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publications is collected to satisfy the needs of a special group of users.

- (f) Selective dissemination of information where material of interest is distributed on an individual basis to users, based on an interest profile.

It should be noted that the six types of service listed above are not mutually exclusive.

At the present time the major national societies are interested in establishing integrated information systems for their respective disciplines. In reviewing the activities of major abstracting and indexing services it is noticeable how many of these are vitally involved in the plans for such integrated systems. An abstracting and indexing service, by the very nature of its operation and product, is an important repository of the significant information in its field or a record of where such information can be found.

Abstracting and indexing services have to cope with an expanding primary literature; for example, the physics literature has increased since 1960 by 77 percent. The average rate of increase is consonant with a doubling of the literature every seven years. This increase in primary publications causes a resulting increase in the size of the secondary publication. The growth of some of the major services can be seen from the following figures taken from a recent National Federation of Science Abstracting and Indexing Services report.

TABLE 1
NFSAIS SCIENCE INFORMATION SERVICES PROVIDED
IN 1966 * 3

<i>Abstract Services</i>	<i>Number of Abstracts Published</i>			
	1957	1965	<i>Estimated for 1966</i>	<i>% Increase over 1957</i>
<i>Applied Mechanics Reviews</i>	4,245	7,900	8,200	93
<i>Engineering Index</i>	26,300	50,000	55,000	109
<i>International Aerospace Abstracts</i>	6,770	26,850	33,000	387
<i>Meteorological and</i>				
<i>Geostrophysical Abstracts</i>	5,000	9,000	9,000	80
<i>Nuclear Science Abstracts</i>	14,042	48,118	50,000	256
<i>ASM Review of Metal</i>				
<i>Literature</i>	8,219	13,214	21,500	162
<i>Scientific and Technical</i>				
<i>Aerospace Reports (NASA)</i>		26,897	30,000	

* Selected member services of NFSAIS only.

Abstracting and Indexing Services in Physical Sciences

In this paper selected services will be discussed briefly with emphasis on those publications which demonstrate the change in the nature of secondary publications. Other physical sciences, such as chemistry, are treated elsewhere in this issue.

Physics. The major abstracting journal in physics is *Physics Abstracts* (Section A of *Science Abstracts*) published monthly in London by the Institution of Electrical Engineers (IEE). This is an archival publication, carrying over 38,000 abstracts in 1966. Abstracts are listed once under a subject heading. Subject and author indexes are provided semi-annually and cumulate periodically. A companion publication to *Physics Abstracts* is *Current Papers in Physics* published twice-monthly since January, 1966. It is a rapid announcement of approximately 90 percent of the articles which later appear in *Physics Abstracts*. It is published in newspaper format and contains author, title, and reference arranged under the broad subject headings used in *Physics Abstracts*.

These publications are good examples of the way in which secondary publications form part of an integrated information service. The American Institute of Physics (AIP) and the Institution of Electrical Engineers (IEE) have for many years maintained a close cooperative relationship. At the present time AIP is studying the elements of an information service for physics while the IEE is setting up an Information Service for Physics, Electrotechnology and Control (INSPEC) in Great Britain. *Physics Abstracts* and *Current Papers in Physics* have been studied closely by both organizations working in conjunction. A user study on current awareness methods and *Current Papers in Physics* has been conducted in the United Kingdom and the United States simultaneously. This study has useful information on the current awareness requirements of the physics community. The subject arrangement of *Physics Abstracts* is being studied and it is hoped that a method of organizing physics information can be developed which will be used by the AIP in its primary journals, and by *Physics Abstracts* in the secondary publications.

Another current awareness service in physics is *Current Contents; Physical Sciences*, published by the Institute for Scientific Information (ISI) in Philadelphia. This journal contains contents pages of journals in space, electronics and the physical sciences. A tear sheet is provided as an additional service. *Current Contents* is the product of a broad-based commercial service, which publishes many science information tools such as *Science Citation Index* and the ASCA Alerting Service.

For additional information on ISI publications refer to the article by Morton V. Malin in this issue.

The major mission-oriented service in physics is *Nuclear Science Abstracts (NSA)* published by the Atomic Energy Commission. Published monthly, NSA covered over 47,000 abstracts in 1966. Indexes are available quarterly with cumulations. Especially useful is the Report Number Index which is also issued quarterly and cumulates regularly.

In addition to the subject indexing used in the published NSA index, material is also indexed using the Euratom Thesaurus. The bibliographical citation and both indexing records are processed in machine readable form.

One aspect of cooperative development should be mentioned in connection with NSA. The AEC announced two years ago that developed countries should undertake to cover the nuclear physics literature published within their geographic area. Bilateral agreements have been made with some countries such as Canada, Japan, Scandinavia and the United Kingdom who are preparing the published material produced in their countries for inclusion in NSA.

The AEC is represented on a working group formed in Vienna in December, 1966, by the International Atomic Energy Agency to explore the concept of an International Nuclear Information System (INIS). This system expects to provide a sophisticated, computer-based information processing system for rapid announcement and retrieval of nuclear physics information.

Aerospace. The major publication is *Scientific and Technical Aerospace Reports (STAR)* published by the National Aeronautics and Space Administration (NASA). Like NSA, this is a mission-oriented publication covering the report literature dealing with the science and technology of space and aeronautics. Several years ago a cooperative agreement was made with the American Institute of Aeronautics and Astronautics (AIAA). It was agreed that AIAA would restrict the coverage of *International Aerospace Abstracts (IAA)* to journal and other non-report literature. This arrangement provided complimentary non-duplicating publications in this field. In 1966 both STAR and IAA published 30,000 abstracts each.

Unlike all the secondary publications mentioned so far (with the exception of *Current Contents*), a "back up" service is available. The material in STAR can be obtained from the Clearinghouse for Federal Scientific and Technical Information (CFSTI). Material cited in IAA can be obtained from the AIAA.

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STAR and IAA input is also processed for machine retrieval. An additional indexing step provides for the assignment of deep indexing terms. The indexing record is matched by computer with interest profiles. Material is distributed on an SDI basis to approximately eight hundred participants. Established initially as an individual service, NASA has recently established a pilot project to study group dissemination of information with the initiation of SCAN (*Selected Current Aerospace Notices*). It is hoped eventually that the group SDI service will replace the individual SDI system.

Engineering. The main U.S. source of engineering information is *Engineering Index*. In 1966 approximately 59,000 items were indexed. A pilot program on two sections of *Engineering Index* has been in progress for several years. The sections under study are electrical engineering and plastics. A vocabulary using the *Thesaurus of Engineering Terms* published by the Engineers Joint Council (EJC) as a base has been developed, and material is deep indexed for a mechanized retrieval system. (Deep indexing is the assignment of additional indexing terms for greater specificity than is normally allowed in a printed index.) An experiment on SDI service using the tapes produced in the pilot program is being conducted by *Engineering Index* staff in conjunction with staff at Diamond Alkali.⁴

Electrical and Electronics Abstracts (Section B of *Science Abstracts*) published monthly by the IEE, London, contained 21,322 abstracts in 1966. This publication is arranged under subject headings as is *Physics Abstracts* and the UDC classification number is printed with the abstract; the subject arrangement used in *EEA* was initially derived from the UDC schedules. IEE also publishes a companion current awareness journal, *Current Papers in Electrotechnology*. Appearing in newspaper format, it provides a rapid announcement of 90 percent of the material in the parent abstract journal and the same broad subject headings are used to arrange this material.

In June 1966 the IEE launched Section C of *Science Abstracts*, *Control Abstracts*. Published monthly, this covers all aspects of control and automation including cybernetics, the electrical, electronic, mechanical, pneumatic and hydraulic aspects of automatic control, computers and all applications. At the same time a companion awareness publication, *Current Papers on Control*, commenced; it is published monthly along the same pattern as the other two current awareness journals published by IEE. These publications, together with *Physics Abstracts*, are the IEE's INSPEC (Information Service for Physics, Electrotechnology and Control) publications. In addition the IEE is

running an experimental SDI test in the field of electronics. This test was started under the auspices of the National Electronics Research Council (NERC) and was transferred to the IEE in 1966.

Metallurgy. The major tool in this field is *Review of Metal Literature* published monthly by the American Society for Metals (ASM). 21,000 items were covered in 1966. The ASM was one of the first to be involved in an automated reference retrieval system. Working in conjunction with Western Reserve University, the Metals Documentation Service of ASM was developed in the late fifties and became operational in January, 1960. At this time a semantic code vocabulary developed. This was followed by the establishment of the Research Associates Program in which companies used the Metal Documentation Service and provided feedback to the ASM on the efficiency of the system. A cooperative program with IBM and Engineering Index was initiated to develop a monthly author and subject index which was first published in 1965.

The ASM's central information retrieval service was discontinued in May, 1967, and negotiations for a decentralized retrieval system are in process at the time of writing (October, 1967). As one of the first organizations to develop a mechanized retrieval system, ASM has provided pioneer experience in the information retrieval field in the United States.

The other major service in this field is *Metallurgical Abstracts* published by the Institute of Metals, London. As noted above for *Electrical and Electronics Abstracts* this is a publication which uses the UDC scheme to arrange material. Input from this publication has been used by the American Institute of Physics in its study of the mechanization of the Universal Decimal Classification and evaluation of its performance as an indexing language.

Mechanics. The principal publication in this field is *Applied Mechanics Reviews*, published monthly and carrying 8,214 items in 1966. This publication reviews world literature in applied mechanics and related engineering sciences. In addition to the annual author and subject index, an experimental index known as WADEX (Word and Author InDEX) has been produced for AMR. Entries are printed under designators which may consist of authors' names and words in the title.

Petroleum. The petroleum industry in the United States is served by the American Petroleum Institute's Central Abstracting and Indexing Service (CAIS), which publishes *Abstracts of Refining Literature*

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and *Abstracts of Refining Patents*. Approximately 13,000 items appear yearly in each of these publications. In addition to the alphabetical subject indexes, a "dual-dictionary" coordinate subject index is supplied for manual use and computer tapes are available for in-depth searching. API publications are priced on a sliding scale based on the assets of the subscribing company. Additional services available from API are microfilm sets of abstracts and of the "dual-dictionary," and an author affiliations index for the *Abstracts of Refining Literature*.

A recent interesting development involves the use of CAIS facilities by the API's Committee for Air and Water Pollution. Using the computer programs and the subject authority list developed by CAIS, and adding as many terms as are necessary to cover the air and water conservation field, a monthly bulletin is published—*Subject Index to Current Literature on Air and Water Conservation*. This index covers approximately two hundred documents per month. It is a good example of how a computer program designed for a larger information retrieval system can be used to produce an economical tool for a select group of people.

The publications listed above are some of the major services which specialize in a given area of the physical sciences. There are, of course, many general secondary publications which are useful to research workers in the physical sciences. These include *Technical Abstract Bulletin (TAB)* published by the Department of Defense, *Fast Announcement Service* from the Clearinghouse for Federal Scientific and Technical Information, and *Government-Wide Index to Federal Research and Development Reports*, published by the U.S. Department of Commerce. Other more general publications are *Applied Science & Technology Index*, published by the H. W. Wilson Company; *British Technology Index*, published by the (British) Library Association, and many others.

In addition to these, there are many specialized abstracting and indexing services covering a specialized subject field. These include such services as *Laser Abstracts*, *Solid State Abstracts*, *Tobacco Abstracts*, etc. It should also be remembered that many research workers use the abstracts section in the primary journals. An example of such a journal is *Journal of the Acoustical Society of America*. The best way to locate an appropriate service for a given field is to use the *Guide to the World's Abstracting and Indexing Services in Science and Technology* prepared by the National Federation of Science Abstracting and Indexing Services in 1963.

Conclusion. In examining secondary services in the physical sciences it would seem that Colonel Aines' suggestion that these services are changing in their philosophy is correct. The Institution of Electrical Engineers (IEE) with the establishment of INSPEC (Information Service in Physics, Electrotechnology and Control) is experimenting with the computer composition of the secondary publication. This process is operational at the American Psychological Association where *Psychological Abstracts* is produced by computer. The IEE's program will link directly with the American Institute of Physics' program to produce primary journals by computer composition. The development at the American Petroleum Institute where a broad-based indexing system has been used to produce a special publication for a small group of users is significant, as are the experiments with SDI being conducted by *Engineering Index* and the National Aeronautics and Space Administration.

Concentration is on the rapid dissemination of information by current awareness and SDI services. Computer tapes will soon be available from several organizations, following the lead of *Chemical Abstracts*. It seems that as the computer technology improves, dissemination in many different forms will become possible with rapid access to stored data. Developments at the Institution of Electrical Engineers and *Engineering Index* are significant in the area of the physical sciences. In other disciplines, notably chemistry and biology, the same trends are noticeable and will continue as the major professional societies proceed to develop integrated information systems to serve their own disciplines. The secondary publication will form an integral part of such information systems.

References

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