicate that current practices and institutions need major revision. Among the problems which must be considered by a comprehensive design are the following:

1) Federal responsibility for scientific and technical documentation must be clarified and formalized. It is stated as a basic proposition that the federal government should be responsible for assuring the existence within the United States of at least one accessible copy of every significant publication in the worldwide scientific and technical literature. This has not heretofore been explicitly accepted as a responsibility of the federal government. As a result many government agencies are not oriented toward implementing such a policy, nor could they do so readily if the policy were formally adopted.

2) The number of users, and their requirements, are increasing. In 1960 there were 2,370,000 scientists, engineers, and technicians in the United States; it is estimated there will be 4,000,000 by 1970 (*5*). The documen-

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tation requirements of these personnel differ substantially, depending on their work. Scientists and scholars require one kind of service, engineers a different kind, and managers of technical efforts a third kind. The present information and documentation system of libraries and information centers does not adequately meet current needs, and it will be even less able to cope with a large increase in users' requirements.

3) The number of publications is ever increasing—in fact, it doubles about every 15 years. One estimate places the number of technical documents published in 1961 at 658,000 and the number to be published in 1970 at 1,143,000. In 1964 the Library of Congress had over 43,000,000 items in its collection. This represents a growth of over 180 percent in the last 26 years. As the number of documents increases, it becomes more and more difficult for research libraries to cope with the problems of acquiring, cataloging, indexing, announcing, circulating, and storing them. Libraries react to these problems by becoming more specialized, restricting their clientele, or reducing their services. Clearly, a rationalized system for dealing with the increasing number of documents is needed (*6*).

4) Under the present system it is difficult for libraries and document centers to render high-quality services. It is hard to give exact figures to support this statement, but many separate pieces of evidence lead to this conclusion.

For instance, in 1965 Congress made a special appropriation of $5 million to the Library of Congress. Part of this will be used to finance an accelerated cataloging effort. Library of Congress catalog cards are used throughout the libraries of the nation, but their publication lag is becoming acute and they are covering a smaller proportion of the total number of documents.

The fact that many new mechanisms for information exchange are coming into use indicates that the traditional means of communication are inadequate. Large numbers of trips from center to center, informal publications, extensive use of preprints, and restricted symposiums are supplementing older and more public methods of communication.

Some libraries have large backlogs of books and other documents which they cannot process into their collections, and are restricting their services. For instance, more and more major university libraries are curtailing their services to nearby industrial organizations because of a lack of adequate library resources.

Studies of library users show a significant dissatisfaction with the present system and, at the same time, a serious lack of information about how to use the system. The user is turning to other sources or is not using libraries or information systems to the extent he should.

The number of people attracted to and trained for librarianship is much less than the demand, and the growth rate in the field is lower than that of the general professional work force.

The budgetary situation for most private research libraries is critical. Large private foundations and philanthropists are no longer supporting library operations, and municipal funds are in short supply.

In an uncoordinated fashion, many parts of the information and documentation system are depending on federal support. Direct subsidies, page charges, special grants, overhead allowances, special working agreements, and contracts all signal dependence on the federal government.

5) Technological innovations have not been utilized by libraries, which with few exceptions use virtually the same manual techniques today that they used 50 years ago. There are three basic causes for this situation. Most librarians and the traditions of librarianship are grounded in the humanities rather than in technology. As a result, many policy makers in libraries tend to be unsure of the potentials of modern technology. Another cause is the relative poverty of libraries. Usually libraries have barely been able to fund their current operations, let alone experiment with new techniques. The third cause is that automated techniques have not yet been developed for easy adaptation to many libraries. The development cost of adapting advanced technology to the problems of document and information centers will be high. So far, the federal government's efforts in this direction have been modest, but if we are to cope with increasing numbers of users and documents, new techniques must be developed and applied.

6) Long-range planning is needed. The present system is composed of many independent units: within the government, at universities, in professional societies, as private efforts, and in industry. Each of these units goes its separate way in terms of plans and resources. Each perceives its individual problems but may or may not be aware of the larger national problem (including problems of overlapping collections, duplicate cataloging, inadequate service to some groups of users, and so forth). There is no national long-range plan or planning body to provide cohesion in these separate efforts. In the past, *ad hoc* study groups or individual government officials have developed plans or suggested solutions to the problems, but these efforts have not led to any consistent action. Often, partial solutions—such as the establishment of the National Library of Medicine and the MEDLARS service it provides—represent the success of a particular group of users. But as the pressures of increasing numbers of users, increasing numbers of documents, and increasing potential of advanced technology continue to mount, the need for long-range planning becomes apparent (*7*).

Method of Studying the Problem

The initial approach in the study sponsored by COSATI was to follow three separate but related lines of endeavor. As a first step previous studies and proposals were reviewed. Congressional studies, reports by the President's Science Advisory Committee, reports from elsewhere within the government, and studies from private sources were collected and analyzed. A second area of investigation centered around studies of users' needs for scientific and technical information. Although over 450 such studies were identified, the SDC study team concentrated on 58 which seemed to be based on significant empirical data, in order to gain an understanding of users' own views of their needs. The third and most extensive effort was devoted to understanding the present scientific and technical information system. Of the large number of institutions in the federal government and in the nonfederal sector that render scientific and technical information services, 47 were visited. In addition, the legislative bases for existing services were reviewed and extensive statistical data were collected.

As a result of these studies (*8*) a series of basic propositions and system requirements was formulated. As the studies were progressing and the requirements were being defined, the team considered and developed ideas for several alternative systems which seemed capable of meeting a major portion of the requirements and which had some practical possibility of being implemented. Six alternative designs were developed and worked out in considerable detail. The designs were drawn from many sources, including previous proposals. Probably no one conception is completely original with the present effort, yet the characteristics enumerated, plus the spelling out of the details of conception and implementation, are a unique product of this study.

Basic Propositions and Requirements

In addition to the federal government's responsibility for assuring that at least one copy of every important scientific and technical publication is available in the United States, the most important principles developed were that the federal government is responsible for assuring that these publications, once acquired, are appropriately announced, processed, and made available to qualified individuals within the United States, and that proposed systems should be evolutionary, in that they should start with the present systems (libraries, information exchanges, and so forth) and evolve into forms which will be consistent with an overall plan. There must be flexibility to allow for new organizational and administrative arrangements.

While each principle needs discussion, an elaboration of the first and most fundamental proposition will give an appreciation of the import of these basic statements. The concept of federal responsibility for assuring the availability of all significant scientific and technical publications contains several ideas that need definition or qualification.

How does one determine whether or not a publication is significant? First of all, a document or a good abstract must be available from which a judgment can be made. If a document is not already available in the United States, then the judgment must be made elsewhere, probably by experts in the country of origin. Moreover, judgments of significance cannot be made in terms of current perception of possible relevance, since relevance is subject to periodic change. Rather, significance needs to be judged in terms of the soundness and professional character of the work reported. In the long run the system should aspire to having each published document available in the United States for evaluation by appropriate United States specialists. As a minimum effort we would want to include all published serials, documents from established monograph services, and books from established publishers. Occasional reports and pamphlets would be the last to be included. How soon this goal can be achieved depends on how important the scientific community thinks it is relative to competing goals and how willing Congress is to make funds available. (We may be closer to this goal than we realize. The open-literature holdings of the intelligence agencies are vast. It was beyond the scope of SDC's study to do so, but an investigation should be made of the extent to which unclassified holdings of these agencies could be made available to the civilian community.)

The federal government's "responsibility" implies that a system in the federal establishment will know what is available in the United States, not only in government depositories, but in private and university libraries. In other words, there must be a national union listing and an indexing of document holdings of major libraries. This will be a vast undertaking.

The concept of accessibility also needs elaboration. It implies that any document can be reached in an effective and timely manner by some yet-to-be-defined class of users.

What is meant by "scientific and technical" literature? There is no disagreement about including astronomy, mathematics, physics, chemistry, and biology, but what about the behaviorial and social sciences? The system should include these disciplines because of their increasing national importance and their rapid advances. In other words, psychology, sociology, cultural anthropology, political science, and economics fall within the definition of science and technology. How far do we go in such areas as industrial engineering, manufacturing technology, and management engineering? The system should include these areas. Its goal is to cover science and technology in the broad sense.

The number of basically different approaches that can be taken to the problem of document information is fairly limited. Four approaches were considered by the SDC team (although there are three variations on one idea). One emphasizes the need for an integrating and planning organization (Capping Agency) to formulate and implement national and federal policy, another emphasizes the establishment of defined responsibilities for the several federal departments and agencies, the third involves the centralization of all operating responsibility in one large federal or private organization, and the fourth features the slow evolution of the existing system. All of these can be given various interpretations and emphases, and they can be considered in several combinations.

The Capping Agency

The Capping Agency would be a new agency within the Executive Branch of government which would have overall directive and review authority relative to scientific and technical information and documentation. The proposed Capping Agency, called the Scientific and Technical Information Bureau, would not be an operating agency, but rather an overall executive or management agency dealing with information and document activities in the various departments and agencies of the federal government and related external groups. The Bureau would formulate policy and be responsible for the functions described below:

There are now several national libraries, and it is argued that several other national systems should be established. The Bureau should determine which are to be covered by which departments and agencies and should define the responsibilities of the various departments and agencies.

The Bureau should establish federal policy with respect to support for and cooperation with nongovernment libraries. As the federal information and documentation program becomes elaborated and standardized, it will affect nongovernment libraries. Some federal agencies may delegate part of their responsibilities to libraries or organizations outside the government. To the extent that major university libraries or private libraries support or back up federal interests, they

should be supported by federal funds.

There are some 300 major science and technology information centers throughout the country. Some of these are supported by the federal government, some are in private industry, and some are in universities. Their operation and services vary considerably, which is to be expected, but such variation is not in accord with any plan or systematic approach to information centers. Policy needs to be formulated regarding support and sponsorship of information centers, and this would be a function of the Bureau.

There are at present over 1200 libraries throughout the country which are depositories of government documents. The extent of their receipts and holdings varies considerably. Policy regarding distribution, processing, and support for these depositories needs to be developed.

At present many practices are being followed with respect to nongovernment scientific and technical publications. In the primary-publication field there is some direct subvention; there is often payment of page charges through research contracts. Similarly, among secondary publications, some abstracting publications receive a very substantial subsidy whereas other abstracting services receive none. Policy and funding patterns in this area need rationalization.

A primary method of communication, both formal and informal, among scientists is through the nondocumentary method of letters, visits, small meetings, symposiums, national meetings, and so forth. Federal policy relative to such activities varies. The whole area of nondocumentary communications needs extensive study, and development and implementation of policy.

Current figures on size of collections, use, budgets, and so forth are often unobtainable or incomplete and are rarely comparable from activity to activity. Reliable statistical information must be developed throughout the scientific and technical information and document area.

The Bureau should establish standards for information handling to be followed by all federal organizations that have responsibilities for information and documentation in science and technology. Performance standards concern such matters as completeness of coverage, speed of service, and nature and quality of services to users. Technical standards apply to such areas as cataloging, classification, bibliographies, micro-storage, and automation.

Presently the National Science Foundation has an important responsibility both for research in information science and for various science information activities. The establishment of the Bureau would change this situation relative to science information. However, it is anticipated that basic research in information science would remain a responsibility of NSF and enjoy the same status as any other major area of scientific research.

Broad guidance and encouragement are needed in the development of advanced technology for document handling. The Bureau should take an active role in fostering the application of advanced technology and automation techniques to government libraries and other information centers.

There is a shortage of information technologists and librarians trained in science and technology, and the situation will not improve under the current level of interest and support. Federal policy regarding the support of training of the necessary personnel needs to be stated, and funds must be made available for training purposes.

There are many more foreign than domestic serials and documents, although 60 percent of all documents are published in English. Extensive study of and policy for the acquisition and translation of the foreign documents are required.

Many scientists and engineers are uninformed about available services. The Bureau should publicize sources of information and services and should help in training users to use the available services effectively.

Information and documentation in science and technology represent a major federal expenditure, on the order of $200 million of direct expense annually. (Some estimates show this figure to be about $400 million.) In addition to normal review by the Bureau of the Budget, there should be an across-the-board funding review for the information and documentation activities.

As the agency responsible for the national information and documentation program, the Bureau should review all relevant Administration-developed legislative proposals. It should generate proposals where national policies are concerned.

The development of science and technology and the growing requirement for service indicate the need for continued planning. The Bureau would be responsible for developing long-range plans.

In addition to considering the functions that need to be performed, the COSATI study spells out in detail a suggested organization for the Scientific and Technical Information Bureau. Four major organizational divisions are indicated: a Systems Office, an External Policies and Support Office, a Technical Applications and Methods Office, and a Plans Office.

Finally, the placement of the Bureau needs consideration. Preferably, such activities would be performed in one of the existing agencies, but after considering the arguments for and against placing responsibility for them in the Office of Science and Technology, the National Science Foundation, the Bureau of the Budget, and the General Services Administration, it was concluded that a new organization in the Independent Offices and Establishments portion of the Executive Branch was needed. If OST or NSF were to have their missions broadened and their staffs expanded, the recommendation regarding placement should be reconsidered. The important point is that the various functions listed need to be performed. Whether a new agency is required, or whether the responsibilities of existing ones can be adequately expanded, is a question that needs to be examined by those most familiar with the broad organizational design for the Executive Branch of the government.

The Responsible Agent System

Under the Responsible Agent System a competent authority would designate a particular organization as the agent responsible for assuring the satisfactory performance of all tasks necessary to provide information services in a defined portion of the broad spectrum of science and technology. The organization would not necessarily perform all these tasks itself, but it would make sure that they were performed, if not by itself, by organizations elsewhere in the government or in the nonfederal sector.

The concept of Responsible Agent grew out of a suggestion in the Weinberg Report which pointed to the information functions being performed

by the Atomic Energy Commission and by the National Aeronautics and Space Administration in their respective fields. However, a detailed analysis of the applicability of the idea to other areas was not made and further support and implementation did not materialize. In SDC's study the applicability of the concept as related to national goals, responsibilities of government agencies, and reasonable groupings of scientific and technical areas is considered in depth.

The combination of the Capping Agency and the Responsible Agent concept was the system recommended by the SDC study team. However, the team considered several alternative systems to the extent of analyzing the general concept, developing an operating scheme, indicating a possible organization, defining functions to be performed, and developing the arguments in favor of and opposed to each of the alternatives. These alternatives were:

1) A New Federal Operating Agency. A new federal agency could be established to take over complete responsibility for information and documentation. The new agency would not only be responsible for policy but would also operate a national service.

2) A Government-Chartered Corporation. Most of the functions and operations to be performed under the New Operating Agency could also be performed by a special private corporation chartered by the government.

3) A National Library Administration in the Executive Branch of Government. It would be possible to amalgamate the major libraries now existing in the federal government. Because of the sizable collections and special status of the Library of Congress the S&T information and documentation problem might be solved by transferring the Library to the Executive Branch and enlarging and redefining the locus of operations and responsibilities of it and of the other major libraries and information services.

4) Strengthening of the Existing System. It can be argued that a somewhat adequate service is now being rendered and that the present system should be allowed to evolve much as it has in the past. The Office of Science and Technology might be strengthened, and small guiding groups in other existing agencies might be formed to achieve some additional coordination.

Evaluations

After the various alternatives were described, each was evaluated in terms of 43 design requirements developed earlier. Although the Capping Agency–Responsible Agent system ranked at the top of the evaluation, it was not markedly superior to the New Operating Agency, Government-Chartered Corporation, or National Library Administration as far as technical considerations were concerned. The evaluation concludes by saying:

> The New Operating Agency and the National Library Administration concepts both involve radical changes in operations and administration which are not consonant with our conception of the requirement for evolutionary development. The bases from which one could arrive at detailed specifications for a centralized operating system are as yet inadequate. Additionally, the National Library Administration concept requires the transfer of the Library of Congress to the Executive Branch, which would probably be politically difficult. Both concepts involve extensive transfers of responsibilities and central control of document-handling services.

The Government-Chartered Corporation is an attractive alternative because of its interfaces with the nonfederal sector, but it has the overriding weakness of infringing strongly on solely federal activities.

The option of simply strengthening the present system was not recommended, on the grounds that it was not currently satisfying many of the present requirements and the probability did not seem high that it would do so in the future.

The recommended design—the combination of Capping Agency and Responsible Agent—is evolutionary and represents the best solution for meeting the requirements. Furthermore, of all the designs considered, it provides the greatest degree of flexibility for adapting to changing requirements. Finally, since it requires the least change in existing operations, it would be the solution most acceptable to the organizations currently responsible for handling scientific and technical documents and information.

The Committee's Recommendations

The SDC study served as background material for the COSATI Task Group on National Systems. The recommendations of the Task Group were endorsed by COSATI, under the chairmanship of William T. Knox of the Office of Science and Technology, who subsequently presented them to the Federal Council for Science and Technology. The COSATI report (*9*) recommended that:

1) The Office of Science and Technology should accelerate its efforts on the overall planning, policy formulation, organization, coordination, and evaluation of the integrated *national* network of information and document-handling systems in science and technology, and should take appropriate steps to clarify areas of responsibility among the federal agencies involved.

2) The Office of Science and Technology, in collaboration with the Bureau of the Budget, federal departments, agencies, and other organizations involved in science and technology, should undertake at once (i) to develop a comprehensive, coordinated program for ensuring the acquisition, cataloging, and announcing of significant scientific and technical literature; (ii) to develop policies concerning the legislative bases for document and information services in or sponsored by the departments and agencies, and (iii) to propose or endorse legislation to enable departments and agencies to assume responsibility for ensuring effective information and document-handling services in agreed-upon areas of science and technology. The establishment of one or more national libraries in fields of science and technology in addition to medicine and agriculture, should be considered as elements of the integrated national network.

3) The Office of Science and Technology, in collaboration with appropriate federal agencies, should encourage the private sector to formulate document-handling plans and programs for its consideration (and for review by appropriate agencies) in the development of the integrated national network.

4) The Committee on Scientific and Technical Information should recommend action for the development of a coordinated plan and criteria for federal support of experiments in information technology, including prototype information systems designed to provide design data for the integrated national network.

Continuing tasks of high priority include the development of standard procedures for processing documents so that interagency exchange can be more efficient and comprehensive, the de-

velopment of guidelines for cost and budgetary analyses and control by agencies of their document and information services, the development of education and training curricula for the operators and users of the document and information systems, and the development of policies for acquisition, dissemination, and translation of unclassified foreign documents in science and technology and for the dissemination of federally produced information and data to foreign countries and organizations.

Summary

As a result of the studies described here and the COSATI recommendations, as well as briefings and discussions at many levels of government and with professional and industrial organizations, the Office of Science and Technology has a blueprint for action and support for forward movement in the handling of scientific and technical documents.

References and Notes

1. VINITI is an acronym derived from the English transliteration of the Russian name for the All-Union Institute of Scientific and Technical Information, Vsesoyuznyy Institut Nauchnoy i Tekhnicheskoy Informatsii. A description may be found in the SDC report cited below. For a critical Russian review of VINITI see V. S. Malov, Results of Check of Fulfillment of Resolution of Council of Ministers of USSR, "About measure for improvement of organization of scientific and technical information in this country," *Sci. Tech. Inform. (Selected Articles)* No. 6, (1964), Report FTD-MT-65-07, Foreign Technology Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio.
2. U.S. Department of Commerce, "Scientific and Technological Communication in the Government" (AD 295 545. Government Printing Office, Washington, 1962).
3. President's Science Advisory Committee, "Science, Government, and Information: The Responsibilities of the Technical Community and the Government in the Transfer of Information" (The White House, Washington, Jan. 1963).
4. L. F. Carter, G. Cantley, J. T. Rowell, L. Schultz, H. R. Seiden, E. Wallace, R. Watson, R. E. Wyllys, "Recommendations for National Document Handling Systems in Science and Technology" (TM-WD-213/001/00, System Development Corporation, Santa Monica, Calif., Sept. 1965. Available as PB 168 267 from Clearinghouse for Federal Scientific and Technical Information).
5. L. J. Carter, *Science* 151, 666 (1966).
6. It is often suggested that much of doubtful value is published and steps should be taken to reduce the amount published. It is easy to agree with this point but very hard to devise methods to reduce the amount of new material. The better journals have a very high rejection rate and new journals are started continuously. Government-required periodic reports further complicate the problem. An attack on this problem should be one of the first efforts of the Capping Agency discussed later.
7. In September President Johnson appointed a National Advisory Commission on Libraries to "evaluate policies, programs, and practices of public agencies and private organizations—and to recommend actions which might be taken by public and private groups to ensure an effective, efficient library system for the nation."
8. L. F. Carter *et al.* (*4*, vol. 2. 404 pp.) give the detailed findings of these studies. In addition, several technologically advanced systems are described and the present and probable near-future capability of the technical components needed for large automated systems are discussed.
9. Federal Council for Science and Technology, "Recommendations for National Document Handling Systems in Science and Technology" (Nov. 1965. Available as PB 168 267 from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va.).

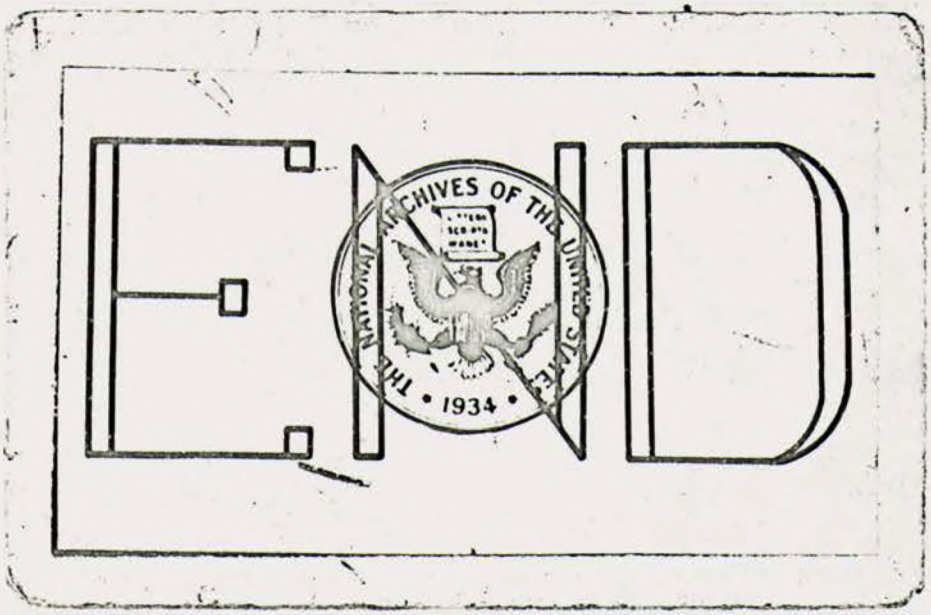
NEWS AND COMMENT

Berkeley: New Crisis Breaks Out on California Campus

U Thant remarked recently of China that it is undergoing a nervous breakdown. The same diagnosis might be applied to the Berkeley campus of the University of California, by some measures the greatest, but by any measure the most havoc-ridden, of American institutions of higher learning.

Last week, 2 years after the Free Speech Movement (FSM) uprooted the *ancien régime* of Berkeley, the campus was again in chaos, the spark for the latest eruption being a protest against the presence of an on-campus recruiting table manned by Navy and Marine Corps officers. In the forefront of the protest was the banished hero of FSM, 23-year-old Mario Savio, returning to the scenes of old glory, like Napoleon from Elba. Savio, whose application for readmission to the university was recently denied (in a challenge of regulations barring political activity on campus by nonstudents, he conspicuously handed out leaflets while his application was pending), joined several other nonstudents in setting up an antimilitary table near the military recruiters. When campus police ordered them to leave, on the grounds that nonstudents, with the exception of government representatives, are not permitted to set up tables on campus, they refused. A crowd gathered, a fight ensued, some 30 outside police—reportedly quite free with their clubs—were summoned by the administration, and Savio and nine others, among them three students, were arrested. Thereupon came mass meetings at which Savio was enthusiastically received when he called for a strike. This was followed by sit-ins and a boycott of classrooms, involving, according to various estimates, 3000 to 9000 of the university's 27,000 students. To the utter despair of the administration, which, in the wake of Ronald Reagan's million-vote victory, feels like Paris after the blitz but before the occupation, Berkeley was again conforming to its popular image as an enclave of tax-supported anarchy.

What happens next is beyond forecast, but, on the basis of a week of conversations at Berkeley just prior to this latest eruption, it is clear that the peace of Berkeley was indeed fragile and that, if the presence of the military recruiters had not provided the precipitating event, another would have served as well. For, 2 years after FSM, Berkeley still had not resolved the basic question of just what it is a university is supposed to be in this rich and turbulent society, and, all along, the tensions evoked by that question have been wrenching the innards of the university community. To which it should be added that, while 2 years of post-FSM skirmishing gave the campus administrators great expertise in crisis-management, it also rendered them so punchy that, just prior to last week, many of them readily expressed concern about the durability of their patience in the face of what they considered to be incessant provocation by a small group of ingeniously disruptive students and campus hangers-on. As Vice Chancellor Earl Cheit, who summoned the outside police in the absence of Chancellor Roger Heyns, put it 2 weeks ago "The administration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