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ABSTRACT

Primary research journals and meetings have long been the principal vehicles for communicating science information within the physics and astronomy community. Both vehicles have been slowly and subtly running into major problems because of expanding sizes and goals of the community, growing interdependencies of subject areas and increasing need for application of new and available technologies. The problem has been defined and initial solutions for improving information flow among physicists have been developed. Current Physics Information (CPI) is intended to supply economically, speedily and effectively the contents of a selected set of quality journals in any format desired by the subscriber. This selected limited coverage of the literature is complemented by comprehensive services available through "Physics Abstracts." (AB)

American Institute of Physics

For the Advancement and Diffusion of the Knowledge of Physics and its Application to Human Welfare

The American Institute of Physics was founded in 1931 as a federation of leading societies in the field of physics, operating as a single agency capable of serving the interest of physics in those functions which can best be performed by the societies jointly. The Institute has about 50,000 members who are the members of its seven societies. In addition there are110 Corporate Associates, 18 Affiliated Societies with an interest in physics, and 6000 student members in the Society of Physics Students.

The largest single activity of the Institute is the publication of physics journals. It has also been planning and developing the National Information System for Physics and Astronomy, to improve the communication of physics and astronomy information. In addition to being the world's largest publisher of physics journals, the Institute makes available to the public reliable communications on physics and its progress; strengthens physics education on all levels; assists in the documentation and study of the history of recent physics; cooperates with local, national, and international organizations related to physics; and, in general, fosters the relations of the science of physics to other sciences and to the arts and industries.

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The American Physical Society
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American Association of Physics Teachers
American Crystallographic Association
American Astronomical Society

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FOREWORD

Primary research journals and meetings have long been the principal vehicles for communicating science information within the physics and astronomy community of the United States. Both vehicles have been slowly and subtly running into major problems because of expanding sizes and goals of the community, growing inter-dependencies of subject matter areas among all of the physical sciences, and increasing need for application of new and available technologies.

The Physics Information Division of the American Institute of Physics has now defined the problems and developed initial solutions for improving information flow among physicists. The work of the Division has been done with financial support from the National Science Foundation and with encouragement and technical support from physicists. The solutions will become more apparent to physicists as the services offered in 1971 are augmented by those to be offered in 1972. This set of services is known by the name Current Physics Information. The CPI service is intended to supply economically, speedily and effectively the contents of a selected set of quality journals in any format desired by the subscriber. This selected limited coverage of the literature is complemented by comprehensive services available through AIP from the publishers of *Physics Abstracts*.

The solutions developed by the Physics Information Division, when fully implemented, should either improve upon or replace certain aspects of our present journals and meetings. The judges of the success of the changes will be principally the membership of AIP member societies. We solicit comments and suggestions from our membership and any other persons who inform and avail themselves of our services.

H. William Koch, Director
American Institute of Physics

PREFACE

This report is one of a series of annual reports on the AIP Program for Physics Information: A National Information System for Physics and Astronomy, being developed and implemented by the Physics Information Division of the American Institute of Physics with support from the National Science Foundation. Its predecessor was *A Program for a National Information System for Physics and Astronomy (1971-1975)* [ID 70P, June 1970].

The work reported here was funded by the NSF under grants GN 863, GN 864, and GN 865. We are indebted to the National Science Foundation for its support and encouragement of this Program and particularly to the staffs of the Information Systems Program and the Information Services Program of the Office of Science Information Services.

We are also indebted to members of the AIP Advisory Committee on the Information Program, the Information Respondents whom they have nominated, the editors of AIP and Member Society journals, and the other physicists and astronomers who gave us the benefit of their advice and criticism and helped us formulate our goals and plans so as to be responsive to the needs of the community we serve.

Physics Information Division
American Institute of Physics
New York, June 1971

Arthur Herschman, Director

Franz L. Alt, Deputy Director

TABLE OF CONTENTS

EXHIBITS, FIGURES, AND TABLES

CHAPTER I

SYSTEM CONCEPT: GOALS, PRIORITIES, AND STRATEGY

1. Introduction. The American Institute of Physics, with support from the National Science Foundation, has been engaged in developing an information system for physics and astronomy. The present document is one of a series of annual reports on the status of the system, its goals, and its future direction. The predecessor of this report, *A Program for a National Information System for Physics and Astronomy (1970-1975)* [ID 70P; see references at the end of the present report], was issued one year ago. The system concepts described in Chapter I of that report, including the goals and priorities, and the strategy for achieving them, are for the most part still valid. However, certain changes in the long-range aspects of the system have been made. These are in response to both the emerging needs for additional kinds of physics information, and the parallel growth in the capabilities of other sources for fulfilling some of the needs previously considered the direct responsibility of this Program.

In this chapter we will restate the goals of the system as modified in the light of these new factors and discuss the significance of these modifications. Chapter II will describe the stage of the system which is currently being or shortly will be implemented, "A System for Selected Current Physics Information". Chapter III will discuss "System Development and Future Projections". Additional technical and background material will be found in the appendices.

2. Purpose and Scope of the System. The principal purpose of the system is to facilitate the flow of physics and astronomy information to all those who must use it: the scientists and engineers involved in research, development, and teaching activities, as well as those responsible for these activities in government, industry, and academic institutions. AIP has studied the

existing information channels in physics and astronomy, as well as the characteristics of the community of scientists and engineers utilizing such information. Some of the principal results of these studies and of the studies made by others were presented in the previous report [ID 70P, Ch. II].

In addition, AIP has involved the user community by actively soliciting the advice of leading practitioners in these sciences, including the members of its Information Advisory Committee (see Appendix A), the supplementary panels nominated by this Committee, the editors of AIP and Member Society journals, the managers of the data centers of the National Standard Reference Data System (of the NBS), and interested members of the community at large. Continued reporting of our progress and plans is made to the AIP Governing Board (see Appendix A), to the officers of the Member Societies, to the Information Advisory Committee, to the Corporate Associates of the Institute, and to the community at large through articles in *Physics Today* and exhibits and presentations at selected scientific meetings.

3. Restatement of System Goals and Priorities. Studies made have indicated that there are three principal channels in which research information flows from producers to users [ID 70P, p.8ff] viz., that of archival information (as epitomized by the primary scientific journal), that of secondary information (information about the material in the archival channel), and that of informal communications (including private communications, information exchanged at scientific meetings, etc.). The three sets of goals stated in the previous report relate to these channels, respectively.

The most important of these channels, both for scientific communication and for its seminal role in the very fabric of science itself, is the archival one [Herschman, 1970]. This channel is not only the physicist's preferred source for seeking information but publication itself represents a prime motivation for scientists to do research, affording them "property rights" to their ideas through peer recognition. In addition, the formal publication process permits the scientific community to control the quality of that which is entered into the public archive and the existence of this archive permits the community of scientific scholars to arrive at a consensus as to what is "public knowledge", i.e., what is passed on to the next generation. The first set of goals relates to the archival information channel:

1. Preserve and improve the public archive.

1.1 Improve the speed and efficiency of primary journals.

1.2 Make the archival literature more accessible to users on a timely basis.

1.3 Encourage the preparation of review articles, compilations, and monographs.

These goals address themselves to overcoming the deficiencies of the archival channel as an information source [ID 70P, p.27]. The archival literature must be made available on a current basis and in a selective manner to those scientists and engineers who have specific need for it. Better access is also needed to the lasting elements in the bulk of the archive through the "distillation" processes of scholarship which result in reviews, compilations, and monographs (see Appendix C).

In order to make the dissemination of archival literature more selective and more current, it is necessary to catalogue and monitor the information on a current basis. This means that one must have an adequate secondary information channel integrated with the archival one. The second set of goals relates to this:

2. Improve the function and value of secondary information.

2.1 Improve its speed, efficiency, and accessibility.

2.2 Improve its responsiveness to user needs.

2.3 Integrate secondary information with the archival channel.

2.4 Facilitate the usage of secondary information by other disciplines and missions, and by information reprocessors.

These goals can only be achieved through the use of a computerized file of current secondary information, which can be organized for the several purposes involved. The last of these goals has been significantly changed since the previous report, where it is stated as : "Integrate secondary information across disciplines and missions." The significance of this change will be discussed in the next section.

Since the principal role of the secondary channel is to expedite the flow of information in the archival one, the achievement of these goals does little to improve the flow of informal communications. These informal communications are the most elusive; their very effectiveness is predicated on their informal nature and the nature of groupings of scientists within the scientific community. Although services for this channel should be provided, care must be taken to insure that the formalization of such services does more good than harm. The third set of goals relates to informal communications:

3. Improve the function and value of informal information.

3.1 Integrate it with the archival and secondary channels.

3.2 Develop special services for informal communication.

The priority for realizing these goals is not as high as that for the others. Some improvements in informal communication processes will come as a natural by-product of other developments; a more concerted effort must be preceded by more careful studies of such communications among scientists, perhaps along the lines of those done at MIT for engineers [Allen, 1970].

4. Horizontal and Vertical Information Systems. The overall strategy for achieving the goals which have been enunciated is that of the evolving system, as described in the previous report [ID 70P, p.5]. In that discussion, it was stated that the achievement of these three sets of goals was to be accomplished in three stages. Each stage results in a system representing the achievement of all or some of certain particular goals, such that the system at each stage has an incremental capacity over that at the preceding stage. A summary of these stages and an additional fourth one, to be described in the next section, appears in Table I.1. This original division of the development into three stages was an arbitrary one, reflecting the approximate timing of the development of various additional capabilities. During 1972 the varied capabilities for Stage II will be available for merging with the capabilities of Stage I and the "System for Selected Current Physics Information" which will result is described at length in the next chapter. An essential characteristic of this system is its vertical integration.

This vertical integration is in the production of the information and in the services provided, from the primary journal article, through the secondary information about that article, to the preparation of reviews and compilations of the concepts and data reported in that and similar articles. It involves such factors as obtaining the secondary information about articles as a by-product of the primary operation, providing back-up copy of the primary article along with the secondary notification, and repackaging journal articles according to the specialty interests of readers. Such procedures for vertical integration are quite feasible if the total number of journals involved is not too large. However, since the services to be provided are current-awareness services which will permit the user to keep up with his field, one need only cover the set of journals which the preponderance of users feel they must be aware of. This set of journals (fewer than 100 titles) appears to be quite manageable, resulting in a system for selected current physics information.

Such an information system does not meet all of the research information needs of the users. There is still the need for comprehensive access to the retrospective literature, a need which appears to recur for researchers on the average of about every three years [ID 70P, pp 9, 22], when embarking on new projects. These needs have been traditionally met through the services afforded by traditional abstract journals and libraries. Those working within physics have been fortunate to have a good English language abstract journal available to them, *Physics Abstracts* (published by the Institution of Electrical Engineers, London), as well as many good research libraries.

The traditional abstract journal and library methods, just as they are inadequate to meet the current-awareness needs of those working within a single discipline, are also inadequate to meet the needs of those whose interests cut across disciplines and related missions. For these, vertically integrated services in several disciplines must be utilized. Within the last few years, various information reprocessing centers have been established under both university and commercial auspices. These centers are equipped to supply selective dissemination of information (SDI) and related services (including, in some cases, interactive access to on-line files) from a variety of data bases. Thus the services offered by these centers are horizontally integrated across disciplines and can meet the interdisciplinary and mission-oriented needs of scientists and engineers. These same facilities are equipped to utilize the computer-readable files produced in conjunction with the operations of comprehensive abstracting and indexing services, to improve the retrospective access mentioned earlier. Since such a capability is coming into being it becomes increasingly important for various information producers to facilitate the use made of their data bases by such reprocessors for horizontal integration, rather than to attempt such integration themselves. Hence the rewording of goal 2.4. This reliance on the information reprocessors to fulfill a major role in the overall information system has affected the planning originally considered for Stage III of the AIP system, in that services such as SDI and interactive access are no longer contemplated (compare Table 1.2 of ID 70P with Table 1.1 of this report).

5. Information within Science and Information about Science. The realization of the three sets of goals enumerated in Section 1.3 would accomplish that part of the system's purpose aimed at meeting the needs of scientists and engineers who require research information. This improvement in the flow of information *within* science was a principal concern of scientists and of information systems in the late 1960's when the concept for the AIP Program in physics and astronomy information was formulated. The inability of the scientists to keep up with research reported in an exponentially growing flood of literature was of paramount concern to scientists, funding agencies, and information services. The lack of a facile, organized access to research information impaired the efficiency of research efforts, resulting in inadequate utilization of results and even duplication of effort in obtaining them.

Recently, other aspects of the information problem have shown an increased urgency. Problems have been posed by the underutilization of the scientists themselves [Koch, 1971], by the poor prospects for the utilization of the number already trained [Cartter, 1971] and being trained in various specialities [Grodzins, 1971], as well as by the fact that priorities among various potential research projects have become increasingly difficult to determine [Bromley, 1970], and have shown that there is a general need for better planning for science and technology [Daddario, 1970; Pitzer, 1971; York, 1971]. Rational planning presupposes the availability of better information [Bromley, 1970] and what seems to be needed is improved resources for information *about* science in addition to information *within* science, information which planners can utilize so that scientific resources are better deployed.

This information is principally in the form of data about research and development, potential applications, education and manpower, funding, etc. It includes such things as the changing number of papers published in various specialities, the number of scientists working in or being trained for these specialities, the deployment of funds for research and for education in various specialities (and in various locations), etc. Files of such data (as well as correlated documents) would be a resource from which services supplying information *about* science could be made available to the science planners in government, industry, and academic institutions.

The techniques which AIP has developed for classifying, tagging, storing, and retrieving document records (see Chapter II) are readily extensible to this information. When merged with AIP's experience in manpower and educational data handling (see list of reports in Appendix A), they would supply a basis for a resource of information *about* physics and astronomy, responsive to the needs of science planners. A fourth set of goals relates to meeting this need:

4. Establish a resource for information about physics and astronomy.

4.1 Establish data bases of relevant information.

4.2 Utilize the research-information data base for this additional purpose.

4.3 Develop further expertise for the handling of these data bases.

The incremental capacity resulting from the achievement of these goals would constitute a fourth stage of the system. Characteristics of Stage IV are sketched in Table 1.1, along with those of the other stages. Figure 1.1 estimates the time scale contemplated for the realization of the capabilities* of each of the four stages as they progress through the phases from concept through planning, development, and pilot operation, and on to operation.

Figure 1.1 Phases of the Stages in Time

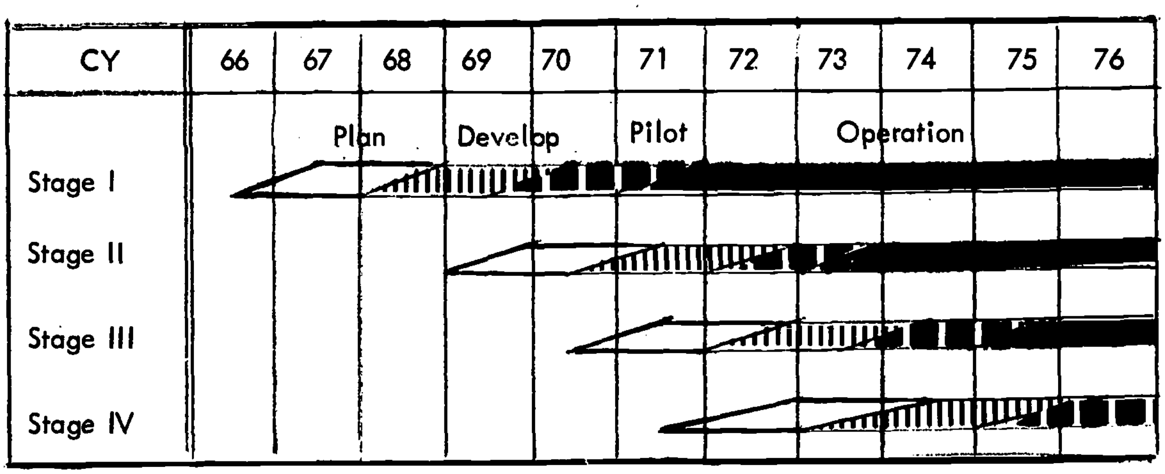


Table 1.1 Characteristics of the Stages of the Evolving System

	Stage I	Stage II	Stage III	Stage IV
Current Phase	Pilot Operation to Operation	Development to Pilot Operation	Planning to Development	Concept to Planning
Kind of Information	Selected Current Information within Physics & Astronomy		Access to Broader Information within Science	Information about Physics & Astronomy
Principal Capability	Secondary Information	Integration with Primary	Integration with Tertiary & with other Systems	Resource for Information about Physics & Astronomy
Services*	SPIN, CPT, CPB, Indexes	CPM, CPAA, User Journals, Special Searches	Review Writing & Referral Services	Information Services for Science-Policy Purposes

* CPT = Current Physics Titles; CPB = Current Physics Bibliographies; CPAA = Current Physics Advance Abstracts; CPM = Current Physics Microform; SPIN = Searchable Physics Information Notices.

CHAPTER II

A SYSTEM FOR SELECTED CURRENT PHYSICS INFORMATION

1. Introduction. In Chapter I we discussed the concept of the new information system for physics and astronomy as an evolving entity. The system has the achievement of an integrated primary-secondary information capability as the principal goal of its current stage, in order to produce current physics information services. In this chapter, we will discuss those activities which are or shortly will be operational, and constitute what we refer to as the current stage of the system. Further development and planning for future stages will be described in the next chapter.

The foremost function of the new information system is to supply the presently unfilled needs of research and development scientists and engineers for current physics information. The system approach is to select articles from the most important journal literature and arrange them for dissemination in such a way as to be most efficiently integrated into the information-gathering habits of the users of this information. The system functions, therefore, are to select and acquire the journals to be included, to create a computerized file of indexed document representations of these journals, to manage and retrieve from the file, and to provide current awareness services based on the file. An important attribute of any current awareness service for physics literature must be the availability of access to the original articles, and AIP has designed this feature into the system. The system functions as listed above will be described in the sections that follow. But first, an overview of the system concept being implemented will be presented, so that the various functions may be understood in perspective.

2. System Overview. AIP occupies a unique position as publisher, translator or distributor of one third of the world's primary physics information. (See Appendix A.) Because of this, it is possible to integrate the flow of infor-

mation in the selected journals in the AIP information system from the primary publication process, through the secondary alerting process, to the tertiary evaluation (review and compilation) process. The system is thus vertically integrated. With the addition of an incremental volume of non AIP-published journals, it supplies to the user information pertinent to his needs from those journals of which he must keep aware on a continual basis.

The flow diagram in Figure II.1 shows how the system is being implemented. The abstracts and bibliographic data from refereed and accepted manuscripts in the selected core journals of physics and astronomy will first be used to produce a journal of preview abstracts entitled Current Physics Advance Abstracts (CPAA) some two months prior to journal publication. CPAA is scheduled to commence monthly publication in January 1972; it will contain only AIP-published articles at first, and will appear in three separate sections, arranged according to subject area. (More details about services will be given in Section 6 of this chapter.) The actual manuscripts go through their normal channels to publication. For those processed by AIP, a computer-readable magnetic tape will be produced; the tape will contain machine searchable "unit" records (itemized in Table II.1) for each article, as a by-product of the keyboarding for publication. This tape thus serves two purposes, toward the achievement of an integrated primary-secondary capability. The first purpose is for computer-aided photocomposition of the primary journal article material that is contained in the unit record on the tape, while the second purpose is to enter the unit record into the searchable file of indexed document representations. For non AIP-processed journals, a similar tape will be created by keyboarding from later copy. The collected set of records on magnetic tape for the selected core journals is called Searchable Physics Information Notices (SPIN). SPIN tapes averaging over 2000 records are issued monthly, and have been offered for lease or license since January, 1971. The SPIN tape is the heart of the system, since all other services (expect CPAA) are produced from or linked to it.

Camera-ready page proof copy of the articles included in SPIN will be used not only to produce the traditional journals, but also to produce a Current Physics Microform (CPM). CPM initially will be a set of microfilm

Figure II.1

Flow Diagram for Physics Information

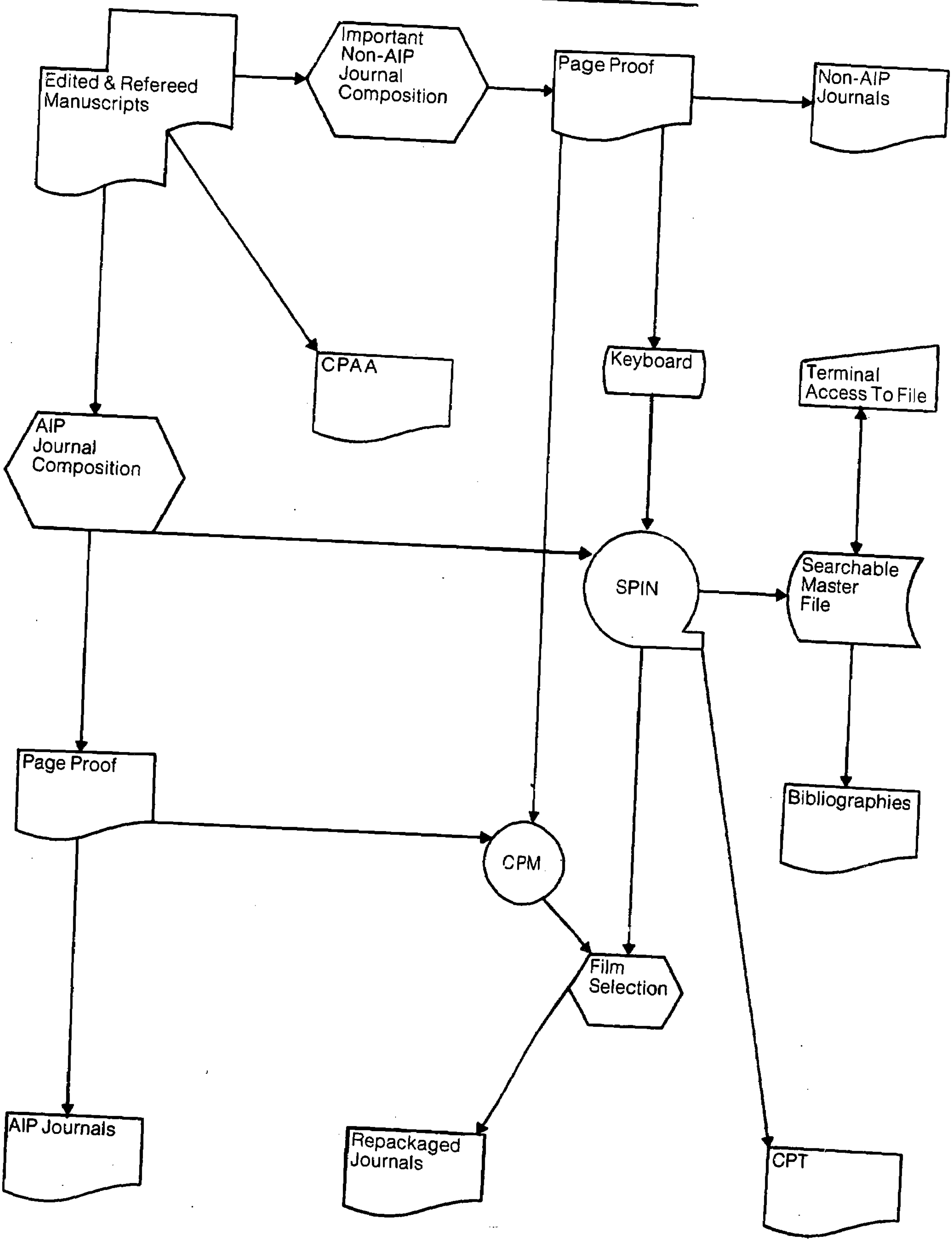


Table II.1 File Input Unit Record for Journal Articles

1. Source Article Identifiers
   - Journal CODEN and Canonical Abbreviation
   - Volume; Issue Number; Date
   - Beginning and Final Page of Article
   - CPM Cartridge and Frame Number
2. Title of Article
3. Author Information
   - Author(s) Full Name(s)
   - Author(s) Affiliation(s)
4. Indexing and Classification
   - Physics and Astronomy Classification Scheme Codes
   - Free-Language Descriptors
5. Abstract of Article
6. References Cited in Source Article
   - Journal Article Identifiers

reels containing all of the articles from the core journals that have been published during a month's time, arranged in sequence by complete journal issue. The cartridge and frame numbers for each article will be incorporated in the SPIN tape record for that article. CPM will be offered for sale on a monthly basis beginning in January, 1972; only AIP-published journals will be included at first. The SPIN tape itself will be used to produce a printed journal (composed by computer-aided photocomposition) using elements from the unit records of the articles contained on it. This journal, entitled Current Physics Titles (CPT), is both a current awareness journal and an index to CPM; it will be offered for sale starting in January, 1972, issued monthly in three sections arranged by subject area.

CPM, CPT and SPIN are the beginning of a true machine-based current awareness service, including hard-copy availability of original articles. An institution can process machine-stored subject interest profiles of its scientists against SPIN and obtain copies of full articles of likely interest from CPM, because of the unambiguous CPM reference contained in SPIN. An individual scientist or engineer can browse through CPT, and then request the articles he finds of interest. Looking further ahead, a group profile in a narrow subject area can be matched against the SPIN tape, and CPM used to produce a repackaged journal of the collection of articles in that subject area, irrespective of the journal of primary issue. Also, the aggregate of SPIN tapes can be arranged into a Searchable Master File (see Appendix B). This file can be used for producing special-interest cumulative bibliographies in narrow subject areas, and for monitoring the growth or decline of interest in the rapidly changing specialty subject areas of physics.

As discussed in Chapter I, this system and its set of services, either operational, soon to become operational, or still in the development or planning stage, was originally formulated to be an evolving one. Thus, at present SPIN is operational, CPT, CPM, and CPAA are in advanced development, and other services are somewhat further off. But each affects the other, and the requirements of each plus feedback and response from the community of users determine the final form of each, and all affect the composition, structure, and flexibility of the computerized file of information. The system functions will now be described in turn, as outlined in Section 1 of this chapter.

3. Acquisitions and Coverage. The need for selection is made evident by a study of the public archive of science. This evidence has been detailed elsewhere [ID 70P, Ch.II], but some salient features should be repeated here. First, the published physics journal, objectively refereed and edited, is by far the most important vehicle used by physicists to record the results of their activities and to search for the record of the activities of their fellow workers. Thus the AIP system is limited to journal articles (primary and review) during its early stages. Another aspect of selection is coverage. A study of physics journals shows that while the volume of articles has doubled approximately every 8 years since 1920, the number of journal titles has increased only linearly during the same period, from about 200 to about 800. Most striking is the fact that of the 800 titles, 23 of them contributed 50% of the volume, and 120 of them contributed 90% of the volume. The citation pattern, reflecting the usefulness of journals, shows a similar compaction:

half of the citations come from only seven titles. Therefore, a selection of the most important journal titles is doubly beneficial: it is efficient for the user in bringing the important journal publications to his attention, and it is efficient for the AIP system in producing moderate-cost services for the community.

Several studies have been conducted to determine which journals should be selected for input. The AIP information respondents (a group of 100 leading physicists and astronomers nominated by the AIP Advisory Committee on the Information Program) were asked to name important additions to our journal list in their areas of expertise. This list was presented in the previous report [ID 70P p.B13]; several journals were chosen from this list for addition to the data base. In addition, there have been two studies of frequency of citation of journals. One was based on three months input of journals to the AIP file at the MIT computer (through the kind cooperation of Project TIP) and the other on three months of journals in the data base for Science Citation Index (kindly supplied to us by the Institute for Scientific Information, Philadelphia, Pa.). These studies have yielded lists of the most frequently cited journals. These lists reflect to some extent the relative sizes of the journals; also, a few journals regarded as important by the information respondents were apparently too small or too recently established to rate very high on the citation frequency list. Based on these three studies, a list of about 100 journals which we feel are the necessary foundation for a selective data base has been developed. The complete list of journals currently being keyboarded is shown as Table II.2. The approximate numbers of individual article records keyboarded in 1969, 1970, and 1971 are 21,000, 26,000, and 27,000, respectively.

4. The Computerized File: Indexing, Input Processing and Maintenance. The process flow for production of the computerized file is illustrated in Figure II.2. As shown, the issue is transmitted to the Indexing and Editing Group after the clerical operations associated with journal acquisition have been completed. The INDEXING and checking tasks provide the system's only intellectual analysis of the article. A discussion of indexing philosophy and the

Table II.2

Current Input Journals

American Journal of Physics
Annals of Physics (New York)
Applied Optics, incl. Supplement
Applied Physics Letters
Applied Spectroscopy
Astronomical Journal
Astrophysical Journal, incl. Supplement
Canadian Journal of Physics
Faraday Society: Discussions and Transactions
Helvetica Physica Acta
High Temperature
Indian Journal of Physics & Proceedings of the Indian Association for the Cultivation of Science
Japanese Journal of Applied Physics
JETP Letters
Journal of the Acoustical Society of America
Journal of Applied Physics
Journal of Chemical Physics
Journal of Geophysical Research
Journal of Mathematical Physics (New York)
Journal of the Optical Society of America
Journal of Physics (London): A,B,C,D and F
Journal of the Physical Society of Japan, incl. Supplement
Journal of Vacuum Science and Technology
Molecular Physics
Nuclear Physics A and B
Nuovo Cimento A, B, and Rivista
Optics and Spectroscopy (USSR)
Philosophical Magazine
Physica (Utrecht)
Physical Review A, B, C, and D
Physical Review Letters
Physics of Fluids, incl. Supplement
Physics Letters A and B
Proceedings of the Royal Society, Series A
Progress of Theoretical Physics, incl. Supplement
Reviews of Modern Physics, incl. Supplement
Review of Scientific Instruments
Soviet Astronomy - AJ
Soviet Journal of Nuclear Physics
Soviet Journal of Optical Technology
Soviet Physics - Acoustics
Soviet Physics - Crystallography
Soviet Physics - Doklady
Soviet Physics - JETP
Soviet Physics - Semiconductors
Soviet Physics - Solid State
Soviet Physics - Technical Physics
Soviet Physics - Uspekhi

Figure II.2

Input Processing and Maintenance

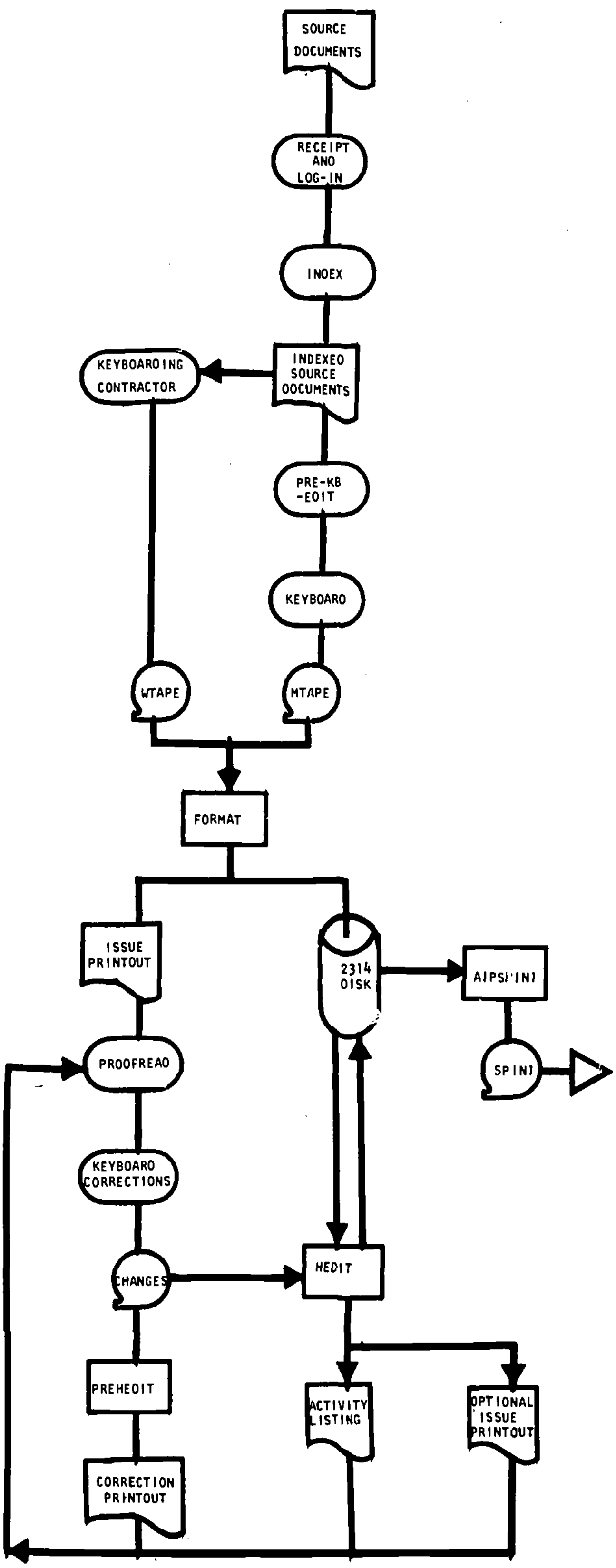
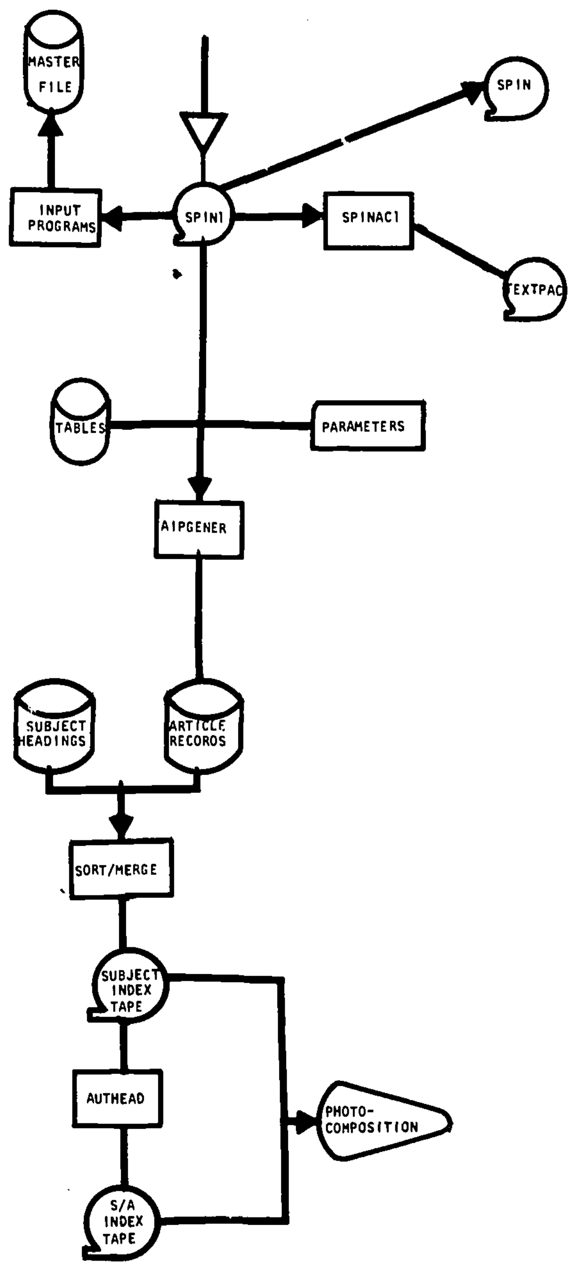


Figure II.3

Output Processing for Services



development of the Physics and Astronomy Classification Scheme (PACS) [ID 71B] has been given in the previous report [ID 70P, Ch.III]. A summary of the current indexing system will be presented here.

The factors in selecting the present indexing system were determined as a result of the interactions between our development staff and numerous representatives of the physics and astronomy user community, and cost-effectiveness considerations for computer storage and retrieval. PACS, which is in operational use, attempts to be an optimal compromise with respect to the considerations of natural language, hierarchy, comprehensiveness, and the ability to have terms added or deleted.

The indexing system consists of two parts.

a) Selection of entries from PACS (minimum of one, maximum of four, with an average of about two). These selections determine the posting of the article in printed indexes, and are also useful in the construction of research area profiles.

b) Selection of key words and phrases from the abstract and introduction to the paper. These selections, together with the title, provide a basis for relevance judgments on the part of the reader of a printed index or the searcher of a stored computer file.

The depth (and therefore cost) of indexing (preprocessing) is limited almost to the minimum necessary for printed indexes, where every document is retrieved from the file. For retrospective searching, where relatively few documents are retrieved from the file (in fact, many documents may never be called for retrieval from the file), some editing (postprocessing) of search results may be necessary. An appropriate balance between preprocessing and postprocessing costs is needed to be cost-effective.

The Scheme can be abridged for eventual use by authors as indexers. At present, AIP staff and consultants perform this function, using the full Scheme; the work is checked by the permanent AIP staff. As the indexing function shifts to authors, the cost of indexing will decrease, e.g., in the case of CPAA, authors will provide indexing data from an abbreviated list of headings supplied to them. AIP staff will convert these headings to the appropriate PACS numbers for entry to the unit record and thus supply additional detail and uniformity. The Scheme will be updated annually, because physics is a rapidly changing science in which new areas for research emphasis are constantly emerging. Because all articles that are entered into the file are surveyed and all printed indexes that are produced from the file are edited, the in-house staff is in a position to recognize these new areas. A procedure has been established for reviewing recommendations for new terms and also for receiving critical comments on existing terms. A form was designed by the indexing staff which provides a standard means for noting difficulties discovered when using the Scheme. This form contains entries for all the usual difficulties which are encountered and provides for detailed notes by the indexing consultants and AIP indexing staff. Weekly meetings of the indexing and development staffs were established to discuss the problems entered in the forms. During 1970 approximately 350 forms were submitted for consideration. Each term in PACS which had been noted as causing difficulties was discussed with the appropriate members of the staff. Solutions to the problems raised were of two general types: (1) "Scope notes" to PACS, which provide either detailed directions for use of the particular term or an expanded definition to eliminate ambiguity and (2) improvements to PACS, which have been implemented for 1971.

As discussed earlier, the basis for the AIP secondary information system is a computerized file of document representations, designed to grow with the increasing volume of the literature of physics and astronomy. For each article acquired and indexed, the representation entered into the file is the unit record, as shown in Table II.1. A full description and history of the system was given in the previous report [ID 70P,Ch.III and App.C], including the design philosophy and the various alternatives that had been considered before making decisions. Suffice it to say here that great efforts were made to insure that the AIP files could be mechanically converted to the formats of other systems, and vice-versa. This has been particularly true with regard to the formats of the IEE (London), the Chemical Abstracts Service, and IBM (TEXTPAC). The AIP programs are designed for use with any computer compatible with the IBM 360 series. These programs are used to transform the file (or a portion of it) into the different formats needed for different purposes, each designed to be efficient for its own purpose. Input keyboarding is currently being done from page proof or printed journal issues; beginning with issues dated January, 1972, keyboarding is planned to be done from manuscript for two journals on a pilot basis. As has been mentioned earlier, this is a further step towards achieving vertical integration, as the magnetic tape produced will be used for computer-assisted photocomposition of a part of the primary journal, as well as for input to the secondary information file.

The growth of the file is shown in Figure II.4. The data show the accumulated number of journal issues by year of issue date, beginning with the small number of titles and limited unit records for the earlier years at MIT, through the present data as estimated for 1971.

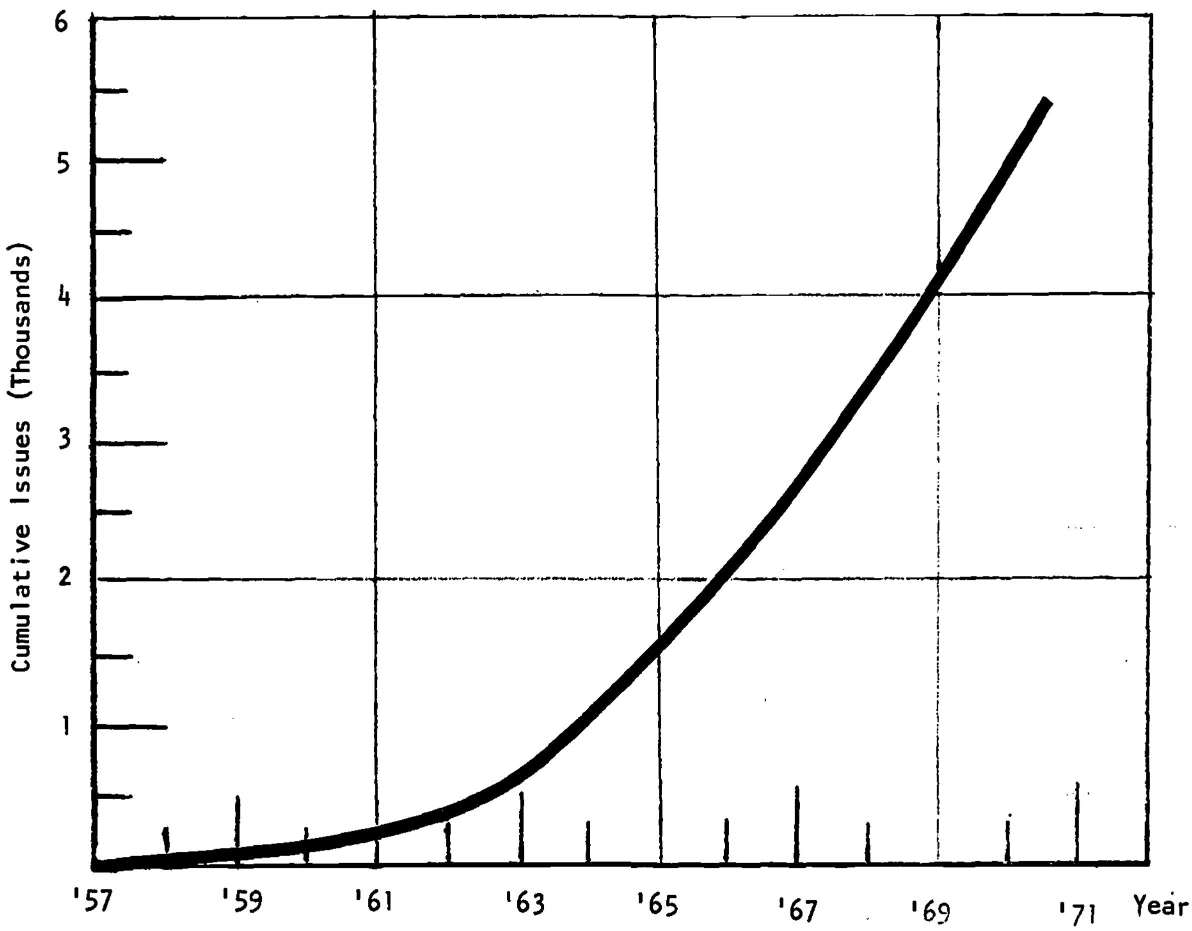


Figure II.4 Growth of the File: Cumulative Number of Issues

Referring again to Figure II.2, after indexing and checking are completed (1-3 days if at AIP, 8-13 days if by outside consultants), the production flow is through keyboarding, proofreading and error correction, and output computer operations.

In-house KEYBOARDING is performed on the Model 1181 Mohawk Data-Recorder, which simultaneously produces a standard 7-channel magnetic tape and a typewritten copy. The Mohawk keyboard contains the upper and lower case alphabet, numerals, punctuation marks, and other symbols; some of the latter are used for special functions. Printed characters which must be represented in the computer-readable file, but which are not available on the keyboard, are represented by their names, enclosed between parentheses and equal signs. For example, the Greek letter α is keyboarded as =(alpha)=. This system permits user installations with line printers and teletype terminals to print the file in a usable form directly. More sophisticated user systems can re-format and print the characters with the appropriate graphics. The keyboard operator types directly to a buffer; when a line is completed and the carriage return key is depressed, the record is written from the buffer onto tape. Thus, the keyboarder can correct his own error by re-keystroking prior to transfer to tape. Operator instructions are provided in a keyboarding manual.

The tape that results from the keyboarding operation is shown as MTAPE in Figure II.2. A portion of the source documents is keyboarded by a contractor (using somewhat different procedures for keyboarding and error correction), resulting in a tape shown as WTAPE.

The PROOFREADING and error CORRECTION routines at AIP are based on the magnetic tapes (MTAPE) that are generated by the Mohawk keyboard. The MTAPE is first subjected to a battery of programs identified in Figure II.2 as FORMAT. This includes a character set conversion, the creation of article records from keyboarded lines, and the grouping of all articles in an issue. The result is stored on IBM 2314 disk packs. Then the tape is printed out on a line printer, and the listing is proofread against the original document from which the keyboarding had been done. The most frequent errors are typographical, omission and format. The typewriter copy originated by the Mohawk is used for resolving ambiguities. The proof listing is marked for corrections, and returned to the keyboard operators for the production of a correction tape, shown as CHANGES. CHANGES is subjected to the PREHEDIT program, and a proofreading-error correction cycles on CHANGES is performed; errors in CHANGES are corrected directly on the tape. When CHANGES is error-free, it is used to correct the original input stored on the 2314, via the HEDIT program; an ACTIVITY LISTING shows the changes effected.

In order to enter a correction, it is necessary to signify to the computer the place on the disk at which a correction is to be made. To do this, the correction identifies the journal issue by AIP's assigned acquisition number and the article within the issue by a generated serial number. Also needed are a command indicating the type of change to be performed, the incorrect character string, the replacement character string, and, where needed, special instructions for insertion or deletion. A proofreading manual provides detailed instruction for performing all of these functions.

The correction cycle is repeated if necessary. On disk, two generations are always on hand: the current data and the prior version. (The WTAPE is also stored on the 2314, after going through FORMAT. The same routines used for correcting the MTAPE can be applied to the WTAPE, where necessary.

Finally, the corrected issues on the disk are removed to form a collection history tape. This tape is passed through a computer program called AIPSPIN1, the final program shown in Figure II.2, to produce an output called SPIN1. (SPIN, for Searchable Physics Information Notices, is the acronym under which system tapes are made available to subscribers.) SPIN1 differs from the history tape in that its data elements form a greatly refined hierarchy. As an example, when a paper has several authors, some with different affiliations, there is a field (data element) for all authors; this is subdivided into several "author groups", each group having a common affiliation; the groups are further subdivided into several authors, and each individual author field is subdivided into given names, family name, and post-particles (such as "Jr."). As an optional input to the AIPSPIN1 program, it may be specified that only certain journals are to be selected from the history tape. (A modification to AIPSPINI will allow for input of the CPM microfilm cartridge and frame numbers to the article unit records.).

The SPINI tape may be viewed as the end-product of the input processing routine. The output processing routines that are applied to SPINI produce the services of the system; these routines are described in the next section.

5. The Computerized File: Output Processing for Services. The SPINI tape is currently considered to have four functions, as shown in Figure II.3 (printed alongside of Figure II.2). First, the SPINI format is the standard distribution format for the AIP tape service, SPIN. Second, for those users who prefer it, the SPINI format is converted to the IBM TEXTPAC format by the program SPINACI. SPINI will also be the input format to the Master File. (See Appendix B). Finally, SPINI is the basis for all of the system's printed services (except CPAA). The programs for producing these services will be described with reference to Figure II.3.

SPINI is passed through the AIPGENER program to produce output tapes for the several printed services, all in the nature of indexes. By means of PARAMETERS punched onto cards, the program is informed of the fields on which the file is to be sorted. The program generates "sort keys" from the contents of these fields. For instance, in the case of a subject index a set of numbers associated with the index terms is generated in such a way that subsequently, when a file is sorted on these numbers, it will emerge in the right order for the index. In the case of an author index the sort keys are authors' names, arranged with last name first, converted to capital letters only, and with proper treatment for blank spaces, hyphens, etc., within the name. Various TABLES are also provided to AIPGENER to convert input forms to output forms, if they have been created differently for any reason. The output of the AIPGENER program is therefore a collection of ARTICLE RECORDS in suitable format, tagged for index production.

The SORT/MERGE program for producing printed indexes, arranged by both subject and author, receives two inputs. One is a data set containing the SUBJECT HEADINGS and their sort keys. The other is the ARTICLE RECORD data set produced in the previously described step; it contains the entries which are to form the index, each with as many sort keys as are appropriate, one for each author and one for each subject category. (Author headings are not part of the input, as they have to be derived from the data.) The two input data sets are run through the SORT/MERGE program. It sorts the data, resulting in the SUBJECT INDEX TAPE file; it contains all the subject headings in their proper order, each followed by entries for all papers falling under that heading, and in addition all the entries for the author index, in alphabetical order of names, but without displayed headings. Next, the AUTHEAD program scans through the author index and, at every change of sort key, produces the following author's name as a display heading. The result is an S/A INDEX tape which contains, in the correct order, all the information to be printed in the index. The tape is then ready for PHOTOCOMPOSITION of the printed output; this operation will be discussed in Appendix B.

The preceding routine applies to any printed index. For CPT, the listing is for papers recently added to the file, the subject headings are from PACS, and the author index step is omitted. For journals, the listing is for a six month or annual cumulation, and the subject headings are either from PACS or are supplied by the journal editor. Bibliographies will be produced by the same method as for journal indexes. A cumulative author index to all AIP-published journals is also being produced, as a service for the AIP Publications Division. This index requires a separate program to eliminate unwanted data from the ARTICLE RECORD, AUTSTRIP (not shown in Figure II.3), and is not photocomposed.

Most of the programs discussed in this section are written in Basic Assembly Language, a few in PL-1, and all operate on an IBM 360/Model 40 computer.

6. AIP's Information Services. A detailed description of the AIP physics information system has been presented in this chapter, including the system flow from acquisition through intellectual analysis and computer operations, to output services. This stage of the system was designed as an integral part

of an evolving system; flexibility of input and output processing routines permit the system to be responsive to the community reaction to early-stage pilot services. This reaction stimulates a response in the system, a response that can be translated into an implementable improvement. Thus more sophisticated later services can be designed with early experiences in hand, and with the system flexibility to be continuously responsive to user needs. Such flexibility incurs a somewhat higher expense, but has the potential of later rewards in the community acceptance of services. This particularly true in the case of services which are not considered in the beginning, but whose need may become apparent later in the system's life; here the content of the article unit record and the respective input fields for computer processing provide the basis for the needed file structure and retrieval. In this last section of the chapter, a discussion of the services of Stage I and II will be presented; these services are in fulfillment of the goals given in Chapter I.

The data base for the AIP information program is the SPIN1 computer-readable magnetic tape. All services (except CPAA) are either produced from or linked to it, as has been discussed earlier. SPIN is the first service to be offered to the public; it has been available on a lease/license arrangement since January, 1971. A condensed fact sheet about SPIN is shown as Exhibit II.1; a report containing all of the details of SPIN has been published [ID 71S]. The offering of SPIN to all interested parties allows the data base to enjoy a much wider use than by AIP alone. Any reprocessor can incorporate SPIN in his base for providing physics information services to the community, including current awareness and retrospective searching services. In this sense, the SPIN tape is a "wholesale" product to the information service community.

The combination of SPIN, CPT and CPM provides an attractive, flexible package of services to those institutional users who have the capability to make use of it. Condensed fact sheets for CPT and CPM are shown as Exhibits II.2 and II.3, respectively. One way the package can be used is for an institution (with even modest computer facilities) to search the SPIN tape against the coded subject profiles of its staff members. Since the article records retrieved contain the microfilm cartridge and frame numbers, corre-

Exhibit II.1

Specifications for SEARCHABLE PHYSICS INFORMATION NOTICES (SPIN)

1.	Description	Machine-readable magnetic tape copies of the current input to the secondary information file.
2.	Frequency, Size	Issued monthly, not less than 2,000 records per month.
3.	Coverage	Currently 60 journals and their supplements. See Table II.2.
4.	Article Record	Unit Record. See Table II.1.
5.	Composition	SPIN Records are written in EBCDIC, at 800 bpi, on labelled 7- or 9- track tapes, with odd parity. Variable record lengths, maximum 3520 characters. Characters not available on standard line printers are represented by special constructions. (Tapes are also available in TEXTPAC format.)
6.	Price	Basic Lease: $2500 per year. Basic License: $2500 per year, plus 5% royalties on gross sales of services derived from SPIN.

Exhibit II.2

Specifications for CURRENT PHYSICS TITLES (CPT)

1.	Description	A new current awareness journal. Entries organized by subject matter. Index headings selected from the AIP Physics and Astronomy Classification Scheme. An average of about two entries per article.
2.	Frequency, Sectionalization, Size	Page size 8 1/4"x11", to be published in 3 different 64 page subject sections per month, color coded as follows: Red - Solid State Physics Blue - High Energy, Nuclear & Plasma Physics; Astronomy & Astrophysics Green - Atomic, Molecular, Chemical & Fluid Physics; Optics; Acoustics; Geophysics; Biophysics
3.	Coverage	Complete set of journals inclued in SPIN. Currently 60 journals and their supplements, including all AIP-published archival and translation journals plus other important physics and astronomy journals.
4.	Article Record	Article title; authors, location of first author; journal title, volume, page & year; keywords; microfilm cartridge and frame numbers for location of the full text of the article in Current Physics Microform (CPM).
5.	Composition, Printing and Mailing	Computer-photocomposition, based on SPIN data set; photo-offset printing, saddle-stitched; mailed without wrap or envelope.
6.	Schedule	To begin publication in January, 1972.
7.	Price	Targeted at $10 per section per member, $25 per section per non-member.

Exhibit II.3

Specifications for CURRENT PHYSICS MICROFORM (CPM)

1.	Description	A combined microform edition of current AIP-published archival journals and translation journals.
2.	Frequency, Size	Issued monthly; each month's CPM consists of the microfilmed pages of the issues printed during the preceding month; about 8,500 pages each month, contained in four 16mm cartridges.
3.	Coverage	To expand to other journals in CPT and SPIN, following negotiations with other publishers.
4.	Special Features	Each numbered page marked for automatic counting equipment as well as for visual scanning; cartridge and frame numbers appear in corresponding article records in SPIN and CPT, so that they are indexes to CPM; permission granted for copying onto paper; royalties paid to publishers.
5.	Schedule	January, 1972 printed issues to be mailed in February, 1972.
6.	Price	Not yet firm; arrangements expected to be similar to those for SPIN.

Exhibit II.4

Specifications for CURRENT PHYSICS ADVANCE ABSTRACTS (CPAA)

1.	Description	A new preview abstract journal. Contains abstracts of articles as early as two months before publication, typed by authors after manuscripts have been accepted by journal editors. Entries organized by subject matter. Index headings selected by authors from a subset of the AIP Physics and Astronomy Classification Scheme. An average of about two entries per article.
2.	Frequency, Sectionalization, Size	Page size 8 1/4"x11"; to be published in 3 different 96 page subject sections per month, color coded as follows: Red - Solid State Physics Blue - High Energy, Nuclear & Plasma Physics; Astronomy & Astrophysics Green - Atomic, Molecular, Chemical & Fluid Physics; Optics; Acoustics; Geophysics; Biophysics
3.	Coverage	Initial publication to include AIP-published archival journals and translation journals. Other journals to be added later.
4.	Article Record	Under principal index heading: title, authors, address for correspondence, abstract, scheduled journal issue. Under other index headings: title, principal index heading number.
5.	Composition Printing and Mailing	Paste-up from author-generated copy; photo-offset printing; saddle-stitched; mailed without wrap or envelope.
6.	Schedule	To begin publication in January, 1972.
7.	Price	Targeted at $15 per section per member, $35 per section per non-member.

sponding to the locations of those articles in CPM, hard copies of the articles can be made readily from CPM. Therefore, hard copies of articles with a high potential for relevance can be provided routinely to staff members, once their profiles have been refined.

For those institutions without computer facilities, the same functions can be performed using CPT, for it is the printed index to SPIN. The user can "browse" through CPT, and request copies of the articles of interest by quoting the CPM cartridge and frame numbers that are printed in CPT. Individuals without access to CPM may obtain copies of articles through conventional library resources, or from services with equipment to process CPM.

The concept of profiles leads to two further services, both related to groups. Just as an individual can be characterized in terms of his narrow interest specialties, so also can a group of individuals. This "group profile" is broader than the interest of an individual, but narrower than a subdiscipline. The number of individuals in a group so defined is difficult to determine, but it is expected to vary from about one hundred to as many as one thousand. Group profiles will be determined by analyzing the Master File for research patterns. Once a group profile is known, a bibliography of articles accumulated from SPIN over a period of six months or one year can be prepared and offered for sale. For titles of sufficiently high interest. a series can be established. The first bibliographies are planned for some time in 1972. The other group profile-related service is the repackaged user-oriented journal. This service becomes technically feasible if an AIP joint SPIN-CPM capability is combined with a group profile: the profile is matched against the current month's SPIN tape, the CPM numbers of the articles retrieved are recorded, and the corresponding CPM frames are made into masters for photo-offset reproduction. The articles that result comprise a truly user-oriented journal for the individuals in the group, independent of the primary journal in which the article first appeared. Target dates for the distribution of user journals are not firm but are expected to be in 1973.

The fourth service that will be offered to the public in the beginning of 1972 is CPAA (Current Physics Advance Abstracts); a condensed fact sheet is shown as Exhibit II.4. This is a new concept in current awareness services, for it offers to subscribers at modest cost advanced notice of articles to be published in the important physics and astronomy journals. These articles will have just been accepted by editors for publication, so that at most scheduled issues for appearance are known. It is likely that some articles will appear in later issues than the ones shown in CPAA, and some may even be withdrawn before publication. However, readers of CPAA will be able to communicate with the authors of abstracts in CPAA, since addresses for correspondence will be printed. CPAA will feature author-supplied copy for photo-offset reproduction, as well as the first large-scale use of the Physics and Astronomy Classification Scheme by users as indexers. As the development of one-time keyboarding from manuscript onto magnetic tape for the primary journal composition and the SPIN tape progresses, the potential for producing CPAA from this same tape will be explored--a further expansion of primary-secondary vertical integration.

In this last connection there are also the services from the secondary information file that are offered for sale to the AIP's own primary Publications Division. The most important of these are indexes. The secondary file can be used to produce camera-ready photocomposed pages of the volume indexes for any journal in the data base using either the new PACS or the journal editors' traditional index headings, if the latter are supplied for keyboarding. At present, indexes are in production for Journal of Mathematical Physics, Journal of Applied Physics and Applied Physics Letters using the PACS headings, and for The Journal of Chemical Physics using the editor's headings. A combined author index to all AIP publications is also sold to the Publications Division, issued and cumulated monthly.

CHAPTER III

SYSTEM DEVELOPMENT AND FUTURE PROJECTIONS

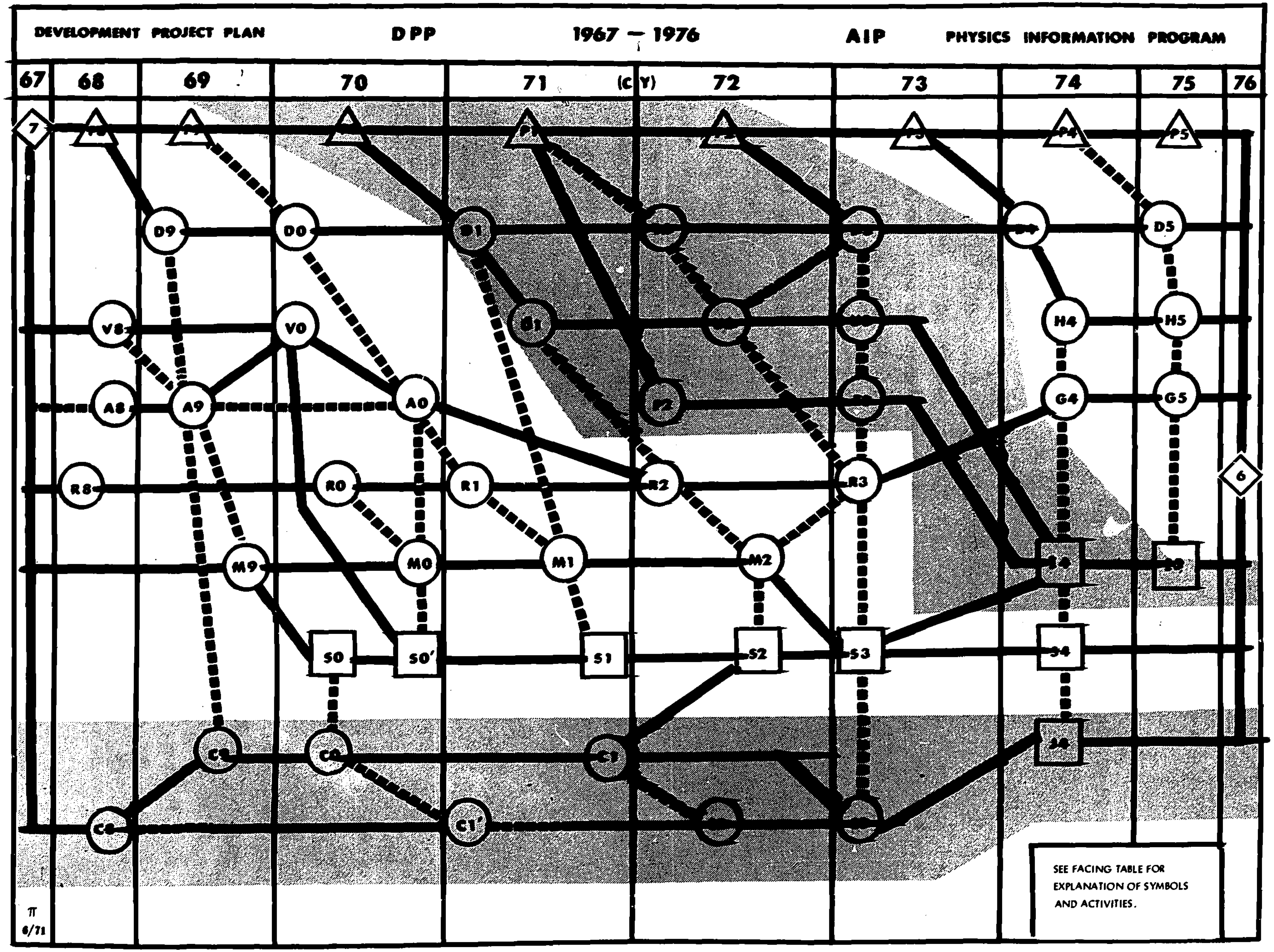
1. Introduction. The previous chapter discussed the nature and configuration of a system for selected current physics information whose completed capability will be that of Stages I and II as described in Chapter I. In this chapter we will discuss the current system in the perspective of a larger information system for physics and astronomy; we will review the developmental and planning activities which led to it, as well as those activities currently being or expected to be carried out, and the capabilities to which they are expected to lead.

The activities will be discussed in terms of a Development Project Plan (DPP, p.32), which is an updated version of the one described in the previous report [ID 70P, p.48]. A discussion of the nature of the plan will be found in that report, as well as a detailed description of events prior to mid-1970; in the present chart these events have been simplified to show only the main thrust of the program, as full details may be found in the earlier report. The DPP distinguishes between three kinds of events: planning and studies [▲], development and design [O], and system capability events [□]; in addition, the initial and final stages of the system for the ten year period of the chart are separately marked [◇]. A solid line joining two events indicates that direct effort is required to arrive at the second event; a dashed line indicates that the first is a prerequisite for the second or exerts an influence on it but does not require separate effort; vertical dashed lines are generally directed towards events where a capability is achieved.

The DPP is divided into four regions, reflecting the four main classes of capabilities aimed for: from the top left and down to the right -- development of an integrated primary-secondary capability (see Chapter II); along the bottom -- development of computer-aided photocomposition capabilities (see Appendix B); from the top center and down to the right -- development of

Information Center capabilities; and at the top right -- development of information capabilities for those who must plan for physics. The discussion which follows will relate to the events, activities, and capabilities of each of these in turn.

2. Development of an Integrated Primary-Secondary Capability. This aspect of the system is designed primarily for current-awareness services. Studies [ID 70P, Chapter II] had indicated that there were two basic modes in which a scientist sought information: one, continually keeping up with the current work in his field as he was engaged in his own projects, and the other, retrospective searching of all relevant material (when he contemplates going on to a new project), a time-consuming operation which occurs, on the average, about once in three years. Although traditional library resources, including comprehensive abstract journals, existed for the latter mode, the tremendous growth in the bulk of the literature made them increasingly inadequate for the former mode, and new procedures were clearly needed. Since it was determined that those utilizing physics information required the full text of important papers in their fields for keeping up, the system was designed with this in mind. It was necessary to devise a means for getting the important relevant articles to the scientist on a current basis without flooding him with extraneous material: important, in the sense of articles from journals he would have browsed in if he had the time, and relevant, in the sense of pertinent to his subject interest. To accomplish this it is first necessary to be able to select articles on a subject matter basis, through the use of an adequately indexed secondary-information file. This file has to be integrated with the primary archive as well, so that the full text of the article can be supplied. Integration is also necessary for the production of the file, in order to realize economies of time and effort. The system thus has to be vertically integrated (regarding primary and secondary information) and of limited coverage. A brief description of the activities and events involved, referring to the DPP, follows; greater detail for the current aspects of the system will be found in Chapter II.


DEVELOPMENT PROJECT PLAN
DPP
1967 — 1976
AIP
PHYSICS INFORMATION PROGRAM
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(CY)
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P5
D9
D0
D1
D5
V8
V0
H4
H5
A8
A9
A0
G4
G5
R8
R0
R1
R2
R3
M9
M0
M1
M2
S0
S0'
S1
S2
S3
S4
C8
C0
C1
C1'
SEE FACING TABLE FOR
EXPLANATION OF SYMBOLS
AND ACTIVITIES.
π
6/71

DPP TABLE OF EVENTS AND ACTIVITIES

◇	State of System in initial and final years of DPP chart.
Ⓟ	Planning and documentation of Program development. (Series of annual reports.)
P8-D9	Study of existing services and systems; complete initial specifications of services.
P0-D1	Complete studies of user education programs; formulate specifications for such a program.
P1-F2	Complete specifications for review-writing fellowship program; establish administrative procedures for implementing program.
P2-D3	Complete studies of information centers; complete specifications for AIP center to supply referral review writing services.
P3-D4	Complete studies of files needed for information about physics and astronomy.
Ⓓ	Service Design Activities.
D9-D0	Design of Stage I services.
D0-D1	Design of initial Current Physics Information services.
D1-D2	Design of remainder of Current Physics Information services.
D1-U1	Implement user education program.
D2-D3	Preliminary design of Stage III services.
D3-D4	Complete design of Stage III services; preliminary design of Stage IV services.
D4-H4	Implement handling of data about physics.
D4-D5	Design of Stage IV services.
ⓋⒶ	Vocabulary and Algorithms for Retrieval.
V8-V0	Develop and test AIP classification schemes.
A8-A9	Feasibility studies of automatic classification using citations.
A9-V0	Development of initial Physics and Astronomy Classification Scheme.
V0-S0'	Develop indexing procedures using initial PACS.
V0-A0	Develop operational version of PACS.
A0-R2	Specifications for Master File for special searches and for subject area management; vocabulary "bridges" with other systems.
Ⓤ	User Education Program.
U1-U2	Initial program to publicize Current Physics Information Services.
U2-U3	Program broadened to cover use of all available physics services.
U3-I4	Implement pilot operation of referral services for Information Center.
Ⓕ	Fellowship Program for Review Writers and Data Compilers.
F2-F3	Test operation of fellowship program for review writing.
F3-I4	Implement program as a service of Information Center.
ⒼⒽ	Data Handling and Generalized Files for Information about Physics
H4-H5	Begin handling of data about physics in generalized files.
G4-G5	Begin development of generalized files about physics.
Ⓡ	Retrieval Programs and Procedures.
R8-R0	Programs for initial Stage I services developed and tested.
R0-R1	Preliminary study of problems of exchanging data with other systems; preliminary specifications of Master File.
R1-R2	Continuation of data exchange studies; complete design for Master File searchable by group interest.
R2-R3	Development of Master File and of programs for searching by group interest and for subject area management.
R3-G4	File structure and programs development for general file containing information about physics.
Ⓜ	Input and Maintenance Procedures and Programs. (Continued updating and improving of programs and procedures.)
M9-M0	Maintenance and editing programs written and implemented.
M9-S0	Input procedures in pilot operation.
M0-M1	Input procedures completed for Current Physics Information Services.
M1-M2	Programs and procedures completed for exchange of information with other services.
M2-S3	File input, maintenance, and editing on a production basis.
Ⓒ	Photocomposition Developments.
C8-C9	Develop techniques to photocompose selected elements.
C8-C1'	Preliminary techniques to photocompose journal text and mathematical formulae (special keyboard devised).
C9-C0	Techniques to photocompose Stage I services from SPIN file completed.
C0-C1	Develop procedures for photocomposing common elements in journal text and from secondary files.
C1-S2	Implement photocomposition procedures for common elements.
C1'-C2	Continue development of techniques for primary journal text photocomposition.
C1-C3	Merge procedures for photocomposition of common elements with text composition procedures.
C2-C3	Text composition done on a trial basis.
C3-J4	Implement text composition on a production basis.
SIJ	Operation Capabilities of System.
S0	Capability of producing computer-readable file of secondary information.
S0'	Indexing and classification information added to information file; SPIN and journal indexes produced; other Stage I services on trial basis.
S1	Capability of producing basic Current Physics Information services.
S2	Capability of accepting information as a by-product of photocomposition as well as from other services.
S3	Capability of producing all Stage I and Stage II services.
I4	Information Center for referral services and for services and encouragement to review writers and compilers.
J4	Capability of photocomposing primary journals.
I5	Limited services on information about physics.

The development of the Physics and Astronomy Classification Scheme [ID 71B], [V0-A0], of procedures for classifying and indexing articles [V0-S0'], and of file maintenance and editing routines [M9-M0], when added to the existing capability for producing the computer-readable data base of secondary information [M9-S0], resulted in the capability for producing the initial secondary services, viz., SPIN and journal indexes [S0']. With further refinement of programs, procedures [M0-M1], and design [D0-D1], the system will have the capability for producing three other initial Current Physics Information services, viz., CPM, CPT, and CPAA, as an integrated package [S1].

This package of four services (SPIN, CPM, CPT, and CPAA) represents the initial part of the System for Selected Current Physics Information; however, it is not sufficient in itself, since further integration with regard to production is needed (see the next section). Also, a means for selecting material on a much narrower group interest basis than that of the three sections of CPT and CPAA (described in Chapter II) involves the ability to monitor the growth and decline of various specialties, as well as the correlations between them (through indexing and citation patterns); to accomplish this, a manipulable master file of the SPIN information is needed (see Appendix B). In addition, it is necessary to improve the access to broader information resources than the selected-coverage system provides; access to broader disciplinary, interdisciplinary, and mission-oriented information is needed. This ultimate responsibility for retailing information on a more individual basis has devolved from the traditional library service to that of the more sophisticated information center and information reprocessor, who can use such products as SPIN and CPM jointly to provide for selective dissemination of information and interactive access services. However, to facilitate the usage of such diverse disciplinary data bases, to provide interdisciplinary and mission-oriented services, it is necessary for the various data base producers to build conceptual "bridges" between their respective indexing systems, as well as standardizations of their computer procedures. They will then be able to exchange information in computer-readable form and thereby also reduce costs through elimination of duplicate file input. The increasing availability of outside sources for such services as selective dissemination of information and interactive access to a secondary file has made it unnecessary for AIP to develop such capabilities, and the developmental activities in the previous report [ID 70P,p.52] relating to these have been discontinued. The following activities and events relate to the needs now recognized.

Work has been done in evaluating the formating and programming difficulties involved in exchanging information on magnetic tape with other services [R0-R1], and no insurmountable problems have been found. Programming for such exchange is expected to proceed [M1-M2], and, with the development of vocabulary standardization and "bridges" [A0-R2] (along the lines of the discussions AIP has had with the staffs of Physics Abstracts, Chemical Abstracts, and Nuclear Science Abstracts), such exchange should be possible [S2]. A master file design will be completed (see Appendix B for early design)[R1-R2], and procedures for utilizing the file for subject area monitoring in order to keep the vocabulary up to date, as well as for determining group-interest profiles, will be completed [A0-R2]. Development of a capability will follow [R2-R3] to make possible the production of specialized bibliographies from the file and the automatic utilization by AIP of SPIN and CPM to produce repackaged journals in relatively narrow subject areas on a current basis [S3].

3. Development of Photocomposition Capabilities. These activities have proceeded along two lines (see Appendix B), viz., the development of procedures for the computer-aided photocomposition of selected elements of articles and the development of such procedures for composing the full text of primary journals. In the first case, this means the ability to photocompose selected elements of the SPIN tapes to produce journal indexes and CPT [C9-C0], and also to compose those elements which are common to the primary journals and the SPIN tape [C0-C1], utilizing a single keyboarding for both [C1-S2] to achieve greater economy and currency. With this capability, the system can obtain a substantial portion of its input either as a by-product of primary journal composition or through exchange with other systems (see previous section) at this point [S2].

The other line of activity for photocomposition is intended to improve the speed and efficiency of primary journals themselves (and incidentally supply the secondary information as a by-product). Earlier experiments had indicated some promise in accomplishing this, except for high costs and difficulties encountered with the composition of mathematical formulae [ID 70P, Appendix D]. Developments by the staff of The Physical Review (of the American Physical Society at Brookhaven National Laboratory) indicated that the problems associated with mathematical formulae could be solved with the aid of a specially designed keyboard. A subcontract from AIP to APS showed that such a keyboard could be constructed and used to solve the basic problem of coding mathematical formulae for composition [C8-C1']. However, efforts to use this procedure for composing full text were not successful due to limitations of the particular photocomposition used (and programmed for) and the difficulties encountered in incorporating adequate error-correction routines into the procedures. Work is expected to continue along these lines under direct AIP auspices [C1'-C2] utilizing additional experience gained in the parallel effort [C9-C0]. Depending on the results of this next trial, full text composition procedures will be developed in a unified way [C2-C3], and the economic and timeliness advantages of primary-journal photocomposition will be evaluated. If the decision is made to implement these procedures, these techniques will be merged with those for producing the overlapping elements [C1-C3], so that the system will not only be capable of producing primary journals by this means [C3-J4] but also of supplying the appropriate elements of these journals to the secondary file [J4-S4].

4. Development of an Information Center. The capabilities obtained through the previously described sets of activities, although resulting in vertical integration of primary and secondary operations and facilitating the horizontal integration across disciplines by information centers and reprocessors, are still incomplete. The system, thus far, does not include procedures for integration with tertiary services, the invaluable operations of reviewing and compiling which result in the compaction of the literature [see Appendix C]. It has not provided aid to the user who must thread his way through the various services which are offered, or through the complementary services which are

offered by other systems (e.g., Physics Abstracts in print and on magnetic tape) or by reprocessors. Finally, it has not yet supplied services to improve informal communications. The activities detailed below, for the development of an Information Center, are intended to satisfy these additional requirements.

Planning and studies have been completed for a user education program to aid users in adequately using this and related systems [P0-D1], and the initial design [D1-U1] has indicated that the first step in such a program is the publicizing of the services which the system is expected to offer beginning in 1972. AIP's new Director of Public Information is helping to carry out this first stage [U1-U2], which is expected to supply valuable feedback to service design. This user education program is expected to continue and include the publicizing of complementary services in its operation [U2-U3], and ultimately, with the completion of planning and design [P2-D3] of an AIP Information Center, be merged with that operation [U3-I4]. It can then supply referral information about AIP and other physics information services to users, both individual and institutional. Studies have also been made about the nature of review writing and compiling [P0-P1], and specific concepts have been developed for procedures to encourage this activity (see Appendix C), namely, a fellowship program for potential review writers and compilers. Administrative details for such a program will be worked out [P1-F2], and the program will be tried for one year [F2-F3]; on the basis of this experience, it will be appropriately modified [F3-I4] and become a service of the Information Center, which will also be able to supply bibliographic aids to review writers and compilers [S3-I4]. These aids will be a by-product, in part, of special procedures for data tagging which will result from the vocabulary "bridges" development [A0-R2-R3]. Further design of services for improvement of informal communications [D3-D4] will also augment the capabilities of the system through services from the Center [I4]. With the capability [S3] the system will have achieved the pilot operation of Stage II (see Chapter I), and with the capabilities [I4, J4, S4] it will have achieved pilot operation of Stage III and accomplished all of the first three sets of goals enunciated in Chapter I. The achievement of the system at this point will be considerable. Having identified the most significant gaps in the information process, it will have filled them with effort appropriate to their magnitude, and without undue duplication, carefully connecting its operations with those of other systems and services, so as to produce a stronger total information service for scientists and engineers using physics information.

5. Development of Information Services About Physics. As discussed in Chapter I, the basic purpose of the information system which is evolving at AIP is to meet the needs for physics information of all users, priority being given to those needs judged most important to the whole community. The capabilities which have been described will supply access to the research information within physics and astronomy to serve a need which has a high priority to the community. In addition, as discussed in Chapter I, the information needs of those who must plan for science, who must establish educational programs, allocate funds for various research and development efforts, and deploy scientific manpower, have assumed an increasing urgency in the past few years. What is needed by scientific planners and policy makers is a better resource of information about science; what is proposed, as the natural extension of the AIP's Program for Physics Information, is the establishment of such a resource for information about physics and astronomy.

Such a resource would extend the techniques developed by the Program for establishing, organizing, maintaining, and retrieving from files of research information within physics, to a similar effort for files of information about physics. It would also build on AIP's experience in handling educational and manpower data (see list of reports in Appendix A) to develop a facility for the utilization of these files so as to produce services in the form of reports, newsletters, and fact sheets of use to this broader community. The kinds of information which these new files are likely to contain are those about physics manpower (demographic, subject specialization, and similar information), educational programs (numbers of students in various programs at different levels and institutions, etc.), funding patterns (various allocations to different programs, etc.), research trends (the growth and decline of different areas of research as shown by the subject-area control capability of the secondary-information file), potential applications of physics (e.g., as found in media other than research journals), and other information needs as they are developed. The capability for providing services from this information base, whose development is sketched below, is ultimately expected to be added to that of the Information Center already described.

Initial planning will elicit the nature of the files to be established [P1-P2-D3] so that work can proceed on file structure and organization [R3-G4]. Planning of service requirements will continue [P2-P3],and procedures for data handling [P3-D4] and staffing will be established [D4-H4]; services resulting from these activities will then be specified [D4-D5]. File construction, maintenance, and manipulation, and the development of services are expected to continue [G4-G5; H4-H5], so that pilot services should be offered from an augmented Information Center capability relatively early [15].

APPENDIX A

THE AMERICAN INSTITUTE OF PHYSICS

and the

AIP PHYSICS INFORMATION DIVISION

1. Function and Responsibility of the American Institute of Physics: In 1931 five leading societies in the field of physics formed a federation and founded the American Institute of Physics to further more effectively their mutual goals and interests. The founding societies were The American Physical Society, the Optical Society of America, the Acoustical Society of America, the Society of Rheology, and the American Association of Physics Teachers. The member societies now include the American Astronomical Society and the American Crystallographic Association as well as the five founding organizations. Eighteen other scientific organizations within the discipline have affiliated with the Institute to make it representative of all aspects of physics and astronomy. Through the seven member societies, the AIP is the focal point for examination of the needs of the discipline and the representative of the unduplicated membership of about 50,000 physicists. Membership figures for the AIP member societies are given in the table below:

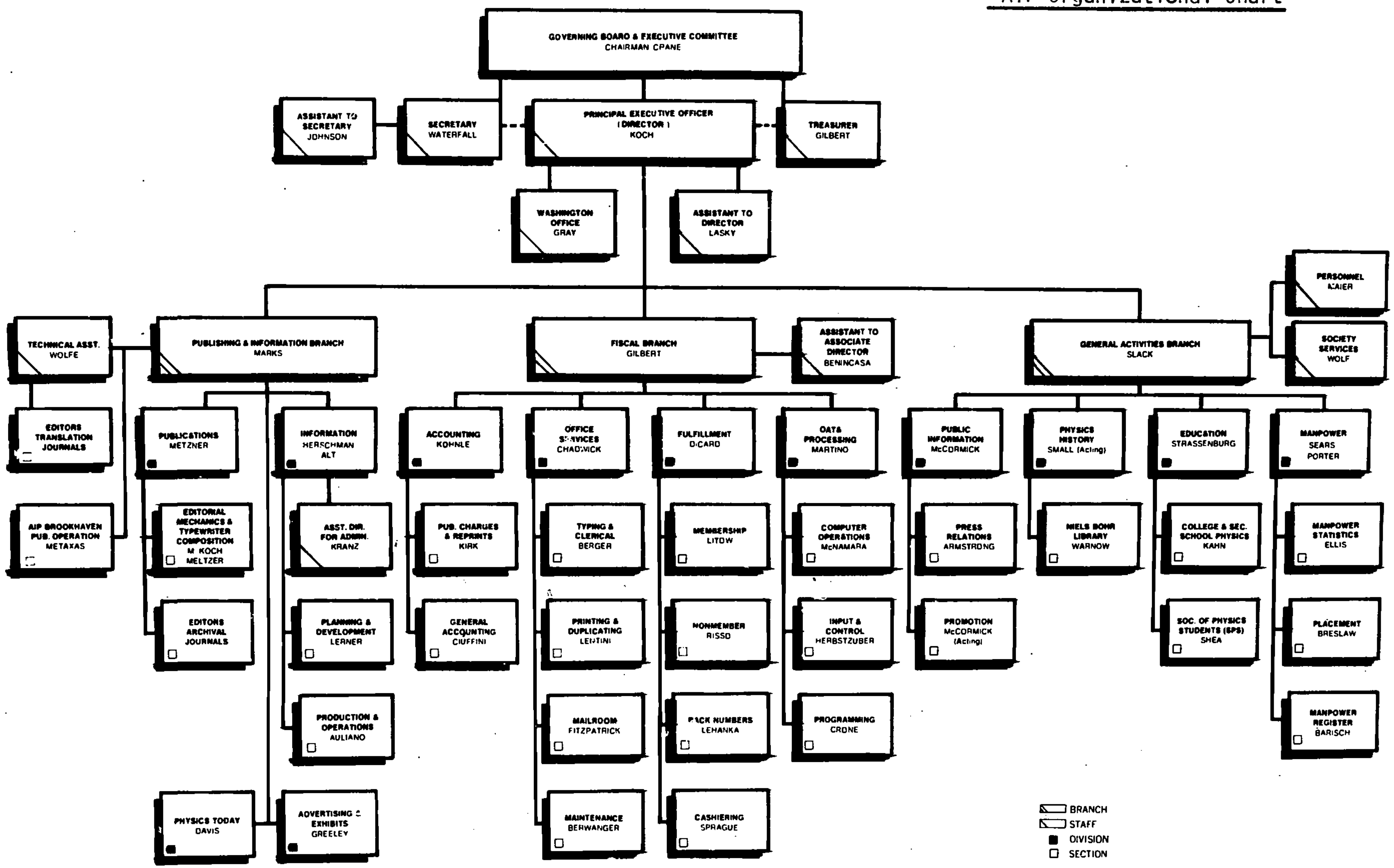
Table A.1 AIP Member Societies - 1970 Membership

The American Physical Society	28,532
American Association of Physics Teachers	13,275
Optical Society of America	6,437
Acoustical Society of America	4,633
Society of Rheology	830
American Astronomical Society	2,701
American Crystallographic Association	1,853
	58,291

In addition to representing this large body of physicists, the Institute, through the Society of Physics Students, represents about 6,000 students enrolled in more than 420 colleges and universities. Close liaison with industrial coprporations, institutions and laboratories is maintained through the 110 AIP Corporate Associates that aid the Institute in the advancement and diffusion of the knowledge of physics and its application to human welfare.

Figure A. I

AIP Organizational Chart



The functions of the Institute [Fig. A.1] are grouped into three major branches: 1) Publishing and Information, 2) Fiscal, and 3) General Activities. The AIP Associate Director for Publishing and Information directs the activities of the Publications Division, the Physics Information Division (formerly the Information Division), the magazine Physics Today, and the Advertising Division. The Treasurer, who is also Associate Director for the Fiscal Branch, is responsible for the Fulfillment, Accounting, Office Services, and Data Processing Divisions. The AIP Associate Director for General Activities directs the Physics History, Public Information, Education, and Manpower Divisions.

Distinguished physicists representing the member societies are appointed to the AIP Governing Board [Table A.2], which is responsible for the policies of the Institute.

The Officers of the American Institute of Physics are:

H. Richard Crane
Chairman of the Governing Board

H. William Koch
Director

Wallace Waterfall
Secretary

Gerald F. Gilbert
Treasurer

Lewis Slack
Associate Director for General Activities

Robert H. Marks
Associate Director for Publishing and Information

As central agency for a federation of scientific societies, the AIP provides the societies with fiscal, editorial and clerical services. In constant dialogue with the societies and individual physicists, the Institute is keenly aware of the problems of the physics community.

The Publications and Physics Information Divisions exemplify the Institute's continuing efforts to improve information transfer and utilization. 35% of the world's physics literature is published by the AIP and its societies. 18 primary journals and 5 society bulletins contained over 71,000 pages during 1970, an increase of about 5% over the 1969 figure. In addition, 27,000 pages were published in translations of Soviet physics journals. The Institute also markets throughout the Americas publications of the Institute of Electrical Engineers and of the Institute of Physics of the United Kingdom.

To promote better popular understanding of the discipline, the General Activities Branch of the Institute informs the press and all public media about physicists and developments in physics. This branch also carries on programs related to physics education and conducts continuing studies of the manpower situation. Up-to-date data on enrollment and employment are maintained as part of these efforts. Table A.3 shows some of the AIP-published reports relevant to education and manpower. Through this branch, the AIP also encourages the documentation and study of the history and philosophy of recent physics.

Table A.2

Governing Board of the American Institute of Physics

H. Richard Crane, Chairman
H. William Koch, ex officio

Elected by	
The American Physical Society	George B. Benedek Joseph A. Burton S. A. Goudsmit W. W. Havens, Jr. A. L. Schawlow Frederick Seitz W. P. Slichter Peter R. Weiss
Optical Society of America	Bruce H. Billings A. I. Mahan Aden B. Meinel Mary E. Warga
Acoustical Society of America	Robert T. Beyer John C. Johnson Wallace Waterfall
Society of Rheology	H. Markovitz
American Association of Physics Teachers	Arnold B. Arons Stanley S. Ballard Irving E. Dayton Bailey L. Donnally Wilbur V. Johnson Robert N. Little
American Crystallographic Association	G. A. Jeffrey
American Astronomical Society	Laurence W. Fredrick Martin Schwarzschild
At Large	Harold A. Daw Michael Ference, Jr. Gerald Holton

Table A.3

AIP Reports on Education and Manpower

Education

Directory of Physics and Astronomy Faculties in North American Colleges and Universities, 1970-71 (Pub. R-135.9)

Heads of Physics Departments, 1970-71. August 1970. (Pub. R-223.1)

Graduate Programs in Physics and Astronomy. July 1968. (Pub. R-205) (Out of print - revision under way)

Handbook of Resources for Physics Departments. April 1969. (Pub. R-213)

List of Colleges and Universities Offering Physics Majors. August 1970. (Pub. R-124.9)

List of Colleges and Universities Offering Astronomy Majors in Astronomy Departments. August 1970. (Pub. R-203.3)

Student's Guide to Undergraduate Physics Major Departments. June 1969. (Pub. R-214)

Manpower

American Institute of Physics Placement Service, A Descriptive Booklet. (Pub. R-136)

Placement Service List of Retired Physicists Interested in Employment. Published in January of each year. (Pub. R-237)

Registrants' Qualification Book, a Collection of Registrants' Applications. Issued January, April, and October. (Pub. R-160)

Summary of Academic Openings. Published in Feb., May, Aug. and Nov. of each year. (Pub. R-138)

Physics Manpower: 1969 - Education and Employment Statistics. August 1969. (Pub. R-220)

Physics Manpower Studies, 1969 - Employment Experience of Recent PhD's and Physics Department Plans for Academic Research and Personnel. July 1970. (Pub. R-233)

Total Physics Enrollments and Degrees in the United States. February 1971. (Pub. R-151.8)

1969-1970 Graduate Student Survey. March 1971. (Pub. R-207.3)

Report on Survey of Physics Bachelor's Degree Recipients, 1969-70. February 1971. (Pub. R-211.2)

Work Complex Study - The Match Between Academic Training and Employment of Physicists. By Susanne D. Ellis, December, 1969 (Pub. R-224)

Table A.4

AIP Fiscal Operations

Summary Statement of Operations—Year Ended 31 December 1970
Including Activities Carried on for Member Organizations

Income	*Total*	*American Institute of Physics*	*For Account of Member Organizations*
Subscriptions	$ 3 610 889.42	$ 2 003 759.17	$ 1 607 130.25
Contributions for the Dissemination of Research Information	3 362 808.36	1 293 322.76	2 069 485.60
Reprint Sales	188 152.16	85 632.47	102 519.69
Back Number Sales	179 057.98	117 600.91	61 457.07
Microfilm Sales	18 017.70	11 023.20	6 994.50
Advertising Sales	661 585.93	470 887.06	190 698.87
Member Societies Dues	54 423.00	54 423.00	
Corporate Associates	138 255.00	138 255.00	
Interest Earned on Investments	48 679.98	48 679.98	
Grant and Contract Activities, Royalties, Exhibits and Other Income	2 414 067.80	2 414 067.80	
Miscellaneous Income	81 529.68	81 529.68	
Other Receipts for Accounts of Member Organizations	1 678 182.30		1 678 182.30
Total Income	$12 435 649.31	$6 719 181.03	$ 5 716 468.28

Expense	*Total*	*American Institute of Physics*	*For Account of Member Organizations*
Composition, Printing, Engraving and Mailing Journals	$ 4 035 263.24	$ 1 695 926.08	$ 2 339 337.16
Translations, Composition, Printing and Mailing Soviet Journals	740 849.67	650 158.06	90 691.61
Expense re Dissemination of Research Information	254 011.37	102 367.40	151 643.97
Printing and Mailing Reprints	93 747.81	40 353.18	53 394.63
Reprint Sales Handling	34 829.22	14 095.63	20 733.59
Back Number Handling and Distribution	49 687.72	20 170.50	29 517.22
Reprinting Back Issues	2 540.00	2 540.00	
Microfilm Production, Handling and Distribution	16 969.11	7 625.33	9 343.78
Editorial and Editorial Mechanics	1 278 986.90	728 340.84	550 646.06
Subscription Handling	344 589.12	174 091.68	170 497.44
Circulation Promotion	1 068.00		1 068.00
Advertising—Printing, Mailing and Selling	270 467.28	173 047.04	97 420.24
Corporate Associates	34 954.53	34 954.53	
Administrative and Organizational Services	848 455.61	848 455.61	
Special Projects	2 190 541.42	2 190 541.42	
Other Disbursements for Accounts of Member Organizations	417 622.89		417 622.89
Total Expense	$ 10 614 583.89	$ 6 682 667.30	$ 3 931 916.59
Net Charge to Organizations to Balance Accounts	1 784 551.69		1 784 551.69
	$ 12 399 135.58	$ 6 682 667.30	$ 5 716 468.28
Net Income or (Expense) Transferred to Accumulated Income	$ 36 513.73	$ 36 513.73	

The fiscal operations [Table A.4] and service functions performed for the scientific societies affiliated with the Institute are constantly expanding. Such activities include subscription fulfillment, dues billing and collection, accounting services, office services, and management of society meetings. Fiscal responsiblities include the administration of budgets, grants, contracts, and the Institute pension plan. The purpose, organization and programs of the AIP are discussed further in the booklet American Institute of Physics, On Its 40th Anniversary (Pub. R-236, 1971). Also see the special issue of Physics Today, June 1971, devoted to the AIP anniversary.

2. AIP Physics Information Division Function and Responsibility: The Physics Information Division was established in 1967 as a formal unit of the Institute, responsible for the design and implementation of an information system for physics and astronomy. This action was a logical outgrowth of earlier Institute studies of the literature of physics, the communication patterns of physicists, etc., and the awareness of the Institute that more innovative information channels needed to be made available. On the basis of these studies [for bibliography see AIP-ID71-1], and in response to the needs of the societies and members of the physics community for better and more diverse information services, a proposal for the design and implementation of the system was submitted to and approved by the National Science Foundation [page A.8, AIP-ID70P].

From the beginning, the Physics Information Division has maintained close liaison with the physics community through the AIP Advisory Committee on the Information Program. Members of the Advisory Committee are leading physicists representing the various societies [Table A.5]. Four subcommittees have been established to enable the Advisory Committee to work more closely with the Division in specific areas. To further insure the responsibility of the system and the viability of its services, a group of 84 Physics Information Division Respondents was established. The Respondents offer the Division a continuing, practical means for early evaluation of proposed services and innovations.

The Division staffing and facilities have been kept minimal. The two major functional units of the Division are: Planning and Development Section, R. G. Lerner, Manager; and Production and Operations Section, John Auliano, Manager. The organization of the Division is shown in Fig. A.2. The staff of the Division has been carefully selected to secure diverse capabilities and backgrounds pertinent to the goals of the system. Biographic data of the senior staff of the Division were presented in AIP-ID70P.

Table A. 5

Advisory Committee on the AIP Information Program

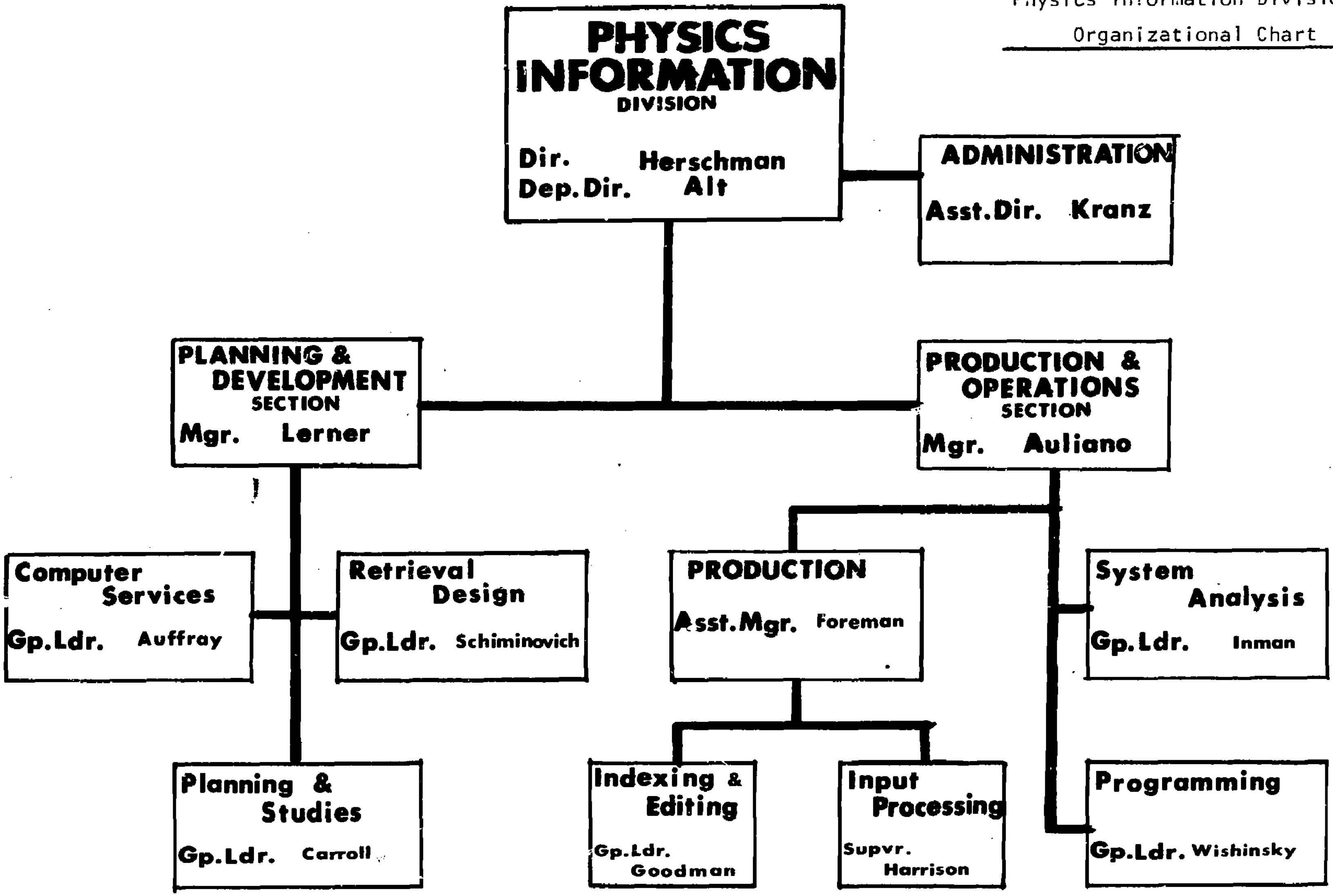
Representing	Name	To
Amer.Phys.Soc. (APS)	Samuel A. Goudsmit	1972
APS - Chem. Phys.	Richard B. Bernstein	1971
APS - Chem. Phys.	Maurice Shapiro	1972
APS - Electron & Atomic Phys.	Philip M. Morse	1972
APS - Fluid Dynamics	Francois N. Frenkiel	1971
APS - High Polymer Phys.	David W. McCall	1972
APS - Nuclear Phys.	Jerry B. Marion	1971
APS - Particles & Fluids	R. F. Peierls	1973
APS - Plasma Phys	Roy W. Gould	1973
APS - Solid State Phys.	*Conyers Herring	1973
Opt. Soc. Amer.	Robert Hufnagel	1972
Acoust. Soc. Amer.	James L. Flanagan	1973
Soc. of Rheology	Ronald S. Rivlin	1974
Amer. Assoc. Phys. Teachers	Sanborn C. Brown	1973
Amer. Cryst. Assoc.	Richard E. Marsh	1974
Amer. Astron. Soc.	H. M. Gurin	1972

*Chairman

Figure A. 2

Physics Information Division

Organizational Chart



APPENDIX B

DEVELOPMENTS IN COMPUTER PROGRAMMING

1. Introduction. This Appendix describes in some technical detail the work on computer programs which are used in the information system. It concentrates on developments during the year ending in June 1971 and on plans for work in the future years.

These programs fall into three areas:
Photocomposition of printed output
Information retrieval from a randomly accessible file
Current file input, maintenance and periodic services

In the Development Program Plan these areas are represented by the lines marked, respectively, C, R, M.

Programs dealing with computer-based photocomposition are discussed in Sections 2 and 3 of this Appendix. AIP's interest in computer-based-photocomposition antedates its concern with an information system. The work was initially funded by a grant from the National Science Foundation (GN-601) starting in 1966. At the expiration of that grant in February 1970, the effort was merged with the development of the National Information System for Physics and Astronomy. A detailed account of earlier activities in photocomposition is given in Appendix D of the report AIP-ID-70P. Recent progress and plans for the future will be reported here. The technical work in this area was performed entirely by subcontractors and consultants; the role of the AIP staff was limited to technical direction and management.

Work on a randomly accessible file ("Master File") during the past year culminated in a set of specifications for such a file. These are summarized in Section 4 below. This work was performed by AIP staff, heavily assisted by an outside consultant.

The area of file input and maintenance includes a variety of new programs or revisions to existing ones, all aiming at improving the speed or cost performance of the system. A set of programs adequate for pilot operation of the system was available by early 1970 and is described in AIP-ID-70P. The more important additions and changes accomplished since then are outlined in Section 5 below. This work was performed entirely by in-house staff.

2. Recent Progress in Photocomposition Programs. Following the program plan given in AIP-ID-70P, the recent work on photocomposition has concentrated on two areas: printed output of selected information elements, and photocomposition of built-up mathematical formulas along with full text for journals having

high mathematical content. In the former area we have followed two approaches, discussed in sections 2.1 and 2.2 below, namely, printed output from the physics information store, and production of selected elements of primary journals from joint input with the information store. The area of photocomposing full text and mathematics is dealt with in section 2.3 below.

2.1 Printed Output from the Information Store. Photocomposition holds a greater economic advantage in this area than in others, because of the fact that a computer-readable file already exists; normally, the cost of creating such a file is the largest part of the entire photocomposition costs. As explained in Chapter II, we have computer programs in operation which arrange the contents of a SPIN 1 tape into the order desired for a particular printed output (for instance, in order of subject headings, or in alphabetical order of authors' names) and which generate and insert the necessary headings and subheadings. Other programs already in operation read the tape so generated, identify the different data elements (author's name, title, etc.), delete those which are not desired for the particular output, and insert formatting instructions (line width, type size, bold face or italics, indentation, etc.) required by the photocomposer. All these programs had been finished by the spring of 1970. During 1970 and the early part of 1971, they were used to produce a number of outputs in an actual production environment. Specifically, all volume indexes (subject and author indexes) for the 1970 volumes of four AIP primary journals were produced successfully, and it is planned to extend this method to a number of other AIP-published journals. Finished sample copies of current awareness titles journals were produced in three formats for three different subfields of physics (Solid State Physics; Nuclei, Particles and Fields; Atoms, Molecules, Fluids and Plasmas). Also produced were sample bibliographies for three fields of specialization (Lattice Dynamics, Transport Processes in Solids, Atomic Processes). All the goals set for this approach for the past year (see AIP-ID-70P) have been reached.

Some unforeseen obstacles were encountered, but they were overcome and procedures changed so as to avoid their recurrence. One example may illustrate these changes. Formerly the information file was first rearranged into the order needed for a given publication, and photocomposed and proofread; it turned out that this required a lengthy error correction step followed by another photocomposition. Now the tape is photocomposed before rearrangement, but each item is printed in exactly the format in which it is to appear in the final publication. This output is proofread and the tape is corrected, then rearranged and photocomposed again. This avoids the need for another correction and photocomposing cycle of the rearranged file, which (because of multiple postings) is four or five times as long as the original file. In the case of journal indexes, these improvements have reduced the preparation time by about two months. It is still somewhat longer than desired, but there are specific plans for reducing it by another two months or so.

2.2 Integration of Primary and Secondary Publications. Almost all material in the computer store (title, author, author's affiliation, abstracts, and references) is taken from the primary journals, where it appears mainly at the beginning and end of each paper. (References are sometimes placed as footnotes at the end of each column, but at AIP, a recently adopted style change collects all of them at the end of the article.) This leads to the obvious suggestion that instead of printing the primary journal first and then copying the material into the computer store, original keyboarding of the material required for the store might be done directly from the author's manuscript and that portion of the primary journal be printed from the resulting tapes by photocomposition. The remainder of the paper would, for the time being, be produced by conventional methods, to avoid the present high cost of photocomposition and difficulties of mathematical typesetting.

Keyboarding for the combined purposes of primary journal photocomposition and creation of a retrievable information store differs appreciably from keyboarding for either purpose alone. Fine distinctions in character style, e.g. between a hyphen and a minus sign, must be indicated, though they are unimportant for the information file; tags and other identifiers, not appearing in print but needed to keep order in the information file, must be keyboarded by use of special characters reserved for this purpose. It was also found desirable to simplify the notation used for the many non-keyboarded characters (e.g. Greek letters and mathematical symbols) needed for both purposes; these are now generally represented by groups of three keyboard characters.

One of the computer programs needed for this procedure accepts the keyboarded tape, puts it into the format required by the photocomposer (or rather, by the general-purpose photocomposition program supplied by the manufacturer), omitting the identifiers and translating field tags into print style instructions. The output of this program is then processed through the photocomposer to produce galley proofs. After these have been read, corrections are added to the original tape and the photocomposition process is repeated. At the same time the corrected tape is subjected to another program which deletes the portions not wanted in the information file, such as informative footnotes interspersed with references, distinctions of character style, etc. It also adds information not initially available, such as inclusive page numbers at which each article is to appear in the primary journal, classifying and indexing information. Finally, the representation of non-keyboard characters is translated from the new three character notation to the one used elsewhere in the system.

2.3 Full Text and Mathematics. In this approach, which is carried out under subcontract with the staff of the Physical Review, some of the goals proposed a year ago have been reached and important progress has been made on others, but in one important respect an unforeseen delay has been encountered.

As has been said elsewhere (AIP-ID-70P, page D.10) there is an increasing trend for using typewriter composition for the publication of scientific journals. In the composition of plain text, typewriter composition is not only less expensive than the conventional monotype or linotype techniques, but also appears, at least up to the present time, to be clearly below the cost of photocomposition. When, on the other hand, we consider mathematical formulas, then typewriter composition becomes very expensive and it is conceivable, although not yet certain, that computer based photocomposition may be less expensive. For a text with a high percentage of mathematics, the net result may be a saving over typewriter composition. There is not enough information available to verify this, but clearly enough to justify some additional work in this direction.

A computer program for producing photocomposed output of mathematical formulas on a Linotron 505 has been available for some time. The goals for 1970 included integration of this program with the photocomposition of text, and design of a more economical input system. The latter goal has been reached; a new specially designed keyboard has been produced by the Physical Review staff at Brookhaven National Laboratory, and has been tested in operation for several months. As to the former goal, the existing computer program has been broadened to allow for the composition of plain text, but this has not yet been tested in a production environment. In particular, it is not yet clear how error correction can be handled economically. The combined program has been partially tested by using it for the index issues of the Physical Review for 1970; this is not a complete test since only a limited amount of mathematics is involved.

3. Future Plans for Photocomposition. It is planned to concentrate on two lines of approach: continuation of the development in full text and mathematics photocomposition, and integration of primary and secondary publication by photocomposition, limited to the data elements common to both.

3.1 Full Text and Mathematics. The present status of this approach, described in the previous section, is at such a crucial stage at this time that it would be hazardous to make any firm long-range plans. It is expected that in the near future trial runs involving entire journal articles will be evaluated. The future course of investigation along these lines will then depend critically on what is learned from this work, expecially in regard to cost. One expects, of course, that the cost of the test runs by themselves will be high, as is inescapable in a development situation. It should be possible, however, to extrapolate from them and obtain approximate cost estimates which would be valid in a production environment. If, as a result, it looks probable that the cost by photocomposition will remain higher than that by typewriter composition, then this approach would be terminated. If, on the other hand, the cost extrapolation looks promising, then we should proceed with the transition from experiment to full-scale production. This will involve obtaining several copies of the special keyboard developed under this experiment, obtaining the services of a photocomposer more appropriate than the Linotron 505 used so far, adapting the existing computer programs to the new photocomposer, and instituting adequate correction procedures. In the event that this course of action is adopted, it remains to determine to what extent the program should be carried on as part of the AIP information effort.

3.2 Integration of Primary and Secondary Publications. We expect to push vigorously for completion of this phase of the project. The next step will consist in completing the computer programs which have been planned and outlined. When they have arrived at the debugging stage, keyboarding will be done for sample issues, in parallel with actual production. Two journals have been selected for these trial runs: the translation of the Soviet Journal for Experimental and Theoretical Physics (JETP), and the Journal of Applied Physics. They have been chosen in part because they are owned and published by AIP, and in part because both are currently produced by typewriter composition. Since photocomposition results in camera-ready copy which is then reproduced by photo offset, it is more easily combined with typewriter composed journals, where reproduction is likewise by photo offset, than with those journals prepared by monotype or linotype, which would involve making engravings from the camera ready copy.

An important part of the effort will be devoted to solving problems of work flow. Keyboarding will have to be done from authors' manuscripts rather than from printed copy. Some information required for the computer store (e.g. page numbers and, usually, classification numbers) are not available at time of regular keyboarding, and have to be inserted at a later stage of the process. The manuscript has to be divided between input for photocomposition and for typewriter, and the two separate production streams have to be merged just before the end of the process. Each of the two streams involves its own correction loops. The solution of these problems is essential for putting the proposed system into operation.

4. Specifications for a Random-Access Master File. The following specifications are based on the fact that the size of our data base will be about 200 million characters as of the end of 1971, and growing rapidly. Much the larger part is in SPIN form or in a form for which programs for conversion to the SPIN form exist. The input to the master file will be assumed to be in SPIN form, on tape.

The hardware will consist of a computer equivalent in capacity to an IBM 360-65 with at least four disc drives, and a printer with upper and lower case capability. The software will draw upon the IBM utilities but will be based on a data management system developed by a consultant and written largely in the PL/1 language. The master file system will be designed to operate in batch mode only. Interactive capability is feasible with appropriate hardware and software but is considered a more long range effort.

4.1 Structure of the Master File. The information pertaining to the physics literature of one year is contained in an aggregate of several files. The "master file" is the collection of these yearly aggregates; in searching the master file, the files for each year must be searched separately. Each yearly aggregate consists of an index file, a file of articles without abstracts, and a file of abstracts. There is also a directory file which contains the names of, and pointers to, all the other files. The index file is an inverted file on three fields -- ID, classification, and author. The ID is a seventeen-character string uniquely identifying an article, and the classification is a set of six-letter codes from the PACS. The file is accessed using a hash coding technique (i.e. utilizing a numerical function of the string to give an address).

All files in the system are BDAM (basic direct access method) files. Records are fixed length. The file structure is that of a threaded list. That is, in the initial portion of each record is a pointer to the next record. If an overflow record is necessary (if, say, an article is longer than the record length) a pointer to the overflow record is provided. The records are in reduced form. This means that following each tag is a pointer to the next tag which is at the same level or a higher level in the tag hierarchy. Such a structure is a compromise between a directory file, fast but rigid, and a pure tagged file like the SPIN tapes, flexible but more difficult to search.

All files (other than the directory file) have a common format so that all methods of accessing, i.e. adding, deleting and correcting bibliographic records and fields, will apply to these files. Each file can be viewed as a one way list of records with a top and bottom pointer, and each bibliographic record can be viewed as a one way list of fields with a top and bottom pointer. (See Figure B.1)

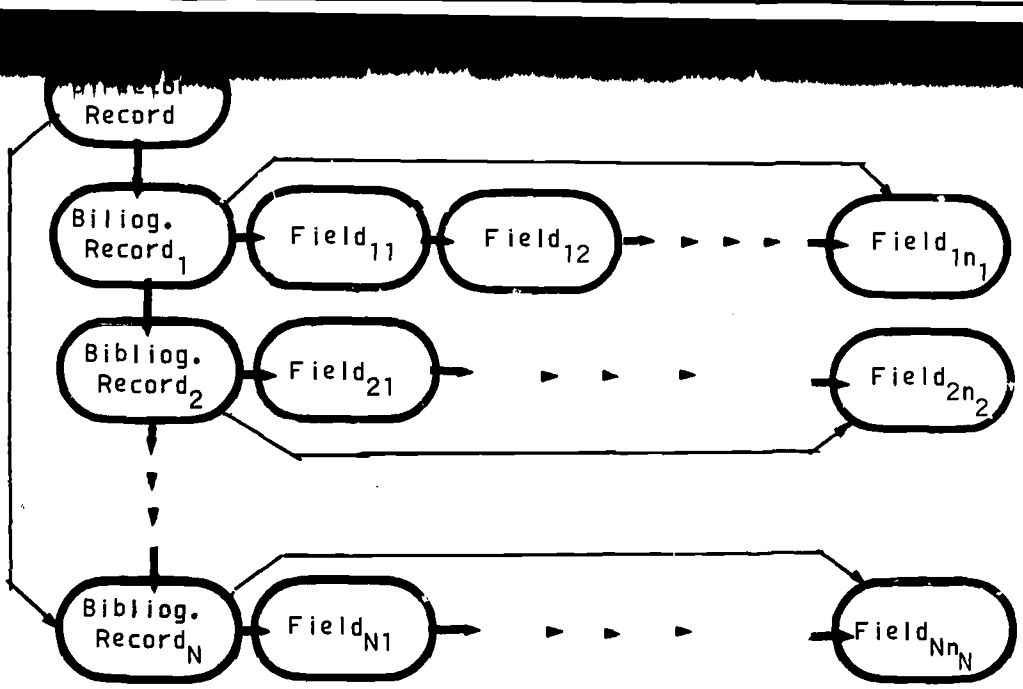
4.2 System Functions. The first function is input. Beginning with a tape in SPIN form, we create or add to the existing article file, the abstract file, and the index file. The second function is maintenance. Here we must provide for backup (periodic copies on tape of the file), addition (of entire articles and/or abstracts to the file), deletion (of entire articles and/or abstracts from the file), substitution (of a corrected form of an article and/or abstract for an incorrect form) and changes (insertion or deletion of fields in a specified article). Of course, any of these may require changes or additions to the index file. The third function is retrieval. Here we may distinguish query decoding (separating the query into its component specifications), query range handling (obtaining a list of articles and/or abstracts which lie within the specified range), query handling -- index phase (obtaining from the list of articles and/or abstracts from the previous step a sublist which satisfy the index phase), query handling -- non-index phase (obtaining a truth value for the non-index phase for each article and/or abstract supplied from the index phase), and output (providing either a printout or a searchable file).

4.3 Format of the Query. The query will have five parts. The input will be on cards, and the parts will be of arbitrary length and each delimited by a special character. The parts are query indentification, query range, index phase of the query sentence, non-index phase of the query sentence, and query output request.

The query identification is a free format string. The query range contains first the name of the search file. This is either one of the yearly files which together compose the master file, or else a searchable file which was the output of a previous search. Next comes either the words ALL FILE or else a sequence of codens and volume nos. (if desired) prefixed by their tags, and connected by &'s (logical ands). The index phase of the query sentence is a sequence of ID's, classifications, and author surnames prefixed by their tags, and connected by &'s and I's (logical ands and logical ors). The non-index phase of the query sentence is a sequence of strings each prefixed by a tag for keyword phrase, title, bibliography author surname, bibliography coden, or abstract paragraph, specifying the field in which the string is to be found. The strings are connected by &'s and I's. The query output request contains first any sequence of field or subfield tags connected by &'s, specifying the desired output, and then one of the words SEARCH or PRINT. If the word SEARCH is given, then a name must be supplied for the output file.

Figure B.1

A Schematic of Records and Fields in a Direct Access Storage File



5. File Input and Maintenance. This section deals with the computer programs described in AIP-ID-70P, Appendix C, Sections 1 and 2. These programs were available in early 1970 and were adequate for pilot operation of the system; they were not, however, in the most economical form possible, nor did we have enough experience at that time to decide what that form should be. In the light of subsequent experience, existing programs have been modified and new programs added.

The SPIN program, originally written in PL/1, was replaced in late 1970 by an assembly language program. At the same time the format of the SPIN tapes was simplified, and the format of input keyboarding was modified. (For example, the start of an author's family name is now marked at keyboarding time, whereas previously it was found by computer logic). As a result of these changes, the SPIN program now runs much more efficiently. Also, the memory requirements for the program were reduced to the point where it can be run on an IBM 360/40 computer instead of the previously used 360/65.

The programs for creating and correcting History Tape previously operated on magnetic tape. Early in 1971 we changed to a system where each input tape is read into a magnetic disk file; the information is kept there through the subsequent error correction steps and until enough material has accumulated to fill one monthly SPIN tape.

The correction of errors is still not completely satisfactory. The replacement of Friden Flexowriters by Mohawk magnetic tape typewriters in the summer of 1970 brought a marked improvement, but the frequency of errors and [illegible] e (a [illegible] constant length, sequentially numbered). It is expected that this change will lead to improved performance.

A program to accept tapes from the IEE system and convert them to AIP format was completed in early 1971.

APPENDIX C

REVIEWS AND COMPILATIONS

1. Introduction. For some time AIP's Physics Information Division staff, aided by a subcommittee of the Advisory Committee on the AIP Information Program, has been exploring ways of facilitating the compaction and digestion of our knowledge about physics. This need for consolidation has been recognized by several groups that have studied problems of scientific communications in depth [Weinberg Report, 1963; SATCOM Report, 1969]. The importance of reviews and compilations for physics and its sister fields is described in an article "Distill or Drown: The Need for Reviews", by Conyers Herring [Herring, 1968]. Wide awareness of the importance of this issue is attested by the fact that this article was also published in the U.K. by the Institute of Physics and the Physical Society [Physics Bulletin, September 1968], and appeared in Russian translation [Uspekhi Fizicheskikh Nauk, June 1969].

2. Study of the Review Literature. During 1970, the Division staff conducted a study [for final report see Stern, 1971] dealing with the generation, publication and dissemination of the existing review literature in physics. It consisted of the following four investigations, focusing in turn on the re- [illegible]

(1) Identification of existing publication outlets for reviews and examination of current editorial policies toward them.

(2) Analysis of motivation, methods used and time spent by authors to complete a review project.

(3) An extension of (2) conducted through personal contact by physicists acquainted with authors of reviews in physics.

(4) Analysis of the evaluation made by readers of a critical review produced in a novel and experimental way.

2.1 Identification of Existing Review Publications and Editorial Policies. For our purpose, identity of the current publication outlets for review literature was established through a single access point, the subject heading "Reviews" in the semi-annual subject indices of Physics Abstracts, 1968. The number of entries indexed was 379, or 0.7% of the total number of abstracts (50,480) published in Physics Abstracts for the year. 157 source publications contained the review material which spanned the years 1964-1968. 110 articles

(29%) were originally published in U.S. and Canadian publications; 269 articles (71%) were originally published abroad. Relatively few (1.8%) appeared in monographs, annual reviews, "progress" series, or volumes of conferences and other meeting proceedings. A number of papers originally presented at conferences and other meetings were indexed under "Reviews". Of these, 19 were found to be journal articles; 36 were published in proceedings volumes. The majority (83%) of reviews abstracted were written in English including 57 articles which had been translated.

A letter was sent to editors of 129 source publications requesting comments on current policy as well as any experimental or innovative efforts being made in support of review literature. 69 replies (53%) were received; 9 respondents stated reviews were not part of their publishing programs; 51 replies were pertinent. The difficulty in assessing the replies is due to the large dispersion of review literature within publications primarily reporting the results of original research. The significance of this is that many information outlets do not have specific editorial policies with respect to inclusion of review literature.

Information obtained from this correspondence disclosed the following editorial policies and procedures relating to review literature:

(a) Selection: The final responsibility for generating review articles is generally considered by the editors to be an editor's function. Criteria for selection of subject fields for this medium are dependent on the scope of the publication and the editor's ability to monitor the needs of his users. The [illegible] are generally invited on the basis of competence and stature in the subject field.

(b) Solicited vs. Unsolicited Reviews: The policy of inviting authors to write reviews was supported by most respondents. The implication was that the standard of solicited articles was very high since the majority ultimately are published, whereas only about half, and in some cases much less, of the unsolicited reviews are acceptable.

(c) Assistance in Preparation of Reviews: With few exceptions, editors do not encourage review writing by offering aid to the author in (a) obtaining bibliographic documentation and source literature; (b) providing instructive guidelines concerning preparation of reviews; and (c) providing clerical help.

(d) Financial Support: Lack of financial support needed both to accelerate the preparation of reviews and to make the task more palatable to potential authors was denoted in two ways: (1) very few publications surveyed had alloted a special or discretionary fund towards this end, and (2) relatively little monies are offered, if any, as a subsidy or compensation to the contributor for the time, effort and work involved. The amount most often quoted was under $150, and rarely exceeded $250. In addition a few journals have introduced or are considering the policy of page charges.

(e) Publication of Review Literature Resulting from Conference Presentations: By and large no definite editorial policy exists by which review presentations are subsequently published. Since not all oral reports merit publication, potential authors are invited to expand their presentations for publication at the editors' discretion. A number of journals published by professional societies indicated that their prime source of review is from presentations at meetings conducted under their auspices.

(f) Publicizing the Need for Review Authors: Publications do not actively pursue would-be contributors through advertisement.

2.2 Analysis of Review Authors. Two separate investigations were conducted to determine (a) the motivations, preparation processes, and associated activities taken to complete individual review projects; (b) the kind of award and financial support received; and (c) the type of assistance and financial aid recommended to encourage prospective review writing based upon the authors' experience.

Using Physics Abstracts as the source of accessibility, 49 authors of articles indexed as reviews in the October-December 1968 subject indices were sent a letter requesting discussion of their particular review projects but also inviting open-ended comments. The sample was composed of 31 U.S. authors and 18 foreign authors. Approximately one-half (25 authors) responded.

As an independent corollary investigation, Dr. Conyers Herring, Chairman [illegible] surveyed a second group of [illegible] review authors [illegible] through a random sampling of citations from papers published during 1970 in the Physical Review, Sections A-D, the Journal of Applied Physics, and the Journal of the Optical Society of America. This group was sent a letter similar to that in the second investigation by various members of the Subcommittee personally acquainted with the individual authors selected to be surveyed. Over 70 per cent (35 authors) responded.

Motivation: One objective of this part of the study was to determine the initial inducement of scientists to involve themselves in a review project. A tabulation is given in Table C.1 for the various contributing factors.

Table C.1 Authors' Motivation to Produce Review Publications

	Motivations	No. of Authors
(a)	Invited by a publication	12
(b)	Invited by a publication and self-perceived need	12
(c)	Invited by a publication; result of conference or other meeting presentation	4
(d)	Based on conference presentation	18*
(e)	Self-perceived need; own submission to publisher/editor	12
(f)	Based on lecture or lecture series	4*
(g)	Based on series of internal talks and reports	2
(h)	Outgrowth of planned appendices to Ph.D. thesis	1

*Author offered information on 5 separate reviews he had written.

Time Spent from Inception to Completion or Final Publication: More than half the authors in the second investigation (20) determined their tasks to have taken less than 8 months. About half judged the intervening period to actual publication to be between 6 and 18 months.

Authors in the third investigation were also asked for an approximation [illegible]-time [illegible] months over sp[illegible] 2 to 4 years. Ten co-authored reviews took from 1 to 8 man-months to complete, with both authors spending about equal time on each project, including 2 which were accomplished over 1 1/2 and 2 years. Of the larger works commented on, 1 book took the authors 20 man-months each, another took the author 60 man-months and his co-author 18.

Financial Awards and Support: The financial incentives offered for authorship of reviews were found to be minimal. 32 respondents (53%) indicated no remuneration was received; 29 respondents (45%) received honoraria, fees, or royalties. These were, for the most part, considered modest or negligible.

Another objective was to identify current sponsorship and to what extent reviews were funded. Few authors in the second investigation acknowledged any support from governmental sources. Only one author was awarded a grant by a private fund. Nearly half the reviews in the third investigation were directly underwritten by governmental or outside sources in the form of subsidization through research grants or contracts. Rarely was funding explicitly given for support of review writing. Only three authors considered their reviews as a central part of the activity for which the monies were allocated. Most viewed their contributions as part of their salaried work.

Assistance of Others: Authors were asked to elucidate on the use made of others in the different phases of developing their projects to the final draft stage. Another approach to gaining more insight in this area was to ask what kind of assistance would have been useful and would be desirable in future undertakings if financial support were obtainable.

Supporting services that authors considered would make the review effort easier to accomplish and more efficiently executed included computer time, translation service, drafting, proofreading, indexing, more accessible means of photocopying, compiling bibliographies, technical writing and editing, and the use of a technical typist.

Table C.2 gives the estimates or ranges for various components in the preparation process suggested by authors, if substantial funding were to be achieved for the production of review literature.

Table C.2 Authors' Suggested Funding

	Type of Service	Estimates or Ranges
(a)	author's salary	$500 - 10,000
(b)	post-doctoral or graduate assistance	Salary for 3-30 man-months
(c)	clerical help	$100 - 5,000
(d)	draftsman	$100 - 600
(e)	reprography	$250
(f)	[illegible]	[illegible]
(g)	technical editing	$300 - [illegible]

2.3 Reader Reaction to a Critical Review Experiment. The opportunity to evaluate reader reaction to a critical review article and the method by which it was generated was made available by Professor Michael Moravcsik, of the Institute for Theoretical Physics, University of Oregon. He had organized a concentrated discussion meeting that brought together 25 authorities actively involved in the Regge Pole theory, a specialized area of high energy physics, and invited a post-doctoral fellow, familiar with the subject, who would not have ordinarily been an attendee, to be present at the meeting and prepare a review article based upon both the conference sessions' discussions and published literature in this subject. Subsequently, 365 preprints of the resulting review article [Hite, 1969] were distributed to a select group of physicists and preprint libraries, both U.S. and foreign. With the assistance of the Division staff, a follow-up letter was sent to the recipients of the preprints. The objective of the query was not only to gain reader evaluation of this particular experiment, but also to ascertain the characteristics and effectiveness of critical reviews generally acceptable to a user group.

Evaluation of the Critical Review: 141 replies (39%) to the query were received. 61% of the respondents were currently active in the subject area covered by the review article. The critical review in question was considered by more than half of the physicists as being of good quality, and, in comparison to other review articles previously read, was judged equally as good or better. 117 (82%) of the respondents indicated that they would like to see more review articles.

Reader reaction was also determined by the rating of some of the elements characteristic of critical review articles. More than 75% of the respondents considered the length (54 pages) to be about right, on the whole scientifically accurate, and referenced by good bibliographic coverage. The amount of personal perspective, evaluation and critique contained in the article was weighed by 51% of the respondents as being too little. However, 47% of the physicists appraised this element as being just about what it should be.

Evaluative Comments Generally Applicable to the Critical Review: 96% of the respondents added evaluative comments in their replies to the survey. From these appraisals of the particular review article, criteria generally considered important to make a good critical review can be summarized as follows:

(1) The reviewer must have experience in the field in order to successfully assess the reported works of others.

(2) The reviewer should be clear as to which audience he is directing his writing -- specialist, novice, semi-outsider, outsider, researcher, student, etc.

[illegible]

(4) [illegible]

(5) Factual details should be balanced.

(6) Subject content must be timely and of current interest.

(7) Text should be a critical discussion and not a compilation of references.

(8) Reviews should contain a good bibliography in addition to the main body of the article.

(9) Length of article is not an important consideration.

2.4 Conclusion. It was concluded that the following activities or services would aid in mitigating some of the difficulties hampering greater productivity of review literature:

(1) Closer identification and improved access through secondary media to the various forms of existing review literature scattered throughout different types of publication outlets.

(2) Compilation of annotated bibliographies of the primary literature in specialized areas of current interest and development.

(3) Publication of bibliographies of review literature already in existence in specific subject areas and updating as necessary.

(4) Availability of technical editorial and clerical services to authors engaged in review projects. Guidelines for standardization of review formats could be formulated and made available to potential review writers.

(5) Financial backing for review writing.

3. A Proposed Experimental Fellowship Program. AIP, through its information program for physics and astronomy, will be capable of performing a variety of services that will encourage more scientists to undertake review writing projects. The first effort presently under examination by AIP is a proposal to [illegible] iate [illegible] program f[illegible] members of the Advisory Committee on the AIP Information Program, which is made up of representatives of the Member Societies, and with additional members of its Subcommittee on Reviews and Compilations.

Membership of the Review Grants Committee: The awarding of grants would be under the intellectual control of a Committee whose members would be chosen by AIP's Member Societies. This Committee would have both the responsibility of formulating the general criteria and priorities for the awarding of grants for fellowships - subject, of course, to the overall framework specified in the formal proposal - and the responsibility of choosing, with the aid of referees, the individuals who would receive such grants. The members of this Committee should be scientists whose names are highly esteemed in their respective professional communities. Though each Committee member will undoubtedly be given particular responsibilities relating to his Society's area, the Committee should operate as a coherent whole; it is, therefore, desirable that each of its members have as broad an outlook as possible.

<u>Operation of Program</u>: What is proposed is to provide support for the preparation of reviews and compilations on as nearly as possible the same basis as support has hitherto been available for new research, and in addition to provide bibliographic and editorial assistance when it is appropriate and practical for a central agency to do so. The availability of grants would be publicized to the physics community; applications, similar to those now made to NSF for research grants, would be accepted and would be screened by the Committee, which would be authorized to call on other competent scientists as referees. Grants would be awarded by the Committee to the best proposals, under suitable constraints of size and distribution over the subject matter of physics. The medium of publication would be chosen by the author; he would be encouraged to make his choice on the basis of maximum availability to potential users, and would be asked to turn over any royalties or honoraria to the project's funds. Evidence of interest on the part of a reputable journal or publisher would strengthen the application, but it should be made clear that the author's freedom to choose his publication outlet will not be interfered with.

Each application would be expected to itemize proposed expenditures for professional salaries (including those of graduate students and post-doctorals assisting in the work as their role is viewed as especially important for the success of the venture - see below), clerical and drafting assistance, travel, computer time, etc. It should supply a rough estimate of the size of the body of literature to be reviewed and the size of the review or compilation to be produced.

As potentially useful though not essential adjuncts to the grant system, AIP would consider making available to grantees [illegible]

<u>Publicizing the Availability of Grants</u>: [illegible] community of potential authors for reviews [illegible] that such grants are available, and [illegible] them. This would be done in <u>Physics Today</u>, [illegible] the news organs of the Member Societies.

<u>Probable Effectiveness of such a Program</u>: [illegible] sion of functions between the principal author [illegible] review writing preparation and would provide assistance [illegible] laborious and time-consuming tasks of a non-evaluative nature. The program would also offer young physicists the challenge of producing meaningful work which would receive recognition from the physics community. The underemployment of young physicists that has developed in the last couple of years [illegible] a new, and significant argument in favor of such a program. There are [illegible] competent young physicists who need employment, who [illegible] valuable assistance to older authorities undertaking reviews [illegible] whose professional education would be furthered [illegible]

prudent level of initial funding for the proposed program would, of course, not be large enough to make a major dent in the present unemployment, it is clear that the modest benefit in terms of conserving human resources would be commensurate with the modest funds expended. One can productively employ more people, per dollar expended, in review preparation than in laboratory research.

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