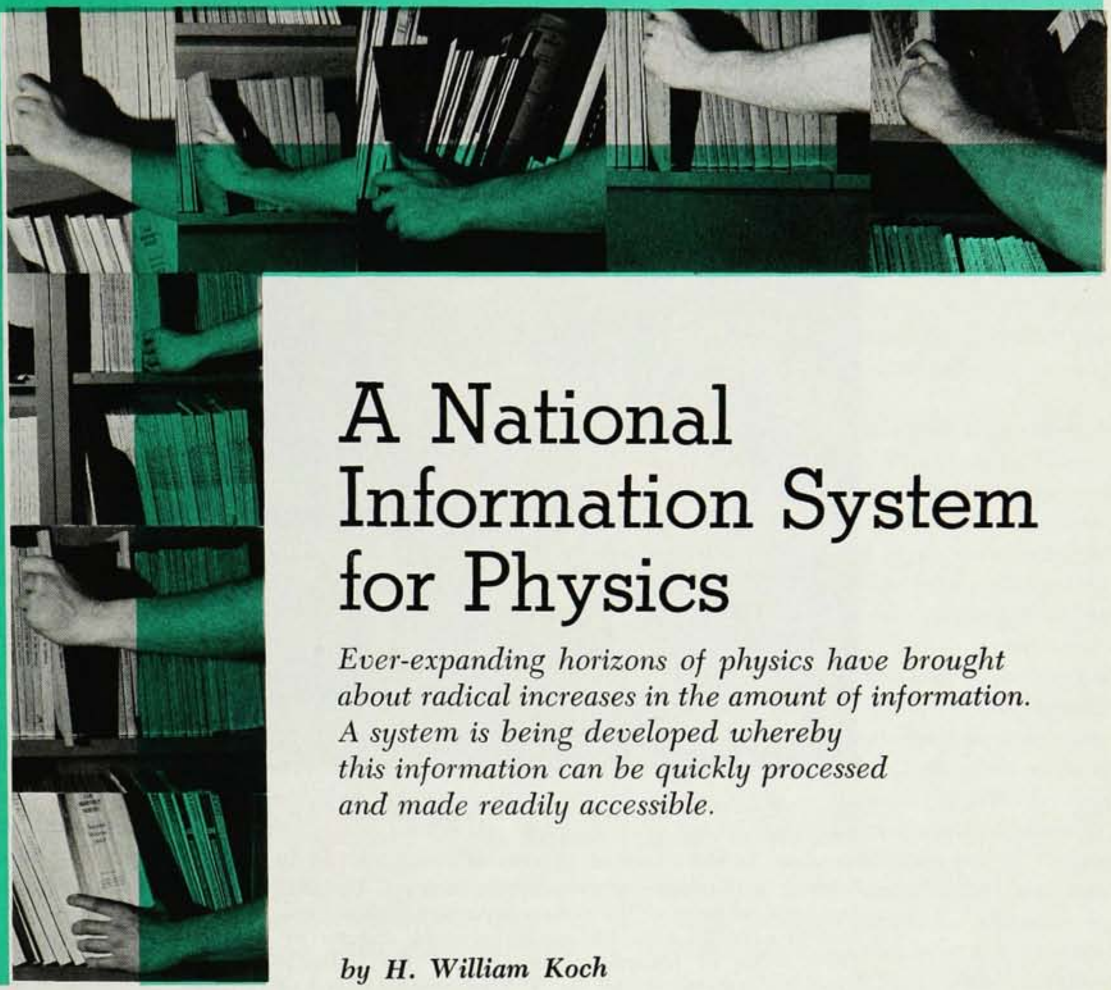


A National Information System for Physics

Ever-expanding horizons of physics have brought about radical increases in the amount of information. A system is being developed whereby this information can be quickly processed and made readily accessible.

by H. William Koch

INFORMATION CONTENT of physics has been influenced dramatically by vigorous developments in research and education since 1946. These developments are the direct result of two federal science policies.

The first policy, in 1946, provided substantial support for research in academic and federal laboratories. In the 1950's, when the gross national product was growing at an annual rate of 5%, federal funds were supplied at a rate that increased roughly 29% per year.[1] Consequent research and education programs have generated a wealth of information that was and is critically needed for the future development of physics.

The second federal policy was the endorsement, in 1961, by the Federal Council for Science and Technology of page-charge payment to nonprofit publishers by the institutions of journal authors whose research is funded by federal agencies. The establishment of this page-charge policy resulted from a recognition by federal research managers that research is not completed until published. These page charges pay the costs of input into archival journals and thus allow the journals to sell at subscription rates covering only runoff and distribution costs. The page-charge concept clearly separates input from output problems of changing production methods and fluctuating subscriptions. This concept has been the key to the success of the American Institute of Physics publication program.

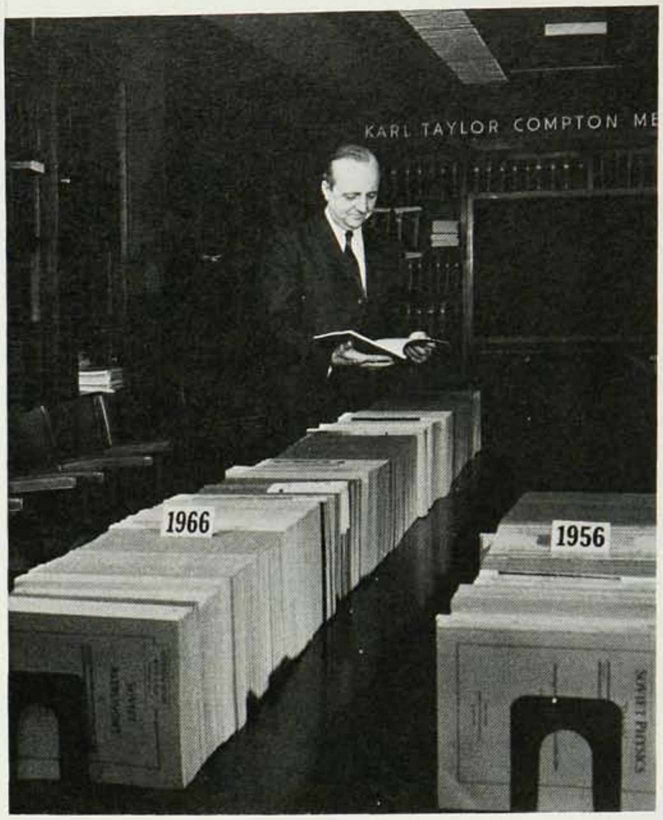
A continuation of these policies and the addition of a third federal science policy will permit physics to maintain its vigorous development. The third policy is being initiated for many science disciplines by the National Science Board of the National Science Foundation. The new policy arose from the recognition that information content in scientific publications is not useful until further applied. Implementation of this policy will require specific involvement of producer and user as well as attention to the flow of information among the sciences. Accordingly, NSF has made decisions for chemistry and physics: Professional societies will be encouraged to enlist the help of individual scientists to ensure effective dissemination, utilization and the application of information.

The decision for physics was made in November, 1967; this has resulted in favorable action by NSF on a proposal submitted by AIP in May, 1967. The proposal was for a two-year study, beginning on the first of this year, of information problems and possible ways of solving them. Therefore in what follows I will discuss information problems, assumption of responsibility by AIP, procedure for the two-year study and future projections.

What is information?

Appreciation and understanding of the problems in physics information and the need for a systems study would be greatly facilitated by defini-

MITCHELL VALENTINE



The author is director of AIP. Having obtained his degrees from Queens College, New York, and the University of Illinois, he went to the National Bureau of Standards in 1949 and worked in the high-energy-radiation section. In 1962 he was promoted to chief of the radiation-physics division and worked in that capacity until his appointment as director of AIP in 1966. One of his special interests is the information expansion, depicted above in a photographic nutshell. This article was taken from a speech given at the Chicago meeting of the American Physical Society in February.

tions as well as by models for information systems and methods for handling information.

Physics information is the totality of knowledge in physics and, as such, includes all written and oral, transmitted and received communications. The term "information system" refers not only to that knowledge, but also to all methods, materials, media, producers and recipients involved in the transfer.

As an introduction to physics information and its problems, let us consider the model for an information system shown schematically in figure 1, in which such a system is assumed to provide the mechanism for transferring information in the form of an idea, experience, conclusion, data, document or a journal of documents from producer to user.

A model can also be provided for the generation of a journal document, which is the most important element in an information system. The generation of a journal document by AIP goes through six stages: production, acquisition, intellectual organization, storage, dissemination and utilization. The relationship of the six stages with the three federal science policies is suggested on the right side of figure 2. Policy 1 is involved with production of information, policy 2 is involved with acquisition, intellectual organization and storage, and policy 3 is involved with dissemination and utilization. The cost to the government in implementing the first two policies has been about \$50 000 per document under policy 1 and about \$400 per document under policy 2. The costs of policy 3 cannot be predicted at this time but would be assumed to be comparable with those under policy 2.

Information systems in the models and in practice have a close analogy to transportation systems, in which an individual is transferred from origin to destination by a variety of methods (airplane, railroad, automobile) and routes selected for convenience, speed, economy, etc. It also has a close analogy to the telephone system. The number of telephone instruments increases with the number of subscribers. As both numbers increase, each instrument becomes more important in transmitting and receiving messages. As these messages grow, the number of links increases more rapidly and communication channels become more complicated. The rise in value, importance and complexity is orderly and desirable; hence it cannot be characterized as an "explosion" as long as it is under control. Similarly, the developments in physics information are orderly and nonexplosive. Areas that are not orderly or controlled are those of unedited or informal reports and letters, some of which have been referred to as misinformation.[2]

An information system has always existed in physics if one can accept the lack of coördination between all parts of the assemblage that make up the information-handling complex. The existing information system has consisted of the simplest forms of meetings, journals, books and libraries that were operated for the producer and were available passively for the user (producer viewpoint of figure 1). This philosophy will undoubtedly have to change when the system focuses on the user, but it will continue to recognize that the user exerts minimal effort in benefitting from the system.

Problems and reactions

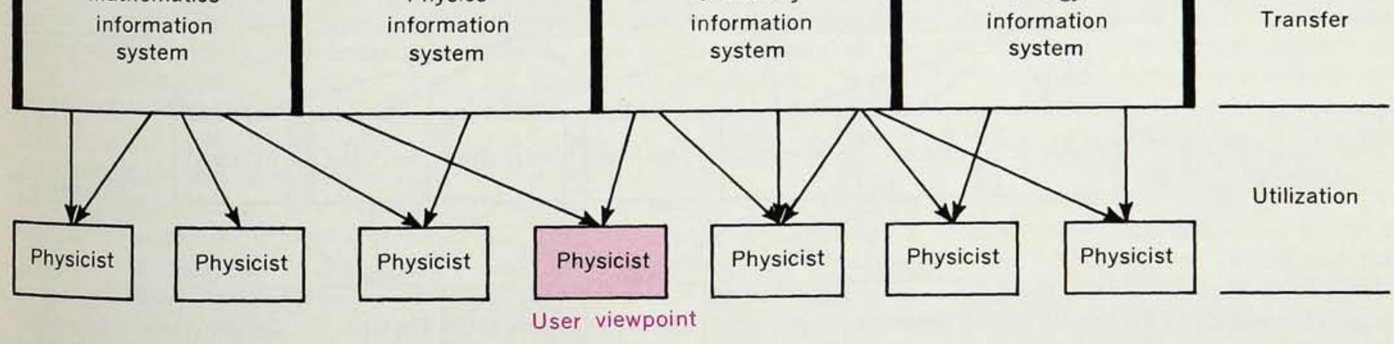
Problems with the existing system have become apparent not only recently to individual physicists who are key elements in the system, but to federal managers of scientific research since about 1957. Since that time a number of prestigious panels have recommended many approaches to the improved handling and dissemination of information, both by the federal government and by related private sectors. These groups have included panels chaired by William O. Baker (1958), James H. Crawford Jr (1962), and Alvin M. Weinberg (1963), the Committee on Scientific and Technical Information (COSATI–1965) of the Federal Council for Science and Technology, and the NAS–NAE Committee on Scientific and Technical Communication (SATCOM–1965). Along with this growth of national awareness and activity there has been a comparable increase on the international level involving, for example, the International Nuclear Information System (INIS); agreements between the US Atomic Energy Commission (AEC), the European Atomic Energy Community (EURATOM) and the International Atomic Energy Agency (IAEA); and activities of the Office of Economic Coöperation and Development (OECD), the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the International Council of Scientific Unions (ICSU).

Much of the alarm about the growth of published literature in science and technology is because this growth is exponential, with a doubling time of 15 years.[3] Within the US physics community, the growth in the national published literature is also exponential, as indicated in figure 3. This graph shows the number of pages published by AIP and the number of abstracts in *Physics Abstracts*; all indicate doubling times of the order of ten years. At the start of 1968 a new document in the AIP and society journals was being added every hour. These document volumes have directly affected the number of production sources required at AIP. Whereas, in 1956, one printer could handle all of the pages, 19 different compositors, engravers and printers are required today. Indeed, composition capabilities for technical information in this country are being sorely taxed. Thus AIP publishing problems are much more severe today than they were even in 1956.

The growth in the number of physics pages published each year has caused delays in publication when timeliness has become increasingly important. The need for speed is emphasized by the decreasing time lag between discovery and application demonstrated by the diagram in figure 4. Since physics has been involved in many of the basic discoveries in the last 50 years, the technology of this country cannot afford significant time delays in the availability of physics information.

In general, individual physicists have not been outwardly aware of or concerned about the information expansion, a characteristic they share with their scientific colleagues. However, physicists as a group have been showing greater evidence of an unconscious reaction to information problems: They have been reacting to the difficulty of maintaining an overview of a given specialization because of the larger number of journals that must be monitored; they have been reacting to slowly increasing subscription costs, time delays in publications and simultaneous sessions at national meetings; they have been reacting to the availability of new information techniques brought about by the facsimile-reproduction machine, the computer and the jet airplane.

Reactions have taken many forms: an increasing use of preprints, laboratory visits, hallway conversations and coffee breaks at meetings to maintain an overview of a given technical field before going into print; decreasing relative individual subscriptions to journals and increasing private collections of separate documents acquired from library subscriptions and facsimile-reproduction machines; greater frequency of multiple authors and multiple speakers; interest in, and use of, information-analysis centers for critical data evaluations and of review articles; more requests for new formats for information. Responses to these requests have been the conventional and nonconventional services for the dissemination of information listed in table 1. New formats represented by information innovations



MODEL OF INFORMATION SYSTEM in which physics is assumed to be just one of the information systems for science that must be connected and related in a comprehensive structure. This model shows the system from both the producer (top) and the user (bottom) viewpoints. —FIG. 1

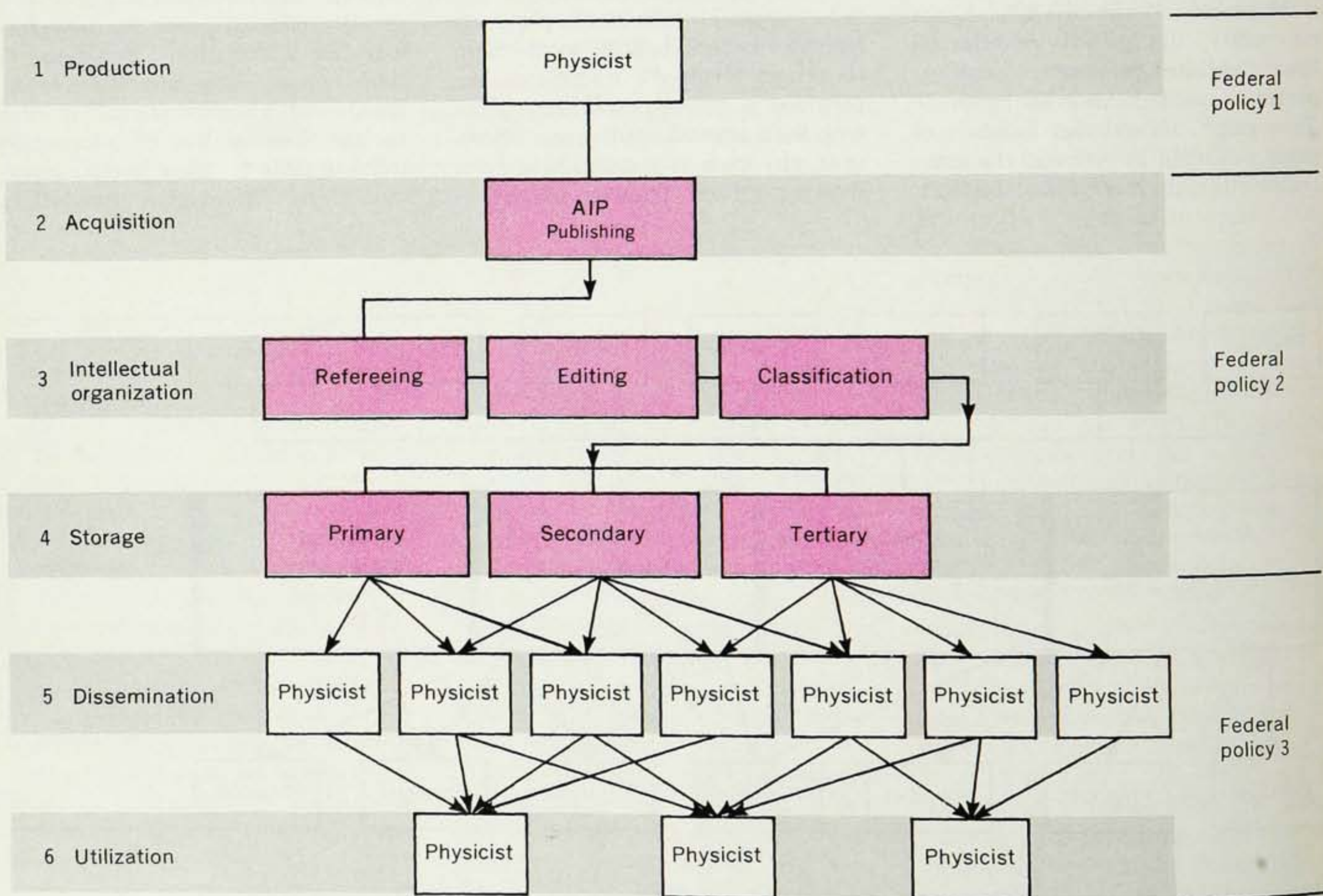
made available during the last ten years are enumerated in table 2.

These reactions and changes are producing an evolution, rather, a revolution, in the role of the archival journal that deserves to be identified. Since journals were first instituted in 1665, they have served at least four separate functions: *scholarship,* in which the experiences and data from the laboratory and lecture room are aggregated into a journal with the aid of reviewers; *record,* in which priority and legal functions are provided; *news,* in which announcements of new experiences are communicated; *storage,* from which information is retrieved. The utility of scholarship and records will necessitate the continued existence of journals to maintain the orderly development of physics. There will undoubtedly be important evolutionary changes—particularly in the news and storage functions of journals—that will markedly alter their format, but these will not make journals and, particularly, documents in journals, obsolete. The most significant change in function will probably be in storage since computer stores will substantially improve the search and retrieval capabilities of physicists over the manual techniques now applied to journals. Therefore just as the airplane has not made the automobile obsolete, so will the new computer and communications technologies not make the journals obsolete.[4] Rather, the journals will be supplemented by these technologies in serving as a continuing and critically important information technique.

AIP and information

As a federation of the leading societies in the field of physics, AIP combines into one operating agency those functions on behalf of physics that can best be done jointly by the societies. AIP's major effort is in the area of publishing. The scientific journals it publishes, devoted wholly or mainly to physics and related sciences, represent 35% of the world's physics literature when the translations of Soviet journals are included. The significance of the AIP publication program can be placed in further perspective by a comparison of the number of members, journals, original pages and translation pages for the institute, the American Chemical Society and the Institute of Electrical and Electronics Engineers (as shown in table 3). An examination of these numbers shows that the number of pages in American journals published by AIP is equal to the sum total of those published by ACS and IEEE, two societies whose interests are closely related to those of physics. The translation pages also represent about one half of the total domestic translation program presently, or at one time, funded by NSF.

AIP presently provides, or is considering providing, a large assortment of materials and media for physicists (figure 2). Primary materials include entire journals, offprints in individual documents, preprints, written reports,

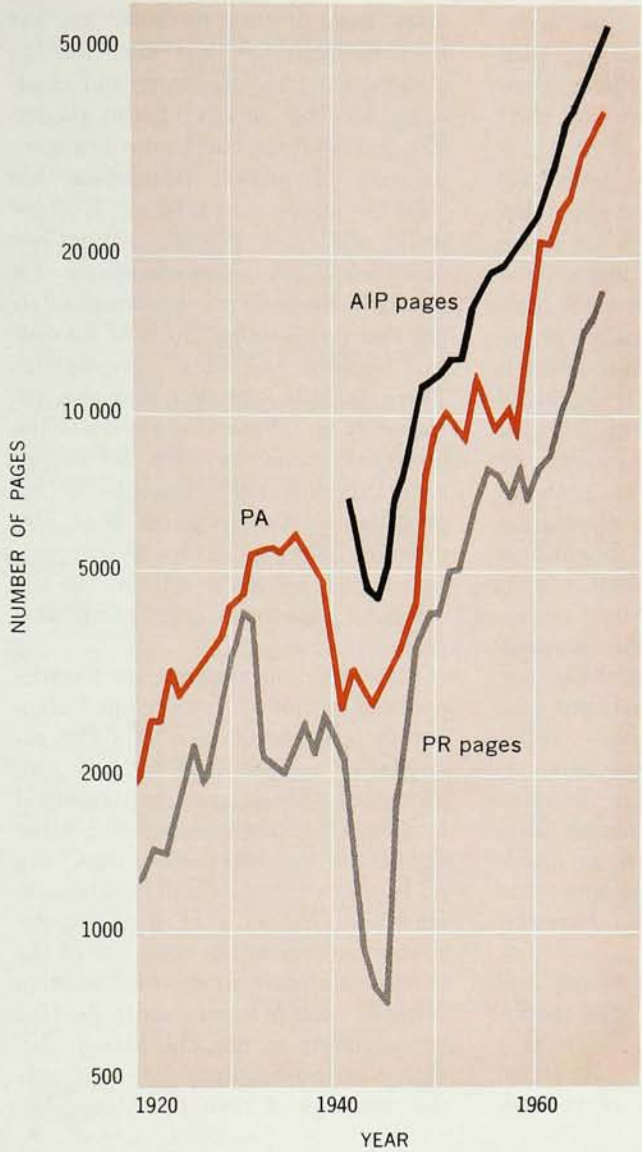


GENERATION OF JOURNAL DOCUMENTS goes through six stages. The federal policies on the right-hand side are related to the particular functions of each stage. —FIG. 2

patents and oral reports; secondary materials encompass abstracts, bibliographies, indexes and references; tertiary materials are surveys, reviews and data compilations. The media may include hard copy, microform copy, digital encoding on computer tape and computer access. AIP is investigating the economics and general feasibility of providing a variety of information services based on these materials and media. AIP is also giving detailed consideration to new computer and communication technologies to ensure the economic viability and general utility of any proposed services in satisfying the information needs of physicists.

Interfaces between AIP in its role in generating physics documents and other organizations contributing to or utilizing those documents are shown in figure 5. AIP serves as a communications or information-switching center. It supplies, or has been requested to supply, a wide range of services to other organizations based on physics documents: copies of cover pages of AIP documents, microfiche masters for industrial information systems, microform copies of entire documents, computer tapes for photocomposition of abstracts by the Institution of Electrical Engineers (IEE), tapes to update the computer file of the Technical Information Project at MIT, and translation journals in hard copy.

As a natural adjunct to the publishing program, AIP has conducted research, since 1958 with NSF support, toward the development of an information system for physics and has developed tools for the analysis and retrieval of information. Indeed, this research and experience have made it possible for AIP to accept the responsibility for the study now under way. Descriptions of the earlier plans and progress have been provided in reports in PHYSICS TODAY.



EXPONENTIAL INCREASE in number of pages published by AIP compared with number of abstracts in *Physics Abstracts* and pages in *Physical Review*. —FIG. 3

Procedure for the study

Overall procedure for the AIP information study will be to examine the methods by which physics information is, or could be, conveyed from producer to user; to identify the various factors that enhance or diminish the flow of such information; finally, to investigate the utility, complexity and costs of the various channels through which such information does or could flow. For practical reasons, emphasis of the study will be on documents themselves rather than on the facts contained in those documents (that is, document retrieval as contrasted with data retrieval) and on the interests of the US physics community (that is, the national system). Additional factors and objectives controlling the study are as follow.

Service to physics and physicists. The involvement of AIP in the study and in coördinating, possibly, the eventual system is justified only if it will accomplish the "advancement and diffusion of the knowledge of physics and its application to human welfare" for which AIP is chartered. Also, active involvement of physicists will be required to improve the present methods employed in the pursuit of physics, which is basically a scholarly effort. Therefore AIP will emphasize procedures that are more scholarly than mechanical, that will involve physicists more than systems engineers, that will improve communication in physics and that will prevent misinformation explosions.

Characteristics of physicists. The involvement of physicists is critically needed so that they can control the development of a system intended to serve them. Physicists understand particularly that one cannot legislate scholarship in their science. They realize that they have very human characteristics limited by their number of working hours per day, their rate for reading and writing, their facilities for comprehension and their life span of productivity, all of which have not altered markedly during the years when information has expanded so voluminously. Physicists are aware of their personal and institutional limitations of funds, equipment, personnel and interests. Finally, physicists understand that their science is an intellectual effort that is organized and pursued in a manner different from that in which chemistry or biology, for example, are pursued. Physics has a conceptual orientation rather than the structural orientation of chemistry or the functional orientation of biology. Therefore an information system for physicists will have a different character from one for chemists, biologists, geologists, etc.

Characteristics of systems. Information systems have unique characteristics that deserve to be identified and understood and that distinguish them from other systems such as transportation, telephone, lighting and weapons. Some of these characteristics are as follow.

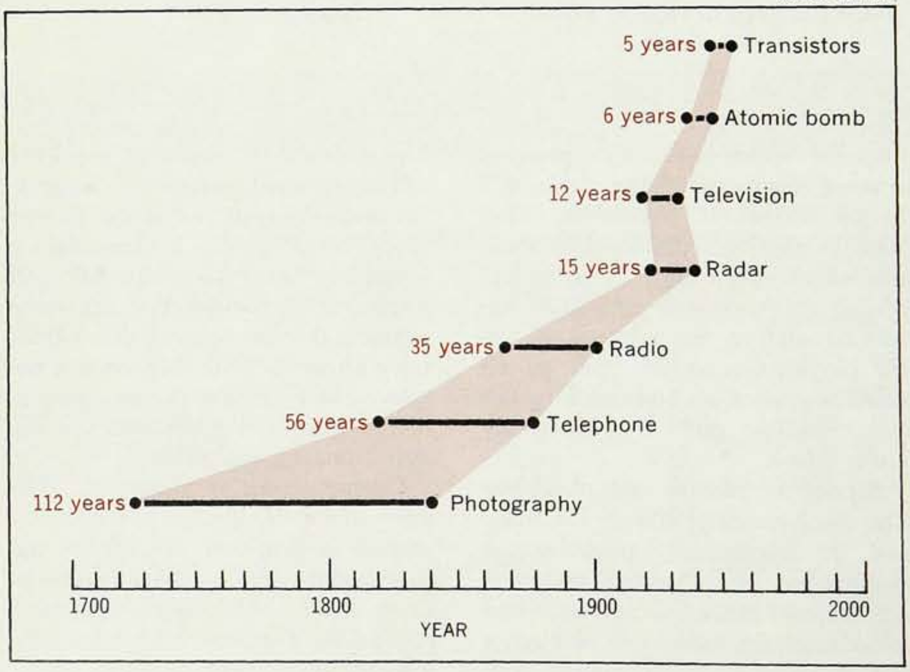
- Science-information systems deal with information, a commodity requiring scholarship that can be neither legislated nor mechanized. As stated earlier, the main purpose of the primary journal since its inception has been to aggregate and filter the experiences in the laboratory and classroom for the benefit of the reader. The principal method for further compression of journal documents has been the mechanical production of abstract and titles journals. What we now need are renewed efforts for scholarly methods of digesting, filtering and compressing, such as by critical reviews and data compilations. There is little question that the response of an information system to the literature expansion must be higher standards, better filters and better aggregations. The response must also provide different levels of compressional and scholarly efforts for the complete spectrum of information users.

- Information systems are interdependent and must be developed compatibly and simultaneously. For example, as suggested in figure 1, information systems must be developed in chemistry, mathematics and other disciplines to ensure that there are no gaps or unnecessary duplications in effort and, indeed, that there is a desirable overlap in the coverage of the various discipline-oriented information systems. Each system must develop coöperatively so that the various discipline-oriented systems serve not only the members of their disciplines, but also related government and industrial missions.

- The size of the sample represented, either in the overall system or the component subsystems, is critically important. An information technique that is successful for a community of 500 physicists may not work at all for 5000 or 50 000 physicists.

- The combination of mechanical and scholarly efforts required in the development of a physics-information system will require suggestions and observations from the entire physics community. As ideas and experiences are identified, they must be evaluated from all points of view with considerable objectivity. For example, unedited government reports, preprints and hallway conversations have their negative aspects in adding to the burden on physicists who want to evaluate all relevant information available to them. However, these same reports, preprints and conversations can be and are regarded in many respects as the natural response of physicists who take the path of least resistance (cost, effort, quantity) in developing techniques for coping with the information expansion. Before physicists benefit from the formal techniques of scholarship and record offered by an archival journal, in hard copy or computer format, they increasingly feel a need to be alerted by their colleagues on new ideas, documents and data.

SCIENCE JOURNAL



SHRINKING GAP between initial discovery and final development. —FIG. 4

Foci of the study

Based on the preceding outline of procedures, factors and objectives, AIP is developing a system with two separate foci. The first focus is the individuals, groups and institutions who will be producers and users of a physics-information system. The second focus is the system itself. The AIP plan with these foci is as follows.

Producers and users. A unique characteristic of AIP is its contact with the physics community. This contact is possible because more than 75% of the 29 000 physicists in 1966 on the National Register of Scientific Personnel were included in the 45 000 members of AIP. AIP will use these contacts by working with separate, key groups of individuals. The groups will be utilized in evaluation and advisory capacities and will provide the mechanism of explaining, developing and reacting to a physics-information system (see table 4).

System development. Four of the six stages in the handling of information (see figure 2) are of particular concern in the development of a system. These stages are acquisition, intellectual organization, storage and dissemination. With some freedom of interpretation, they correspond to the four sections of the AIP information division. These stages are as follow.

Acquisition—Acquisition refers primarily to the production of printed materials as done by the publications division. Since this is a well-established activity, system design will be concerned mainly with the introduction of new techniques by the computer-composition section of the information division. Computers are already in use for the composition of some scientific journals. And AIP has begun some preliminary work on computer-based photocomposition. The promise in these methods comes about not only because of the various derivatives possible from the master magnetic tape of the full manuscript (that is, abstract-journals tape, titles-journals tape, citation tape, etc.), but also because of the probable time and cost savings in the rigorous checking of material at the galley and page-proof stages required for present printing processes.

Intellectual organization—Most previous AIP effort has been devoted to detailed study and research of the intellectual organization of physics concepts and literature. This effort is now concentrated in the information-retrieval section of the information division. Its activities are centered on improving the services for information retrieval (journal indexes, abstract-journal indexes and existing classification methods) through the development of an advanced classification scheme. This scheme, based on an analysis of document information and the way in which it is used, combines the classification and indexing of a document. Classification is according to a fixed, faceted and hierarchical vocabulary and is intended to place a document into the various subdisciplines to which it is appropriate. Indexing is according to free language and is intended to flag the particular items or type of data to be found. We expect that classification and indexing will be author generated and approved by reviewers and editors; that is, classification and indexing will be produced by the same team of experts responsible for the existence of the paper.

Another activity of the information-retrieval section during the past year has been the development of a pilot model of a computerized retrieval system based on a faceted classification scheme in chemical physics, plasmas, lasers and masers. Interdisciplinary programs have been set up with Chemical Abstracts Service and with IEEE to study the compatibility of this classification with the information needs of scientists in other disciplines. Search requests have been formulated, and computer searches have been run on a test base of 1000 documents in chemical physics. Members of the APS division of chemical physics and of the ACS division of physical chemistry have assisted in developing the classification, have submitted real search requests related to their research interests, and will evaluate the results. We are now developing a larger model of a retrieval system encompassing all AIP journal publications and thus providing a broader coverage of physics. We are benefitting from the active participation of several groups of physicists who are helping us to revise our classification and to index the large number of documents that will form the input for our next model. Work on the retrieval system is benefitting from the extensive programming experiences and existing com-

Table 1. Information-Disseminating Services

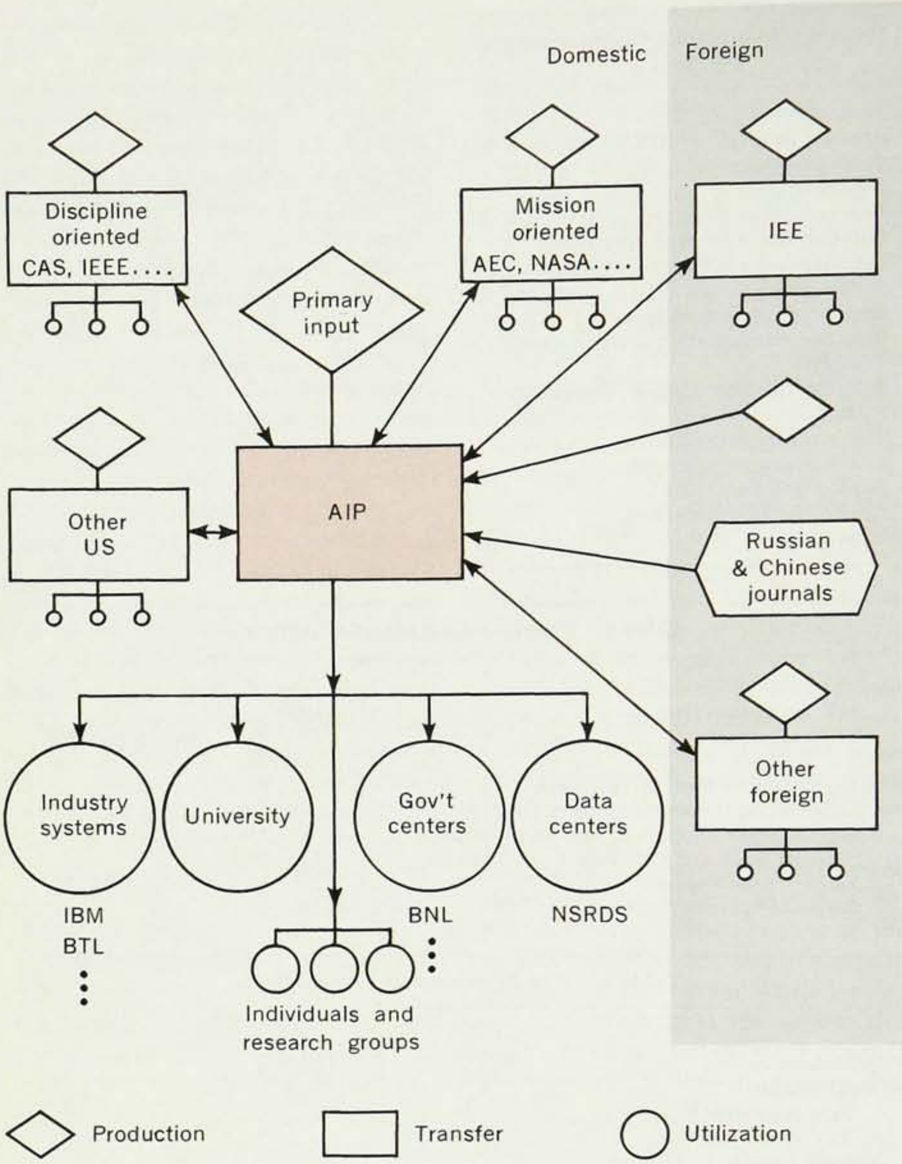
Journal subscriptions
Abstract journals
Titles journals
Published indexes
Sale of bibliographic tapes
Offprint distribution of documents
Preprint announcement and/or exchange
Depository of manuscripts
Selective dissemination of documents (SDD)
Selective dissemination of information (SDI)
Microform distribution
Current-awareness service
Bibliographic searches
On-line computer service
Patents

Table 2. Physics-Information Innovations

Item	*Starting dates*
AIP translation journals	1956
Letters journals	*Phys. Rev. Letters*, Aug., 1958 *Appl. Phys. Letters*, Sept., 1962
Topical conferences by invitation	~1960
Facsimile reproduction on big scale	~1960
Page-charge endorsement by federal council	Oct., 1961
National Standard Reference Data System	June, 1963
Nuclear Data Compilation Journal	1965 by Academic Press
Current Papers in Physics	Jan., 1966

Table 3. 1966 Membership Journal Data

	AIP	*ACS*	*IEEE*
Membership	40 900	100 000	160 000
Publications			
Primary journals	19	18	36
Translated journals	11	0	5
Editorial pages			
Primary journals	54 000	33 900	18 600
Translated journals	21 750	0	7 900



INFORMATION SWITCHING by AIP in conjunction with other organizations. AIP offers a variety of services to domestic and foreign groups. —FIG. 5

puter store available at the Technical Information Project of MIT.

Storage—The computer-store section of the information division contains marketing, computer and programming specialists. Its responsibility will be a dual one of developing the general computer applications required by the information division, as well as continuously evaluating the market parameters for various information services: costs, speed, effort required, etc.

Dissemination—Dissemination is the specific task assigned to the system-development section. In general, internal organization of AIP is such that some system-development activities are carried on outside of the system-development section. Each of the other three sections of the information division, and to some extent the publication division, is contributing to system development. The system-development section is left with two general tasks: integration of the system as a whole and detailed planning of those functions not assigned to other sections. Two of the specific tasks that demonstrate the importance of dissemination as the principal goal are as follow.

- Study of information patterns in physics. Some results on these patterns will be obtained from contacts with advisory committees, correspondents, data centers, etc. Items to be studied include the flow of information, its sources, destinations, volume, speed, cost and benefits; meetings, informal communications, "invisible colleges"; the publication process; secondary information and libraries; critical surveys, compilations, condensations.
- Interface problems with non-AIP components in physics (IEE, TIP), other discipline-oriented information systems (CAS, IEEE, AMS) and mission-oriented systems (AEC, NASA, NLM) as suggested in figure 5. Subjects include compatibility, standards, media and formats for information exchange.

Future projections

The future of a physics information system is difficult to predict and project. Therefore it is fortunate that AIP has won the support of its member societies to examine systematically and thoroughly the needs and trends in physics information. Fortunately, also, there are many important experiments now in progress in other scientific communities that will have considerable relevance to physics. Some of these information experiments are as follow.

Mathematical Offprint Service. To ensure rapid dissemination of current information on an individually tailored basis, beginning in this year the American Mathematical Society will offer a new type of service to the mathematics community. By submitting a detailed interest profile, a subscriber will be able to specify the types of documents that he wishes to receive. Documents that satisfy his criteria will be regularly mailed to him along with listings of documents in which he indicated peripheral interest. The cost of the service will be $30 for 100 offprints.

Chemical Abstracts Service: an experiment in selective dissemination of information. During 1967, 11 government and industrial organizations participated in a coöperative enterprise with CAS to establish the feasibility of a wholesale approach in providing SDI services to individuals. CAS provided the input to the system (that is, abstracts of 15 000 journal documents, both in hard-copy and magnetic-tape form) and the software. Participants prepared the user profiles and performed the searching on location. For an additional fee searching could also be performed at CAS head-

Table 4. Information-Program Liaison Groups

Description	Number	Remarks
In AIP		
AIP Governing Board & Executive Committee	25	7 meetings/year
Member-society officers	48	1 meeting/year
Advisory committee (society representation)	14	2 meetings/year
Advisory subcommittee–additional members	15	Meetings as required
AIP publications board	22	1 mtg/year (15 Jan.)
Information correspondents	160	Mail contact
Corporate associates	150	1 meeting/year
AIP members (1967)	45 000	PHYSICS TODAY contact
Outside AIP		
Non-AIP physics editors (through IUPAP)	50	
Physics information evaluation centers	30	
Industrial & federal information centers	~50	
Related disciplines (chem, math, IEEE, IEE)	4	
National information committees (COSATI, SATCOM)		

quarters. The cost was evenly divided among participants and totaled $8000 per year per participant.

American Chemical Society: research results service. This enterprise is basically a manuscript depository. The service consists of regular listings of papers that have been submitted and are under consideration for publication by the journal, *Industrial and Engineering Chemistry,* and its three affiliated quarterlies. The operation is author controlled, thus ensuring that nothing is listed without the author's consent. Interested individuals can submit orders to ACS headquarters for desired items. The cost is $1.00 for each ten pages for subscribers and twice as much for nonsubscribers. Manuscripts are handled as private communications and can only be cited with the author's permission. The service's real assets consist of speed of announcement and speed of delivery.

Institution of Electrical Engineers, London: selective dissemination of information investigation. This wholesale operation has been providing rapid dissemination of current English-language journal articles to 600 participants, 540 of whom are individuals and 60 are small organizations, departments or sections, treated as single units. Based on a match of individual-interest profiles and documents, the service sends out weekly notifications of items that should be of interest to its participants. IEE handles input and searching but relies on local libraries for distribution of notices to individuals. This year IEE hopes to make the system fully operational.

Our study and the experience of these related activities should enable us to make reasonable and knowledgeable projections in two years. The future should have many things in store for physics as is evident from three technological developments that will soon be practical and available to the general public as well as to the physicist. The developments are every bit as revolutionary as was facsimile copying, which was introduced on a large scale after 1960 and which has had major effects on scientific-information exchange. The developments are described in the following quotations from the news media.

The 4 Jan. 1968 issue of the *New York Times* stated, "'Digital systems that convert all forms of information—speech, data or pictures—into streams of pulses are speeding the day when telephone users will see each other as they talk, or watch figures spring from a computer,' H. I. Romnes, chairman and chief executive officer of the American Telephone and Telegraph Company, said here yesterday.

"'I think for example that Picturephone Service will be in very considerable use within less than ten years,' Mr. Romnes said. 'By this, I mean person-to-person connections, over a switched network and similar connections between people and computers, with the output of the computers shown on the Picturephone screen.'"

Physicists have recognized that hand waving and blackboards are vital to informal communications in physics. The telephone has probably not influenced communication patterns as much as the jet plane, which has made possible face-to-face meetings. Therefore one can expect a considerable influence of the picturephone on the way physics is informally communicated.

The 25 Nov. 1967 issue of the *New Yorker* stated, " . . . the New York Public Library recently became part of a statewide network . . . " that "employs facsimile devices that transmit their messages by microwave relay . . ." "This atypical development has come about through an experiment authorized by and financed by the state legislature. Six libraries and eight library systems are involved . . ." ". . . and the point of the whole thing is to make printed material available to researchers without the delays normally encountered in interlibrary loans."

The 28 Aug. 1967 issue of the *New York Times* stated, "A revolutionary electronic device that allows the playback of motion pictures or other visual material through a conventional television set was announced yesterday by the Columbia Broadcasting System.

"The device, known as Electronic Video Recording, can now be manufactured for about $280. It involves use of a seven-inch cartridge of special film that can be inserted or removed from a playback machine with the ease and economical cost now associated with long-playing records.

"The system is scheduled for world marketing in late 1969 or early 1970."

These developments are interesting. However, with the emphasis of the AIP study on the physicist, his needs and particularly his resources, the developments may not be practical within the next ten years. Meanwhile, AIP urges its members to participate in the dynamics of this study. New ideas and suggestions will be welcome and appreciated; for only through a truly coöperative effort can the system answer the needs of the physics community.

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