INFORMATION SERVICES AND OPERATIONS OF THE AEROSPACE RESEARCH APPLICATIONS CENTER (ARAC)*

Richard W. Counts

Historical Background of the Aerospace Research Applications Center (ARAC)

In the Space Act of 1958 the Congress required that the National Aeronautics and Space Administration (NASA) should provide for the transfer of the technology generated by government-sponsored space research to benefit the industry of the nation. This requirement gave the nation the opportunity to obtain an additional return from its research and development expenditures. In addition to its responsibilities in the area of space exploration, NASA was thus given the task of pioneering in yet another area, that of technology utilization.

In approaching this problem area of "transfer of technology," the question arises, "What, in fact, constitutes technology?" One obvious representation of the state-of-the-art of NASA technology was the published literature generated from NASA research projects. Much of the information contained in the NASA published literature was certainly of interest from many points of view. The basic problem here, however, was that so much literature was being published as to make it doubtful that anyone would be either able or willing to sort through it all.

As attempts to interact with industry were begun in the early days of the "technology transfer experiment," it became evident that a free information exchange with industry might well be hampered by possible involvement of information considered by individual companies to be highly confidential. It was obvious that before NASA could attempt to help solve a problem in industry, the nature of the

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Richard W. Counts is Manager of Information Systems, Aerospace Research Applications Center, Indiana University, Bloomington, Indiana.

problem would have to be known. Making the nature of the problem known, however, could well involve divulging a company's long-range research plans or some specific competitive advantage which a given organization might be enjoying. NASA was thus faced with the fact that, while many companies were certainly interested in what NASA had to make available, and while NASA was certainly interested in making its technology available, there was little common ground on which to meet. It appeared that no direct dialogue could be effectively established between industry and NASA in areas where confidential information might be involved.

A final and possibly more significant question was that of the worth of NASA information. Granted that space research and the rigorous requirements of blast-off, re-entry and extra-terrestrial travel forced NASA to work at the limit of the state-of-the-art in many areas of technology, this in no way guaranteed that any such efforts would have any applicability whatsoever to the industrial sector of our economy.

Against this background of difficulties, the stage was set for the establishment first of ARAC at Indiana University late in 1962, and later of several other similar centers at other universities throughout the country. The approach employed was to establish university-based centers to act as co-ordinators between NASA's technology base and industrial needs. The universities were also able to function as handlers of companies' highly confidential information. This approach has proved successful in the main, as ARAC and other centers have demonstrated their ability to work closely with industry.

What, Exactly, Can be Done to Transfer Technology?

The attempt to answer this question will provide the opportunity both for an exposition of what ARAC does and also for pointing out the pertinence of its approach to problems which do exist, and probably will become evident in connection with library operations in the near future.

We may focus attention for a moment on the published literature generated by NASA programs. NASA began to organize and index this literature on a large scale in 1962. This effort was and is still carried out by Documentation Incorporated of College Park, Maryland. In the Documentation Incorporated system, all documents are classified under one of the 34 NASA information categories, as is evident in any issue of Scientific and Technical Aerospace Reports. This breakdown by category is obviously rather broad. To make the data base amenable to automated retrieval, each document is further indexed using subject terms from the NASA thesaurus (of some 18,000 terms). A given document is assigned on the average 15 to 20 index terms. The indexing system employed is a form of double posting. Under this system, four or five terms used in indexing each document are very broad in nature and serve to define the content of a given document generally, but yet more explicitly than the 34 previously mentioned information categories. The remaining subject index terms, which are used to characterize the document more completely, are very specific in nature.

Thus, there exists an organized corpus of documents that is reasonably well indexed, from the point of view of machine retrieval. At present, there are roughly 250,000 such documents. The semi-monthly addition rate to this NASA data base tends to be of the order of 2,500 documents and is holding relatively steady. It might be noted also at this point that the NASA data base receives input from many sources. Approximately half of the 2,500 documents are from open literature sources which have pertinence to aerospace research. In addition, Department of Defense as well as Atomic Energy Commission documents pertinent to aerospace research are included. The total, then, represents a major resource which can be applied to the solution of industry's problems, and to the serving of information needs generated by technological development.

The first type of such information needs, historically speaking, is represented by questions on what has been done in the past or what is the present state-of-the-art in a given area of technology. This involves of course, a retrospective search of all information, usually concerning a very specific question, in a given data base. To satisfy such requests, ARAC operates a Retrospective Search Service (RSS) for a data base of a quarter of a million documents.

A second type of information need, which is becoming more important and of greater interest to the technological community than the RSS, is met through the Current Awareness Service (CAS) or Selective Dissemination Service (SDS). The interest in this regard has been brought about by the need of scientists or engineers to keep abreast of their fields in the face of voluminous amounts of new information in any given technology.

The Current Awareness Service

To do justice to the ARAC Current Awareness Service, it is not sufficient to treat only its computer aspects. To appreciate other factors which weigh heavily in determining the success of such a system, it is necessary to examine the total operating system.

Consider, for example, the potential customer. He is typically an engineer. He does not read extensively; he probably does not have time. He is also probably of the opinion that with the volume of information growing so rapidly, the problem of keeping up would be overwhelming, and that by the time he had ferreted out all the information concerning his interest, little time would remain to make use of it. Added to this may be the fact that his company is still showing a good profit from older methods which have been used for years.

With such factors in mind, ARAC set up a staff of some twenty information engineers, who work on a part-time basis, as a link between the user and the computerized data base. These engineers release a user from the frustrations which can occur when one is unaccustomed to the rigors of doing business with a computerized system. In addition, they serve a highly important function in filtering out non-relevant information which may be selected by the computer.

To give a quantitative impression of this problem at ARAC today, only about 42 percent of all the documents identified by the computer are ultimately sent to a user. The remaining 58 percent are evaluated and rejected by an engineer as not relevant to the user's needs and interests. Part of the reason for the rejection of 58 percent of those items selected by the computer stems from the nature of the task which is being attempted. The NASA file, obviously, has a distinct aerospace emphasis. ARAC is attempting, however, to service non-aerospace information needs with an essentially aerospace-oriented file. The 350 users who are currently served by this system are given service of a quality that no other approach, in ARAC's opinion, could provide as effectively at similar cost.

The computerized system of the over-all Current Awareness Service is in actuality composed of three subsystems. These subsystems were by no means defined at the inception of the Current Awareness Service. Their separate existences were brought about by the appearance of distinct problems in the effective handling of the information which is involved in the Current Awareness Service. An analysis of these information-handling problems will serve to introduce these subsystems in detail.

<u>Interest Profile</u>. First to be considered is the Interest Profile, by which I mean the collection of allowed subject index terms and categories which are used as input to the current awareness system. Such a collection of profile elements designates the specific interest of a particular user.

An Interest Profile in the ARAC system can contain up to one hundred subject index terms and eighteen categories. Earlier in ARAC's development a Boolean scheme was used for searching, but this has since been replaced by a weighted term system. In a weighted term system, each subject index term and each category included in the profile are given an importance weight. When a match occurs between a profile index term or category and a document index term or category, the document in question is assigned a weight equal to the weight which was preassigned that term or category in the profile. The document may be identified by the computer as relevant to the profile being processed, provided it accrues a weight greater than a preassigned cutoff value.

The Profile Maintenance Subsystem. As indicated earlier, there are at present approximately 350 computer-served profiles in the system. At any given time, somewhat fewer than 10 percent of these are in the process of modification. In order to keep the file as up to date as possible, it is necessary to have an operating subsystem which handles completely the details of this maintenance.

The Profile Maintenance Subsystem, as this subsystem is called, also handles administrative matters. It maintains control as to which companies are to be served by requiring master identification of a company's ARAC membership before processing any individual profiles to be run. Additions and deletions of single profiles or profiles for entire organizations are similarly handled. With each updating of the master profile file, a complete status report on the file is given. Features of this nature are definitely requisite to any effective control and accounting of an operation of the size of the ARAC SDS system. The cycle of operation for this subsystem is approximately every other day. Operating on this basis the content of the master profile file is current to within forty-eight hours.

The scope of this subsystem is such that the transactions with the file might amount to adding a new member company and its profiles, updating presently existing profiles and deleting existing profiles. The separate operations are indicated to the computer through the medium of punched IBM cards. Upon discovering that a new member company is to be added, the computer system updates its own information concerning the existence of this new member company. It is then able to process information concerning the company, namely current awareness profiles, and add this information to the master file. Had the previous information concerning the existence of a new member company not been available to the computer, the new profile would have been rejected along with reasons for the rejection.

When any information is processed, complete records of all transactions are produced and ultimately reach the hands of the SDS co-ordinator. Should a profile not be accepted (i.e., not added to the master file) complete diagnostics are produced by the computer. With this information concerning a problem in a given profile, the Current Awareness Service co-ordinator can have immediate action taken to resolve any difficulties. Since all information produced by the Profile Maintenance Subsystem must pass through the co-ordinator, this person despatches output from the system to the various internal users. One section will go to accounting, another to master records, and yet another to the ARAC engineer who initiated the transaction.

The point in going into such detail is to make clear the effort made to have as much of the ARAC operations and information flow as possible automatically coordinated in one place and at one time. This type of automated coordination is vitally necessary if an operation of the nature of ARAC is to deliver the kind of service necessary for success.

The Selective Dissemination System. The Profile Maintenance Subsystem provides highly current and accurate information for the subsystem next in sequence, the Selective Dissemination System (SDS). The SDS can assume information which is accurate in content and format. The "Profile File" which is maintained by the Profile Maintenance Subsystem, is one of the inputs to SDS. This is the portion of input which is a representation of the customer's interest.

The other information to be specified is that contained in the documents which are being newly announced. At this point, an analysis of the intended function of the SDS system may be made.

On the one hand, the information contained in the documents should be as accessible to retrieval as possible. This implies that as much information as possible, pertinent to a given document should be included in the document file. Since the presently operating ARAC system is a magnetic tape-oriented system, a large amount of information concerning each document will tend to make the file rather lengthy and expensive to process. To offset this, we made a critical analysis of the data contained in the NASA file, which is supplied to ARAC by Documentation Incorporated. Of the vast amount of information contained in the file, it was decided that, for ARAC's purposes, only subject index terms, accession number, document category, and language of origin information for a given document were necessary. By including only these items in the file, information such as personal author, corporate author, title, etc. is excluded. The decision to exclude this information limits the nature of output which the computer can supply. The method for ultimately delivering information which is useful to human beings will be discussed later.

A residual benefit of establishing this standardized ARAC file format, which requires only a few separate items of information, is that of working with non-NASA data bases. Now, rather than writing a rather complex and expensive computer program to retrieve information from each new data base that one might encounter, all that has to be done is to write a simple and inexpensive program to extract those needed items of information from the new data base and arrange them to conform to the format which the presently existing computer system can understand.

This approach to dealing with additional data bases was the subject of much experimental effort at ARAC about a year ago. The Department of Defense magnetic tape file was reformatted into a file which was compatible with the existing ARAC SDS system, and extensive testing aimed at evaluating the effectiveness of this approach gave positive results. So one might conclude that on this point of system philosophy, namely the standardized file format, there exists additional evidence to support this approach.

The file which is produced is in linear format; that is, on the magnetic tape, information is organized so that an accession number is followed by all the descriptive subject index terms pertinent to that accession number. Another file format is that of the inverted file, which has the information arranged so that a subject index term is followed by all the accession numbers for documents which have been indexed by the term. In many real time, direct access systems the stored information is arranged in both linear and inverted formats to gain the separate advantages which each file offers without suffering the disadvantages. This is possible since one usually finds that a weakness of the linear file is a strength of the inverted file, and vice versa. ARAC has operated under both file formats and can really express no extreme preference for one over the other for the present operation.

The two files, the master profile file and the document information file, are the total input to the SDS subsystem. As mentioned earlier, the nature of the output is limited by this input, in this case to a simple list of accession numbers. However, we may clarify at this point how this list of accession numbers is related to the information sought.

Returning to the information supplied by the Documentation Incorporated file, we may note that the most meaningful elements for identifying a document's content are the title of the document and those indexing terms which have been assigned to it.

Of course, titles are often notoriously poor as indicators of a document's content. The index terms are presumably at least as useful as the title, and to someone versed in the NASA file they are probably more useful. So one might assume that the combination of title plus subject index terms would probably be specific enough for those versed in the information retrieval business. However (and this is the problem) can such information be sent to the average scientist or engineer and receive a sympathetic response? Evidently not. What the user normally wants in order to judge a document's worth is at least an abstract of the document. There is, however, no abstract on the basic NASA file as distributed by Documentation Incorporated. (There are several reasons for the absence of the abstract. The main one is that textual information of this type would tend to make the basic magnetic tape file much too long to be usable.)

At this point, some of the reasoning which indicated the earlier adoption of the restricted information format should become evident. First, the item which was really sought was not to be found on the original magnetic tape file. Secondly, the information which was on the file was not considered adequate, so there was no loss in ignoring it—provided at some later point superior information was obtained.

What is done, and this is the least automated portion of the ARAC SDS operation, is to make a multilith master of each abstract as it appears in Scientific and Technical Aerospace Reports (STAR) or International Aerospace Abstracts (IAA), which is part of the NASA file also, and run off as many copies of each abstract as are needed. The output, namely the accession numbers for each profile, is then used to pull out, by hand, one copy of each abstract required. These abstracts are then forwarded to the ARAC engineer who is coordinating the profile in question. The engineer then further edits these abstracts, based on his personal understanding of the definition of the profile. In this manner, the user is supplied highly relevant material of sufficiently small quantity to receive his proper attention.

This last operation would appear to tie things neatly together; however, one rather important aspect has been ignored. The problem is the effective control, on the part of the ARAC engineer, of the twenty to twenty-five profiles for which he is responsible. Since each profile can contain eighteen categories and up to one hundred descriptor or subject index terms, the possibility of many combinations of terms and categories joining forces to select voluminous amounts of information definitely exists. This problem, in fact, did become so pressing that it became necessary to develop the "Profile Analysis Subsystem" to cope with it.

The Profile Analysis Subsystem. The purpose of this subsystem is to give the engineer, at a glance, an indication of the performance of subject index terms and categories contained in a given profile. This subsystem was also developed to reduce the amount of paper passed through the over-all Current Awareness System.

The analysis of a profile is a fairly straightforward process. In the first place, a profile consists of (1) a set of subject index terms to which have been assigned, *a priori*, importance weights, and (2) a set of analogously weighted categories. It is on the adequacy of these elements that the effectiveness of the profile depends. The problems which can occur with a profile stem either from a poor assignment of importance weights to subject index terms or categories, or from the lack of inclusion of the proper subject index terms or categories in the profile. The profile analysis subsystem is directed toward exposing such defects.

After the engineer has evaluated the output of the SDS system, he submits this information, in the form of lists of relevant and non-relevant document accession numbers, along with the current awareness profile which produced the output under discussion to the profile analysis computer program. The information which is produced by this program is capable of indicating the existence of the previously described profile defects.

This program gives the engineer the subject index terms (with their respective frequencies of occurrence) that were used by the indexer in preparing the documents for computerized retrieval, in both the relevant and non-relevant lists. The program also provides a distribution by categories of the relevant and non-relevant documents. Finally, and most importantly, the engineer is informed of the frequency of occurrence of each term in his profile in both the relevant and non-relevant sets of documents. With this collection of information, the engineer can adjust the importance weights which he has assigned to the categories and index terms. He can also add or delete index terms or categories as indicated.

Many of the problems encountered in developing the separate subsystems have suggested new directions for research. This is especially true in the area of profile analysis.

With the amount of information provided and the numerical specificity of the information, the engineer's task in making an already analyzed profile effective is almost routine. He either includes or deletes subject index terms or categories depending on the frequencies of occurrence supplied to him. He adjusts the importance weights assigned to these elements according to the relative frequencies or occurrence of the given index term or category in the relevant and non-relevant lists. It should be possible to achieve some set of decision rules or algorithms which could automatically perform the above-mentioned tasks at the time the profile is analyzed. This in turn might make it possible for a great portion of the current awareness service to function with only a minimum of human intervention.

With such a goal in mind, ARAC, under a separate contract to NASA, is carrying on a research program along these lines. Four different decision rules are to be tested. Presently existing profiles, which will be chosen as representative of the thirty-four categories into which NASA divides scientific information, will be used as the test vehicle. The effectiveness of the pre-selected sets of decision rules will be compared on a continuing basis for some extensive period of time against the effectiveness of an ARAC engineer in maintaining a given profile.

Perhaps we may digress for a moment on the importance of including, in this experiment, profiles from all the existing NASA information categories. In a study* which was done several years ago using the NASA data base in conjunction with ARAC, it was found that all areas of information did not behave identically when subjected to attempts to improve the relevance of current awareness profiles. The problem may be explained by the following example.

First, assume that there exists a corpus of documents about which a person is completely knowledgeable. That is, the exact number of documents related to physics, chemistry, metallurgy, etc. is known. Given this, it is possible to know whether or not a profile which has been written to select information from any one given area is selecting all the available information. The ratio of the number of documents in a given area selected by the computer to the total number of documents in a given information area which exist in the corpus of documents is called the "Recall." If the profile under discussion selected all the pertinent or relevant documents in the file, we would say that the "Recall" was 100 percent. The "Relevancy Ratio" of a profile is the ratio of the number of relevant documents selected to the total number of documents selected by the profile. If all the documents selected by a given profile were truly relevant, the "Relevancy" would be 100 percent.

Keeping these definitions in mind, let us imagine there exist two profiles; one in neutronics (or neutron related technology) and one in physiology. Suppose next that some technique such as profile analysis is applied to each of these profiles. The effect found in such instances indicates that while it may be possible to improve the relevancy of the neutronics profile without altering its recall, it might well not be possible to improve the relevancy of the physiology profile by even 10 percent without destroying its recall completely. This is what is meant by "non-identical behavior of information areas."

Given the possibility of this type of difficulty, care will have to be exercised in the research program previously described. It may well be that no single rule will be dependable; some highly elaborate set of decision rules may provide the only workable solution.

Yet another area of endeavor is the creation of a current awareness profile from a written description of a user's interest. Whereas the information and tools for an experiment in automated profile maintenance are immediately available, those required for original profile creation are not. One item which would be needed is a master file relating scientific and technical vocabulary of the English language to all synonymous or even remotely synonymous terms in the closed thesaurus which is being used to index the data set. It would also be

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*Sprague, Ralph H., Jr. A Comparison of Systems for Selectively Disseminating Information (Indiana Business Report No. 38). [Bloomington, Ind.], Indiana University, Bureau of Business Research, 1965.

necessary to specify the degree of synonymity of terms. Upon the completion of the present research project, this may well be the next area of inquiry.

The Retrospective Search System

When an organization is contemplating entering into a new product area, it wants to know as much as is available about the technology of a given product. Likewise, when a project has come to a stumbling block in the path of development, an organization needs to know as much as possible about what has been done in relation to the given problems. As previously indicated, problems of this nature are handled at ARAC by the Retrospective Search Service (RSS).

Typically, a user from a member company may either write or telephone in an RSS request. There is an RSS coordinator whose function is to analyze the question being asked and to assign the specific search to an ARAC engineer professionally qualified in the technological area in which the search seems to belong. Upon being assigned the search, the ARAC engineer contacts the person who submitted the request and discusses the search until the problem is clearly defined. Once the problem is clearly defined, the ARAC engineer devises a suitable search strategy. In certain cases in which the problem area has proven troublesome on previous occasions, the engineer may simultaneously attempt several search strategies.

The present computerized system which serves the Retrospective Search Service is distinguished only by the fact that it does seem to function effectively. The weighted term approach which was described in conjunction with the ARAC Current Awareness Service is also used in the RSS.

However, an experiment which was conducted by the Bunker-Ramo Corporation under contract to NASA, and in which ARAC participated, should be of interest in the area of library operations. The experiment consisted of testing a real-time, remote access retrieval system. The computer handling the retrieval task was located in New York City. It was a very modest piece of equipment, a Univac 1050. Remotely coupled to this computer, by means of microwave transmission towers, were several other small, special-purpose, process control computers. Connected to the latter computers were two communication stations through which information could be passed to the special-purpose computer and from there to the computer in New York. The results of the search were displayed on a cathode ray tube.

As mentioned earlier, both linear and inverted file formats may be used in such systems. For purposes of actual searching, an inverted file format was employed, with entries provided by subject index term, by author, by corporate source, and by contract number for each document in the NASA data base. Inverted files, when used in conjunction with Boolean search logics, can provide quite rapid search systems. However, to provide certain other types of output, such as a list of the descriptors used to index a given document, it is usually necessary to have a linear file format if real-time response is to be given. During this experiment, response time was of the order of 30 seconds to one minute. The results which were being supplied so rapidly also agreed accurately with the searches that had been run under the ARAC system.

In the description of this system, we noted that the computer which accomplished this task was very modest. Most university libraries could probably afford such equipment. Consider for a moment the type of operation which could be established if this type of system concept were established. Stored on mass storage devices at the central library would be indices by author, by Library of Congress number, and the like. Situated in convenient locations throughout the campus would be remote communication consoles. A user could easily query the computer at the central library concerning the status of a book or periodical. The computer could respond with the availability data. If the book or periodical were not checked out, the computer could instruct the librarian to reserve the book for the user. Were the book or periodical checked out, the computer could inform the user as to when the book was due back or who presently was in possession. Should the book be already overdue, the computer could alert the librarian to request the return of the item and reserve it in the name of the user. Such a system is certainly within the realm of present retrieval methods and computer hardware. The previously described real-time experiment would seem to indicate the existence of all the necessary know-how.

What is NASA Technology Worth to Industry?

Much attention has here been devoted to the subject of identifying technology and devising means for transferring it. However, the outstanding question among the people involved in the technology transfer business is whether or not the type of advanced technology which NASA has developed will find adequate application in industry. Without this, it would certainly be impractical to expend vast sums of tax dollars on the effort to disseminate this technology. NASA has therefore devised an approach to the problem which should answer this question clearly.

The possibility always existed that as long as some government agency was carrying the cost of disseminating information, industry would continue to express an interest in the information, although it might be used for little more than browsing. The attitude on the part of industry might well be that since the information was essentially free, there was no reason not to take part in the dissemination efforts. A true test, then, would be whether or not industry would be willing to pay for these services. Of course, such a test would be a harsh method of gauging interest and need, but it is also true that industry will not support an idea unless it pays off in net profits at some point. The information dissemination idea was by no means tested when ARAC was established. ARAC was, indeed, established to test this idea. It was obvious that in the early stages of ARAC's operation, some NASA subsidy would have to be supplied to permit ARAC to establish its information services and iron out their operations. With this in mind ARAC was given five years to become self-supporting.

Stated quite simply, the above approach represented NASA's point of view. Let us look at things from ARAC's point of view. First of all, any businessman knows that the best products or the best services in the world are not going to be a financial success if the business responsible for them incurs costs in producing the product or service which exceed its revenues. So, in addition to devising and supplying meaningful information services, ARAC must do so for a price that will convince national industry that it is getting a bargain and still cover costs.

This aspect of the ARAC operation should prove of interest to the library community also. What, exactly, are the costs of information services? How does one actually find these costs and keep control of them? Toward this goal, ARAC was forced to establish an elaborate cost accounting system. (To keep control of the costs, once they had been identified, it was necessary to automate this cost accounting system.) A new fee schedule based on this system appears to offer ARAC the opportunity to cover costs and yet make its price for services to industry attractive.

This is the fifth and final year of NASA subsidy for ARAC dissemination efforts. In this year the new fee schedule just mentioned is being presented to ARAC member companies. Future survival and success of ARAC could depend very heavily on two factors. First, are ARAC services worth what they are going to cost? Second, is the cost accounting system devised representative of ARAC costs? Time will provide the answer to these questions.

How does this Affect Libraries?

I have emphasized the cost aspect of the ARAC operation because considerations of this nature could profitably be applied to library operations.

Libraries presently offer a group of services. These services will undoubtedly be expanded in view of new ideas. The problem is that there probably cannot be any significant expansion of funds available for the operation of these services. In effect, then, a group of services will be competing for funds. Which services will be most profitably—in a very broad sense—emphasized and to what extent? In the past it has been possible to make fairly accurate judgements based on intuition and operational information available to a single individual or group of individuals. In the future, intuition can at best be only a vague indicator, and operational information will have to be more clearly identified and refined for any individual or group of individuals to make successful decisions.

The Situation in Review

In an effort to execute a responsibility assigned to NASA by the Space Act of 1958, a number of organizations were established to attempt a transfer of NASA technology. ARAC was the first of such organizations.

In order to accomplish this transfer of technology, it was first necessary to identify the relevant technology and then figure out ways to transfer it. To aid in this transfer, ARAC established a group of services, two of which have been described in detail in this exposition of ARAC services.

A final note may serve concerning several other ARAC services which have not been discussed because they have little direct bearing on libraries. They include the Computer Information Service, which distributes computer program and computer related information, the Industrial Applications Service, and the Marketing Information Service. Such services are primarily aimed at industry, although with the rapid proliferation of computers, libraries in the future may indeed deal in computer programs as well as books.

In any event, ARAC is attempting to test the existence of a market for such information services as have been described. All indications are that a market for such information services as have been described does exist. However, the only true test will be the continued operation of ARAC-like services in coming years.