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A User's Evaluation of a NASA Regional Dissemination Center

**A USER'S EVALUATION OF A
NASA REGIONAL DISSEMINATION CENTER**

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Office of Technology Utilization
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SUMMARY

Retrospective searches provided by a NASA Regional Dissemination Center (RDC) were found to be of substantial value to researchers during a six-month experimental period at the University of Denver's Research Institute (DRI). The purpose of the experiment was to gain a better understanding of the usefulness of an RDC to a user organization.

Denver Research Institute subscribed to the services of the University of New Mexico's Technology Application Center (TAC), a computer-based NASA RDC established to facilitate the transfer of technology. The entire process was closely monitored and evaluated by staff members in the Industrial Economics Division of DRI.

Within DRI, professional staff members in six divisions¹ received 15 retrospective searches. Three additional staff members received TAC's selective dissemination service. Retrospective searches were requested in connection with pre-proposal review of the literature, proposal preparation, and project work. Additional special uses included article preparation, identification of knowledgeable individuals in a field, a professorial check on a dissertation bibliography, and maintenance of an awareness in a scientific field.

The major advantages perceived by participants during the experimental period were:

- An increased level of confidence in a previously conducted manual search.
- Uncovered new information.
- Saved researchers' time valued at \$1,721 in direct costs.
- Identified a void in past research and thus uncovered a potential research opportunity.
- Faster response compared to conventional search methods.

The major negative aspects of TAC's retrospective search service were:

- Communications difficulties between DRI staff members and TAC personnel.
- Lack of access to classified literature.
- Lack of timeliness in the data base.
- Loss of a learning experience typically associated with a manual search.
- Omission of key articles.

¹ The six divisions were: Chemistry, Electronics, Industrial Economics, Mechanics, Metallurgy, and Physics.

The authors' major conclusions, after monitoring the experiment and analyzing the evaluation of individual participants, were:

- The NASA data base is not adequate for the purposes of most DRI needs. Therefore, the augmentation service offered by TAC is a valuable part of the total service.
- The services of TAC are not a total answer for individual researchers. A TAC retrospective search usually increased the confidence of a researcher in his own efforts, but in no case was it completely sufficient in itself.
- The usefulness of a TAC retrospective search is related to the researcher's level of sophistication in a particular field. If a researcher is moving into a new but related field of endeavor, the search is more likely to be viewed as valuable than in his primary field.
- The possible loss of a learning experience because of not manually searching the literature may be offset by the experience gained in dealing with a computerized information storage and retrieval system, and by the necessity for more carefully defining search strategy and objectives.
- The lack of access to classified information, although mentioned by some participants, does not appear to be a serious problem. Individuals engaged in classified research projects usually have other resources at their disposal.
- In comparing retrospective versus current awareness searches, there was little demand for current awareness service, and those who did participate generally were disappointed in the results. This is contrary to the experience of some other RDC's.
- An internal champion in the user organization appears to be an essential element for achieving customer utilization and satisfaction. The service does not sell itself.

It was recommended to DRI management by the authors that DRI subscribe to the services of TAC. Based on this experiment, the expected benefits from DRI's subscription should exceed the cost.

It was recommended to TAC, in dealing with a customer like DRI, that:

- TAC be careful not to build customer expectations above a reasonable level.
- TAC continue to augment searches and do a better job of explaining how the augmentation is accomplished.
- TAC more formally establish communications with some participants to avoid any misunderstanding over the purpose of a specific search.

INTRODUCTION

Late in 1967, NASA contracted with the University of Denver's Research Institute (DRI) to develop the Project for the Analysis of Technology Transfer (PATT).² This report covers one aspect of technology transfer, the use of services provided by a Regional Dissemination Center (RDC).

Background

The primary purpose of this research project was to gain a better understanding of the usefulness of a NASA-sponsored RDC to a user organization. The user, in this experiment, was DRI. The RDC selected for the experiment was the University of New Mexico's Technology Application Center (TAC).

The first RDC was established in 1960 as an experimental mechanism to make scientific and technical information available to business firms, academic institutions, and other organizations. Each RDC is supplied by NASA with the information collected by the Scientific and Technical Information Division of NASA. This information consists of references to documents in the NASA data base stored on magnetic tapes and microfiche copies of reports on the science and technology of space and aeronautics. At the present time there are six RDC's. The names, organizational affiliations, locations, and other selected information on these and two former RDC's are summarized in Table 1.

NASA's fiscal year 1969 support of its six RDC's was \$1,355,000. Aerospace Research Application Center (ARAC) at Indiana University, and the Knowledge Availability Systems Center, University of Pittsburgh, have developed substantial local support, and their dependency on NASA funds is decreasing. However, the other four RDC's have not achieved substantial non-NASA support. NASA financial support of two additional RDC's, Project ASTRA (Midwest Research Institute) and the Center for Application of Sciences and Technology (Wayne State University), was concluded in 1968.³

The University of Denver's Research Institute (DRI) was selected, for several reasons, as the customer for this research project. The most important consideration was the ease of monitoring the experiment. A second consideration was the lack of proprietary interests in most of DRI's sponsored research, thus freeing researchers to more openly discuss their use of the TAC material. Third was the support of the DRI administration. Finally, it was possible to reimburse individuals through project charges for extra time involved in evaluating the information received from TAC. (Although DRI staff members were advised of this possibility, none took advantage of the opportunity to charge time to this project.)

² Information on PATT is available in: Theodore D. Browne, *et al.*, *Project for the Analysis of Technology Transfer-The Initial Year* (Denver, Colorado: University of Denver's Research Institute, 1968).

³ The administration of Wayne State University has decided to continue operation of the Center for Application of Sciences and Technology even though NASA financial backing is no longer available.

TABLE 1. NASA REGIONAL DISSEMINATION CENTERS

Name	Parent Organization	Location	Began Full Operation	Services
Aerospace Research Applications Center (ARAC)	Indiana University	Bloomington, Indiana	September 1963	Retrospective searching; current awareness; industrial applications reports; engineering information service; abstracts and documents.
Center for Application of Sciences & Technology (CAST)	Wayne State University	Detroit, Michigan	July 1964	NASA support discontinued, 1968.
Knowledge Availability Systems Center (KASC)	University of Pittsburgh	Pittsburgh, Pennsylvania	September 1964	Retrospective searching; current awareness; abstracts and documents.
New England Research Application Center (NERAC)	University of Connecticut	Storrs, Connecticut	July 1967	Retrospective searching; current awareness; abstracts and documents.
North Carolina Science & Technology Research Center	Research Triangle Institute	Research Triangle Park, North Carolina	November 1964	Retrospective searching; current awareness; abstracts and documents; wholesale search services.
Project ASTRA	Midwest Research Institute	Kansas City, Missouri	May 1962	Discontinued February 28, 1968.
Technology Application Center (TAC)	University of New Mexico	Albuquerque, New Mexico	March 1966	Retrospective searching; current awareness; natural resources; industrial applications reports; abstracts and documents.
Western Research Application Center (WESRAC)	University of Southern California	Los Angeles, California	April 1967	Retrospective searching; current awareness; abstracts and documents.

Source: National Aeronautics and Space Administration, "Regional Dissemination Centers," January 1, 1969 (Unpublished).

Methodology

The Technology Application Center contracted with the University of Denver's Research Institute to supply retrospective searches at \$125 each and selective dissemination reports over a six-month period at \$150 each (the twelve-month rate for each selective dissemination profile is normally \$250).

In May 1968, a TAC representative visited DRI to explain TAC services to the DRI Director, others in the Director's Office, and to several DRI Division Heads. All other Division Heads were personally contacted by the authors for the purposes of explaining TAC's services and soliciting suggestions for participants. About the same time, a meeting was held with the Library Committee of the University of Denver, where a number of DRI Divisions were represented, and the TAC experiment was again explained.

Following the initial round of meetings, thirty DRI staff members were offered the opportunity to participate in the experiment. Ten of these were able to respond, and a total of eight retrospective searches and three selective dissemination services resulted.

In October, all other professional staff members were offered the opportunity to participate in the experiment. Seven individuals asked for assistance, and the result was seven additional retrospective searches.

To participate in the experiment, several steps were required. First, the authors met with each individual or research team requesting the search to ascertain whether or not TAC could help. The next step was usually a telephone call to TAC (monitored by the authors) or face-to-face conversation with a TAC representative to describe the research problem. The participants were also asked to complete a detailed questionnaire pertaining to their established information acquisition patterns.⁴ After receiving the results of the TAC retrospective search or selective dissemination, participants were asked to evaluate the abstracts received and to participate in an interview with the authors. Finally, participants reviewed write-ups of their experience, and most met for an evaluation seminar where the results of the experiment were presented and discussed.

Limitations

The main limitation of this experiment was that DRI participants did not pay for either retrospective searches or selective dissemination reports. The costs of the searches were borne by PATT. Under normal circumstances, the costs of TAC services would be a legitimate charge to the projects of participating staff members.

Another possible limitation was that the authors did a considerable amount of promoting of TAC services within DRI, and the response may have been somewhat greater than would normally have been the case.

⁴ The questionnaire was the same one used in the DRI report, *Channels of Technology Acquisition in Commercial Firms, and the NASA Dissemination Program*, NASA CR-790, June 1967. A copy of the questionnaire is reproduced on pp. 125-133 of that report.

Denver Research Institute may not be a "typical" RDC customer. TAC officials were of the opinion that DRI was fairly typical of their more sophisticated customers and of customers that have a research rather than a problem-solving orientation. The types of requests received from DRI were not significantly different, according to TAC, from those received from industrial clients.

Another possible limitation to the experiment was that TAC may have given DRI preferential treatment as a customer. For example, it is possible that TAC might have been more responsive to the need for returning retrospective searches within a two-week period, or may have manually augmented the computer searches to a greater extent than normal. TAC officials claim to have made a conscious effort to avoid preferential treatment of DRI and to consider DRI as a normal customer. As a check, the authors contacted two other TAC customers in the Denver area and could find no evidence of special TAC treatment of DRI.

Acknowledgments

Within the University of Denver's Research Institute, we are especially grateful for the continuing interest and support of the TAC/DRI experiment coming from S. A. Johnson, Jr., Director; James Blackledge, Associate Director; and Robert Venuti, Assistant Director for Operations. We also appreciate the support of all DRI Division Heads in encouraging staff members to participate in the experiment, and, of course, we are most grateful for the patience of the nineteen DRI staff members who participated in the experiment.

William Shinnick, Walter Long, and Thomas Lyons, Technology Application Center, University of New Mexico, were especially helpful in the performance of this research.

SECTION I. DESCRIPTION OF THE TECHNOLOGY APPLICATION CENTER (TAC)

TAC came into existence as a Regional Dissemination Center (RDC) on March 1, 1965, under a contract between the University of New Mexico and the National Aeronautics and Space Administration (NASA). At that time TAC was designated as a division of the Bureau of Business Research.

The "Statement of Work" in the NASA contract said:

The contractor shall use its best efforts, working with various facilities, centers and departments of the University of New Mexico and enlisting the support and cooperation of regional planning and development activities, to develop a system for the dissemination and transfer of NASA-generated technological information to industry.

In 1969, TAC was a part of the newly created Institute for Social Research and Development of the University of New Mexico. The director of TAC reported to the Institute's director (see Figure 1). Organizationally, TAC had two programs, the Industrial Program and the Natural Resources Program.

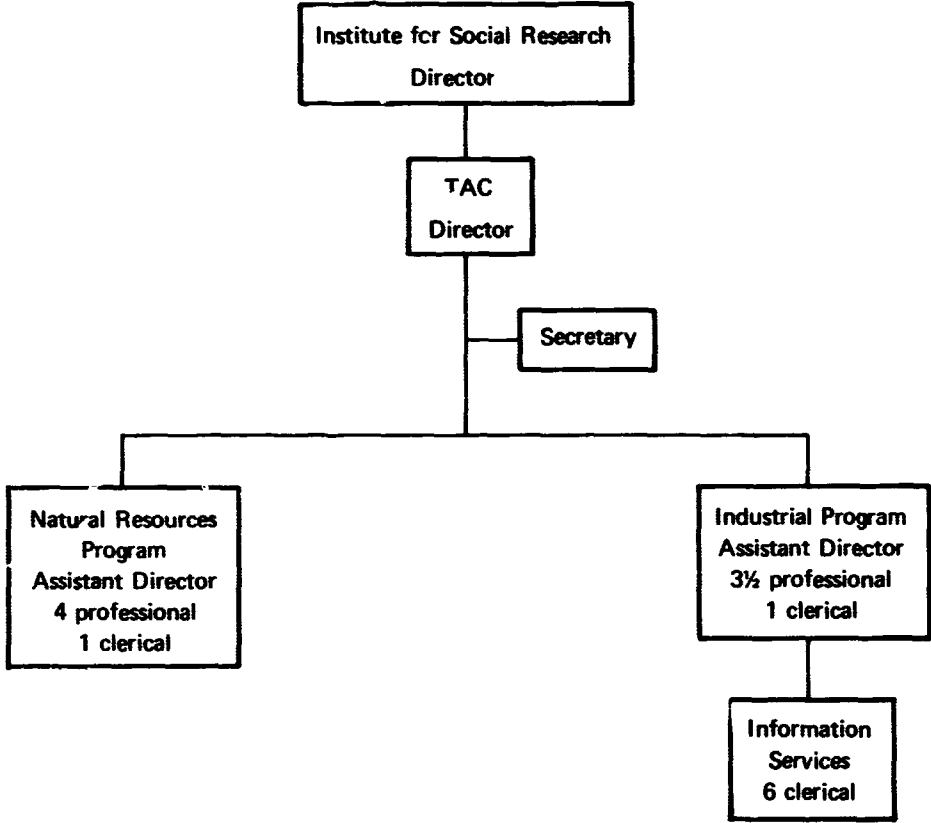
The Natural Resources Program disseminated information directed to the disciplines involved in the study, evaluation, and exploitation of the earth's resources. Established in recognition of the natural resources existing in the Rocky Mountain region, this program has been TAC's area of specialization. The major categories of information available through this program included: remote sensing and imagery, geology, geochemistry, geophysics, oceanography, engineering, and pollution. In December 1968, the Natural Resources Program had 10 companies with annual memberships. The typical customer was involved in an extractive industry or in research.

TAC's primary service area included New Mexico, Arizona, Utah, Colorado, and Texas. This is a difficult service area for an RDC to become self-sufficient in because there is no major concentration of industry.

TAC's Data Base

The TAC data base consisted primarily of the computer tapes (supplied by NASA) of *Scientific and Technical Aerospace Reports (STAR)* and *International Aerospace Abstracts (IAA)*. There were approximately 700,000 references on tape to reports and the open literature back to 1962. This base is growing at the rate of approximately 6,000 documents a month. STAR covers the worldwide unclassified report literature on the science and technology of space and aeronautics. Scientific and technical reports of NASA and its contractors, government agencies, universities, and research organizations throughout the world are abstracted and indexed in STAR. It is issued twice a month on the 1st and the

Figure 1. TAC Organization Chart – January 1969



15th. The American Institute of Aeronautics and Astronautics in cooperation with NASA publishes IAA on the alternate weeks. IAA abstracts and indexes the worldwide published literature on the science and technology of space and aeronautics. Approximately 1,200 periodicals are reviewed as well as books, meeting papers and conference proceedings issued by professional societies and academic organizations, and translations of journals and journal articles. Figure 2 shows the origin of items announced in STAR and IAA. The NASA Scientific and Information Facility in College Park, Maryland, maintains this data base and assembles it into an information bank that is machine searchable. TAC has in-house microfiche copy of all the documents indexed in STAR.

TAC also has access to the unclassified computer tapes of the Defense Documentation Center, *Engineering Index*, and *Index Medicus* (MEDLAR). In addition, TAC has in-house the *U. S. Government Research and Development Reports*, *Nuclear Science Abstracts* back to 1951 and an index back to 1947, *Geophysical Abstracts*, *Abstracts of North American Geology*, and some frequently used periodicals. When necessary, TAC has the resources of the University of New Mexico Zimmerman Science and Engineering Library available and will go to outside information sources such as the Science Information Exchange (SIE), special cooperative exchange programs with several information centers, and the National Referral Center for Science and Technology.

Services offered by TAC

Services currently offered by TAC include the Retrospective Search Service, Selective Dissemination Service, Standard Interest Profiles, Industrial Application Reports, Technical Interest Profiles, and TAC Action Reports.

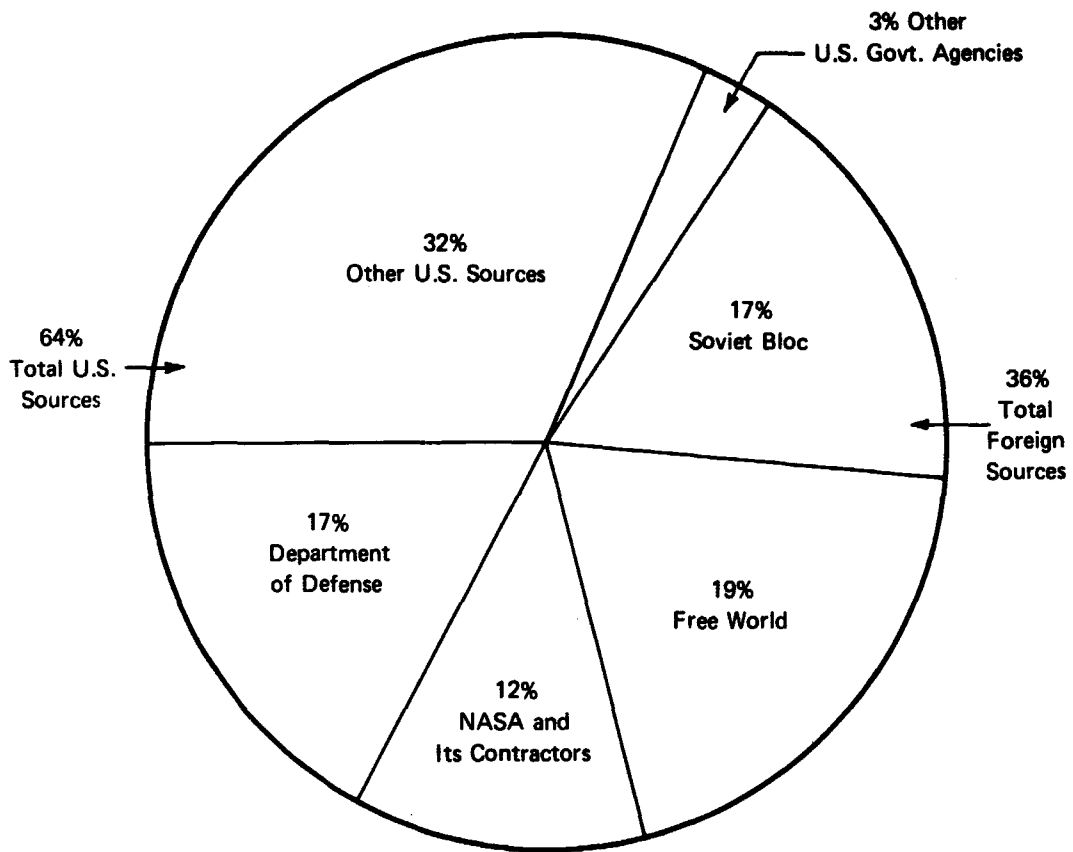
The Retrospective Search Service (RSS) is a computerized search of the NASA data base. TAC staff members design a search strategy after discussions with the client. The NASA tapes are then searched. The computer output is reviewed by a TAC staff member for applicability, and relevant abstracts are sent to the client. If the computer output is not sufficient in the opinion of the TAC staff member, the search is augmented manually until the output meets the client's perceived needs. In the July 1968-December 1968 period, 28 computer searches, 38 manual searches, and 15 computer/manual searches had been run.⁵

The Selective Dissemination, or current awareness, service provides semi-monthly reports to a member firm on the new additions to the NASA data base in his area of interest. A TAC staff member develops an "interest profile" on the client, develops a search strategy, and searches the updated NASA tapes. The computer output is reviewed for applicability as in the RSS, and relevant abstracts are packaged and sent to the client. The purpose of this service is to provide a current awareness service in a particular field. There is no manual augmentation of the selective dissemination service. In the July 1968-December 1968 period, TAC mailed 164 selective dissemination reports.⁶

⁵ William A. Shinnick, *Quarterly Status Report: July-September 1968, October-December 1968* (Albuquerque, New Mexico: Technology Application Center, The University of New Mexico, 1969), p. 3.

⁶ *Ibid.*

Figure 2. Origin of Items Announced in STAR and IAA



Source: University of Southern California, Western Research Application Center, *WESRAC Client Manual* (Los Angeles, [1968]), p. 17.

Other TAC services are:

Standard Interest Profiles are similar to the Selective Dissemination Service except that they are interest profiles which have been standardized by TAC and other RDC's.

Industrial Application Reports are a continuing series of technical abstracts distributed selectively to TAC clients on the basis of their interest profiles. They are a summary of new developments, ideas, and processes which become known to TAC engineers through their review of documents.

Technical Interest Profiles are standard information packages developed by TAC for their customers. They differ from *Standard Interest Profiles* in that the output consists of report citations (report title, author's name, report number, name of journal, name of company, and date of report), a brief notation of content, and the key words or terms which describe the content.

TAC Action Reports are similar to an *Industrial Application Report* but are issued by the Natural Resources Program on a twice monthly basis.

Natural Resources Program special services include retrospective searches in the areas of Remote Sensing and Geothermal Phenomena, dissemination of earthlooking spacecraft photography from the Gemini and Apollo missions (the photographs have been catalogued by TAC staff), and a referral service in the natural resource area.

TAC's Method of Operation

TAC receives a request for a search from a client by some form of communication between the client and a TAC staff member. This may be by mail, telephone, or face-to-face. According to TAC officials, the policy is to use whatever form of communication is most convenient to respond to a client's request.

Once the search request is received, it is translated into subject words by a TAC engineer who uses the *NASA Thesaurus*.⁷ At this point, a senior engineer evaluates the request to see how well the NASA data base can satisfy it. He does this by looking through the *Thesaurus Posting Statistics* and the *Subject Authority List*⁸ to see how many documents the NASA data base will yield using the key words and terms taken from the *Thesaurus*.

If it is found that the NASA data base will not yield sufficient information to be responsive to a client's need, a decision is made to either augment the base through a manual

⁷ The *NASA Thesaurus* is an alphabetical listing of terms by which documents in the NASA data base are indexed.

⁸ These publications show how many documents have been indexed under a particular term.

search or to refuse the search. According to TAC officials, there is no formal policy on augmentation. Generally, searches which must be augmented are accepted if they are from good clients, if there is a time urgency, or if TAC feels it can gain a new customer.

When a decision is made to augment a search before the computer run, the customer is informed of the action and given an idea of the sources to be used. Sometimes a search is augmented after the TAC staff sees the computer output.

The search strategy is formulated by a TAC engineer. If the engineer is not the TAC staff member who had the original contact with the client, he will maintain close contact with his colleague. Retrospective searches are then called in to the North Carolina Science and Technology Research Center (another RDC) for computer processing. Selective dissemination searches are run on the University of New Mexico's IBM 360/40.

The computer output, which simply consists of an abstract number, is then given to the engineer who prepared the search strategy. The abstract cards are pulled, reviewed, and judged for relevance. Abstracts with low relevance or which duplicate others are rejected. The remaining abstracts, along with article reprints and other materials resulting from augmentation, are packaged, a cover letter is written, and the search mailed to the client along with an evaluation form and a document request form.

TAC Staff

In December 1968, TAC employed 16 people, 8.5 full-time equivalents of whom were professional. Three of the professional staff members were part-time employees. The skill levels represented by the professional staff included geology, geophysics, meteorology, electrical engineering, mechanical engineering, nuclear engineering, and hydraulic engineering.

TAC Finances

For fiscal year 1969, TAC had a total budget of approximately \$225,000. NASA provided approximately \$145,000 of this amount. The difference was made up by income from user fees and by the University of New Mexico.

Membership fees in TAC range from \$500 to \$5000 per year⁹ depending on the set of services desired by the company. Starter packages are available for \$500. As of December 1968, TAC had 27 clients plus five ad hoc (pay-as-you-go) customers.

The cost of TAC services was:

Retrospective Search	\$125
Selective Dissemination (for one year)	250

⁹ The membership fee is a drawing account for TAC's services. There is no charge for being a member.

Standard Interest Profile (for one year)	\$125
Industrial Application Report (for one year)	75
Technical Interest Profile (for one year)	65
Back Search (for one year)	45
TAC Action Report (for one year)	Free to Natural Resources Members
AEC/NASA Tech Briefs (for one year)	45

SECTION II. THE CUSTOMER – DENVER RESEARCH INSTITUTE (DRI)

Denver Research Institute, an integral part of the University of Denver, is engaged in sponsored research for government and industry. Established in 1947 to broaden the research activities of the University of Denver, the Institute has conducted over 1,250 different research investigations totaling more than \$56 million. Present operations are at an annual volume of \$6.5 million performed by approximately 480 scientists, engineers, and supporting personnel.

The Institute is organized into seven divisions representing a number of scientific and engineering disciplines. These divisions are Chemical, Electronics, Industrial Economics, Mathematical Sciences, Mechanical Science and Environmental Engineering, Metallurgy, and Physics. Within DRI, 19 individuals participated in the RDC customer evaluation experiment by receiving either retrospective searches or selective dissemination services.¹⁰ The organizational affiliation of each individual, the type of service received, and a descriptive title of the search is indicated in Table 2. Table 3 presents additional information on individuals participating in the experiment.

The majority of participants (10) requested a TAC retrospective search to survey a potential scientific or technical area for a possible proposal, to assist in preparing a proposal, or in the precontract stage in anticipation of beginning a project. Five participants requested a search at the time they were performing a project. Other reasons given for requesting a search included article preparation, a professorial check on a dissertation, identification of knowledgeable individuals, and to maintain awareness in a field of interest. For those receiving retrospective searches, Table 4 shows the participation in the experiment by purpose of search.

Selective Characteristics of DRI Participants

At the time a search was requested, each DRI participant was asked to complete a detailed questionnaire. This questionnaire was originally used in the data gathering effort for a study on the channels of technology acquisition conducted by DRI in 1966. The DRI participants' questionnaires were compared with about 100 research-oriented respondents of the earlier study.

Respondents were asked to rank the three most important internal channels of technological information. The results of this comparison showed that DRI participants felt that personal or in-house library facilities and library personnel were most important; personal knowledge, experience, or experimentation was a very close second; and other personnel and organizations, colleagues, etc., ranked third. These results were identical to the results in the 1966 DRI experiment.

¹⁰ Brief case studies on each individual research team participating in the experiment were prepared but have not been included in this report. These cases are available upon request.

TABLE 2. PARTICIPANTS IN DRI-TAC EXPERIMENT

DRI Division	Participant	Title of Search
		Retrospective Searches
Chemistry	John A. Krimmel	Organic Spiro Polymers
Electronics	Donald R. Dubbert	Infrasonics
	John R. Meyer Ross W. Buchanan	Analysis Techniques for Ultrasonic Test Signals
Industrial Economics	John J. Schanz	Oil Shale Economics Economics of Air Pollution and Control
Mechanics	Robert M. Blunt	Factors Affecting Reactivity of Sodium Nitrate or Metallic Magnesium
	Eugene Grubin Chester R. Hoggatt	Aircraft High Input Loading
	Ronald J. Hensen	Cost Effectiveness of Weather Modification and Run-off Management
	James P. Kottenstette Ralph Williams	Particle Combustion
Metallurgy	William H. Snyder	Ammonium Nitrate-Fuel Oil Explosives
	William C. Hagel	Chemistry and Physics of Lunar Surface Materials
Physics	Robert C. Amme	Electron Excitation Cross Sections or Excitation Probabilities During Atomic Collisions
	Boyd D. Barker	Fourier Transform in Infrared Spectroscopy
	Karl A. Brunstein	Cosmic Rays/Flying Ionization Chambers
	David G. Murcay	Solar Spectrum as Modified by the Earth's Atmosphere
Selective Dissemination		
Chemistry	John A. Krimmel	Thermostability of Fluids
Electronics	Maynard L. Moe	Computerized Design and Simulation
Mechanics	James P. Kottenstette	Human Factors (a Standard Interest Profile)

**TABLE 3. PARTICIPATION IN CUSTOMER EVALUATION EXPERIMENT
BY DRI DIVISION**

DRI Division	Retrospective Search	Current Awareness
Chemistry	1	1
Electronics	2	1
Industrial Economics	2	—
Mathematical Sciences	—	—
Mechanics	5	1
Metallurgy	1	—
Physics	<u>4</u>	<u>—</u>
TOTAL	15	3

**TABLE 4. PARTICIPATION IN CUSTOMER EVALUATION EXPERIMENT
BY PURPOSE OF SEARCH**

Purpose of Search	Number of Retrospective Searches
Pre-proposal	5
Proposal preparation	5
Precontract	3
Project in process	2
Article preparation	1
Identification of knowledgeable individuals	1
Check on dissertation	1
Maintain awareness	<u>1</u>
TOTAL	19*

* Total is larger than the number of retrospective searches because of more than one purpose for some searches.

DRI participants were asked to rank the five most important external channels of technological information for awareness and for problem solving. These results are shown in Table 5. The most notable difference between DRI participants and research-oriented personnel in the 1966 study was that DRI participants said that government publications were more important external channels of technological information. However, it was found in the 1966 study that research-oriented personnel with experience working for an aerospace firm, NASA, the Atomic Energy Commission, or the Department of Defense also ranked government publications higher.

TABLE 5. IMPORTANCE OF EXTERNAL CHANNELS, DRI PARTICIPANTS

Awareness	Problem Solving
(1) Professional Journals	(1) Professional Journals
(2) Conventions and Meetings	(2) Textbooks
(3) Trade Publications	(3) Government Publications
(4) Government Publications	(4) University and Other Consultants
(5) Vendor Catalogues	(5) Conventions and Meetings
(6) Textbooks	(6) Libraries
(7) University and Other Consultants	(7) Supplier Personnel
(8) Contractor Personnel	(8) Vendor Catalogues
	(9) Contractor Personnel

The comparisons of internal and external channels indicate that DRI participants do not differ substantially from the group of 100 research-oriented scientists and engineers queried in 1966.

Technical and Scientific Sources of Information Available

The alternatives available to DRI's staff members, had TAC's services not been offered, appear to be fairly typical of any research organization. The University of Denver libraries include a science-engineering library¹¹ which offers standard library services as well as preparing a table of contents current awareness service. The University of Denver libraries are also a partial depository for government documents.

As NASA and DOD contractors, the Institute may utilize the search facilities of NASA's Scientific and Technical Information Division (STID) and the Defense Documentation Center (DDC) at no charge.

¹¹ This library subscribes to 1,000 titles and has a collection of 19,000 books, 20,000 bound periodicals, and 30,000 reports.

SECTION III. SEARCH EVALUATION

Benefits Received – Retrospective Searches

Collectively, DRI participants perceived five benefits from the retrospective searches including: (1) served as a check on a manual search; (2) uncovered new information; (3) saved time; (4) identified a void; and (5) speed of response.

Check on a manual search. Six participants reported that the TAC search helped them to check on their own manual search which had been previously conducted. This check, in turn, increased the confidence of the researcher in the adequacy of his previous efforts.

Uncovered new information. Five participants said that a TAC search uncovered new information.

Saved time. Five participants said that a TAC search saved them time. The time saving per search, and the direct dollar value (excluding overhead) assigned is shown below:

One man-month, Graduate Research Assistant	\$ 645
Two man-days, Professional	110
One man-week, Graduate Research Assistant	150
One man-week, Professional	272
Two man-weeks, Professional	<u>544</u>
Total	\$1,721

Identified void/research opportunity. Three participants noted that the retrospective search identified a void in the literature in their area of interest. This void, in turn, could be viewed as a research opportunity. For example, Dr. Ronald Hensen said his search helped him in writing a proposal because it revealed that no one was doing work in a specific area. He added the search also identified knowledgeable people in related technical areas.

Speed of response. Two participants observed that the speed of the response from TAC was an advantage of using TAC.

Conclusion. The most frequently cited reasons for using TAC's services were that a search either supplemented what the researcher already knew or uncovered new information. It was generally found that the TAC search provided the greatest benefits when the researcher was going into a new area and needed a state-of-the-art review. (An industrial TAC client in Denver stated that his firm most often used TAC searches to survey a new area.)

Negative Aspects of the Retrospective Searches

Four of the participants in the experiment did not identify any negative aspects to the retrospective searches. Six disadvantages were cited by the remaining DRI participants:

Lack of classified literature. Two participants stated that the lack of classified literature was a disadvantage. Because of this, one researcher considered the search to lack depth.

Timeliness of search. Two participants said the references did not reflect the latest available information. The time lag was estimated to be six months.

Loss of learning experience. Some participants, mainly those engaged in teaching, concluded that by using a service such as TAC there was some loss of learning experience. Dr. Karl Brunstein said that one of the limitations of any machine search is that it does not provide the opportunity to accidentally discover material that may be of potential value. He believed, however, that a search had the advantage of freeing graduate students to search in more general areas.

Omission of key articles. Two participants reported that the TAC search missed key articles in their field. One participant was of the opinion that TAC missed 25 out of 30 relevant articles and reports in his subject area. However, he pointed out that all major authors in the field were identified among the abstracts included in the TAC search.

Reliability of search. Participants who noted TAC had missed key articles in their field had some reservations about the reliability of a TAC search. For example, Dr. Robert Amme felt that there was some ambiguity in TAC's interpretation of his search request and because of this, the abstracts were not on target. Amme considered it a responsibility to search the literature himself. Others were of the opinion that their subject area could only be searched by a subject specialist.

Overall Evaluation

The overall evaluation of the TAC searches by DRI participants was favorable with only three retrospective search participants expressing dissatisfaction.

The remaining twelve participants ranged in their comments from "worth the cost but no panacea" to "very pleased, would use TAC again." Most participants concluded that they would like to continue using TAC. The searches were found most helpful when someone was going into a new area. Some participants stated the retrospective search was good insurance; some observed that it was a wedge into a new area; and one reported it was a potentially useful approach to answer specific questions on experimental approaches. Generally speaking, the participants considered the cost of \$125 for one retrospective search reasonable.

Selective Dissemination Evaluation

Because only three DRI staff members received current awareness services (two received the Selective Dissemination Service and one a Standard Interest Profile), it is not possible to present an overall evaluation.

In one case, the researcher's field of interest had shifted away from the topic originally selected.

In the second case, the recipient was generally dissatisfied with the service: "The service was more a curiosity than a help. I found out about one document that I probably would not have known about without the service." This recipient was also bothered by the time lag in documents getting into the NASA data base. "When you subscribe to a service that is to keep you up to date, you expect to see current material."

In the third case, the DRI staff member receiving a Standard Interest Profile was satisfied with the service. He said, "While the abstracts identified were not right on target, I did run across some peripheral material of interest to my work." He did, however, express some concern over the intermittent nature of the Standard Interest Profiles.

SECTION IV. CONCLUSIONS

Eight conclusions have been drawn from this study concerning:

- (1) NASA data base/augmentation
- (2) Confidence
- (3) Usefulness versus sophistication
- (4) Loss of learning experience
- (5) Classified information
- (6) Price/cost
- (7) Retrospective versus current awareness
- (8) Internal champion

NASA Data Base/Augmentation

With two exceptions when TAC was instructed specifically not to augment, most of the retrospective searches were manually augmented by TAC. It appears that the NASA data base, without augmentation, is inadequate for the purposes of DRI participants. Conversely, DRI participants thought that the augmentation provided by TAC, generally in the form of reprints of articles, was a valuable addition to the search. In a few cases, DRI users thought the augmentation was the most valuable part of the service.

Confidence

As discussed in the previous section, DRI participants expressed some concern over how completely they could rely on TAC to perform their literature searching. While TAC was found to be helpful as a supplement to a researcher's own efforts, it was not a substitute for all literature searching efforts.

Usefulness versus Sophistication

The TAC retrospective searches proved to be most helpful when the researcher was in the proposal or precontract stage. Thus, there appears to be some correlation between the researcher's level of understanding of a topic and the usefulness of a TAC retrospective search.

Loss of Learning Experience

As noted previously, two DRI participants reported the use of a machine system resulted in a lack of learning experience. This was not perceived by most to be a problem

and, in fact, some participants said that having a service like TAC could free both the student and the researcher to do other work.

Classified Information

Although two participants considered the lack of classified information to be a negative aspect to a TAC search, most participants did not see it as a problem. Those participants who work on classified projects have found that when they have a contract in hand, it is not generally difficult to obtain access to the classified literature.

Price/Cost

Because the searches were provided to DRI participants free of charge to their project budgets, an evaluation of the pricing system of TAC could not be made. However, participants were asked if they would have been willing to pay for their search. In most cases, the participants thought that a cost of \$125 per search was reasonable.

Retrospective Searches versus Selective Dissemination

As described earlier, DRI personnel were offered Retrospective Searches and Selective Dissemination Service. Most participants did not think the Selective Dissemination Service would be of value to them because they were already on the forefront of their scientific or technical field.

The DRI/TAC experience with Selective Dissemination is somewhat different from that reported at another NASA Regional Dissemination Center, Aerospace Research Applications Center (ARAC). Dr. Joseph DiSalvo, Director of ARAC, reports that current awareness services are more heavily used than its retrospective searches.

Internal Champion

In recruiting participants for this experiment, there was a need to promote the service internally. Thus, when internal memo's suggesting possible use of TAC services were sent to DRI personnel, there was a response. When there was no letter or other promotion, there were no requests for TAC services.

SECTION V. RECOMMENDATIONS

Recommendations to Technology Application Center

In the marketing of TAC's services to DRI personnel there were several examples of customer expectations exceeding that which could reasonably be expected from TAC. Although not deliberate, there appeared to be a tendency when talking about the NASA data base and TAC services to communicate to the customer that there really was more available than TAC could produce. It is recommended, therefore, that TAC and other Regional Dissemination Centers be careful not to raise customer expectations above that which can reasonably be satisfied.

The TAC promotional material does not appear particularly relevant to a research-oriented organization such as DRI. The emphasis in the TAC brochure is on problem solving and product development and neither of these are meaningful to DRI researchers. In the case of DRI, a much more meaningful way of describing retrospective searches would have been to call them something like "computerized literature searches."

The area of communications between DRI researchers and TAC staff members could be improved. It is recommended that TAC be more sensitive to the needs of the individual customer and at least offer to confirm, in writing, any agreements or understandings the customer desires. Such an arrangement might preclude later misunderstandings.

The augmentation aspect of TAC services on retrospective searches was particularly important to DRI researchers participating in the experiment. It is recommended that TAC continue to augment the NASA data base where necessary, with the additional suggestions that TAC do a more complete job of describing the augmentation procedure, and identifying sources used in augmentation.

Recommendations to DRI Management

We have recommended that DRI continue to subscribe to the services of Technology Application Center. The services represent a legitimate project charge when used in connection with a project. In proposal preparation, a retrospective search appears to represent a useful investment toward improving the quality of a proposal and in saving time. As the Institute attempts to move into new research areas, the retrospective searches can be particularly helpful.

In terms of the type of service, we have recommended that DRI subscribe on a limited basis (\$500.00 sustaining membership) and pay for individual searches or other services as the need arises. We estimate that, with proper promotion, DRI researchers will require from 15 to 20 retrospective searches per year. We believe there may be additional needs for the current awareness service (either Selective Dissemination or Standard Interest Profiles) and suggest that DRI staff members be encouraged to use these services.

An additional recommendation to DRI management was that someone within the Institute be designated as an internal champion to promote and otherwise communicate with DRI staff members about the availability of TAC services. Whether such an individual should be in the Director's Office, in the library, or elsewhere in the Institute, is not clear. Such an individual should be interested in the concept of computerized searches, respected by other researchers in DRI, and motivated to see that researchers use all available resources in preparing proposals and conducting their research.