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A Review and Evaluation of the Langley Research Center's Scientific and Technical Information Program

Results of Phase V - Design and Evaluation of STI Systems: A Selected, Annotated Bibliography

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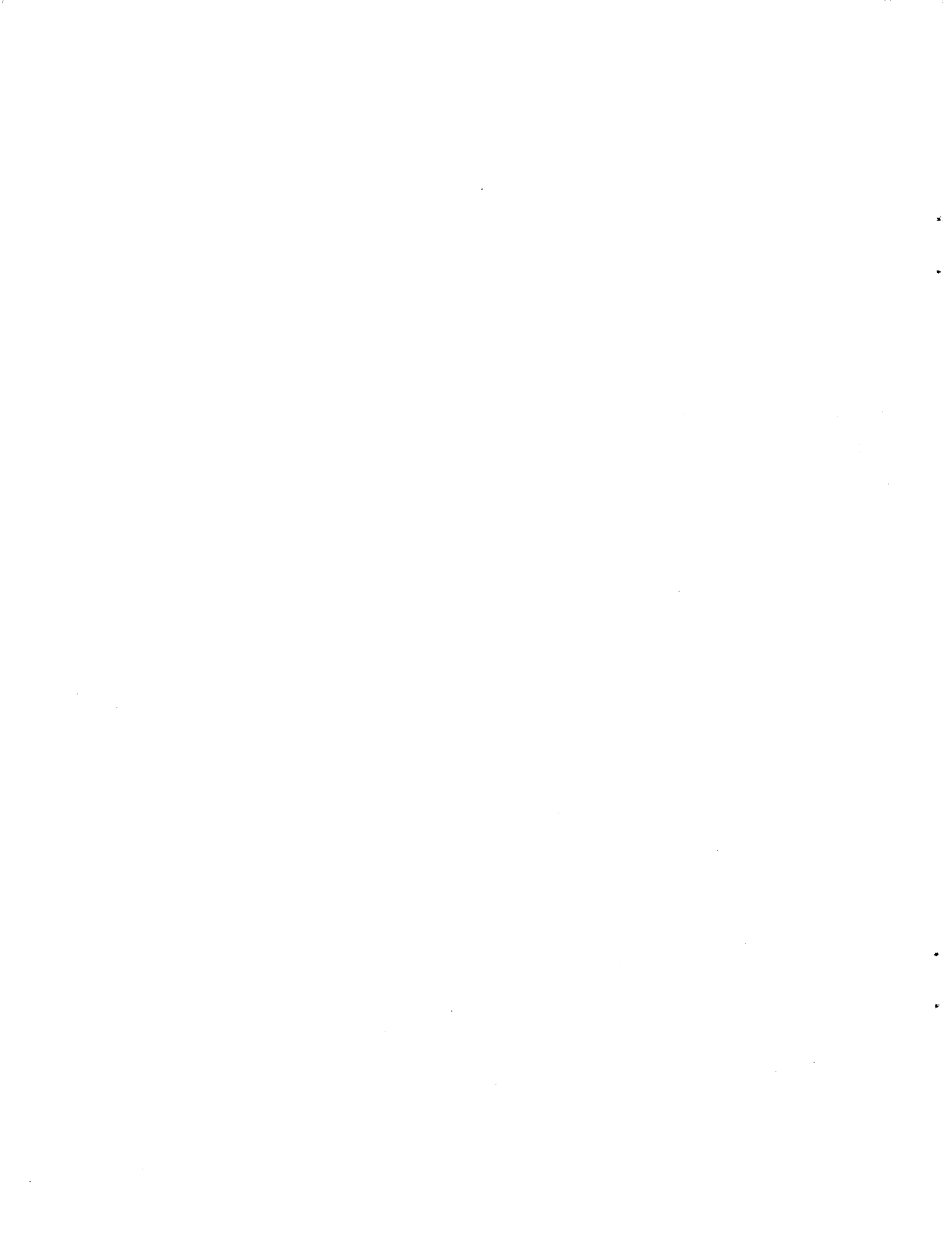
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and Jack M. Jaffe

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A Review and Evaluation of the
Langley Research Center's Scientific
and Technical Information Program
Results of Phase V - Design and Evaluation of
STI Systems: A Selected, Annotated Bibliography

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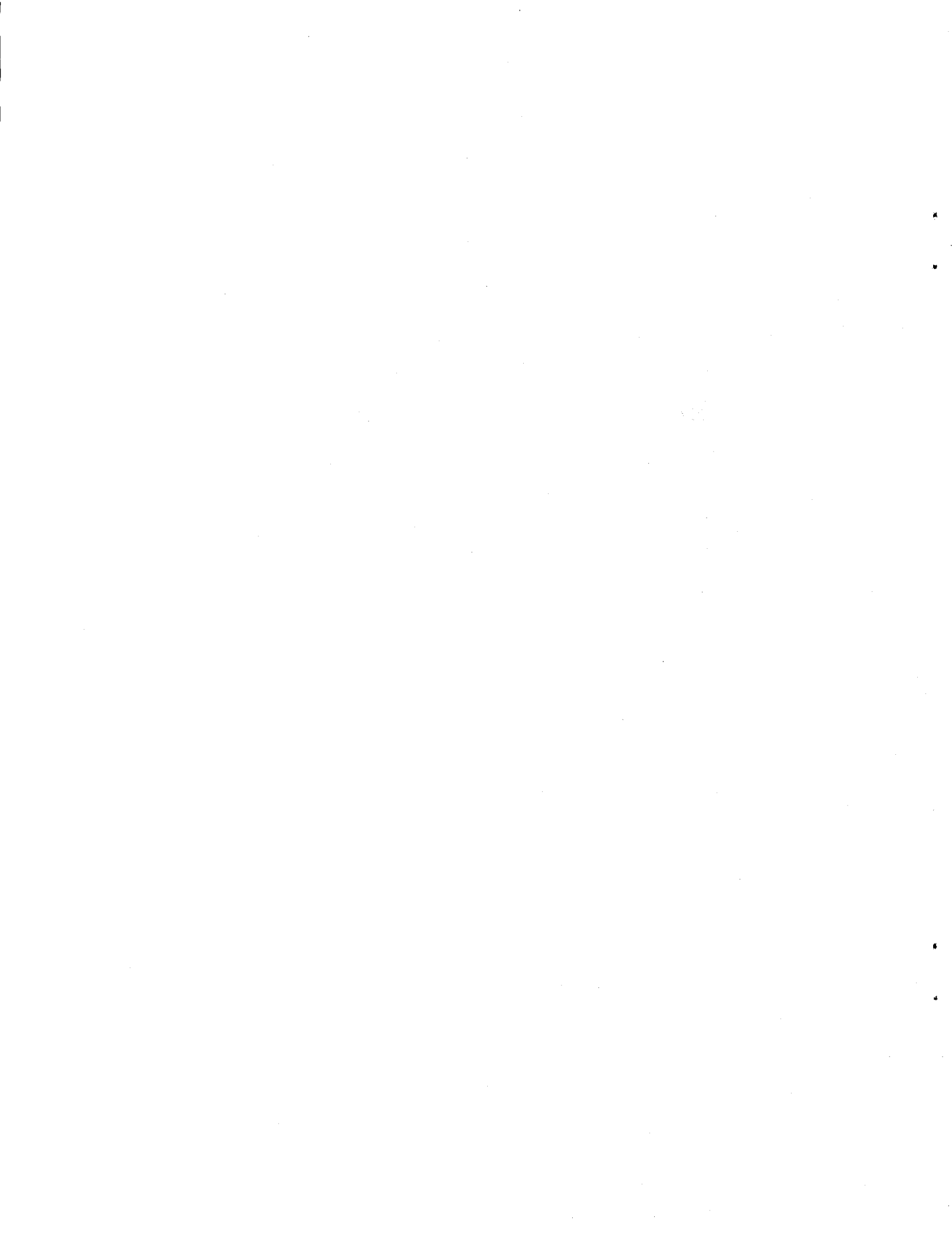
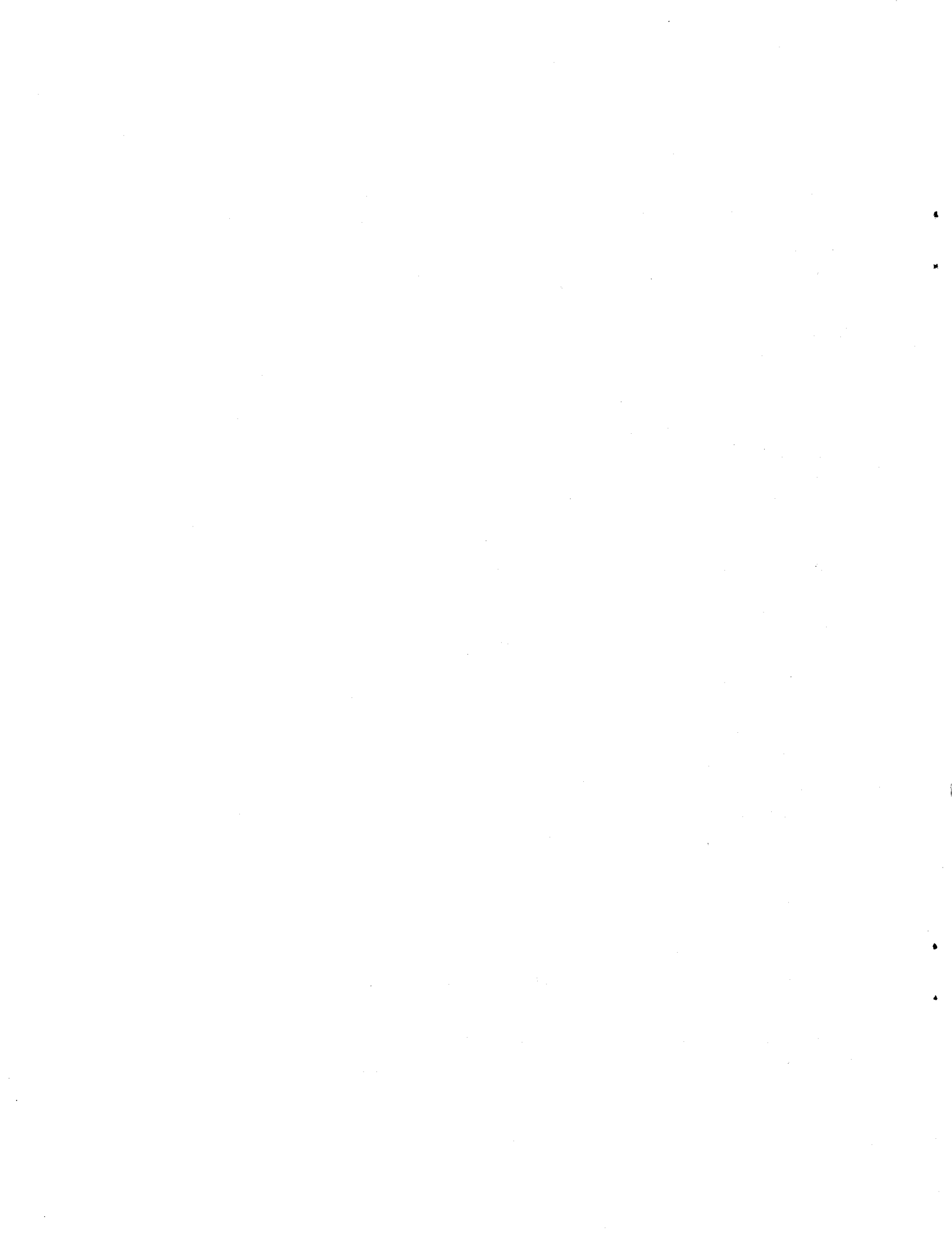


TABLE OF CONTENTS

| | Page |
|---|------|
| INTRODUCTION | 1 |
| STATEMENT OF THE PROBLEM | 1 |
| Purpose of the Study | 1 |
| Importance of the Study | 2 |
| Scope of the Study | 2 |
| GLOSSARY | 2 |
| CONDUCT OF THE STUDY | 3 |
| Design | 3 |
| Methodology | 4 |
| Availability | 5 |
| Classification | 5 |
| RELATED RESEARCH AND LITERATURE | 5 |
| The User Dimension | 6 |
| The Flow of Scientific and Technical Information | 6 |
| Information Needs/User Studies | 6 |
| Evaluation of Information Systems and Services | 7 |
| Systems Approach to Design and Evaluation | 8 |
| Informal and Formal Information Seeking | 9 |
| New Trends: National Information Systems and Networking | 9 |
| Economic Consideration | 10 |
| Aspects of Needs and Uses | 10 |
| Evolution of Evaluation Procedures | 11 |
| Extended Scope of User Studies | 11 |
| SUMMARY | 11 |
| CONCLUSIONS | 12 |
| REFERENCES | 13 |
| BIBLIOGRAPHY | 15 |
| Information - General | 15 |
| Information Systems - Design and Evaluation | 32 |
| Information - Use and Need | 47 |
| Information - Economics | 63 |
| APPENDIX - A Project Plan for the Review and Evaluation of the Langley Research Center's Scientific and Technical Information Program | 67 |



INTRODUCTION

A comprehensive review and evaluation of the Langley Research Center's scientific and technical information (STI) program was conducted. The purpose of the review and evaluation was to determine the extent to which the program was meeting the needs of Langley research personnel and the recipients of Langley-generated STI, the areas of the program which needed improvements, and ways in which the program could be modified to improve its overall efficiency and effectiveness. The goal of the review and evaluation project was to determine if the dissemination of the Center's research output could be made more effective.

The project utilized both survey research and systems analysis techniques. A steering committee composed of one representative from each research division was used to develop the objectives and guide the project through its completion. The individual tasks required to accomplish the objectives were established and included as phases in the project plan which is the Appendix of this report. The results of Phase V - Design and Evaluation of STI Systems: A Selected, Annotated Bibliography are contained in this report.

STATEMENT OF THE PROBLEM

During the 63-year history of the Langley Research Center, a comprehensive review and evaluation of the Center's STI program had never been conducted. Portions of the Langley STI program had received periodic or occasional assessment; however, no valid empirical data existed which could be used to evaluate the overall program.

Purpose of the Study

The purpose of Phase V was to compile a selected, annotated bibliography of literature citations related to the design and evaluation of scientific and technical information (STI) systems. Phase V required the use of manual and machine-readable literature searches; the review of numerous books, periodicals, reports, and papers; and the selection and annotation of literature citations. The results of Phase V provided a theoretical understanding and base upon which the methodology of the review and evaluation project was founded.

Importance of the Study

Phase V resulted in the compilation of a selected, annotated bibliography of source material devoted to the design and evaluation of scientific and technical information (STI) systems. The bibliography was produced because (1) the information was needed to develop the methodology for the review and evaluation project, and (2) a survey of the literature did not reveal the existence of a single published source of information pertinent to the subject. Thus, the bibliography represents the first or the most recent collection of information specifically devoted to the design and evaluation of STI systems.

Scope of the Study

The study was limited to (1) searches of manual and machine-readable data bases; (2) bibliographies pertaining to the evaluation of information systems; (3) books, periodicals, reports, annual reviews, conference proceedings, and research specifically concerned with information systems; and (4) bibliographies and references found in a variety of published sources. In compiling the bibliography, emphasis was placed on those references published in the time period between 1974 and 1980. However, certain references dated prior to this period were included because of their significance.

GLOSSARY

| | |
|--------|--|
| AGARD | Advisory Group for Aeronautical Research and Development |
| ARIST | Annual Review of Information Science and Technology |
| ASIS | American Society for Information Science |
| Aslib | Association of Special Libraries |
| CDA | Comprehensive Dissertation Abstracts |
| COSATI | Committee on Scientific and Technical Information |
| DDC | Defense Documentation Center |
| DoD | Department of Defense |
| DSA | Defense Supply Agency |
| DTIC | Defense Technical Information Center |
| ERIC | Educational Resources Information Center |
| IEEE | Institute of Electrical and Electronic Engineers |
| JASIS | Journal of the American Society for Information Science |
| LaRC | Langley Research Center |

| | |
|---------|---|
| LISA | Library and Information Science Abstracts |
| MEDLARS | Medical Literature Analysis and Retrieval System |
| MEDLINE | MEDLARS On-Line |
| M.I.T. | Massachusetts Institute of Technology |
| NASA | National Aeronautics and Space Administration |
| NSF | National Science Foundation |
| NSTIF | NASA Scientific and Technical Information Facility |
| NTIS | National Technical Information Service |
| RECON | Remote Console Interactive Computer System |
| SCATT | Scientific Communication and Technology Transfer System |
| SSIE | Smithsonian Science Information Exchange |
| STI | Scientific and Technical Information |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |

CONDUCT OF THE STUDY

Phase V required the compilation of a selected, annotated bibliography on the design and evaluation of STI systems. The principal purpose of the study was to provide a single source of information pertinent to the subject. This information was used in the development of the methodology for the review and evaluation project and could also be used by others interested in this aspect of information science.

Design

The scope of this bibliography focused on literature pertaining to the design and evaluation of STI systems. Citations covering the general topic of information and such topics as the design and evaluation of information systems, information use and needs, the economics of information, and information products and services were included because they contained substantial or innovative material pertinent to the subject.

Several bibliographies were discovered during the search of the literature and were consulted during the preparation of this bibliography. The last comprehensive bibliography on the evaluation of information systems, which was compiled by Beth Krevitt and Belver Griffith and published in 1973, represented an updating of the bibliography on the same topic which was compiled by Madeline Henderson and published in 1967. In 1978, Donald W. King published a compilation

of key papers on the design and evaluation of information systems. Although not a bibliography, the work by King does provide a comprehensive set of papers that covers a range of topics pertinent to the subject.

Daniel N. Woods compiled and published in 1971 a bibliography on user studies which was devoted to the information gathering habits of engineers and scientists. Sylvia Faibisoff compiled and published in 1976 a comprehensive review of the literature on user studies which included citations devoted to the information needs among scientists and engineers. Since 1977, Mary E. Young has published a continuing bibliography on user needs in documentation and information. The Young bibliography covers a variety of information needs, including those of engineers and scientists.

In 1971, Harold Anker Olsen published a comprehensive bibliography on the economics of information. In 1972, a supplementary listing was published. Both editions contained citations which embrace the importance of economic consideration in information services, including information systems. In 1980, Donald W. King, Nancy K. Roderer, and Harold A. Olsen published a compilation of key papers on the economics of information. While not a bibliography, their work does represent the most current thinking concerning the costs, budgeting, and financial operation of information systems.

Citations in these bibliographies pertinent to the design and evaluation of STI systems were included in this bibliography. Preparation of this bibliography began in February 1980, thus excluding publications from late 1980. The cutoff was necessary to meet the timetable established for the project. Approximately 200 citations have been included.

Methodology

The basic tools used to compile this bibliography were (1) searches of machine-readable data bases via CDA, ERIC, LISA, NTIS, NASA RECON, and SSIE; (2) Library Literature and ISA; and (3) ASIS conference proceedings. Extensive use was also made of bibliographies in the ARIST. The bibliographies and references of the citations contained in this publication were also used as sources of possible citations.

Availability

Every attempt was made to identify the availability of the citations included in this bibliography. Citations which were not published or readily available were excluded. Works by the same author(s) having similar titles were included in an attempt to increase the user's ability to obtain the desired material. When both PB and ED numbers appeared for the same citation, both were included.

Citations which appeared as NTIS documents can be purchased from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161. Citations which appeared as ERIC documents can be purchased from the ERIC Document Reproduction Service, P.O. Box 190, Arlington, Virginia 22210.

Classification

Four subject areas were used to classify the selected citations. These areas included (1) information - general; (2) information systems - design and evaluation including information products and services; (3) information - use and need; and (4) information - economics. Each citation was listed under one and only one area within the classification scheme.

RELATED RESEARCH AND LITERATURE

The development of the methodology and procedures for the review and evaluation of the Langley scientific and technical information program which would provide maximum effectiveness required a complete understanding of (1) the operational dimensions of the Langley STI program and (2) the theoretical basis, including relevant research, for the design and evaluation of STI systems. The operational understanding was acquired from the familiarity and experience with the Langley STI program. The theoretical basis, which was needed to determine the methods and concepts essential to design and evaluation, was developed from a thorough understanding of the related research and literature. An historical overview of the evolution of the evaluation process, which reflected the changes in attitudes, emphasis, techniques, and technological developments in the design and evaluation of information systems, was prepared and presented chronologically.

The User Dimension

Prior to the 1950's, few studies of the users' needs had been performed although information workers had been providing a variety of information products and services for years. The first user studies, which were conducted during the late 1950's and early 1960's, involved engineers and scientists as subjects. Most of these studies were conducted on a small scale, with participants drawn from a specific discipline, the broad population of engineers and scientists, or, less frequently, from users of specific systems. The technique most commonly employed to elicit knowledge concerning the general information-gathering habits and needs of users was the self-administered questionnaire. The results of these studies revealed that the information needs and habits of engineers and scientists were more diverse than had previously been thought, thus diminishing the potential use of the results in terms of the design and evaluation of information systems.

The Flow of Scientific and Technical Information

One of the earliest methodological studies was conducted by Menzel (1). Menzel reviewed papers published prior to 1960 on the flow of information among scientists. He found only 26 studies which contained empirical findings. Techniques cited by Menzel from these studies included: examination of library circulation records, analysis of reference questions, self-observations, observations by others, diaries, questionnaires, interviews, and reference counts. Paisley (2) reviewed the literature on the flow of scientific literature up to December 1965 and found only 33 studies which used empirical research to document information-gathering activity.

Information Needs/User Studies

By the end of 1963, empirical research on the information needs and uses of scientists and technologists appeared in the literature. In addition to preference, demand, and experimental studies, research during the mid-1960's began to take other directions. During this time, investigations were conducted concerning the habits and patterns of scientists in terms of information gathering, use, and dissemination. These investigations focused on the information channel(s) to determine the flow of information within the scientific community.

The critical incident study appeared at this time. The critical incident study recorded sample information - receiving episodes, including a description of the event, the communication function this event served, and the scientist's satisfaction (or lack thereof) with the information obtained. The studies by Rosenbloom (3) and the Auerbach Corporation (4) illustrated the critical incident methodology. A further refinement of this technique was the critical incident decision study which concentrated on information-receiving events that caused decisions in the work of scientists. M.I.T.'s Research Program on the Management of Science and Technology (5) produced a number of diverse and creative approaches to information transfer studies. One approach studied the communication channels used during different stages of completion of research projects. Another was the "matched case approach" which employed the same research design to compare the performance of the two or more groups being studied.

In commenting on the literature of 1966 dealing with user studies, Herner and Herner (6) reviewed papers which utilized the following techniques: user records, personal interviews, observation, and questionnaires. Herner and Herner noted the following seven problems related to the 1966 user studies: the few techniques used, the diversity of user groups to which these few techniques were applied, the diversity and ambiguity of the language used to discuss the techniques and their results, the absence of innovation, the failure to profit from prior mistakes, and the absence of rigorous experimental design.

Evaluation of Information Systems and Services

The problems inherent to the design and evaluation of information systems and services received increased attention in the literature and were discussed at national and international meetings. At the 1966 annual convention of the American Documentation Institute, a panel focused on a number of basic issues including the problems in methodology, relevance as a measurement criterion, replication of experiments, and difficulties in making generalizations based on past research. Persistent methodology and conceptualization problems, together with a scarcity of empirical data, plagued attempts to discuss the actual performance of information systems and services.

Snyder (7) published a critical review of the design and evaluation literature and identified the following methodological problems: confounding of independent variables; using only retrieval effectiveness criteria to examine the effects of independent variables, using gross measures to determine relevance, insufficient control of possibly significant sources of variance, inadequate sampling procedures, inadequate statistical techniques, failing to discuss other relevant research results, and failing to report sufficient methodology details. Marks (8) reached the same general conclusions as Snyder after reviewing behavioral research in information retrieval.

Salton (9) reported on the continued development of a specialized computerized information and retrieval system. A large number of automatic retrieval procedures were tested, including automatic information analysis, automatic dictionary construction, and iterative search procedures with user interaction. The final report of the Aslib-Cranfield Project (10), issued in 1966, represented an extensive and complex effort in analyzing the effect of index language devices on recall and performance of an information retrieval system. Considerable debate appeared in the literature concerning the merits and shortcomings of this work.

Systems Approach to Design and Evaluation

The literature of 1967 showed a trend toward the systems approach to design and evaluation of information systems, as reflected in the attention given to information components and their interactions. A discussion of the pros and cons of recall and precision as measures of information system performance occurred during this period. The necessity of cost-benefit analysis of competing systems was recorded. Operations research, a general analytical and evaluation method, was widely used in the evaluation of information systems in the late 1960's.

Trends toward automation were evident in the literature of 1968. Publications reflected a maturing discipline, with documented accounts of actual steps toward automation including cost analyses. Man/machine interfaces in projected on-line computerized retrieval systems began to receive attention in the literature, but a recognition was growing that system evaluation measures needed to be broader than mere retrieval performance.

Informal and Formal Information Seeking

By 1968, the number of studies concerned with social and behavioral aspects of information-seeking had increased substantially. In addition many user studies employed more sophisticated techniques to elucidate particular characteristics of user behavior. Citation analyses and indirect observation techniques were introduced. Informal information transfer began to be studied and recognized as a major channel of information flow. The concepts of "gate-keepers" and "invisible colleges" appeared. Although information acquisition and use became more fully understood during this period, the increased knowledge was not directly applied in system design. Computers became more widely used in information systems.

New Trends: National Information Systems and Networking

Considerable activity in the design of comprehensive national information systems devoted to broad subject disciplines occurred during 1969. In the U.S., most programs were designed and implemented by leading scientific and technical societies such as those in the fields of physics, mathematics, and linguistics. The programs consisted of a machine-readable data base of indexed citations from which a variety of bibliographic products could be generated, including indexes, literature searches, bibliographies, and selective dissemination services. An example of such a system was NASA's RECON.

Another important trend around 1969 was the integration and connection of bibliographic services by networking concepts. Some of the first such networks were MEDLARS and ERIC. By this time, only a small number of actual evaluations of operating systems had been done. MEDLARS was the only large national information system which had been thoroughly evaluated. The availability of on-line systems revived interest in research on automatic indexing, classification, vocabulary control, and automatic searching. Concept definition, methods of data collection, and theory had developed so that now there was some consistency in observations about user needs and uses. Recognition of the growing importance of cost effectiveness was reflected in the literature of 1969.

Economic Consideration

By 1970, economic restrictions had become the most important factor in the design, operation, and evaluation of information systems. Managers of existing systems were called upon to justify costs, and proposals for new systems were carefully studied and compared with the informal sources used by researchers. In-house testing of existing systems was growing, based on the realization that the support and respect of users, potential users, and management were essential. Cost effectiveness as applied to operational decision-making was the focus of the work of a group of researchers and information specialists, notably Lancaster, King, and Bryant. Research by these individuals led to emphasis on evaluating the cost effectiveness and benefits tradeoff of information systems. Evaluation began to impact more importantly on specific decisions concerning system design, implementation, modification, and discontinuance.

Aspects of Needs and Uses

Studies concerned with information needs and uses on national and international basis emerged in 1971. Systematic studies were conducted in the U. S. at Stanford University, Johns Hopkins, and by the American Psychological Association. The 1970's produced many studies of the information needs and uses of scientists and engineers in other countries, including Russia, East Germany, England, Canada, and the Netherlands. International cooperation among scientists through informal communication networks was a topic represented in the papers of the early 1970's.

Research which led to the understanding of the social structure and organization of the research environment was undertaken during this period. Work performed by Thomas J. Allen at M.I.T (11) determined the structural characteristics of R&D laboratories. Informal relationships and physical locations were shown to have direct bearing on information transfer within an R&D organization. Rubenstein investigated the communication systems used by engineers and scientists. The conclusions drawn from this research indicated that engineers tended to prefer oral communication sources, while basic scientists relied on both oral and written channels.

Evolution of Evaluation Procedures

In the literature of 1973-1974, evaluation procedures and tools tailored to information system environments emerged. Debons and Montgomery (12) enumerated the following procedures: systems analysis, operations research, benefit-cost analysis, planning-programming-budgeting, value/analysis engineering, management audit, and evaluation. Greater cost consciousness and more attention to users and user studies in nonscientific disciplines were continuing trends in information science. User satisfaction was suggested as a substitute for relevance in evaluating system effectiveness.

Extended Scope of User Studies

Crawford (13) showed that of the 95 user studies published between 1975 and 1977, 24 were focused on physical sciences (still the largest representation); however, 20 were focused on the social sciences (second largest representation). The other categories and counts were biological/health sciences, 9; human needs, 10; mass media, 3; general information centers/systems, 13; specific techniques (mostly user interfaces with on-line services), 10; and theory, 6. Of the 24 papers in the physical science category, 10 were case presentations on the use of a specific system, 9 were surveys, and 5 were conceptual or review papers.

A National Forum on Scientific and Technical Information was held during 1976-1977 consisting of 375 professional users of information, providers of information, and those who make public policy. Five problem areas were defined, and it was concluded that a focal point should be established within the government to address these problem areas, providing both leadership and financial support.

SUMMARY

The design and evaluation of information systems had progressed from simplistic and unscientific research to the current sophisticated and empirical framework. Both the methodology (how to measure) and concepts (what to measure and why) differed in scope, depth, criteria, and techniques in accordance with their appropriateness to the evaluative purpose. The literature revealed that

research existed to assist in the choice of valid, reliable, reproducible evaluative procedures and the formulation of valid assessment measures. The assessment of information systems had grown to include the organization, functions, and operations of the system; the products and services of the system; and the clientele and organizations served by the system. A periodic evaluation which incorporated a combination of social science concepts and management tools and techniques was established as an essential function of management.

CONCLUSIONS

The purpose of Phase V was to compile a selected, annotated bibliography on the design and evaluation of STI systems. The results of Phase V provided a theoretical understanding and base upon which the methodology of the review and evaluation project was founded.

Periodic review and evaluation of an information system should be considered an essential responsibility of management. Evaluation should be (1) summative, providing decision-makers with information about the effectiveness of the system; (2) formative, producing information that is fed back into the program for improvement during development or operation; and (3) on-going, disclosing the strengths and weaknesses of the system, suggesting ways to improve the overall performance of the system, and providing future orientation and direction for system development. Evaluation of an information system should include the structure, functions, and operations of the system; the products and services of the system; and the individuals and organizations served by the system. However, the most meaningful parameter in the design and evaluation of an information system involves the needs of the information user. Consequently, the needs of the information user must be viewed as an essential aspect of any information system evaluation.

The development of the Langley STI review and evaluation plan was based upon these considerations. The individual tasks required to accomplish the objectives of the project were established and included as phases in the project plan which is the Appendix of this report.

REFERENCES

1. Menzel, Herbert. Review of Studies in the Flow of Information Among Scientists, 2 volumes. New York: Columbia University, Bureau of Applied Social Research, 1960 (Mimeograph).
2. Paisley, William J. The Flow of (Behavioral) Science Information: A Review of the Research Literature. Palo Alto, Calif.: Stanford University, Institute for Communication Research, 1965 (Mimeograph).
3. Rosenbloom, Richard S., McLaughlin, C. P., and Wolek, Francis W. Technology Transfer and the Flow of Technical Information in a Large Industrial Corporation, 2 volumes. Boston: Harvard University Graduate School of Business Administration, 1965 (Mimeograph).
4. Auerbach Corporation. Review of Methodologies for Studying User Needs for Scientific and Technical Information. Philadelphia, Pa.: Auerbach Corp., 1965.
5. Allen, Thomas J. The Utilization of Information Sources During R and D Proposal Properties. (Report No. 97-64, Research Program on the Organization and Management of R and D.) Cambridge, Mass.: M.I.T., 1964.
6. Herner, Saul, and Herner, Mary. "Information Needs and Uses in Science and Technology." In (1967) Annual Review of Information Science and Technology. Vol. II. Edited by Carlos A. Cuadra. New York: John Wiley and Sons, 1967, 1-34.
7. Snyder, Monroe B. and others. Methodology for Test and Evaluation of Document Retrieval Systems: A Critical Review and Recommendation. McLean, Va.: Human Sciences Research, Inc., Jan. 1966 (Avail. NTIS PB-169 572).
8. Marks, Melvin R. Behavior-Related Research in Informal Storage and Retrieval. Rochester, N.Y.: University of Rochester, College of Business Administration, November 1966.
9. Salton, Gerard. "An Evaluation Program for Associative Indexing." Statistical Association Methods for Mechanized Documentation. Washington, D.C.: National Bureau of Standards, Miscellaneous Publication 269, 1964.
10. Cleverdon, Cyril and others. Factors Determining the Performance of Indexing Systems, 2 volumes. Cranfield, Bedford, England: Aslib-Cranfield Research Project, 1966.
11. Allen, Thomas J. "Roles in Technical Communication Networks." Communication Among Scientists and Engineers. Nelson, C. E. and Pollock, D. K., eds. Lexington, Mass.: Heath Lexington Books, 1970.

12. Debons, Anthony, and Montgomery, K. Leon. "Design and Evaluation of Information Systems." In (1974) Annual Review of Information Science and Technology. Vol. IX. Edited by Carlos A. Cuadra. Washington, D.C.: American Society for Information Science, 1974, 25-55.
13. Crawford, Susan. "Information Needs and Uses." In (1978) Annual Review of Information Science and Technology. Vol. XIII. Edited by Martha E. Williams. White Plains, N.Y.: Knowledge Industry Publications, Inc., 1978, 61-81.

INFORMATION - GENERAL

Adkinson, Burton, W. Two Centuries of Federal Information. Stroudsburg, Pa.: Dowden, Hutchinson, and Ross, Inc., 1978.

This book provided an overview of the federal government's involvement in scientific and technical information (STI). Included were an historical account of the period from 1790 to 1972 and an examination of the federal government's relationship with non-federal organizations and cooperative exchange programs with foreign organizations and countries. The author provided information about the trends in STI, the people who influenced the growth and direction of the federal government's STI programs and activities, and future directions in federal STI programs and policies.

Allen, Thomas J. "Communicative Networks in Research and Development Laboratories." Research and Development Management, I (1) (October 1970), 14-21.

Communication networks in R&D laboratories were shown to have structural characteristics, which when properly understood could be employed to more effectively maintain the laboratory personnel's awareness of technological developments. Informal relations and physical location were shown to be important determinants of this structure. Informal relations could be developed through formation of project teams and intergroup transfers and loans. The effect of physical location on communications was especially strong and should be given serious consideration when designing research facilities.

Allen, Thomas J. Managing the Flow of Technology: Technology Transfer and Dissemination of Technological Information Within the R&D Organization. Cambridge, Mass.: M.I.T. Press, 1977.

Office layout and the role of certain individuals in transmitting technical information gleaned from outside sources to colleagues within an organization were felt to provide important insights for understanding the flow of technological data within a research and development establishment. The contributions of conventions, journals, abstracts, and informal discussions to solving research problems were also assessed. The possibility of developing a nonterritorial office layout to promote communication and increase problem-solving efficiency was mentioned.

Allen, Thomas J., and Cohen, Stephen I. "Information Flow in Research and Development Laboratories." Administrative Science Quarterly, XIV (March 1969), 12-19.

Technical communication patterns in two research and development laboratories were examined using modified sociometric techniques. The structure of technical communication networks in the two laboratories resulted from the interaction of both social relations and work structure. The sociometric "stars" in the technical communication network who provided other members of the organization with information either made greater use of individuals outside the organization or read the literature more than other members of the laboratory.

Anderla, George J. The Growth of Scientific and Technical Information: A Challenge. Washington, D.C.: National Science Foundation. January 1974 (Avail. NTIS PB 232-040).

A report was made of two lectures given by Dr. J. George Anderla, Professor of Economics, The Sorbonne, under the sponsorship of the National Science Foundation. The lectures presented an analysis of the projected worldwide output of scientific and technical publications in the coming decades.

Anderson, James D., and Lake, Dale G. From Information to Action: Information Systems and the Use of Knowledge. Washington, D.C.: The Alban Institute Inc., 1974.

In this paper, James Anderson and Dale Lake laid the groundwork for a comprehensive understanding of the role of information in the processes of institutional change. The authors attempted to help the policy-makers of the Episcopal Diocese of Washington, D.C. obtain effective access to the information necessary for decision making. Based on particular instances of decision making, they analyzed where information was and was not available and where it was and was not asked for. The authors distinguished between the different kinds of information needed at various stages of creative problem-solving and identified the variety of roles required of the decision-makers during those stages.

Atherton, Pauline. Guidelines for the Organization of Training Courses, Workshops and Seminars in Scientific and Technical Information and Documentation. Paris, France: UNESCO, April 1975 (Avail. ERIC ED 145-848).

Guidelines designed to be used in planning nondegree courses in information science and services were described. Courses referred to would contribute to improvement of the role and place of information professionals, information work, and information science in servicing personnel in scientific and technical fields, particularly in developing countries. Checklists to verify the completeness of the plan and to suggest means for evaluating the experience were included. The guidelines covered the planning, organizing, implementing, and evaluating of courses. Sample course announcements, application forms, activities and time tables, participant evaluation reports, budget/financial reports, and checklists were appended.

Bagikian, Ben H. The Information Machines -- Their Impact on Men and the Media. New York: Harper and Row, 1971.

Speculations were offered on what new technical systems (computers, innovations in the transmission of signals, and new ways to feed images into and out of this system) would do to the content and form of news in the U.S. during the remainder of this century. This book focused on what the content of daily information would be, in what form it would be delivered, and how it would be distributed throughout the population. It considered what technologies were likely to change the way the next generation received its news, what changes the rapid reporting of daily events would make in human affairs, what the audience for news in the U.S. was like, and what some of the peculiarities of the news in this country were.

Becker, Joseph. A National Approach to Scientific and Technical Information in the United States. Los Angeles, Calif.: Becker and Hayes, Inc., July 1976 (Prepared for National Science Foundation; Avail. NTIS PB 261-270 and ERIC ED 129-240).

The study articulated the federal government's responsibility in providing for the dissemination of scientific and technical information. It presented an historical overview of the field; it described the new directions of science today which posed obvious challenges to the scientific communication system; it identified and explained the pressures which were affecting the nation's ability to fully utilize its scientific knowledge; and it described the action the federal government could take now to ensure the harmonious and continuing development of the nation's scientific communication enterprise. Based on the recommendations of past studies and reports and a discussion of the new directions of science, it suggested that the federal government establish (1) a locus of responsibility for making science information policy at the national level; (2) a dynamic, federally funded research and development program; and (3) a voluntary organizational mechanism for coordination of STI activities in the public and private sectors.

Buryi-Shmaryan, O. E. The Principle Channels for Transmitting Scientific and Technical Information and Their Effectiveness Based on Survey Results. Boston Spa, England: National Lending Library for Science and Technology, 1971 (Avail. NSTIF 71N-29116).

After analysis of the operating experience of information services in a number of businesses, review of data from literature sources, and discussion with specialists, the author defined and ranked four main information channels. Listed in descending order of importance, they were (1) reference books and information obtained directly by the receiver of the information; (2) participation in conferences, seminars, meetings, and exhibitions; (3) participation in scientific visits to firms in the particular subject interest; and (4) personal contact between specialists while carrying out work. Relative costs for these channels were also discussed.

Capital Systems Group, Inc. The Growth of Scientific and Technical Information: A Challenge. Rockville, Md.: Capital Systems Group, Inc., January 1974 (Prepared for National Science Foundation; Avail. NTIS N74-22601).

This book was designed to alert editors, publishers, and others responsible for the primary dissemination of scientific and technical information (STI) to ideas, procedures, systems, and technologies that could be used to disseminate information more effectively and economically. It described innovations and improvements in several areas: innovations in conventional journal and monographic publishing, print-on-paper alternatives to conventional publication, non-print paper and mixed-media innovations, trends and prospects, and innovations needed.

Capital Systems Group, Inc. Improving the Dissemination of Scientific and Technical Information: A Practitioner's Guide to Innovation. (Final Report). Washington, D.C.: Capital Systems Group, Inc., April 1975 (Prepared for National Science Foundation; Avail. ERIC ED 118-151).

The aim of this guide was to alert persons with an operational interest in scientific communication to new ideas, techniques, and equipment in the field of communication media and publications. The focus was on the dissemination of scientific information via the technical journal or its equivalent. Secondary dissemination of information such as bibliographies, data bases, and services are treated incidentally. The guide was organized into five sections: innovations in conventional journal and monography publishing, print-on-paper alternatives, non-print-on-paper and mixed media innovations, trends and prospects, and innovations needed. Each section was subdivided into individual entries describing particular processes or innovations. This guide was designed as an "idea book" to help small scientific societies, journals, and publishers as well as to increase general awareness of innovations and stimulate development of new ideas.

Chambaud, S. C. Requirements in Scientific and Technical Information: Government Viewpoint. Advisory Group for Aerospace Research and Development. The Hague, Netherlands: Ministry of Economic Affairs, January 1979 (Avail. NTIS N79-20914).

Although the needs of industries for scientific and technical information varied according to the type of enterprise considered, it was shown that governments could analyze and attempt to meet these needs. Three essential factors which influenced the way in which an industry perceived its need for information were the type of industry, its domain of activity, and its status (growing, declining, or stationary). Industries needed information concerning research and production methods, technical-juridical information covering patents and licensing, and technical-economic data related to commerce and marketing.

Collons, Rodger D. Incentives for the Generation, Dissemination and Use of Scientific and Technical Information. Philadelphia, Pa.: Drexel University, September 1977 (Prepared for National Science Foundation; Avail. NTIS PB 276-180).

This report detailed a conference in which key decision-makers and specialists in scientific and technical information systems were brought together with incentive area experts from law, economics, sociology, and psychology to address the issue of incentives for the generation, dissemination, and use of scientific and technical information. Included were workgroup reports and presentations by speakers. It was generally concluded that the issue of incentives was too complex to permit the development in any single workshop of a set of incentives which were particularly applicable to information systems; however, the conference did develop insights into how to approach the issue of incentives.

Committee on Scientific and Technical Information. The Role of the Technical Report in Scientific and Technological Communication. Washington, D.C.: Federal Council for Science and Technology, December 1968 (Avail. NTIS PB 180-944).

A study was conducted by COSATI to appraise the role of the technical report in the scientific-engineering communication process. Topics addressed included scientific journals; secondary literature (abstracts, indexes, and literature reviews); technical reports; reviews and monographs; economics of publication, informal information exchange; and the quality of technical literature. It was concluded that technical requirements necessitated continued coexistence of the various scientific and technical communication media; however, the strengths of each medium must be recognized and nurtured.

Creager, William A., and others. Plans and Recommendations for Establishing and Operating a Clearinghouse for Innovation in Scientific Communication. Rockville, Md.: Capital Systems Group, Inc., March 1975 (Prepared for National Science Foundation; Avail. NTIS PB 243-461).

The fundamental recommendation was for the establishment of a Clearinghouse for Innovation in Scientific Communication. It was recommended that the Clearinghouse's first activity be the publication of a guidebook that would describe innovations applicable to primary dissemination of scientific and technical information. Recommendations and tentative plans were also presented for the gradual enlargement of the Clearinghouse's scope to include, within the first year of operation, the secondary and tertiary dissemination of information.

Creager, William A., and others. Developing a Planning Guide for Innovation in The Dissemination of Scientific and Technical Information: Final Report of Phase I. Rockville, Md.: Capital Systems Group, Inc., March 1975 (Prepared for National Science Foundation; Avail. NTIS PB 243-469).

This report summarized the experience of a project designed to (1) identify and describe innovations that might be applied to the primary, recorded dissemination of scientific and technical information, and (2) organize the project's findings into a guidebook that might be used by editors, publishers, and others responsible for communication programs. In addition to this report, the project culminated in a prototype of the guidebook and a proposed plan for large-scale production and distribution of the guide. The final report included chapters on project history and methodology, the results of the project, and observations concerning innovation in scientific communication.

Dewhirst, H. Dudley. "Influence of Perceived Information-Sharing Norms on Communication Channel Utilization." Academy of Management Journal, XIV:3 (September 1971), 305-315.

Research on communication channel use had shown that interpersonal channels were generally more efficient than written channels. However, using interpersonal channels involved a psychological cost, particularly for individuals who believed that free and open sharing of information was not the norm. This study explored channel use among a group of scientists and engineers and suggested that channel use, both within and outside the organization, was influenced by the individuals' perceptions of organizational information-sharing norms.

Fenichel, Carol, ed. Changing Patterns in Information Retrieval. Proceedings of the Tenth Annual National Information Retrieval Colloquium. Washington, D.C.: American Society for Information Science. 1974.

The theme for the papers presented at the Tenth Annual Information Retrieval Colloquium was the state-of-the-art of information science. The decennial colloquium attempted to update and extend the symposium presented at the 1961 Annual Meeting of the American Documentation Institute (ADI). The papers reviewed the growth and change within the field and predicted future directions for information science.

Ganz, Carole. "The Role of Scientific Communication in the Process of Technological Innovation." Aslib Proceedings, XXVIII (November/December 1976), 385-91.

The results of two projects aimed at increasing the understanding of the role and contribution of scientific and technical information the process of innovation were summarized. One project concentrated primarily on the kinds and channels of scientific and technical information used by the innovators during the ideation/conception stage. The second project provided a framework for understanding the flow of scientific and technical information in applied research. Both studies concluded that people, and not formal channels of communication, were more effective for transmitting technical information. In addition, frequency of communication among researchers was found to be determined more by the architecture of the work place than by the technical needs of the research group.

Gellman Research Associates, Inc. Social Control of the Scientific and Technical Information System: Public Utility Regulation and International Transmission (Final Report). Washington, D.C.: Gellman Research Associates, January 1977 (Prepared for National Science Foundation; Avail. NTIS PB 279-425).

The scientific and technical information (STI) system which supports business, government, and society was studied. The study concerned government management of STI flow and the application of public utility regulation. The focus was on the future applications of technology and better uses of resources in STI. Also considered were (1) STI and its relationship to society, (2) STI regulation, (3) adaptations in STI, (4) forecast of STI technologies, (5) STI in foreign affairs, and (6) STI as a regulated public utility.

General Accounting Office. Better Information Management Policies Needed: A Study of Scientific and Technical Bibliographic Services. Washington, D.C.: General Accounting Office, August 1979 (Avail. GAO PSAD-79-62).

GAO's study of government information centers providing bibliographic services to the scientific and technical community was presented. It confirmed the need for better management. Evidence of duplication, proliferation of facilities, and inconsistent cost recovery practices were found. The vagueness of authorizing laws and function statements was found to contribute to the duplication of services. It was recommended that each department and agency designate a top official to coordinate and manage its information, and that the Office of Management and Budget establish a committee to coordinate government scientific and technical information activities.

The George Washington University Medical Center. Preliminary Report of the Providers' Perspective Conference of the National Forum on Scientific and Technical Communication. Washington, D.C.: National Science Foundation, February 1977 (Avail. NTIS PB 269-058).

Problems and issues encountered in adequately meeting the needs of scientific and technical information users were addressed. The viewpoints and perceptions of professional librarians, publishers, information specialists, and educators were reported.

The George Washington University Medical Center. Preliminary Report of the Policymakers' Perspective Conference of the National Forum on Scientific and Technical Communication. Washington, D.C.: National Science Foundation, August 1977 (Avail. NTIS PB 272-988).

The conference addressed the question, "Are there current needs for public policies affecting scientific and technical communication in the United States, and if so, what are the options?" Policymakers and their staffs, experts in scientific and technical communication, and decisionmakers from all sectors came together to discuss their viewpoints and perceptions about the problems and issues related to scientific and technical information.

Giuliano, V., and others. Passing the Threshold into the Information Age -- Perspective for Federal Action on Information. Volume I -- Basic Findings Report. Cambridge, Mass.: Arthur D. Little, Inc., January 1978 (Prepared for National Science Foundation; Avail. NTIS PB 281-720).

Scientific and technical information transfer has had only low priority for national attention recently. Three eras of scientific information transfer were identified: a continuing traditional era that emphasized transfer of disciplinary knowledge, a post World War II era devoted to mission-related information, and an emerging era oriented toward socio-economic-technical systems problems. A description of the information eras and their implications, current issues and problems, the stakeholders involved and their perspectives, and possible action steps to improve the present infrastructure were provided.

Griffith, Belver C., ed. Key Papers in Information Science. White Plains, N.Y.: Knowledge Industry Publications, Inc., 1980.

More than thirty key papers from a variety of interdisciplinary academic and professional journals and publications were presented in this volume. The contents were divided into the following five subject areas: Structure and Dynamics of Science Information Flow, Innovation: Required Flow of Knowledge, The Structure of Literature and Documents, Information Retrieval and Analysis, and Tools and Ideas.

Hess, Edward J. "Toward the Measurement of Benefits From the Use of Information Services." Innovative Developments in Information Systems: Their Benefits and Costs. Proceedings of the 36th Annual Meeting of the American Society for Information Science. Edited by Helen J. Waldron and F. Raymond Long. Washington, D.C.: American Society for Information Science, 1973, 91.

This paper proposed a dependable and systematic feedback loop for monitoring the use of media by clients and staff members to determine who benefited from the media, and to some extent what benefits were derived. Purposes for which the media were likely to be used were influenced by the environment in which the information system might find typical purposes for its use to be (1) support of the instructional program, (2) research, or (3) general transmission of the cultural heritage not specifically related to the curriculum.

Johnson, J. H., and Ivy, L. Development of a Science and Technology Information System. Oklahoma City, Okla.: Oklahoma State Legislative Council, March 1979 (Avail. NTIS N79-34091).

The activities of the Oklahoma Legislative Council to establish capabilities in the area of systematic transfer of scientific and technical information were described. Oklahoma was one of 42 states involved in the State, Science, Engineering, and Technology (SSET) program initiated to provide state policymakers with much of the best technical information possible to be used in the decision making process. The survey technique was used to obtain evaluations from a random sample of the legislature for the information resources available to them. Both needs and resource assessments were presented, including a series of models describing several types of information for the purpose of evaluation, a resource directory, flow charts, and an organizational chart. Questionnaires for needs assessment and resource assessment were contained in the appendices.

Johnston, Ron, and Gibbon, Michael. "Characteristics of Information Usage in Technological Innovation." IEEE Transactions on Engineering Management (February 1975), 27-34.

The characteristics of information which contributed to the resolution of technical problems during thirty on-going innovations in British industry were studied to determine the patterns of information flow consonant with successful innovation. Three findings emerged: (1) Information obtained from literature contributed as much as that from personal contact. The innovation process was most efficient when these two sources were used in a mutually supportive fashion. (2) Different sources were selectively used to obtain different types of information. The choice of appropriate sources in an appropriate order had a considerable impact on the innovation process. Improvement in the choice pattern was associated with better educated problem-solvers and research-intensive firms. (3) No direct correlation was found between the frequency of use of a source and its relative contribution to the innovation. Some vital pieces of information were obtained from sources infrequently used. Implications for researchers and management were drawn.

King, Donald W., and others. Statistical Indicators of Scientific and Technical Communication (1960-1980). 1977 Edition. Rockville, Md.: King Research, Inc., May 1977 (Prepared for National Science Foundation; Avail. NTIS PB 278-279).

Research in developing statistical indicators of scientific and technical communication was described, with special emphasis on the periodical literature including new estimates of the number of journals and other periodicals, characteristics of journals, journal prices, number of subscribers, type of publishers, and coverage by abstracting and listing services. Special analyses were also presented for the value of the journals and for the economics of page charges.

King, Donald W., and others. Statistical Indicators of Scientific and Technical Communication (1960-1980). Volume I: A Summary Report. Rockville, Md.: King Research, Inc., May 1976 (Prepared for National Science Foundation; Avail. NTIS PB 260-374).

Statistical indicators of scientific and technical communication were provided for use by planning and policy decision makers and managers of scientific and technical information services. An analysis of past trends and projections to 1980 were included.

King, Donald W., and others. Statistical Indicators of Scientific and Technical Communication (1960-1980). Volume II: A Research Report. Rockville, Md.: King Research, Inc., May 1976 (Prepared for National Science Foundation; Avail. NTIS PB 254-060).

The data, framework, and mathematical models used to generate the statistical indicators for the formal scientific and technical literature, such as books, journal articles, and technical reports, were described. A bibliography and appendices describing the methodology were included.

King, Donald W., and others. Statistical Indicators of Scientific and Technical Communication (1960-1980). Volume III: A Data Appendix to Volume II. Rockville, Md.: King Research, Inc., May 1976 (Prepared for National Science Foundation; Avail. NTIS PB 255-503).

Data from a longitudinal study of 191 journals published between 1962 and 1974 were analyzed. Tables showed characteristics of these journals, such as number of issues, number of articles, number of pages, number of characters per page, and bibliographic citations. The work was presented as a data reference tool to other researchers involved in the study of the scientific and technical journal literature.

King, Donald W., and others. The Journal in Scientific Communication: The Roles of Authors, Publishers, Libraries and Readers in a Vital System. Rockville, Md.: King Research, Inc., May 1979 (Prepared for National Science Foundation; Avail. NTIS PB 296-263).

The scientific and technical journal system in the United States was described. Data about authorship, publishing, libraries, abstracting and indexing, and reading of scientific and technical journals were included. The flow of information among the principal participants in this system was also discussed. Some data were derived from surveys of authors, publishers, abstracting and indexing services, and scientists and engineers (as readers). Substantial data were given on the cost of the entire system. Much of the information dated back to 1960 and was projected to 1985.

King, Donald W., and Roderer, N. K. Systems Analysis of Scientific and Technical Communication in the United States. Annex 1: Communication Functions in Science and Technology. Rockville, Md.: King Research, Inc., May 1978 (Prepared for National Science Foundation; Avail. NTIS PB 281-848).

The development of a functional framework for scientific and technical journal communication was documented. Generic functions, origination, transmission, recording, preservation, and end-use were defined. Both the current practices and the electronic alternatives were specified in terms of activities comprising these functions. The bases for the functional definitions of scientific and technical communications were also presented.

King, Donald W., and Roderer, N. K. Systems Analysis of Scientific and Technical Communication in the United States. Annex 2: The Current Practice. Rockville, Md.: King Research, Inc., May 1978 (Prepared for National Science Foundation; Avail. NTIS PB 281-849).

The current practices in scientific and technical journal communication in the United States, focusing primarily on 1975, were described. Cost and volume data were presented for the activities of authors, publishers, libraries, secondary services, and end-users. Analyses included consideration of three sizes of journals, four fields of science, three communication paths, and trends observed over time. A major focus was the economic interactions between participants.

King, Donald W., and Roderer, N. K. Systems Analysis of Scientific and Technical Communication in the United States. Annex 3: An Electronic Alternative. Rockville, Md.: King Research, Inc., May 1978 (Prepared for National Science Foundation; Avail. NTIS PB 281-850).

A likely electronic alternative to current journal communication practice was described in terms of generic functions. The annex discussed positive and negative factors which would influence developments in this area.

King, Donald W., and Roderer, N. K. Systems Analysis of Scientific and Technical Communication in the United States. Annex 4: The Cost Model. Rockville, Md.: King Research, Inc., May 1978 (Prepared for National Science Foundation; Avail. NTIS PB 281-851).

The cost model used in the systems analysis of scientific and technical journal communication was described. A large number of model parameters reflecting volume, process, and cost information were associated with the activities performed under each function. By selecting appropriate parameters, it was possible to simulate either current practice or the electronic alternative under a wide variety of input process and output conditions. The annex included descriptions of model components, methodologies for using the model, and some specific model results.

Miller, Richard H., and others. Innovation in the Dissemination of Scientific and Technical Information. Stanford, Calif.: Applied Communication Research, Inc., April 1975 (Prepared for National Science Foundation; Avail. NTIS PB 244-333).

This planning guide provided an introduction to each of the many multidisciplinary procedural tools and technological innovations applicable to scientific and technical information communications, with discussion of their specific applications. It was designed to help the reader make an informed first step toward choosing and implementing such innovations. The planning guide was organized for reader-controlled access to its information.

Myatt, Dewitt O., and Jover, Susan I. Compilation of Major Recommendations From Five Studies Relating to National Scientific and Technical Information Systems. McLean, Va.: Science Communication, Inc., April 1970 (Prepared for National Science Foundation; Avail. NTIS PB 193-345).

One hundred twenty-five recommendations from four studies commissioned by COSATI and one performed by SATCOM of NAS-NAE were included. Part I presented the recommendations as concise statements, listed according to the subject categories of central management concepts for national programs, roles and responsibilities of organizations generating information for the scientific and technical community, and suggested techniques for approaching areas such as user/operator education, standardization, informal communications, and literature handling. Part II presented the recommendations individually, giving the concise statement form and the full text of each recommendation, page numbers of important related discussion in the report, other related recommendations in the report, and additional annotation on background and import of the recommendation which might not be immediately apparent.

National Science Foundation. Annotated Bibliography, 1973-1977. Washington, D.C.: National Science Foundation, June 1979 (Avail. NTIS PB 298-866).

This bibliography contained the resumé of reports, articles, conference papers, and other publications produced during 1973-77 by projects supported by the Division of Science Information. The bibliography contained 123 citations which were listed alphabetically by year. The citations were indexed by author, corporate source, title, award number, and subject.

National Science Foundation. Federal Scientific and Technical Communication Activities: Annual Report, January-December 1976. Washington, D.C.: National Science Foundation, 1976 (Avail. NTIS PB 272-800).

Descriptions were given of the federal scientific and technical information activities of more than 60 programs during 1976, including the Library of Congress and the Smithsonian Institution. The descriptions, provided voluntarily by federal agencies, emphasized new developments and achievements rather than routine ongoing activities. A prefatory chapter analyzed and summarized significant activities, developments, and trends within the federal scientific and technical information community, based on the agencies' submissions. Appendices included a glossary of acronyms, a listing of key personnel associated with individual programs, and a general index.

Nelson, Carnot E., and Pollock, Donald K., eds. Communication Among Scientists and Engineers. Lexington, Mass.: Heath Lexington Books, 1970.

This volume included papers presented at a conference on "Communication Among Scientists and Technologists" sponsored by Johns Hopkins University and the National Science Foundation. The objectives of the conference were: to bring together researchers and system developers to discuss the current models of the processes by which scientists and technologists communicate, to present system developers with research results to date, and to encourage the discussion of the applicability of current research to the development of science information programs. The volume dealt with the communication structure of science and the production of scientific information, the utilization of scientific information, and the development of scientific information systems.

Nisenoff, Norman, and Clayton, Audrey. A Forecast of Technology for the Scientific and Technical Information Communities. Arlington, Va.: Forecasting International, May 1976 (Prepared for National Science Foundation; Avail. NTIS PB 253-937).

This study was an exploration of the future of scientific and technical communication. Primary achievement of the project was the development for the first time of a unified body of data representing "best judgment" forecasts of communication system performance, costs, and availability for the next 25 years, in conjunction with a parallel of the usage patterns and needs of representative user groups in the scientific and technical community.

Olson, Edwin E. Organizational Factors Affecting the Flow of Scientific and Technical Information in Industrial R&D Divisions: Final Report. Rockville, Md.: Research Division Westat, Inc., January 1978 (Avail. NTIS PB 277-761).

Based on an organizational diagnosis of the R&D divisions of three companies, this exploratory study found that the information-seeking behavior of scientists and engineers and their effectiveness in obtaining information were affected by the organization's work structures and processes, by the patterns of interpersonal interactions and organizational climate, and by the rewards and support they received for taking risks to seek information. For example, the functional organization of an R&D unit could lead to barriers between the information specialists and those who need technical information services. In companies where the climate did not support information-sharing across project or department lines, the informal information channels were under-utilized. Individuals who perceived it as risky to ask for or provide technical information also believed that their work groups were ineffective in getting the information they need.

Olson, Edwin E., and others. The Impact of Behavioral and Technical Information Interventions on Industrial R&D Projects. Rockville, Md.: Capital Systems Group, Inc., November 1979 (Avail. NTIS PB 80-110265).

The acquisition, use, and transfer of information both within the research and development lab and between the research and development lab and the engineering and manufacturing divisions in one company were investigated. The experiments included information searches for individual projects, information specialists joining project teams, workshops to improve the management of information, and improved communication between research and development scientists and engineers and their clients in the operating divisions. Findings about the correlation of behavioral and technological changes in technical information with the quality of research and development results and implications for augmenting existing formal and informal channels of communication were discussed.

Office of Science Information Service. Federal Scientific and Technical Communication Activities: 1974 Progress Report. Washington, D.C.: National Science Foundation, June 1975 (Avail. NTIS PB 242-318).

This report presented highlights of 1974 activities of more than 50 federal scientific and technical information programs in 13 major departments and independent agencies, the Smithsonian Science Information Exchange, the Government Printing Office, and the Library of Congress. Each program prepared its own description. The Office of Science Information Service, National Science Foundation, compiled the resulting descriptions and prepared a list of acronyms and abbreviations and an index.

Rathswohl, Eugene J. "Educating Management Students in Information Utilization." The Value of Information. Collection of Papers Presented at the 6th Mid-Year Meeting of the American Society for Information Science. Syracuse University, Syracuse, N.Y.: American Society for Information Science, May 1977, 140-147.

The rationale and approach taken in designing two undergraduate management courses in the area of information utilization at the University of Texas were described. The courses were conceived as user education courses and were offered as electives in the undergraduate management major curriculum. They were designed on the premises that undergraduate management students needed to heighten their awareness of the possibilities provided by information resources and that as information users they needed to develop practical skills for coping with the realities of existing information arrangements.

Rosenbloom, Richard S., and Wolek, Francis W. Technology and Information Transfer. Boston, Mass.: Harvard University, 1970.

By analyzing the various sources used by the researcher as functional elements of a single system, the authors explored the nature of the information and the circumstances which led to the acquisition of the information. The corporations surveyed were engaged in the creation of new technology; however, the government contracting laboratory and the small technically oriented firm were eliminated. An analysis was offered by categories of information sources, by task, by experience in discipline, by degree of seniority, by educational level, by professional activity, and by periodical readership. From these results, a predictive model was established. The final conclusion was that the individual himself provided the core for the networks of sources of information available to him.

Saracevic, Tefko. "Ten Years of Relevance Experimentation - A Summary and Synthesis of Conclusions." The Information Conscious Society. Proceedings of the 33rd Annual Meeting of the American Society for Information Science. Edited by Jeanne B. North. Washington, D.C.: American Society for Information Science, 1970, 33-36.

This paper described briefly some two dozen experiments concerned directly with relevance which have appeared in the literature over the past 10 years, and summarized the experimental findings, especially as they were applicable to the practice of information handling. It was believed that these experiments represented the totality of experimental work on relevance. The experiments were basically concerned with the effects of a variety of variables on human relevance judgment. The conclusions were arranged in terms of five major classes of variables investigated: documents and document representations; queries; judgmental situations and conditions; modes for expression; and people -- the human characteristics.

Saracevic, Tefko, ed. Introduction to Information Science. New York: R. R. Bowker Company, 1970.

This book compiled 66 journal articles representative of the information science literature published during the 1960's. Broad topics covered were basic phenomena, information systems, and evaluation of information systems. The articles demonstrated the complexity and interdisciplinary nature of information science.

Shapero, Albert, and others. The Effective Use of Scientific and Technical Information in Industrial and Non-Profit Settings: A Study of Managerial Interventions. Austin, Tex.: University of Texas, June 1978 (Prepared for National Science Foundation; Avail. ERIC ED 165-720).

A study conducted in a nonprofit research and development organization and in the technical development department of a profit corporation was designed to develop and implement interventions that would modify the information-communication behaviors of the technical professional in these organizations and measure and analyze the effects of the interventions. The four interventions studied included the hiring of a "high communication" -- an individual who tended the gates of technical information flow within an organization; the rearrangement of offices and people within a department; the resignation of a "high communicator"; and the progress of individual projects through time. Findings suggested a need for a close look at the "high communicator" concept to account for the professional's individual preferences in function and style, as well as differences encountered over time.

Strawhorn, John M., and Creager, William A. "Innovations to Improve the Primary Dissemination of the Scientific and Technical Information." Information Revolution: Proceedings of the 38th Annual Meeting of the American Society for Information Science. Edited by Charles W. Husbands and Ruth L. Tighe. Washington, D.C.: American Society for Information Science, October 1975, 99-100.

The results of a study of innovations in the primary dissemination of information through the technical journal or its equivalent were presented. Four trends were identified (1) pluralism in communication - growing diversity and flexibility; (2) the foregoing of some aesthetic values for greater economy; (3) increasing exploration of ways of involving the author in editorial processing and composition; and (4) a tendency by publishers to differentiate products for institutions from those for individuals. The results of the study were used to prepare a guide, Improving the Dissemination of Scientific and Technical Information: A Practitioner's Guide to Innovation.

Strawhorn, John M., and others. Improving the Dissemination of Scientific and Technical Information: A Practitioner's Guide to Innovation. Rockville, Md.: Capital Systems Group, Inc., April 1975 (Avail. NTIS PB 247-057).

The Guide's focus was on the primary dissemination of scientific information, the technical journal or its equivalent. It dealt with the initial recorded transmission of information. The Guide's contents were organized into sections, according to the degree of departure from conventional journal and monographic publishing. Each section was made up of a number of individual entries describing particular innovations.

U.S. Congress, Senate, Committee on Labor and Public Welfare. Federal Management of Scientific and Technical Information (STINFO) Activities: The Role of the National Science Foundation. Washington, D.C.: Government Printing Office, February 1976 (Avail. ERIC ED 139-373).

An overview of the role of the National Science Foundation in the federal management of scientific and technical information (STINFO) was given, with an emphasis on understanding present activities through an historical perspective. Discussed were STINFO's functions, authorities, accomplishments, and problems. Among the appendices were a list of acronyms for key STINFO organizations, a chronology of selected events, synopses of major reports, and science information program monetary obligations.

U.S. Congress, Senate, Committee on Labor and Public Welfare. Federal Management of Scientific and Technical Information (STINFO) Activities: The Role of the National Science Foundation. Washington, D.C.: Government Printing Office, July 1975 (Avail. NSTIF N75-28954).

The study examined the role of the Federal Government, in particular, the National Science Foundation, in managing and monitoring scientific and technical information (STINFO) activities in both the public and private sectors. The study contained an overview of the conceptual and factual information essential to an understanding of this complex subject area, including a review of salient developments during the past two decades. An analysis of the role performed by the National Science Foundation in encouraging and often funding selected STINFO systems and services was presented. The study provided a retrospective look at the full range of studies, policy-level decisions, and organizational actions affecting the evolution of the STINFO community in the period 1950-1975. Congressional efforts to stimulate, support, and occasionally scrutinize these scientific and technical information services were presented.

Whalen, Bruce K., and others. Scientific and Technical Information: Options for National Action. McLean, Va.: MITRE Corp., November 1976 (Prepared for National Science Foundation; Avail. NTIS PB 281-863 and ERIC ED 135-385).

An analysis of Public Law 94-282, the National Science and Technology Policy, Organization, and Priorities Act of 1976, was conducted to identify major scientific and technical information issues and action alternatives for the Office of Science and Technology Policy. Past reviews and studies were used as the basis of the analysis.

Winter, Donald C., and others. A Technology Assessment of Advances in Scientific and Technical Information Services. Pasadena, Calif.: Xerox Electro-Optical Systems, February 1977 (Prepared for National Science Foundation; Avail. NTIS PB 265-839).

This report postulated advances in scientific and technical information (STI) services in the following fields: microform publications, full-text files, machine-readable submission for publication, copyright changes, demand publishing, library automation, and high-speed high-quality facsimile. Possible secondary and higher order impacts of such advances were identified and weighed as to whether they were of concern or no concern to society. Impacts of concern to society were placed in three categories: those for whom action was required, was desirable, or was optional. Possible corrective action was identified in each case. The report also included sections showing the possible long-term impacts of technological advances and making impact chains more concrete in terms of recent public concerns. A summary of the current (1975) technology applicable to STI services was presented.

INFORMATION SYSTEMS - DESIGN AND EVALUATION

Ackoff, R. L., and others. The SCATT Report: A Tentative Idealized Design of a National Scientific Communication and Technology Transfer System. Philadelphia, Pa.: University of Pennsylvania, July 1975 (Avail. NTIS PB 247-242.)

The research team developed an ideal system for the scientific and technical information enterprise in the United States. The methodology was based on successive revision of a conceptual framework for organizing the flow of information from points of origin to all possible points of application. One of the advantages of this approach was that all affected parties -- information generators and users as well as information processors -- can help shape the evolving model.

Battelle's Columbus Laboratories. Development and Assessment of Scenarios for the Scientific and Technical Information Search System of the Future, Executive Summary. Columbus, Ohio: Battelle's Columbus Laboratories, April 1977 (Prepared for National Science Foundation; Avail. NTIS PB 268-711).

Four scenarios for the STI search system of the future, each assuming different combinations of levels of the environmental parameters -- technology utilization, information priority, and competition -- were developed and assessed in this study. The resulting scenarios portrayed futures ranging from highly advanced technology-oriented systems to systems showing little technological progress with even deterioration of current levels of services. From the assessments it was indicated that information priority was the dominating environmental parameter. Progress depended on the support of the decision-makers and funders in government and industry and on the information demands of the scientific, engineering, and academic communities. Any necessary technology was forecast to be readily available.

Borman, Lorraine, and Dominick, W. Profile Evaluation, Research and Modelling for Science Information Systems: A Report on the Development of a Generalized Evaluation Methodology to Study User Interaction. Final Report. Evanston, Ill.: Northwestern University, June 1978 (Avail. NTIS PB 283-979).

The behavioral and performance patterns of individuals using interactive information systems were studied to identify factors which served to improve use of such systems and develop a generalized evaluation methodology. Data collection was accomplished through automated interaction monitors (operating in a relatively unobtrusive mode to the users) within two information systems at different universities, with many data bases and a broad user community. A series of questions covered such factors as system usage, errors and error recoveries, user experience, and success and satisfaction with the system.

Brown, Raymond N., and Agrawala, Ashok K. "On the Behavior of Users of the MEDLINE System." Changing Patterns in Information Retrieval. Tenth Annual National Information Retrieval Colloquim. Edited by Carol Fenicke. Washington, D.C.: American Society for Information Science, 1974, 36-38.

Data were gathered in connection with an ongoing performance study of MEDLINE, an interactive version of MEDLARS (medical literature analysis and retrieval system) of the National Library of Medicine. The MEDLINE data base consisted of about half the citations which were published in the last three to four years of Index Medicus. These citations contained bibliographic descriptions and assigned index terms from articles in the biomedical fields. In three-quarters of the search sessions, the original requestor was not present. When present, he was usually assisted by a trained search analyst. Quantitative observations of terminal usage were discussed.

Cleverdon, Cyril W. "Design and Evaluation of Information Systems." In (1971) Annual Review of Information Science and Technology. Vol. VI. Edited by Carlos A. Cuadra. Chicago: Encyclopedia Britannica, Inc., 1971, 41-73.

This chapter presented a review of selected new literature in 1970 (81 citations) on the design and evaluation of information systems. Papers were grouped and discussed in topics, including review papers, methodology, theoretical investigations, experimental evaluation tests, development tests investigating the optimum design in a given situation, tests of operating systems, cost effectiveness, and on-line systems.

Committee on Information Hang-Ups. Users Look at the DOD Information Transfer Process. Washington, D.C.: Committee on Information Hang-Ups, January 1975 (Avail. NTIS AD-A005400).

The Committee on Information Hang-Ups examined Defense Documentation Center (DDC) services to information users and looked at some aspects of the information transfer process within the Department of Defense (DoD). While minor aspects of DDS's operations were criticized, users felt that no major changes were required, although greater efforts needed to be made to educate users in what DDC offers. Serious obstacles to the information transfer process within DOD were identified. A substantial part of the difficulties found in transferring information arose because there was no coordination of the process among divisions of the Executive branch of the government.

Cooper, William S. "On Selecting a Measure of Retrieval Effectiveness." Journal of the American Society for Information Science, XXIV (March/April 1973), 87-100.

In Part I (JASIS, March-April 1973) the author proposed a methodology for evaluating a retrieval system based on how much users were willing to pay to use the system. Part II set forth steps in testing the methodology through the analysis of underlying assumptions and through experimentation.

Corriodore, Michael C. Scientific and Technical Information Needs of Users or Potential Users of DSA-Administered DOD Information Analysis Centers: Final Report. Alexandria, Va.: Defense Supply Agency, 1976 (Avail. NTIS AD A024-937).

Two separate but related survey efforts were conducted. The first effort was aimed at determining the level of satisfaction of DoD Research and Development activities with the DSA-administered DoD Information Analysis Centers (IACs). The second survey effort attempted to identify specific, job-related scientific and technical information needs of Defense scientists and engineers which could be incorporated into the DSA-administered DoD IACS Five-Year plan as a set of long-range, technical objectives. Principal findings from this effort included (1) three of every four Defense scientists and engineers experience problems in locating, obtaining, and using scientific and technical information, (2) the most important products or services that could be produced or offered by the IACs were handbooks and databooks, and (3) DoD scientists and engineers expressed a need for scientific and technical information in over thirty-five different areas.

Debons, Anthony, and Montgomery, K. Leon. "Design and Evaluation of Information Systems." In (1974) Annual Review of Information Science and Technology. Vol. IX. Edited by Carlos A. Cuadra. Washington, D.C.: American Society for Information Science, 1974, 25-55.

Developments in the design and evaluation of information systems over the period 1971-1973 were reviewed in this chapter. Major topics were theoretical developments, status of operational advances in design and evaluation, management systems, communication systems, information networks, and important trends and conclusions. The findings of the 104 publications cited were interpreted in relation to their significance in information science.

Dewhirst, H. Dudley. The Role of the LRC Technical Library in Fulfilling the Information Needs of Professional Employees. Washington, D.C.: National Aeronautics and Space Administration, August 1970 (Avail. ED 066-174).

This library evaluation was based primarily on responses of some 320 members of the professional research staff and 50 members of the professional administrative staff at the Langley Research Center to a questionnaire. Evaluation first considered the library as only one part of a total system of information sources serving professionals. This was followed by an evaluation of the collection, facilities and tools, and services of the library based on responses of those who used the library more than six times a year. A major feature of the evaluation was the use of a critical incident technique in which respondents furnished details of a recent incident when they located information which proved useful in their work.

Franz, C. R. "Contingency Factors Affecting the User Involvement Role in the Design of Successful Information Systems." Ph.D. dissertation, Nebraska University (Avail. University Microfilms, 80-01065)

A field survey was conducted to test various contingency hypotheses. Different types of user involvement in designing and implementing information systems were examined along with the resultant success of the information systems to the user. User involvement was studied under various organizational and user conditions to determine the effect which these various conditions had upon user involvement as well as the subsequent user-perceived usefulness of the information system. It was concluded that user involvement was an important variable in producing successful information systems. It was emphasized that more attention should be devoted to developing other measures of user involvement and system's success.

Fry, Bernard M. Evaluation Study of ERIC Products and Services. Final Report. Bloomington, Ind.: Indiana University, Graduate Library School, 4 volumes and a summary volume, March 1972 (Avail. ERIC ED 060-923, 060-924, 060-925, 060-926, 060-922).

This study examined the use of Educational Resources Information Center (ERIC) products and services by members of the educational community and evaluated the extent to which the ERIC system was achieving its objective of guaranteeing ready access to the nation's current significant literature in the field of education. The introduction, summary of findings, and recommendations were contained in both volume I and the summary volume. Also contained in volume I were discussions of the characteristics of ERIC users and demonstration of the extent to which ERIC was meeting its goal of making significant but previously unavailable documents easily available to the educational community.

Discussed in volume II were the ERIC Clearinghouses' information analysis activities, ERIC's efforts to help strengthen existing communication channels, ERIC activities designed to contribute to the development of a national information network, and profiles of organizations which provided ERIC services and products. Volume III described the methodology of this study and the questionnaires used, summarized the conclusions and recommendations of ERIC study advisory panels, and provided background information. Volume IV was an appendix containing supplementary and parallel tables keyed to Chapters 4-7 of volumes I and II. The summary volume contained the introduction, summary of findings, and recommendations. The findings called attention to conditions, trends, and issues concerning use and user reactions to provide a concise, analytical basis for evaluating how well ERIC had met its goals and to identify deficiencies and weaknesses. The recommendations proposed improvements and courses of action to correct deficiencies identified by this study.

Greenberg, Bette, and others. "MEDLINE Demand Profiles: An Analysis of Requests for Clinical and Research Information." Bulletin of the Medical Library Association, LXV (January 1977), 22-30.

The results of a statistical analysis of professional use of the National Library of Medicine's bibliographic retrieval system, MEDLINE (Medical Literature Analysis and Retrieval System On-Line), at a large medical school library were presented. Results indicated that (1) demand for MEDLINE service was primarily research oriented, (2) frequency of use bore a relationship to rank and departmental affiliation, (3) broad and comprehensive searches were requested more frequently than searches for specific information, (4) usage showed an interesting curvilinear relationship with age and status of the user, and (5) grant funds and support correlated with the number of searches requested. Implications of these findings were that since clinicians' use of MEDLINE was found to be minimal, information services should be reevaluated in order to assist in meeting their information needs more effectively.

Grashof, John F. An Operational Experiment for the Marketing of Scientific and Technical Information Innovations. Final Report. Harrisburg, Pa.: Pennsylvania Science and Engineering Foundation, May 1976. (Avail. NTIS PB 261-578.)

The application of modern scientific marketing research technology to the scientific and technical information (STI) industry is described through one case study. The identification of those involved in the purchase and use of STI within an organization, their roles, and purchase patterns were investigated. Special attention was focused on users knowledge of STI systems and how that knowledge was applied to purchase decisions. A total of 274 interviews with 171 firms were conducted to determine those within an organization who make STI purchase decisions. Small, medium-sized, and large firms were included in the sample. The results suggest that STI designers should consider offering a number of products to match the needs of various industrial segments.

Henderson, Madeline M. Evaluation of Information Systems - A Selected Bibliography with Informative Abstracts. Washington, D.C.: National Bureau of Standards, (NBS TN-297), December 1967 (Avail. NTIS PB 188-657; ERIC ED 061-497).

A survey of the literature on evaluation of information systems was conducted. During the early stages of the survey, the literature was divided among descriptions of programs which compared the performance of two or more information systems, accounts of programs which studied the performance of one system, papers and reports which discussed the problems of evaluation programs, and documents which proposed new techniques for evaluation of systems. From the total literature collected, those references which were judged to be most useful were abstracted. The abstracts were designed to give a summary of the content of the corresponding paper; the author's own wording was used extensively, in order to avoid misinterpretations. All the references collected were listed, in alphabetical order of author's names, in the appendix to the main body of the publication.

Hensley, Susan. Evaluation of Users' Responses to the Information Analysis Products of the ERIC Clearinghouse on Tests, Measurements, and Evaluation. Princeton, N.J.: National Institute of Education, March 1978 (Avail. ERIC ED 159-217).

To obtain user evaluations of the information analysis products (IAPs) produced by the Educational Resources Information Center Clearinghouse on Tests, Measurement, and Evaluation (ERIC/TM), questionnaires were administered to subjects randomly drawn from a 1976 list of the clearinghouse's IAP orders. Indicators of quality were document length, organization, writing, and format. Utility was judged according to the purpose for ordering the document, whether the document was passed on (if so, to whom and for what), and the document's impact on the requestor's subsequent work activities. User evaluations of ERIC/TM's products tended to be high and indicated that the publications were used as reference tools by educators to keep abreast of the literature. The questionnaire and resulting data were appended.

Herner, Saul, and others. An Evaluation of the Goddard Space Flight Center Library. Washington, D.C.: Herner and Co., July 1979 (Avail. NTIS N80-25198; NASA CR-159-969).

The character and degree of coincidence between the current and future missions, programs, and projects of the Goddard Space Flight Center and the current and future collection, services, and facilities of its library were determined from structured interviews and discussions with various classes of facility personnel. In addition to the tabulation and interpretation of the data from the structured interview survey, five types of statistical analyses were performed to corroborate (or contradict) the survey results.

Katter, Robert V. "Design and Evaluation of Information Systems." In (1969) Annual Review of Information Science and Technology. Vol. IV. Edited by Carlos A. Cuadra. Chicago: Encyclopedia Britannica, Inc., 1969, 32-70.

Most system development activities were not associated with a brand new system totally divorced from any previous system, but rather with the replacement of an older system by one that was newer, usually more expensive, and presumably more effective. The design and evaluation literature of 1968 was reviewed in the context of such a system redevelopment cycle. One hundred eighty-one references were discussed under the following topics: the system redevelopment process (planning and modeling aids, textbooks, and management); the system's demand environment; the systems's support resources; the system's operational constraints (copyright, data file security, standardization, functional overlap); cost-effectiveness analysis (measures of retrieval effectiveness, error sources in search accuracy measurement, search accuracy studies, man-system interface arrangements, hardware, and software); and conclusions.

King, Donald W. "Design and Evaluation of Information Systems." In (1968) Annual Review of Information Science and Technology, Vol. III. Edited by Carlos A. Cuadra. Chicago: Encyclopedia Britannica, 1968, 61-103.

The 1967 literature indocumentation and information retrieval was reviewed and discussed (201 references). Topics covered were: information systems concepts and analytical techniques, measures and criteria for design and evaluation defined by costs, measures of system benefits, measures of system performance, test and evaluation methodology, and results of test and evaluation in search and retrieval subsystems and announcement subsystems.

King, Donald W., and Bryant, Edward C. The Evaluation of Information Services and Products. Washington, D.C.: Information Resources Press, 1971.

This textbook addressed the evaluative and quality control aspects of library and information system design and operation. It covered the evaluative and control aspects of: classification and indexing processes and languages; document screening processes; composition, reproduction, acquisition, storage, and presentation; and user-system interfaces. The book also contained brief primers on user surveys, statistics, sampling methods, and experimental design.

King, Donald W., ed. Key Papers in the Design and Evaluation of Information Systems. White Plains, N.Y.: Knowledge Industry Publications, Inc., 1978.

Evaluation has played a particularly important role in the evolution of information systems over the past two decades. During the early and mid-1960's, a large amount of funds were expended in the United States on innovations in information retrieval systems. In the 1970's, the focus changed to operations of library systems, networks of libraries, and networks of information retrieval systems. The evaluation that had taken place over the years had influenced specific system designs and the results of past evaluation studies had affected the way in which system designs were implemented. This volume provided a single source of recent and/or classic papers for students, instructors, and practitioners who wished to use or study this facet of information science.

Krevitt, Beth I., and Griffith, Belver C. "Evaluation of Information Systems. A Bibliography, 1967-1972," Information Part 2; Reports Bibliographies, II (6) 1973. 1-34 (Avail. ERIC ED 083-988).

The scope of this bibliography was limited to literature dealing with the design, testing, and evaluation of information storage and retrieval systems. A number of papers describing the implementation of specific systems were selectively included because they contained substantial or innovative material on evaluation; however, the bibliography generally emphasized techniques applicable to a wide variety of systems. Similarly, articles dealing with specific products and services were included when they showed broad implications for evaluation. On the other hand, discussion of specific library systems were excluded as they were considered outside the scope of the bibliography.

Lancaster, F. Wilfrid. Information Retrieval Systems.: Characteristics, Testing and Evaluation. New York: John Wiley and Sons, 1968.

Indexing policy and practice, vocabulary control, searching strategies, and user-system interactions were represented as factors which significantly affected the performance of all information retrieval systems. Only subject retrieval systems were actually discussed. Topics covered in 16 chapters included: subject indexing, using both traditional and concept coordination retrieval tools; search files and searching methods; current awareness; performance of retrieval systems; index languages (complete sets of terms used to describe document content); approaches to mechanized systems (statistical analysis, automatic assignment of terms and classifications, automatic searching); evaluation of operating efficiency and economic efficiency; and user interaction with systems.

Lancaster, F. Wilfrid, and Gillespie, Constantine J. "Design and Evaluation of Information Systems." Annual Review of Information Science and Technology. Vol. V. Edited by Carlos A. Cuadra. Chicago: Encyclopedia Britannica, Inc., 1970, 33-70.

This chapter reviewed selected 1969 publications on design and evaluation of information systems, particularly those papers illustrating important trends. Topics covered were: national and international information systems and networks; system design (components, fully automatic systems, and on-line interactive systems); personal information files; relevance and relevance predictability; and evaluation of complete systems, system components, published indexes, literature usage, library services, human factors, and economic efficiency. (134 references)

Linguist, Mats G. "Dynamic Modeling of Information Services: Project Overview." Information Revolution. Proceedings of the 38th Annual Meeting of the American Society for Information Science. Edited by Charles W. Husbands and Ruth L. Tighe. Washington, D.C.: American Society for Information Science, 1975, 43-44.

This study was aimed at a comprehensive analysis of the interaction between the users and the information service. The methodology chosen was that of system dynamics. The thrust was to analyze the structure of systems, and to identify possibilities for improving system performance. The developed model (given) was oriented towards the management of an information service.

Liston, David M., Jr., and Schoener, Mary L. "A System Approach to the Design of Information Systems." Journal of the American Society for Information Science, XXII (2) (March/April 1971) 115-122.

A systems approach to the design of document-handling information systems required a detailed examination of the choices made in the design process and the ramifications of possible choices in terms of the capabilities, performance, cost, and other characteristics of the system. The authors advocated a systematic procedure involving six steps (1) identification of fixed parameters, (2) identification of variable parameters, (3) identification of available options for each variable parameter, (4) identification of factors affecting a choice among available options, (5) identification of factors affected by a choice among available options, and (6) logical analysis of the picture thus presented. The analysis determined the optimum sequence for decision during the design process and the nature of the decision process itself.

Lucas, Henry C., Jr. "Systems Quality, User Reaction, and the Use of Information Systems." Management Information, III, 1974, 207-212 (Avail. ERIC ED 089-771).

One hundred seventeen administrators, users of both batch process and on-line computer systems at a major university, responded to a questionnaire designed to discover attitudes toward the quality of the system and services, the users' evaluation of the service, and the relationship of these attitudes with voluntary use of the system. These attitude, evaluation, and use factors were considered in relation to the actual quality of the system as rated independently by the information services department staff. Data were collected on input-output quality, adequacy of training, management support, quality and kinds of reports generated, input error ratings, usefulness, accuracy, timeliness, flexibility, completeness, and pressure to reprogram the system. The data showed an association between actual quality of systems and quality as perceived by users with favorable user attitude. These favorable attitudes and evaluations were also positively associated with system usage. Further increased voluntary use may be predicted by favorable attitudes, which provided good reasons for information services to develop high quality systems and favorable user attitudes.

McCarthy, Susan E., and others. "Evaluation of MEDLINE Service by User Survey." Bulletin of Medical Library Association, LXII (October 1974), 367-373.

An evaluation of the MEDLINE service at the Calder Memorial Library of the University of Miami School of Medicine was conducted. A one-page questionnaire was sent to 350 patrons who had requested MEDLINE searches in 1973. The response validated many assertions about the user group and their reasons for using MEDLINE. Quite surprising were the degree of enthusiasm, the willingness to pay out of personal funds, the apparent lack of knowledge about SDILINE, and the number of critical comments. The experience gained by this assessment has suggested improvements in some aspects of service, as well as more subject-specific evaluations at intervals on the future.

Milcarek, Barry I., and Struening, Elmer L. "Evaluation Methodology: A Selective Bibliography." Handbook of Evaluation Research. Vol. I. Beverly Hills, Calif.: Sage Publications, Inc., 1975, 667-676.

In choosing the bibliography entries, the focus was on general issues in the methodology of program evaluation. Writings concerned with describing methodological resources, their limitations, and the modifications demanded by practical applications were given most serious attention. References were arranged under the following headings: issues in conceptualization, issues in measurement, issues in design, and issues of interpretation.

Moll, Wilhelm. "MEDLINE Evaluation Study." Bulletin of the Medical Library Association, LXII (January 1974), 1-5.

MEDLINE (MEDLARS-on-line) is an on-line, interactive bibliographic searching system developed by the National Library of Medicine. The system provides users with lists of bibliographical citations and other information from a file of over 1,250 bio-medical journals. A survey testing user reactions was conducted at the University of Virginia Medical Library. The results of the survey were based on replies by 246 users who requested one or more MEDLINE searches between September 1972 and March 1973. The findings indicated that more than 93% believed the MEDLINE was a substantial improvement over the traditional methods of searching through the printed indexes. These respondents also stated that the results of MEDLINE searches had assisted them in their clinical or research work, or both. Asked whether they would continue to use MEDLINE after the imposition of user charges on July 1, 1973, about 75% said that they would. Since the remaining 25% expressed some reservations and doubts, a decline in the use of MEDLINE was projected once user charges were imposed.

Pinelli, Thomas E., and others: A Review and Evaluation of the Langley Research Center's Scientific and Technical Information Program: Results of Phase I - Knowledge and Attitudes Survey, LaRC Research Personnel. NASA TM-81893. Washington, D.C.: National Aeronautics and Space Administration, November 1980, (Avail. NTIS Pending).

The results of Phase I - Knowledge and Attitudes Survey, LaRC Research Personnel were contained in this report. Phase I was conducted as part of the Langley STI Review and Evaluation Project. The purpose of Phase I was to assess the effectiveness of the Langley STI program based on feedback obtained from Langley engineers and scientists. Phase I utilized survey research. The survey procedure was conducted in two stages. Stage one involved personal interviews with 64 randomly selected Langley engineers and scientists. The interviews were used to obtain information for questionnaire development. Stage two involved the collection of data through the construction and administration of a questionnaire. The questionnaire, which was based on information gathered in stage 1, covered various aspects of the Langley STI program, utilized both open- and closed-ended questions and was pretested for finalization. The questions were organized around the six objectives for Phase I. From the 647 completed questionnaires, a random sample of 300 were analyzed. From the analysis of the data, recommendations were made for improving the Langley STI program.

Pinelli, Thomas E., and others. A Review and Evaluation of the Langley Research Center's Scientific and Technical Information Program: Results of Phase IV - Knowledge and Attitudes Survey, Academic and Industrial Personnel. NASA TM-81934. Washington, D.C.: National Aeronautics and Space Administration, February 1981, (Avail. NTIS Pending).

The results of Phase IV - Knowledge and Attitudes Survey, Academic and Industrial Personnel were contained in this report. Phase IV was conducted as part of the Langley STI Review and Evaluation Project. The purpose of Phase IV was to assess the effectiveness of the NASA and Langley STI program based on feedback obtained from engineers and scientists from the academic and industrial community. Phase IV utilized survey research. The survey procedure was conducted in two stages. Stage one involved personal telephone interviews with randomly selected scientists and engineers within the United States (Alaska and Hawaii excluded). Stage two involved the collection of data through the administration of a questionnaire. The questionnaire covered various aspects of the NASA and Langley Research Center STI programs and utilized both open- and closed-ended questions. The questions were organized around seven objectives for Phase IV. From the 492 mailed questionnaires, 381 valid returns were analyzed. From the analysis of the data, recommendations were made for improving the NASA and Langley STI program.

Pryor, Harold E. "An Evaluation of the NASA Scientific and Technical Information System." Special Libraries, LXVI (11), (November 1975), 515-519.

NASA interviewed users of its scientific and technical information system in order to assess the usefulness of the present system and to find ways to make it more effective. Emphasis was on announcement and current awareness services, the publication program, and the interactive retrieval system.

Pryor, Harold E. "Listening to the User," In AGARD The Problem of Optimization of User Benefits in Scientific and Technological Information Transfer. Paris, France: AGARD, March 1976, (Avail. NTIS N76-25109).

A system evaluation study of the NASA scientific and technical information system was described. The thrust of this examination was to evaluate the usefulness of the present information system to those it was intended to serve (engineers and scientists working in their professional roles) and to identify areas and ways in which the system could be made more responsive to user needs. Techniques used covered the range from personal, in-depth interviews to widely distributed questionnaires. The findings were positive. Many refinements made to on-going programs and projects and new endeavors begun in direct response to stated user needs were discussed. In the main, these needs were not unreasonable and thus could be responded to with cost effective system modifications.

Rees, Alan M. "Evaluation of Information Systems and Services." In (1967) Annual Review of Information Science and Technology. Vol. II. Edited by Carlos A. Cuadra, New York, John Wiley and Sons, 1967, 63-86.

This chapter summarized and discussed the state of the art in testing and evaluation in 1967. The few substantive research projects involving testing and evaluation were outlined in some detail. Although a distinction was made in this review between laboratory-based experimentation and tests of operational systems, the methodology used in each instance was substantially the same. A number of research projects in areas cognate to testing and evaluation were described, and some general conclusions were provided with respect to past and future activity. (52 references)

Scott, Helen B. "The Development and Administration of a System: The Dissemination of Scientific and Technical Information." Unpublished Ph.D. dissertation, Texas A & M University, 1978 (Avail. University Microfilms, 79-09235).

A study to develop a more efficient system for the dissemination of scientific and technical information which could be adapted to other users with similar information needs on a national and international basis was conducted in the Department of Agricultural Communications, Texas A & M University. Publications of the Texas Agricultural Experiment Station (TAES) were used. Two phases were developed for the dissemination system: (1) an abstract notification system for notifying the TAES distribution list that a publication was available and (2) a brief publications format more comprehensive than an abstract but less comprehensive than the full text of the publication.

Severy, Lawrence J. Evaluation: Problems and Prospects. Princeton, N.J.: National Institute of Education, November 1975 (Avail. ERIC ED 117-190).

This publication presented a comprehensive but non-technical discussion of the issues surrounding program evaluation and the experimental method. Methods for effectively employing program evaluation were suggested to administrators, educators, graduate students, novice researchers, and program and project directors. Discussions included (1) the reasons for applying the experimental method to program evaluation, (2) the basic elements of the experimental method, (3) refinements and variants of the experimental method with examples from program evaluation in the social sciences, (4) ways in which funding directives can be adapted to the experimental method, and (5) potential problems connected with the experimental approach.

Smith, William A., Jr. Studies in Evaluation of Information System Effectiveness. Bethlehem, Pa.: Leigh University, Department of Industrial Engineering, June 1972 (Avail. NTIS AD 744-027).

The varied characteristics and purposes ascribed to information systems were identified, including the requirement to support the decision process at one or more levels of activity. The value of information and its impact on organizational objectives were discussed. A proposed information-decision model stressed the recurring, dynamic demands for system output. Measures of effectiveness were derived from functional objectives in both qualitative and quantitative terms. Economic and behavioral influences on these performance indicators were considered.

Smith, William A., Jr., and Wechsler, Ben L. Planning Guide for Information System Evaluation Studies. Norcross, Ga.: American Institute of Industrial Engineering, Computer and Information Systems Division, August 1973.

This monograph proposed a comprehensive, systematic approach to the planning of evaluation studies for information systems. It suggested a careful analysis of the reasons for such a study; the nature of the system; and the functional, user-oriented requirements which were to be supported. The issues related to assessment of information processing activities and to definition of measures of effectiveness were discussed. Emphasis was placed upon identifying tangible benefits wherever possible. Organization of evaluation studies was covered and an illustrative example was provided.

Struening, Elmer L., and Guttentag, Marcia, eds. Handbook of Evaluation Research. Beverly Hills, Calif.: Sage Publications, Inc., 1975.

One purpose of this handbook was to provide a reference which evaluators could consult as they developed their studies. The second purpose was to serve as a textbook for courses in evaluation at the graduate level. Volume I, divided into eight parts, focused on some aspect of the evaluation process. Papers were compiled under the following headings: preface, policy and strategy in evaluation research, conceptualization in design of evaluation studies, development and evaluation of measures, data collection through social ecology, data analytic methods, and communication of evaluation results. Volume II focused on evaluations in context. Several content areas, their special problems, and the evaluation methodologies applicable to them were presented and discussed. Papers were presented under the headings: preface, politics and values in evaluation research, cost-benefit approach to evaluation, evaluation of mental health programs, and selected content areas in evaluation research.

Swanson, Rowena W. "Design and Evaluation of Information Systems." In (1975) Annual Review of Information Science and Technology. Vol. X. Edited by Carlos A. Cuadra, Washington, D.C.: American Society for Information Science, 1975, 43-101.

The literature selected for this chapter consisted of 1973 and 1974 publications, which were reviewed and discussed under the following sections: design of information systems, methodological approaches to evaluation, evaluations of information systems, performance measures, and evaluation methodologies of information science. The design section was subdivided to reflect both outcomes of design activities and appraisal components of the design process. The second section provided descriptions of seven major evaluation methodologies that have been explored and developed by non-information-science groups. Evaluations within information science were treated primarily from a methodological viewpoint. (276 references)

Swanson, Rowena Weiss. "Performing Evaluation Studies in Information Science." Journal of the American Society for Information Science. XXVI (3), (May-June 1975), 140-156.

This paper considered conceptual and methodological components of information science evaluation studies. The paper discussed the judgmental process of evaluation and the scientific nature of evaluation study in the context of purpose statements; criteria; the selection of variables and data collection and analysis techniques; and requirements of validity, reproducibility and reliability. Industrial value analysis/engineering methodology was described and related to assessments of information products and services. The state-of-the-art of evaluation study in information science was analyzed with respect to (1) the scope of evaluation studies, (2) the use of laboratory type environments, (3) the use of surrogate judges, (4) selection of variables, (5) frequency of study, and (6) comparability of study results. Evaluation study was seen as essential to the management of information centers and systems and as having appreciable growth potential.

Sweezy, Eldon, Hopper, Janice. Obstacles to Innovation in the Scientific and Technical Information Services Industry. Washington, D.C.: Institute of Public Administration, October 1975 (Prepared for National Science Foundation; Avail. NTIS PB 253-449).

The objective of this report was to evaluate the efficiency and effectiveness of the scientific and technical information services serving the needs of the state and local public sector decisionmakers, with a view to enhancing service capabilities and improving state and local officials' understanding of what is available and how it serves them. The topics addressed were (1) how scientific and technical information requirements in the public sector differ from the needs of commercial and corporate users, (2) whether cost considerations affect public sector information users differently from private sector users, and (3) how information users and suppliers evaluate all of the separate factors in formulating their plans.

Taube, Mortimer. An Evaluation of "Use Studies" of Scientific Information.
Washington, D.C.: Documentation, Inc., 1959.

An evaluation of the total literature on use studies was attempted. The evaluation accepted the conclusions drawn by other surveys of use studies which appeared before the International Conference on Scientific Information in November 1958 and brought those conclusions up to date by abstracting and evaluating the studies prepared for the conference. An attempt was made to analyze the reasons for the generally accepted failure of use studies by establishing a distinction between consumer services and professional services. It was concluded that the organization and dissemination of scientific information was a professional activity, the value of which could not be measured by consumer responses, and that such responses could not supply direction for the design of more effective scientific information and reference systems.

Weiss, Carol H. Evaluation Research: Methods for Assessing Program Effectiveness. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972.

This book dealt with the application of research methods to the evaluation of social programs, such as programs in education, social work, health, mental health, and technical assistance. The basic theme of the book was that evaluation used the methods and tools of social research but applied them in an action context that was intrinsically inhospitable to them. A principal purpose was to alert readers to prevalent issues and problems and offer guidance for adapting textbook methods to real world evaluation settings.

Wolek, Francis W. "Professional Work: The Context for Evaluating the Impact of User Studies." Changing Patterns in Information Retrieval. Tenth Annual National Information Retrieval Colloquium. Edited by Carol Fenickel. Washington, D.C.: American Society for Information Science, 1974, 34-35.

It was proposed that amount of usage was not the proper criterion for evaluating formal systems because only a small number of people in a field are actively involved in original work. Progress in many fields consisted of relatively small incremental advances within established lines of work. While interaction with formal systems constituted only a small part of users' total activities in acquiring information, a strong need to understand the users' problems was predicted.

INFORMATION - USE AND NEED

Advisory Group for Aerospace Research and Development. Scientific and Technical Information - Why? Which? Where? and How? Paris, France: AGARD Lecture Series No. 44, February 1971 (Avail. NTIS N71-23501).

This publication consisted of eight papers presented in an AGARD lecture series. The primary purpose of this series was to bring to the attention of users (technologists and scientists), the present capabilities of information systems, services, and media retrieval techniques. The series covered the basic background on what information can do for scientists and technologists, the needs of the technical community, sources of technical information, information channels and formal services for obtaining information, and selective dissemination techniques. The concept, mission, and operation of scientific and technical information analysis centers were also presented, and their relationship to conventional information centers was described.

Advisory Group for Aerospace Research and Development. The Problem of Optimization of User Benefit in Scientific and Technological Information Transfer. Neuilly Sur Seine, France: Advisory Group for Aerospace Research and Development, 1978, AGARD Conference Proceedings No. 179 (Avail. NTIS N76-25098).

A summary of a panel discussion on the fifteen papers presented during the Technical Information Panel Specialists' Meeting was given. The papers were concerned with investigating the user/service interface and defining users' problems particularly for aerospace, scientific, and technical information. User population and their needs were examined with the view toward helping system designers and managers provide services to meet these requirements.

Allen, Thomas J. "Information Needs and Uses." In (1969) Annual Review of Information Science and Technology. Vol. IV. Edited by Carlos A. Cuadra. Chicago: Encyclopedia Britannica, Inc., 1969, 3-29.

The literature appearing during 1968 on information needs and uses was reviewed in the conceptual framework of the scientist as an information processor and communicator within a work team, professional society, invisible college, and other organizations. Both formal structure and informal organization were important factors in communication patterns and information flow.

Allen, Thomas J. Meeting the Technical Information Needs of Research and Development Projects. Cambridge, Mass.: Massachusetts Institute of Technology, November 1969 (Prepared for National Science Foundation; Avail. ERIC ED 047-748).

Data from a large number of recent research studies were brought to bear on the problem of providing for the technical information needs of research and development projects. The importance of proper support by the technical staff was shown, and it was argued that the best way to couple the project team to information sources outside the organization was by an indirect route through key personnel among the laboratory's technical staff. Informal relations and physical location were shown to be important determinants of the structure of organizational communication networks. The effect of physical location on communications was especially strong and required serious consideration when designing research facilities. The formation of project teams and intergroup transfers and loans were presented as opportunities for the development of informal relations.

Allen, Thomas J. "Organizational Aspects of Information Flow in Technology." Aslib Proceedings, XX (November 1968), 433-54.

A study was conducted by a research group working at the Massachusetts Institute of Technology to explore the information needs of scientists and engineers, the means for meeting these needs, and interrelationships between different means and the efficiency of research work. Among the information channels investigated were literary sources, contractors, buyers, in-house studies, and laboratory staff. The utilization of these channels by specialists and the efficiency of information received through them were also studied. A major conclusion was that internal information channels were more efficient than the external ones and that the majority of engineers made much less use of literary sources than might have been expected. On the other hand, every laboratory had on its staff a number of specialists who were particularly active users of external channels, kept abreast of periodicals in the field, and regularly read special literature. They served as information sources for their colleagues, who, as ascertained, often turned to them for consultation on various technical problems. The important role such specialists had to play in research was emphasized.

Bates, Marcia J. User Studies: A Review for Libraries and Information Scientists. Bethesda, Md.: Leasco Information Products, Inc., 1971.

This selective review covered user studies done from the standpoints of both the library and the user. Catalogs, reference services, circulation, browsing, and library facilities were included, as were information-gathering habits of scientists and the general public. Studies of whole information systems and the methodology and philosophy of user studies were discussed. The coverage of 181 listed papers was restricted to those in the English language through 1968, with a number of 1969 papers included.

Barnes, R. C. M. "Information Use Studies: Comparison of Some Recent Surveys." Journal of Documentation, XXI (1965), 169-176.

Two information-use surveys (one conducted by the National Lending Library for Science and Technology, and one conducted on behalf of the Advisory Committee on Scientific Policy) were compared with each other and with earlier surveys in regard to sampling, design and format of the survey, analysis and reporting of data, and selected results. This examination showed that, while the results were not contradictory, differences in principle and method made it impossible to demonstrate close agreement. It was concluded that direct comparison of results from different surveys was difficult, and the superficial comparisons could be misleading.

Berrill, Allison, and Corbett, Lindsay. "User Needs and Information Supply: Report on the Scottish Branch Conference." Information Scientist, VII (March 1973), 20-22.

A one-day conference on user needs and information supply was held at the University of Stirling (Scotland) on November 10, 1972. Brief summaries were given on the following papers: "Secondary Information Services and the User" by T. M. Aitchison; "User Needs in the Product Data Field" by W. Tyson; "Assessing User Needs in an Information Context" by J. L. Schofield; and "Some Economic Aspects of Information Supply" by J. N. Wolfe.

Boies, Stephen J. User Behavior on an Interactive Component System. Yorktown Heights, N.Y.: Watson Research Center, August 1972 (Avail. NTIS AD-754836).

The results of an analysis of user behavior on an interactive system were presented. Empirical data on user behavior were presented concerning: (1) the duration and frequency of user terminal sessions, (2) the use of language processors, (3) user response time, and (4) command usage. The results were discussed in terms of the behavioral literature relevant to the design of interactive systems. Suggestions were made with respect to those areas which could be investigated by behavioral scientists.

Brittain, John M. Information and Its Users: A Review With Special Reference to the Social Sciences. Calverton Down, Bath, England: Bath University Press, 1970.

An extensive investigation of the literature and studies related to information requirements in the social sciences was conducted. The author concluded that user studies in the social sciences had: (1) only recently begun to appear, (2) drawn heavily on user studies in the sciences on methodological issues, and (3) been conducted without strong theoretical or conceptual frameworks.

Cleverdon, Cyril W. "User Evaluation of Information Retrieval Systems."
Journal of Documentation, XXX (June 1974), 170-80.

Recall and precision were established as the measures for determining the performance of a system. To determine the value or usefulness of a system to the actual users or to discover how to attract new users, the form of the evaluation must be user-oriented rather than management-oriented. Providing the basic operational characteristics of the system were known, three dimensions for evaluating the performance of a system in regard to user satisfaction were established: the quantitative measure of "search length," the qualitative measure of "satisfaction," and the number of relevant citations consulted. Use of these dimensions would provide basic data for an analysis permitting either an increase in user satisfaction or a decrease in operating costs.

Crane, Diana. "Information Needs of Users." In (1971) Annual Review of Information Science and Technology. Vol. VI. Edited by Carlos A. Cuadra. Chicago: Encyclopedia Britannica, Inc., 1971, 3-39.

This chapter reviewed 109 publications, mostly issued in 1969 and 1970, concerned with information needs of users. The first section examined literature on user needs in the basic sciences. Subtopics included the social organization of the research area, intellectual development of research areas, connections between research areas, diffusion of information from the research area to the formal communication system, information seeking, the scientists and the formal communication system, and innovations in formal communications systems: current controversies. Section two dealt with publications on information needs and uses in technology, and section three was concerned with literature on international aspects of information needs and uses.

Crawford, Susan. "Information Needs and Uses." In (1978) Annual Review of Information Science and Technology. Vol. XIII. Edited by Martha E. Williams. White Plains, N.Y.: Knowledge Industry Publications, Inc., 1978, 61-81.

This paper reviewed 95 publications on information needs and use studies, issued during the period 1975 through 1977, which had been identified from "Information Science Abstracts," "Library Literature," and informal sources. It addressed developments in four major areas: the concepts of information needs and uses, methodology of use studies, uses of information, and review of use studies published during 1975-1977. The use studies were categorized and discussed by area of focus: physical science and technology, biological/health sciences, social sciences, human information needs, mass media, use of specific techniques, and conceptual or review papers.

Disch, A. "The Voice of the User: His Information Needs and Requirements (Which Are Not What the Information Specialists Think They Are)." The Problem of Optimization of User Benefits in Scientific and Technological Information Transfer. Paris, France: AGARD, March 1976 (Avail. NTIS N76-25098).

Two user studies were carried out in Norway. In the first one, 1,400 engineers were asked to list those information sources that they had used lately and which had proved to be of practical value in their daily work. The follow-up was a detailed study of the information gathering habits of a limited number of users. It was found in both studies that the traditional information channels were of little practical value to the user. Two attempts to remedy these findings were described.

Faibisoff, Sylvia G., and Ely, Donald P. "Information and Information Needs." Information Reports and Bibliographies. V. N.Y.: Science Associates/International, Inc., 1976, 2-16.

After a conceptual framework in which information, information needs, and communication were defined and discussed, this paper reviewed the literature on studies of information needs in the areas of the sciences, the social sciences, the professions, and the general public. The emphasis of past studies was found to cluster in four groups (1) the behavior of the user; (2) the nature, amount and source of information being sought; (3) the quality of the information; and (4) the timeliness of the information. Given the findings of past needs studies, 12 guidelines for the design of user-oriented information systems were presented.

Forecasting International, Ltd. An Application of Market Research Techniques to the Dissemination of Scientific and Technical Information. Arlington, Va.: Forecasting International, Ltd., February 1977 (Avail. NTIS PB 265-130)

The goal of the project was to develop a methodology for providing data to enable the producers and distributors of STI products and services to target their product design, distribution, and promotion efforts more effectively. The project was developmental, with a focus on knowledge about user characteristics in general. The methodology was based on the market research technique called market segmentation. Questionnaires were completed through personal interviews with a scientifically designed, nationwide sample of 402 chemists and electrical engineers. The respondents ranked nine types of information needs. The data analysis provided a description of six market segments in each discipline which had characteristics in common. The study validated the application of market segmentation to STI markets for improving user access to information.

Freeman, James E., and Rubenstein, Albert H. The Users and Uses of Scientific and Technical Information: Critical Research Needs. Denver, Colo.: University of Denver Research Institute, November 1974 (Prepared for National Science Foundation; Avail. NTIS PB 237-941).

To help identify what user and use problems should be given highest research priority in the near future, the NSF arranged for a workshop in Denver in November 1973 at which 21 industrial, governmental, and academic representatives generated and set priorities on 50 critical research issues. Participants also completed two post-workshop evaluations of the original set of scientific and technical information user/use issues. Results of the workshop and the followup activity were presented in this report.

Garvey, William D., and others. "The Dynamic Scientific-Information User." Information Storage and Retrieval, X (March/April 1974), 115-131.

The concept of the information user was examined, and data were discussed relative to "intraindividual variations" (changes which occur within individual scientists as their scientific work progresses) and "interindividual variations" (physical vs social scientists, basic vs applied scientists, experienced vs inexperienced scientists, and scientists working in the same subject-matter area vs scientists who recently changed their areas). All of these were found to produce significant variation in the information needs of scientists and in the sources they used to satisfy these needs. Some implications of these findings relative to information technology were discussed.

Gellman, Aaron. The Role and Application of Scientific and Technical Information in the Process of Innovation: Invention and Conception. Final Report. Jenkintown, Pa.: Gellman Research Associates, Inc., December 1975 (Prepared for National Science Foundation; Avail. NTIS PB 256-580).

The information gathering and use habits of a sample of scientists and engineers who, by job function and performance, were found to be innovators were explored. The data were collected for the study using a structured interview format with a number of open-ended questions. The survey was administered in person by a member of the project staff. Formal channels of communication, particularly the STI subset, were not extensively employed by the innovators.

The George Washington University Medical Center. Preliminary Report of the User's Perspective Conference of the National Forum on Scientific and Technical Communication. Washington, D.C.: National Science Foundation, November 1976 (Avail. NTIS PB 269-057).

Availability and utilization of scientific and technical information was assessed by professionals from public and private organizations, public interest groups, and the press. Problems contributing to inadequate service to users were discussed.

Goodman, Arnold F., and others. DOD User-Needs Study, Phase II -- Flow of Scientific and Technical Information Within the Defense Industry. Final Report. Anaheim, Calif.: North American Aviation, Inc., November 1966 (Avail. ERIC ED 018-239 and ED 018-240; Overview ED 018-237).

A study was made of the nation's defense industry to determine its information needs and the flow of scientific and technical information (flow process) necessary to satisfy these needs. Volume I of the three volume final report was an overview of the other two volumes and included a nontechnical summary, guidelines for management decisions, and recommendations for the future. Volume II described the technical approach, findings, and recommendations of the study. The third volume presented the reduced data collected from 1500 individuals in 83 organizations within the defense industry. Analysis of the data included frequency distributions, stepwise regression relationships, and comparison of phase I (an earlier part of the study carried on within the defense industry) and phase II distributions.

Grose, J. H., and Krall, George F., Jr. The Conceptual Framework for a Comprehensive and Continuing STI Resource Inventory. Radnor, Pa.: Krall Management, Inc., April 1978 (Prepared for National Science Foundation; Avail. NTIS PB 282-345).

An assessment of the requirements of users and suppliers of these resources and the current STI enterprise capabilities was made. Various implementation considerations were compiled and synthesized, and a conceptual framework for the continuing pursuit of an STI resource inventory was formulated. The primary function of such an STI resource inventory was to act as an interface between the users and suppliers of STI in the information industry.

Hall, Homer J. User Values in the Selection of Information Services. Linden, N.J.: Exxon Research and Engineering Co., February 1977 (Prepared for National Science Foundation; Avail. NTIS PB 269-507).

The value systems by which the users of purchased information services select which one to use or buy were found to differ sharply between different user populations. Selection variables were summarized in a matrix of user values and interaction effects. The research function user preferred original documents and tended to choose subjectively. The operating manager more often stopped with abstracts and emphasized quantifiable factors. The planning manager wanted a digest of ideas, not references, and tended to judge a service first by its reliability. These three functions attached entirely different connotations to the same words for key parameters. Apparent conflicts could be resolved by dimensional analysis of differences in values perceived as illustrated by case histories, interviews, and questionnaire results.

Hall, Homer J. "Which Service to Buy and Why?" Information Politics. Proceedings of the 39th Annual Meeting of the American Society for Information Science. Edited by Susan K. Martin. Washington, D.C.: American Society for Information Science, 1976.

Identifiable groups of users of scientific and technical information services were found to differ sharply in the value systems they applied in deciding what service to buy or use. A guide to user-identification developed for NSF/DSI took the form of a dimensional analysis of characteristic selection factors and a matrix of their interaction effects. When selection factors were grouped into three dimensions (quantifiable, qualitative, and judgmental), differences were observed in the relative importance attached to these by different user populations. Value systems varied with the specific use, and use appeared to be a more significant factor than the user as an individual.

Herner, Saul. "Determination of User Needs for the Design of Information Systems." In Information Systems Workshop: The Designer's Responsibility and His Methodology. Washington, D.C.: Spartan Books, 1962.

For designing information storage and retrieval systems, this study advocated compromise to achieve broad user acceptance, maximum economy, and minimum bias. User requirements were said to be important not only in determining what should be included in a system, but also what is not needed, and what is needed but available from other sources in a satisfactory manner. Analytical techniques for measuring relevance to user needs and sources of bias were discussed.

Herner, Saul, and Herner, Mary. "Information Needs and Uses in Science and Technology." In (1967) Annual Review of Information Science and Technology. Vol. II. Edited by Carlos A. Caudra. New York: John Wiley and Sons, 1967, 1-21.

This review primarily covered publications appearing in 1966. The publications were discussed in categories based on methodology employed. Sections included the present state and problems of user studies, diaries and user-administered records, interviews observations, questionnaires, indirect studies, combined technique studies, and implications and conclusions.

Harmon, Glynn. "Information Need Transformation During Inquiry: A Reinterpretation of User Relevance." The Information Conscious Society. Proceedings of the 33rd Annual Meeting of the American Society for Information Science. Edited by Jeanne B. North. Washington, D.C.: American Society for Information Science, 1970, 41-43.

Findings of two key relevance investigations, the Cuadra-Katter and Rees-Schultz experiments, were reinterpreted against a user information need model. Nonexpert users, like initiators of research, generally possessed few if any adequate cognitive organizers. They must mentally acquire and permute information elements until a personally satisfactory conceptual organization emerges. Expert users at the outset of inquiry, or researchers in the post-hypothesis stages of inquiry, generally possessed adequate cognitive organizers. As the user elaborated his cognitive map, information gaps and alternative arrays became increasingly apparent. He was then better able to designate various information elements as either essential, redundant, or irrelevant to his cognitive mapping. The system user thus needed alternative access to both organizing form and content.

Kidd, J. S., and others. "Information Seeking Behavior of Scientists as a Guide to Information Product Design." Current Research on Scientific and Technical Information Transfer. N.Y.: Jeffrey Norton Publishers, Inc., 1977.

Specific instances of user need assessment and information product development were described. The work reported was one component of a multiphase project. The particular user set studied in this phase was comprised of scientists engaged in cross-disciplinary projects, mainly environmental studies. An information product consisting primarily of extracted and reformatted journal materials in the topic area of the effect of herbicides on aquatic plants was employed to illustrate the outcomes.

King, Donald W., and Palmour, Vernon E. "User Behavior." Changing Patterns in Information Retrieval, Tenth Annual National Information Retrieval Colloquium. Edited by Carol Fenichel. Washington, D.C.: American Society for Information Science, 1974, 7-33.

The paper discussed a conceptual framework for user behavior, the knowledge gained concerning the user interface with the system, and what more needed to be discovered about system users and their behavior. Since this Colloquium was traditionally focused on formal scientific and technical information systems, the paper was limited to this area. Discussed but purposely not stressed, were informal communications within organizations and invisible colleges, although the importance of the informal mechanisms for transmitting information was not underestimated.

Kunz, Werner, and others. Methods of Analysis and Evaluation of Information Needs. Munich, W. Germany: UNESCO, 1977 (Avail. Verlag Dokumentation, Postfach 711009, 8000 Munich 71, West Germany).

Trends and approaches of user studies in the information sciences were reviewed, leading to strategies for future work. The study analyzed and evaluated information needs, examined their practicability and utility within the framework of planning national information systems (i.e., planning the national documentation, library and archive infrastructures) and proposed a direction for future user and use research. It was organized in six parts: introduction, theoretical concepts of information needs and behavior, conventional empirical methods of user research, newer approaches and methods for analyzing and evaluating information needs, conclusions, and prospects. A list of 124 references completed the work.

Ladendorf, Janice M. "Information Flow in Science, Technology, and Commerce." Special Libraries, XV (May/June 1970), 215-221.

Information of user characteristics has been of crucial importance in the design of information systems. Unfortunately, many scientists and engineers have not used information even when it was readily available to them. Characteristic communication behavior was established for two basic types of users: the successful research scientist and the average industrial technologist. Communication activities did not represent an isolated behavior pattern. They were deeply tied to social, professional, and institutional relationships. There were limits on the extent to which these behavior patterns could be modified to increase the use of information.

Lancaster, F. Wilfrid. "Assessment of the Technical Information Requirement of Users," in Contemporary Problems in Technical and Library Information Center Management. Edited by Alan Rees. Washington, D.C.: American Society for Information Science, 1974, 59-85.

Measurement of technical information needs of users was discussed, and the various types of user surveys, which could be categorized as library-oriented and user-oriented, were described. Methodologies of the surveys were discussed and evaluated as to effectiveness. General conclusions which could be drawn from user studies were: libraries and information centers, as well as librarians, were not ranked highly as information sources; librarians may be responsible for this problem in their failure to educate their patrons and themselves; information sources were generally chosen based on ease of use; personal collections were preferred to even the finest central information facility; and informal channels of communication, such as personal contacts, were frequently more highly valued than formal channels. The applicability of user studies to Army and other government information centers was discussed.

Landau, Herbert B. "Methodology of a Technical Information Use Study." Special Libraries, LX (July/August 1969), 340-346.

A methodology for conducting a study of the needs of a technological information user was presented. The methodology could be used, with little or no modification, by an organization of moderate size where the majority of the technical staff members were situated at one main location. This technique utilized an informal interview approach which could be employed by a single interviewer. The technique was employed at the Auerbach Corporation in the first half of 1968 and was found to be successful.

Lin, Nan, and Garvey, William D. "Information Needs and Uses." In (1972) Annual Review of Information Science and Technology, Vol. VII. Edited by Carlos A. Cuadra. Washington, D.C.: American Society for Information Science, 1972, 5-37.

This publication was a summary of the 1971 literature on (1) attitudinal and behavioral patterns of information needs, exchange, and uses among scientists and technologists, and (2) organizational and institutional efforts to manage and improve the information system. Topics discussed were: factors generating differential information needs; types of information needs; patterns of information exchange; information uses of scientists, technologists, and laymen; and innovations in scientific and technical information systems. (96 references)

Lipetz, Ben-Ami. "Information Needs and Uses." In (1970) Annual Review of Information Science and Technology. Vol. V. Edited by Carlos A. Cuadra. Chicago: Encyclopedia Britannica, Inc., 1970, 3-32.

This annual review covering selected 1969 literature contained three major sections: surveys and measurements, methodology, and theory. The surveys and measurements section contained reviews of publications that reported actual data on information uses and needs. The methodology section covered publications that reported on new techniques for observing or detecting information uses and needs. The third theory section discussed articles on definition, explanation, prediction, and theory. (114 references)

Martyn, John. "Information Needs and Uses." In (1974) Annual Review of Information Science and Technology. Vol. IX. Edited by Carlos A. Cuadra. Washington, D.C.: American Society for Information Science, 1974, 3-24.

The author reviewed selected publications issued during 1973 and part of 1972 dealing with information needs and uses. Major categories of references discussed were systems-oriented studies, component-oriented studies, and background research. (32 references)

Menzel, Herbert. "Information Needs and Uses in Science and Technology." In (1966) Annual Review of Information Science and Technology. Vol. I. Edited by Carlos A. Cuadra. New York: John Wiley and Sons, 1966.

For this first volume of the annual Review, coverage included studies published as early as December 1963. The reader was given a rounded picture of a period during which research progressed along the following lines: (1) substantial advances in the more systematic and fruitful application of the (critical incidents) technique, (2) the introduction of at least two very promising approaches (solution development records and comparison of research teams working on identical tasks), and (3) an increase in the number of efforts at comprehensive study of the information-flow situation in given disciplines. Selected papers published during this period were grouped and reviewed under the following classifications: preference, demand, and experimental studies; use studies (e.g., channel studies and critical incident studies); dissemination studies; and comprehensive study programs.

Paisley, William J. "Information Needs and Uses." In (1968) Annual Review of Information Science and Technology. Vol. III. Edited by Carlos A. Cuadra. Chicago: Encyclopedia Britannica, 1968, 1-30.

In this review of 1967 literature, the author examined studies of information-gathering and information-disseminating behavior of scientists and technologists. The publications were reviewed in the conceptual framework of the scientist within a series of systems: his own head, his work team, a formal organization, an invisible college, his reference group, a membership group, a formal information system, a political system, and his culture. (68 references)

Ranganathan, S. R. "Annotation on 'User's Survey.'" Annals of Library Science and Documentation, (March/June 1970), 1-22.

Substantial comments by Ranganathan on a paper, "User's Survey Concerning Teachers and Research Scholars in the Department of Chemistry, University of Delhi," by Krishan Kumar (ISA 70-3030) were presented. Direct quotes from Kumar's paper were followed by Ranganathan's comments. The author offered several suggestions for the improvement of survey reports, including unity of idea, sequence, verbal plane, section heading, notational plane, index and cross reference, and technical terminology.

Rawdins, Eugene. "Field Survey of Information Needs of Industry Scientific and Technical Library Users." Information Revolution. Proceedings of the 38th Annual Meeting of the American Society for Information Science. Edited by Charles W. Husbands. Washington, D.C.: American Society of Information Science, 1975, 41-42.

Library resources may be regarded as products and services. Library users in industry exchange time and either direct or allocated funds when using library resources. That is, a library visit involves a transaction. Whenever a transaction occurs, consumer behavioral theory may be invoked. Consumer behavioral theory and related information science literature formed the basis for selecting variables for a field study of industrial scientific and technical library users. One of the purposes of the study was to investigate and relate information need/use parameters to other parameters in order to describe and explain the behavior of industry scientific and technical library users.

Rubenstein, Albert H., and others. Critical Field Experiments on Uses of Scientific and Technical Information. Evanston, Ill.: Northwestern University, November 1977 (Prepared for National Science Foundation; Avail. NTIS PB 279-693).

A two year project was designed to identify critical field experiments involving behavior of users of scientific and technical information (STI). Tasks of the project included: literature analysis, selective surveys of target audiences; development of a propositional inventory and an overall framework; and delineation of researchable questions and specific experimental designs. The output included field experimental designs on these subjects: the effects of accessibility, ease of use, and quality on preference for and use of STI systems and services (SS); the roles of key communicators; group cohesiveness as a factor in adoption of new STI/SS; marketing strategies for STI in LDCs; the role of face-to-face communication; nonstandard search strategies; and the integrated nature of Technology Exchange Transactions.

Rubenstein, Albert H., and others. Critical Field Experiments on Uses of Scientific and Technical Information. Evanston, Ill.: Northwestern University, Dept. of Industrial Engineering and Management Sciences, November 1975 (Avail. ERIC ED 143-302).

Research was done on the behavior and preferences of researchers with respect to technical literature, computer-based information systems, and other scientific and technical information (STI) systems and services. The objectives on this project were: (1) to review the state-of-the-art in various aspects of the field and to develop researchable questions, and (2) to design key experiments to be carried out in a large number of organizations and administrative experiments to be carried out by individual managers of research and development (R&D) or STI to solve specific STI problems. Other major sections of the report included a literature analysis, a survey of STI users, a survey of on-going and proposed experiments by STI users, the development of a propositional inventory, and the exploration of the feasibility of a framework for analysis of the STI process. A list of working papers on the same project were presented.

Schoenborn, Theodore F. "Information User Needs Survey -- A Decision Guide for Resource Allocation." The Information Age in Perspective. Proceedings of the 41st Annual Meeting of the American Society for Information Science. White Plains, New York: Knowledge Industry Publications, Inc., 1978, 287-290.

The value of an information user needs survey in determining appropriate service levels was established: concrete information, instead of the expectations of the management, would be made available. In addition, NIOSH program objectives were in the context of the staff's perceived need for and satisfaction with the information services and resources available.

Schuchman, Hedvah L. Information Transfer in Engineering. Glastonbury, Conn.: The Futures Group 1980 (Prepared for the National Science Foundation; Avail. The Futures Group, 76 Eastern Blvd., Glastonbury, Ct. 06033).

The effects of changes in scientific and technical information transfer on the engineering profession were examined. The objectives of the study were to: identify the information used by technologists of various disciplines and specialties, identify the major modes of communication and patterns of use, describe changes which might be anticipated in information use patterns and communication modes as a result of changes in information storage and dissemination methods, and identify policy implications resulting from these evolutionary changes.

By means of a large scale survey, a broad spectrum of engineers were asked to provide information on their use of scientific and technical information. Data collected were analyzed to provide information profile and use patterns of engineers and to project changes in the profile and use pattern resulting from advances in information processing technologies.

Skelton, Barbara. "Scientists and Social Scientists as Information Users: A Comparison of Results of Science User Studies with the Investigation Into Information Requirements of the Social Sciences." Journal of Librarianship, V (April 1973), 138-156.

An attempt to compare the information seeking behavior of scientists and social scientists was made. A general profile of the scientist as an information user was drawn, based on thirteen science user studies which contained data for areas covered by the INFROSS (Investigation Into Information Requirements of the Social Sciences) survey. A profile for the social scientist as information user was drawn, based on the results of a national survey of a wide range of social scientists in different disciplines and environments. It was concluded that scientists and social scientists did not differ to any large extent in their information seeking behavior. However, the extent of use of different methods and the degrees of problems encountered were varied and accounted for differences in the information seeking behavior of scientists and social scientists.

Skelton, Barbara. "Investigation Into Information Requirements of the Social Sciences." Design of Information Systems in the Social Sciences: Working Paper I. University Library, Bath University of Technology, U.K., July 1971 (Avail. ERIC ED 078-866).

The investigation into Information Requirements of the Social Sciences (INFROSS) was conducted for the Office of Scientific and Technical Information from 1968 to 1970. The study was on a national scale and sought to obtain data on information requirements of social scientists in various environments. This report attempted to draw from previous science user studies possible general conclusions that could be compared with the results of INFROSS. The investigators concluded that because there were many problems connected with comparing studies, only broad trends could be discerned. It was concluded that information requirements varied according to job function and scientific discipline, that user studies had been poorly designed and could not be correlated, and that better studies were needed. A review and comparison of the findings of previous science user studies and a description of problems encountered in comparing studies were included.

Thuronyi, Geza T., and Pietkiewicz, Wesley. "User Participation in an Information System." The Information Conscious Society. Proceedings of the 33rd Annual Meeting of the American Society for Information Science. Edited by Jeanne B. North. Washington, D.C.: American Society for Information Science, 1970, 141-146.

A small information system was described from three points of view: as a bibliographic support service to the sponsoring agency, as a published index for general dissemination, and as part of a large information system. It was shown how the principal users (research scientists of the sponsoring agency) were built into the system and how the feedback received from them improved the system, especially in the areas of document selection, indexing, and bibliographic format. It was proposed that large information systems could be conceived in the form of interlocking cells, each of which incorporated a representative user group as part of its regular activity.

Tierney, Cliff. "Users' Role in the Development of a Technical Information Network Serving a Decentralized Manufacturing Company." Innovative Development in Information Systems: Their Benefits and Costs. Proceedings of the 36th Annual Meeting of the American Society for Information Science. Edited by Helen J. Waldron and F. Raymond Long. Washington, D.C.: American Society for Information Science, 1973, 229-230.

The effectiveness of technical communications in industry was found to depend more on the system used than on the attitude of those using the system. Whirlpool Corporation approached the development of a technical information transfer system in terms of user preferences and attitudes and found that the process of development produced the key benefit.

Wood, Daniel N. "User Studies: A Review of the Literature From 1966-1970." Aslib Proceedings, XXIII (1971), 11-23.

The paper considered a wide range of investigations into the information gathering habits of scientists, engineers, social scientists, and others and reported information on which managers could base policies regarding library and information services at all levels. Although an increasing number of studies were carried out in Eastern Europe and in the USSR, no major work was reported. Consequently, the review considered mainly British and American Investigations.

Young, Mary E. User Needs in Documentation and Information. II. Springfield, Va.: National Technical Information Service, April 1979 (Avail. NTIS PB 80-807910).

Reports on meeting the needs of the information sciences user in the most direct and specific way were cited, including methods used to determine those needs and measures taken to fulfill them in educational resources, data bases, data management, library networks, photographic recording systems, technical information centers, and consulting services. This updated bibliography contained 213 abstracts, 50 of which were new entries to the previous edition.

INFORMATION - ECONOMICS

Bickner, R. E. "Concepts on Economic Cost." In (1971) Cost Consideration in Systems Analysis. Edited by Gene H. Fisher, N.Y.: American Elsevier Publishing Company, 1970, 24-63.

Evaluation and design of information systems cannot be performed without some unifying concept of economic costs. In order to set forth a general framework for economic costs, this paper was included in the key papers. The examples presented in the paper were not related to information science, although they were easily transferable. The paper presented a very clear, understandable and non-mathematical explanation of a broad range of issues concerning economic costs. These issues included such important concepts as cost versus benefits; how to identify, measure and evaluate costs; how to handle past and future costs; minimizing costs versus maximizing benefits; the distinction between dollar expenditures and total cost; discount theory; macro-cost analysis versus micro-cost analysis and so on. The paper was highly useful to the novice as well as to persons engaged in cost analysis.

Bishop, Ethelyn F., and Clayton, Audrey. "An Application of Market Research Techniques to the Dissemination of Scientific and Technical Information." The Value of Information. Collection of Papers Presented at the 6th Mid-Year Meeting, American Society for Information Science. Syracuse University, Syracuse, N.Y.: American Society for Information Science, May 1977, 12-16.

A methodology which would improve user access to scientific and technical information (STI) by enabling producers and distributors of STI to better target their product design, distribution, and promotion efforts was described. An analysis of the data gathered through a pilot survey of 402 electrical engineers and chemists identified six segments in each discipline whose members had similar STI needs and other common characteristics including demographics, sources used to satisfy STI needs, and perceptions of current STI sources.

Bishop, Ethelyn F., and Nisenoff, Norman. An Application of Market Research Techniques to the Dissemination of Scientific and Technical Information. Arlington, Va.: Forecasting International Ltd., February 1977 (Prepared for National Science Foundation; Avail. NTIS PB 265-130).

This study used the market research technique of market segmentation and cluster analysis to identify segments of the user market with similar STI needs and to describe these groups in terms of their common STI use characteristics, their personal characteristics, and their access requirements, thus allowing the development of strategies more responsive to those needs. A questionnaire was administered to 201 electrical engineers and 201 chemists in person interviews. Each respondent was asked to rank types of scientific and technical information in order to need. These rankings were submitted to a computerized statistical analysis. Six segments were identified within each discipline included in the sample.

Cooper, Michael D. "A Cost Model for Evaluating Information Retrieval Systems." Journal of the American Society for Information Science, XXIII (September/October 1972), 306-312.

A mathematical model for use in studying how to minimize the cost of operating a mechanized retrieval system was developed. Through the use of cost analysis, the model provided a method for comparative evaluation of information retrieval systems.

Cooper, Michael D. "Evaluation of Information Retrieval Systems: A Simulation and Cost Approach." Unpublished Ph.D. dissertation, University of California, Berkeley, 1971 (Avail. University Microfilms 71-25445).

Two specific approaches to evaluation of information retrieval systems were explored. The first is a mathematical model for use in studying how to minimize the cost of operating a mechanized retrieval system. This model divided the costs of a retrieval system into two components: system costs and user costs. With this approach it was possible to determine the allocation of user and system time that minimized the total cost of operating the system. The second approach to the evaluation of literature searching systems was the development of a simulation model as a preliminary step toward the creation of a tool for system design and evaluation. The simulation program created a well specified collection of documents and analyzed the effect of changes in query file characteristics on system performance.

King, Donald W., Roderer, Nancy K., and Olsen, Harold A., eds. Key Papers in the Economics of Information. White Plains, N.Y.: Knowledge Industry Publications, Inc., 1980.

In its three major parts: Economic Cost of Information, Pricing of Information, and Value of Information, this volume provided a comprehensive look at an issue of timely importance to library and information science professionals. Both theoretical and applied viewpoints were represented, from a general discussion of values and benefits to the very basic and controversial question of whether a public library should charge for providing information.

Lancaster, F. Wilfrid. "The Cost-Effectiveness Analysis of Information Retrieval and Dissemination Systems." Journal of the American Society for Information Science, XXII (1) (January/February 1971), 12-27.

A distinction was made between cost-effectiveness analysis and cost-benefits analysis as applied to information systems; and the relationship between costs, performance, and benefits was discussed. Some factors influencing the cost-effectiveness of retrieval and dissemination systems was identified. Various aspects of system operation that were susceptible to cost-effectiveness analysis were discussed, including system coverage, indexing policies and procedures, system vocabulary, searching procedures, and mode of interaction between system and user. Possible tradeoffs between input and output costs, and the effects of these tradeoffs on cost-effectiveness were presented.

Ljungberg, Sixten, and Tullgren, Ake. "Investigation on the Use of Information in R&D in a Research Intensive Company." In (1977) Information Management in the 1980's. Proceedings of the 40th Annual Meeting of the American Society for Information Science. White Plains, N.Y.: Knowledge Industry Publications, Inc., 1977.

The objective of this case study of a pharmaceutical firm was survey the balance between the users' well-defined needs for information, especially with regard to current awareness, and the allocation of resources. The study was carried out through inquiries, interviews, quantitative measurements of the handling of information, and qualitative appraisals of sources and selected material. The results were evaluated with regard to organizational aspects and from the point of view of technical communication. Great attention was paid to cost-benefit analyses and to methods for continuously checking the effectiveness and the profitability of the Information and Documentation Unit. Such operations, in combination with interviews, have turned out to provide a good basis for budgeting and strategic planning.

Olsen, Harold Anker. "The Economics of Information: Bibliography and Commentary on the Literature." Information Part 2 Reports and Bibliographies, 1 (2) (March/April 1972), 1-40, (Avail. ERIC ED 076-214)

Since the date of original publication, nearly 500 items were located which pertained to the economics of information. The 160 deemed most significant were selected for inclusion in the supplementary listing. As in the first edition, citations were included from both the information literature and the economics literature. Perhaps the most significant trend noted this year was the substantially greater awareness by the information profession of the significance of economic factors to information management.

Olsen, Harold Anker. The Economics of Information: Bibliography and Commentary on the Literature. Washington, D.C.: ERIC Clearinghouse on Library and Information Science, January 1971, (Avail. ERIC ED 044-545).

This report explored the bodies of literature pertinent to the economics of information, a topic of growing interest to the information community and to economists. As used here, economics of information referred to the concepts and tools of economics as they applied to information activities. The report consisted of (1) a short section of the economists' framework for analysis, (2) a table that divided the pertinent literature into 14 categories, briefly defined each category, and explained why it was important to information activities; (3) a brief commentary on the state of this literature; and (4) a selected bibliography of more than 300 items. An exhaustive list of all items was not done in this initial effort, but most recent literature, especially monographs, technical reports, and literature surveys, were covered to the extent that a reader could obtain a good introduction to this literature. In addition, 25 items were identified as giving particularly informative overviews. These items represented the full range of material from theoretical studies to applied analyses, plus several surveys.

Taylor, Robert S., ed. Economics of Information Dissemination: A Symposium. Appearing in Frontiers of Librarianship, XVI, Syracuse, N.Y.: Syracuse University School of Library Science, 1973 (Avail. Syracuse University School of Library Science).

A symposium was held to explore the problems of cost and benefits of information and its dissemination. Topics covered in the symposium included: (1) the development of a concept of information in the marketplace as an economic commodity; (2) the role of information in the decision-making processes; and (3) viable models for management decision-making in support of planning cost-benefit considerations, long-term budgeting; and (4) the design, development, and marketing of information products.

Tressel, George W., and Brown, Patricia L. A Critical Review of Research Related to the Economics of the Scientific and Technical Information Industry. Final Report. Columbus, Ohio: Battelle Memorial Institute, March 1975 (Avail. ERIC ED 111-429 and NTIS PB 245-665).

A review of expert opinion and recent literature on the critical issues and open questions relating to the economics of the scientific and technical information industry was presented. The authors concluded that: (1) there was hardly an area that did not call for more and better research, not nearly so much for quantity as for a more coherent and meaningful pattern, (2) a broad effort was needed to collect available data and to develop standardized collection methodologies which could meet critical scrutiny as well as provide the necessary comparative and additive information, and (3) increased research and policy study of the roles and processes of information diffusion into the private sector was also needed.

Zais, Harriet W. "Economic Modeling: An Aid to the Pricing of Information Services." Journal of the American Society for Information Science, XXII(2) (March 1977), 89-95.

As budgets tightened in the late 1960's and early 1970's, many policy-makers and administrators began to ask whether users of information products and services should be charged for their use. Several studies were conducted at that time to look into methods for charging. The article presented a good summary of the methods that could be used in pricing information products and services. Typically, price strategies of these products and services involved (1) service provided at no charge, (2) average cost pricing, (3) price discrimination, or (4) marginal cost pricing. This article discussed the strengths and weaknesses of each of these pricing strategies. Furthermore, an example was presented which served as a prototype for pricing selective dissemination of information (SDI) products and services.

APPENDIX

A PROJECT PLAN FOR THE REVIEW AND EVALUATION OF THE LANGLEY RESEARCH CENTER'S SCIENTIFIC AND TECHNICAL INFORMATION PROGRAM

INTRODUCTION

One of the most important results of exploration and research and development is information. The National Aeronautics and Space Administration's scientific and technical information system is one of the largest and best known federal STI programs in the country. The mission of the NASA STI is twofold: (1) to acquire worldwide research in aeronautics, space, and related disciplines to keep NASA personnel abreast of current activities and developments; and (2) to contribute to the expansion of STI through timely dissemination of NASA-generated and -sponsored research, development, testing, and technical evaluations. The Langley STI program is an integral part of the Agency's STI program and is responsible for implementing Agency and Center policies concerning the management of STI. Expeditious publication of the Center's research is Langley's contribution to the Agency's goal of timely dissemination of NASA research.

BACKGROUND

The Langley Research Center (LaRC) is one of the leading national laboratories for research and development in the sciences of aeronautics and space technology. Founded in 1917, Langley was the nucleus of the former National Advisory Committee for Aeronautics (NACA). For more than 60 years, Langley engineers, scientists, and technicians have been conducting basic and applied research in fluid and flight mechanics, flight systems, structures and materials, acoustics and noise reduction, measurements and instrumentation systems, data systems, and space and earth sciences. The results of this research are disseminated through NASA scientific and technical publications as well as non-NASA media such as technical or professional society journals and similar periodicals; domestic and foreign presentations of papers, talks, and lectures; and in the proceedings of conferences and symposia. For calendar year 1979, the output of the Center's 1,330 Aerospace Technologists (AST's) totaled 1,061 items which included 186 NASA formal technical publications; 116 Quick-Release Technical Memorandums; 149 journal articles; and 610 speeches, lectures, and presentations.

The documented research output of the Center is processed throughout the Langley Scientific and Technical Information Programs Division (STIPD), which is an integral part of the Agency's scientific and technical information program.

STATEMENT OF THE PROBLEM

During the 63-year history of the Langley Research Center, a comprehensive review and evaluation of the Center's STI program has never been conducted. Portions of the Center's STI program have received periodic or occasional

assessment; however, no valid empirical data exist which can be used to evaluate the total program's efficiency and effectiveness.

PURPOSE OF THE STUDY

A comprehensive review/evaluation of the Center's STI program will seek to determine the extent to which the program is meeting the needs of Langley research and professional personnel and the recipients of Langley-generated scientific and technical information, the areas or portions of the program which need improvement, and ways in which the program can be modified to improve its overall efficiency and effectiveness. In conjunction with the evaluation project, a theoretical and analytical review of the NASA formal report as a medium for information transmittal will be conducted. The results of the study will enable NASA to develop a more effective medium for transmitting the results of its research.

An annotated bibliography of literature citations on the topic of the design and evaluation of scientific and technical information systems will be completed and published as a resource for future evaluations.

Significance

This study will provide information which can be used to evaluate and improve the Langley STI program. The information gathered by this study will establish the following:

1. Knowledge of and attitudes toward the Langley STI program by internal and external users
2. Information needs of internal and external users of Langley STI
3. Perceived usability, technical quality, and prestige of Langley formal series reports and journal articles by these users
4. Familiarity, use of, and attitudes toward selected NASA STI products and services by these users
5. Assessment of the services provided by STIPD by Langley researchers, identifying areas of concern and recommendations for improvement
6. Recommendations for improving the effectiveness of the dissemination of Langley STI
7. Effectiveness of the Center's policies and procedures for managing and publishing Langley STI
8. Bibliography of literature citations on the topics of STI transfer and dissemination models, systems, and procedures

9. Bibliography of literature citations on the evaluation of the STI programs, and

10. Effectiveness of the NASA Formal Report as a medium for transmitting information.

Overview

The study will utilize both descriptive and experimental research and will be directed by Thomas E. Pinelli, Assistant Chief, STIPD. A steering committee of 17 individuals will be used to help focus, develop, and guide the study through its completion. Each research division will nominate a representative to serve on the committee. Mr. George Chandler, Chief, Scientific and Technical Information (STI) Branch, NASA Headquarters, will serve as an ex-officio member of the committee. The individual tasks established for the study will be executed using Langley, Old Dominion University, and professional contract personnel.

Limitations

The study will be limited to the scientific and technical information output of the Center as processed or disseminated through the Langley STI program. The study is not concerned with either informal transfer or secondary application of the Center's research output. The study will involve researchers at the Langley Research Center and NASA information users in other government agencies, industry, and academic institutions.

REVIEW OF RELEVANT RESEARCH

A search is underway to identify literature relevant to the study. The results of Langley and Headquarters' STI studies and assessments conducted since 1968 will be collected and used to help develop the research methodology for the study. A review of existing systems and models for transferring and disseminating scientific and technical information and evaluating scientific and technical information programs will be undertaken. In addition, an annotated bibliography of literature citations on the topics of the transfer, dissemination, and evaluation of scientific and technical information programs will be completed.

RESEARCH METHODOLOGY

The study will investigate the effectiveness and efficiency of the Center's scientific and technical information program, with particular emphasis placed on improving the effectiveness of the dissemination process. The specific actions to be taken are described in the following phases.

Phase I: Knowledge and Attitudes Survey, Langley Research Personnel

Phase I of the review and evaluation project requires an assessment of the adequacy of the Center's STI program in meeting the needs of Langley research and professional personnel. Areas of the program which need improvement will be identified and ways in which the program can be made more effective will be recommended. This task involves (1) determining through open-ended questions during in-depth interviews the areas and dimensions of the program which researchers consider important, (2) constructing a closed-ended survey to be distributed to all research personnel, (3) tabulating and analyzing the responses to the closed-ended questions and compiling and analyzing the proposed changes and recommendations solicited by several open-ended questions and, (4) presenting the findings of the questionnaire in a final report.

The outcome of Phase I will be an evaluation of Langley's and the Agency's programs for meeting the needs of Langley research and professional personnel.

Phase II: Audit of Publication Process

Phase II of the review and evaluations project requires an "audit" or management analysis of the policies, procedures, and practices used by the Langley Research Center to process, publish, or otherwise handle scientific and technical information. This task involves (1) identifying the various media used by the Center to output its scientific and technical information; (2) compiling all regulations, policies, and instructions applicable to these media; (3) documenting the procedures as currently prescribed; (4) comparing current or actual practices with published management instructions to identify discrepancies or gaps in procedural guidance; and (5) recommending additional or modified procedures.

The outcome or stated purpose of the task is to define the total current procedural framework for processing, publishing, or otherwise handling Langley's scientific information and to supplement existing practices and procedures to create a comprehensive, effective, understandable, and practical framework covering the handling of all research output.

Phase III: Audit of the Report and Manuscript Control Office (RAMCO)

Phase III of the review and evaluation project requires an audit or management analysis of the policies, procedures, and practices used by RAMCO (Report and Manuscript Control Office) to manage and report the Center's scientific and technical information output.

The audit involves (1) documenting the current manual system using flow-charts, tables, and other systems analysis tools and techniques; (2) determining whether changes to the current manual system are necessary and justifiable; (3) proposing a new manual or automated (internal or external) system with appropriate justification for selection; (4) examining the feasibility of in-house automation capabilities; and (5) presenting the procedural framework, underlying models, analysis, comments, and recommendations in a final report.

The outcome or stated purpose of the audit will be an analysis and documentation of the current RAMCO operations, identifying areas for potential improvement including possible automation. The audit will emphasize the records management aspect of the operation.

Phase IV: Knowledge and Attitudes Survey, Industrial and Academic Personnel

Phase IV of the review and evaluation project requires an assessment of the benefits, usage, and perceived quality of the NASA/Langley STI Program and STI output by recipients/users in industry, government, and academia. Since the Langley STI program is an integral part of the Agency's STI program, NASA Headquarters has requested that the survey used by the consulting firm include questions pertaining to the Agency-wide STI program and output.

This task involves (1) preliminary telephone interviewing of NASA STI users to supply both content and direction for a closed-ended questionnaire, (2) constructing a closed-ended questionnaire to determine the extent to which the program is meeting the needs of industrial and academic users of NASA/Langley STI, (3) tabulating and analyzing the responses to the questionnaire, and (4) presenting the findings of the questionnaire in a final report.

The outcome of Phase IV will be an assessment of Langley's and the Agency's programs for meeting the needs of non-NASA users of NASA STI products, services, and outputs.

Phase V: Bibliography

Phase V of the review and evaluation project requires the development of a selected, annotated bibliography of literature citations on the topic of the design and evaluation of a scientific and technical information system.

Phase VI: The NASA Formal Report

Part I: Effectiveness of the NASA Formal Report

Part I of the review and evaluation project requires a comprehensive evaluation of the NASA formal report as an effective medium for transmitting scientific and technical information. This task involves (1) developing criteria for the structure and use of the various report elements, (2) analyzing the relationship of those parts within the total report context, and (3) examining the overlapping areas of verbal and graphic presentation to determine the validity of the present format and/or possible modification.

The outcome or stated purpose of this evaluation will be the establishment of benchmarks by which the NASA report can be evaluated.

Part II: Quantitative and Qualitative Criteria for Evaluation
(Bibliography, Index, and Tables)

Part II of the review and evaluation project requires a theoretical and analytical review of the formal report as a medium for information transmittal.

This task includes (1) obtaining, through a manual and computer search, an exhaustive bibliography of literature and (2) describing in quantitative terms the usage of report components in the report environment. The bibliography will contain (1) an index of reports produced by government, colleges, and private enterprise (acquired during prior research); (2) literature which describes the usage of components in the scientific/technical report; and (3) literature which pertains to the evaluation of these communications elements in the scientific report.

The outcome of the review process will be the development of criteria for efficient report organization.

Part III: A Review Assessment and Recommendations

Part III of the review and evaluation project requires an assessment of the overall report organization, the component parts of the report, and the relationship of those parts within the total report context. This task includes (1) contrasting other industry and agency reports (illustrated in prior research) with the NASA report, (2) determining which evaluative criteria can be applied to the formal evaluation and possible modification of the NASA Langley technical report format, (3) establishing a methodology for evaluating the NASA report format, (4) outlining a sequence for the component parts and spelling out what each should include, and (5) preparing and presenting a final report.

The outcome of this phase will be a suggested outline for a sequence and hierarchy of parts for specific users and a series of criteria for graphic and verbal elements.

COSTS

LaRC

Obligated for:

- Phase I - Knowledge and Attitudes Survey, Langley Research Personnel
- Phase II - Audit of Publication Processes
- Phase III - Audit of the Report and Manuscript Control Office (RAMCO)
- Phase IV - Knowledge and Attitudes Survey, Industrial and Academic Personnel
- Phase V - Annotated Bibliography

Headquarters

Obligated for:

- Phase VI - The NASA Formal Report

REPORTING

The project will be documented in a final summary report. The report will be divided into sections containing a review of related research; presentation and analysis of the data; and summary, findings, conclusions, and recommendations. Where possible, phases of the project will be presented in individual articles. A selected, annotated bibliography on the design and evaluation of STI systems will be prepared and published as a NASA Quick-Release Technical Memorandum.

SCHEDULES - PHASES

| Phase/Title | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | |
|--|-------|-----|-------|-------|-----|-----|-----|-------|-------|-----|-----|-----|--|
| <u>Phase I</u> Knowledge and Attitudes Survey, Langley Research Personnel | | | ----- | | | | | | | | | | |
| <u>Phase II</u> Systems Analysis: Audit of Publication Process | | | | ----- | | | | | | | | | |
| <u>Phase III</u> Systems Analysis: Audit of the Report and Manuscript Control Office (RAMCO) | | | | | | | | | ----- | | | | |
| <u>Phase IV</u> Knowledge and Attitudes Survey, Industrial and Academic Personnel | | | | | | | | | ----- | | | | |
| <u>Phase V</u> Annotated Bibliography | ----- | | | | | | | | | | | | |
| <u>Phase VI</u> The NASA Formal Report | | | | | | | | ----- | | | | | |
| Part I: Effectiveness of the NASA Formal Report | | | | | | | | ----- | | | | | |
| Part II: Quantitative and Qualitative Criteria for Evaluation (Biblio- graphy, Index, and Tables) | | | | | | | | | ----- | | | | |
| Part III: A Review Assessment and Recommendations | | | | | | | | | ----- | | | | |

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| 15. Supplementary Notes *Assistant Chief, Scientific and Technical Information Programs Division +Research Associate, Old Dominion University Research Foundation ++Research Associate, Scientific and Technical Information Programs Division | | | | | |
| 16. Abstract The results of Phase V - Design and Evaluation of STI Systems: A Selected, Annotated Bibliography are contained in this report. Phase V was conducted as part of the Langley Scientific and Technical Information (STI) Review and Evaluation Project. The purpose of Phase V was to compile a selected, annotated bibliography of literature citations related to the design and evaluation of STI systems. The use of manual and machine-readable literature searches; the review of numerous books, periodicals reports, and papers; and the selection and annotation of literature citations were required. The bibliography was produced because (1) the information was needed to develop the methodology for the review and evaluation project, and (2) a survey of the literature did not reveal the existence of a single published source of information pertinent to the subject. This bibliography contains approximately 200 citations classified in four subject areas. The areas include information - general; information systems - design and evaluation, including information products and services; information - use and need; and information - economics. | | | | | |
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