

DOCUMENT RESUME

FD 309 410

CS 211 885

AUTHOR Pinelli, Thomas E.; And Others  
 TITLE Technical Communications in Aeronautics: Results of an Exploratory Study. NASA Technical Memorandum 101534, Parts 1 and 2.  
 INSTITUTION National Aeronautics and Space Administration, Hampton, Va. Langley Research Center.  
 PUB DATE Feb 89  
 NOTE 190p.  
 AVAILABLE FROM National Technical Information Service, Springfield, VA 22161-2171 (Part 1, \$19.95; Part 2, \$14.95).  
 PUB TYPE Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC08 Plus Postage.  
 DESCRIPTORS Analysis of Variance; Communication Research; \*Engineers; Information Centers; Information Dissemination; Occupational Surveys; Professional Development; \*Scientific and Technical Information; \*Scientists; Technical Writing  
 IDENTIFIERS \*Aeronautics; \*Technical Communication

ABSTRACT

An exploratory study investigated technical communications in aeronautics by surveying aeronautical engineers and scientists. The study had five specific objectives: to solicit the opinions of aeronautical engineers and scientists regarding the importance of technical communications to their profession; to determine their use and production of technical communications; to seek their views in light of their technical communications experience on the appropriate content of an undergraduate course in technical communications; to determine their use of libraries, technical information centers, and online databases; and to determine the use and importance of computer through a randomly sampled self-administered mail questionnaire to the members of the American Institute of Aeronautics and Astronautics (606 responded out of 2,000). Results indicated that (1) the ability to communicate technical information effectively is important to aeronautical engineers and scientists; (2) memos, letters, and audio/visual materials are the technical information products most frequently produced by the aeronautical engineers and scientists; (3) about 70% of the respondents had taken a technical communications or technical writing course either at the undergraduate level, after graduation, or both; (4) 94% use a library or technical information center; and (5) 91% use computer technology for preparing technical communications. (Forty tables of data are included, and 43 references and four appendixes containing the survey instrument, additional data, and subjects' open-ended comments comprise Part 2.) (MS)

\*\*\*\*\*  
 \* Reproductions supplied by EDRS are the best that can be made \*  
 \* from the original document. \*  
 \*\*\*\*\*

ED309410

# NASA Technical Memorandum 101534, Part 1

## Technical Communications in Aeronautics: Results of an Exploratory Study

Thomas E. Pinelli, Myron Glassman,  
Walter E. Oliu, and Rebecca O. Barclay

FEBRUARY 1989

**NASA**

BEST COPY AVAILABLE

2

U. S. DEPARTMENT OF EDUCATION  
Office of Educational Research and Improvement  
EDUCATIONAL RESOURCES INFORMATION  
CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it
- Minor changes have been made to improve reproduction quality
- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

58811885

# NASA Technical Memorandum 101534, Part 1

## Technical Communications in Aeronautics: Results of an Exploratory Study

Thomas E. Pinelli  
*Langley Research Center  
Hampton, Virginia*

Myron Glassman  
*Old Dominion University  
Norfolk, Virginia*

Walter E. Oliu  
*U. S. Nuclear Regulatory Commission  
Washington, DC*

Rebecca O. Barclay  
*Rensselaer Polytechnic Institute  
Troy, New York*

# NASA

National Aeronautics  
and Space Administration

Langley Research Center  
Hampton, Virginia 23665

## Editorial Review Committee

Mary Jo V. Arnold  
The Ohio State University

Patricia Carlson, Ph.D.  
Rose-Hulman Institute of Technology

Maurita P. Holland  
University of Michigan

Michael L. Keene, Ph.D.  
University of Tennessee, Knoxville

Judith A. Ramey, Ph.D.  
University of Washington

Frank R. Smith, Ph.D. (retired)  
McDonnell Douglas Corporation

### Recommended Citation:

Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. *Technical Communications in Aeronautics: Results of an Exploratory Study*. Washington, DC: National Aeronautics and Space Administration. NASA TM-101534, Part 1, February 1989. 106 p. (Available from NTIS, Springfield, VA.)

# CONTENTS

## Part 1

LIST OF TABLES . . . . .	v
INTRODUCTION . . . . .	1
BACKGROUND . . . . .	2
ACRONYMS . . . . .	6
RELATED RESEARCH AND LITERATURE . . . . .	7
The Importance of Technical Communications . . . . .	7
Use and Production of Technical Communications . . . . .	12
Content for an Undergraduate Course in Technical Communications . . . . .	17
The Use of Libraries, Technical Information Centers, and On-Line Databases . . . . .	19
Use and Importance of Computer and Information Technology . . . . .	24
Discussion . . . . .	29
PRESENTATION AND DISCUSSION OF THE DATA . . . . .	31
Demographic Information About the Survey Respondents . . . . .	33
Survey Objective 1: The Importance of Technical Communications . . . . .	38
Survey Objective 2: The Use and Production of Technical Communications . . . . .	43
Survey Objective 3: Content for an Undergraduate Course in Technical Communications . . . . .	57
Survey Objective 4: Use of Libraries, Technical Information Centers, and On-Line Databases . . . . .	64

Survey Objective 5: Use and Importance of Computer and Information Technology . . . . .	67
SUMMARY AND IMPLICATIONS . . . . .	74
Demographic Information About the Survey Respondents . . . . .	75
Limitations of the Study . . . . .	76
Survey Objective 1: The Importance of Technical Communications . . . . .	77
Survey Objective 2: The Use and Production of Technical Communications . . . . .	79
Survey Objective 3: Content for an Undergraduate Course in Technical Communications . . . . .	83
Survey Objective 4: Use of Libraries, Technical Information Centers, and On-Line Databases . . . . .	86
Survey Objective 5: Use and Importance of Computer and Information Technology . . . . .	88
BIBLIOGRAPHY . . . . .	92
APPENDICES	
Part 2*	
A. SURVEY INSTRUMENT. . . . .	97
B. AGGREGATE TOTALS . . . . .	103
C. CROSS TABULATIONS -- PART A . . . . .	109
C. CROSS TABULATIONS -- PART B . . . . .	131
D. OPEN-ENDED COMMENTS . . . . .	169

\* Published under separate cover

## LIST OF TABLES

Table

A	Non-Use, Use, and Potential Usefulness of Computer and Information Technology by Engineering Disciplines . . . . .	27
B	Summary: Professional Duties . . . . .	34
C	Summary: Type of Organization . . . . .	34
D	Summary: Years of Professional Work Experience	35
E	Summary: AIAA Interest Group . . . . .	36
F	Summary: Level of Education . . . . .	36
G	Summary: Engineer or Scientist . . . . .	37
H	Summary: American English is First (Native) Language . . . . .	37
I	Summary: Gender . . . . .	38
J	Summary: Importance of Technical Communications	39
K	Summary: Hours Spent Per Week Communicating Technical Information to Others . . . . .	40
L	Summary: Hours Spent Per Week Working With Technical Information Received From Others . . .	41
M	Summary: Professional Advancement -- Amount of Time Spent Communicating Technical Information to Others . . . . .	42
N	Summary: Professional Advancement -- Amount of Time Spent Working With Technical Communications Received From Others . . . . .	43
O	Summary: Technical Information Product Production . . . . .	44
P	Comparison of the Average Number of Technical Information Products Used by Organizational Affiliation . . . . .	45

Q	Summary: Technical Information Product Use . . .	46
R	Comparison of the Average Number of Technical Information Products Produced by Organizational Affiliation . . . . .	48
S	Summary: Technical Information Production -- Sources of Help . . . . .	48
T	Summary: Artwork -- How Produced . . . . .	49
U	Summary: Types of Technical Information Produced in Performance of Present Duties . . . . .	50
V	Comparison of the Types of Technical Information Produced by Organizational Affiliation . . . . .	51
W	Summary: Types of Technical Information Used to Perform Present Duties . . . . .	52
X	Comparison of the Types of Technical Information Used by Organizational Affiliation . . . . .	53
Y	Summary: Solving a Technical Problem -- Source of Technical Information Used . . . . .	55
Z	Summary: Technical Communications/Writing Coursework Taken . . . . .	58
AA	Summary: Technical Communications/Writing Coursework -- How Helpful . . . . .	58
BB	Summary: Topics for an Undergraduate Technical Communications Course for Aeronautical Engineers and Scientists -- Principles . . . . .	59
CC	Summary: Topics for an Undergraduate Technical Communications Course For Aeronautical Engineers and Scientists -- Mechanics . . . . .	60
DD	Summary: Topics for an Undergraduate Technical Communications Course for Aeronautical Engineers and Scientists -- On-the-Job Communications . . . . .	61
EE	Summary: Topics for an Undergraduate Technical Communications Course for Aeronautical Engineers and Scientists -- Types of Technical Reports . . . . .	62



FF	Summary: Use of Library or Technical Information Center . . . . .	65
GG	Summary: Use of Electronic Databases . . . . .	66
HH	Summary: Use of Electronic Databases -- How Searched . . . . .	66
II	Summary: Use of Computer Technology for Preparing Technical Communications . . . . .	67
JJ	Summary: Computer Technology -- Increase Ability to Communicate Technical Information . . . . .	68
KK	Summary: Use of Software to Prepare Written Technical Communications . . . . .	68
LL	Summary: Use of an Integrated Graphics, Text, and Modeling Engineering Workstation for Preparing Written Technical Communications . . . . .	69
MM	Summary: Use of Electronic or Desk-Top Publishing System for Preparing Written Technical Communications . . . . .	70
NN	Summary: Use, Non-Use, and Potential Use of Information Technologies to Communicate Technical Information . . . . .	71

TECHNICAL COMMUNICATIONS IN AERONAUTICS:  
RESULTS OF AN EXPLORATORY STUDY

INTRODUCTION

This exploratory study investigated the technical communications practices of aeronautical engineers and scientists. The study, which utilized survey research in the form of a self-administered mail questionnaire, had a twofold purpose -- to gather baseline data regarding several aspects of technical communications in aeronautics and to develop and validate questions that could be used in a future study concerned with the role of the U.S. government technical report in aeronautics.

The study had five specific objectives. The first, to solicit the opinions of aeronautical engineers and scientists regarding the importance of technical communications to their profession; the second, to determine their use and production of technical communications; the third, to seek their views in light of their technical communications responses on the appropriate content of an undergraduate course in technical communications; the fourth, to determine their use of libraries, technical information centers, and on-line databases; and finally, to determine the use and importance of computer and information technology to them.

Data were collected by means of a self-administered mail questionnaire shown in Appendix A. The questionnaire was developed within the project team; circulated to selected technical communicators for review and comment; and pretested at the NASA Ames Research Center, the NASA Langley Research Center, and the McDonnell Douglas Corporation in St. Louis. Members of the American Institute of Aeronautics and Astronautics (AIAA) comprised the study population. The sample frame consisted of approximately 25 000 AIAA members in the U.S. with either academic, government, or industry affiliations. Simple random sampling was used to select 2,000 individuals from the sample frame to participate in the exploratory study. Six hundred and six (606) usable questionnaires were received by the established cut off date. The study, which spanned the period from July 1988 to November 1988, was conducted in conjunction with Old Dominion University under NAS1-18584, Task 28, to help ensure the objectivity and confidentiality of the data and to obtain research skills not readily available to the project.

#### BACKGROUND

The aerospace industry continues to be the leading positive contributor to the U.S. balance of trade among all merchandise industries. According to the U.S. Department of Commerce (1987), the U.S. aerospace industry can look forward to the next five

years with optimism. At the same time, international industrial alliances will result in a more rapid diffusion of technology, increasing the pressure on the U.S. aerospace industry to push forward with new technological developments.

According to Mowery (1985), the U.S. commercial aircraft industry is unique among manufacturing industries in that a government research organization, the National Advisory Committee on Aeronautics (NACA), which became the National Aeronautics and Space Administration (NASA) in 1958, has for many years conducted and funded research on airframe and propulsion technologies. In its wind tunnels and laboratories, the NACA conducted both basic and applied research, guided by committees made up of representatives of industry, the military services, and university aeronautical engineers and scientists. According to Shapley and Roy (1985), a pattern of collaboration grew up that provided the technical basis for the success of the U.S. aerospace industry.

Shapley and Roy (1985) view the NACA as a model for implementing federal research and development (R&D) because the NACA approach "offered science, applied science, technology, and a system for coupling knowledge with the people who use it in the field." In other words, the NACA model can be viewed as a model for the diffusion of innovation in the U.S. aerospace industry.

Rogers (1983) defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of the social system." He further states that diffusion is "a special type of communication in that the messages are concerned with new ideas."

In terms of empirically derived data, very little is known about the diffusion of innovation in the aerospace industry both in terms of the channels used to communicate the ideas and the information-gathering habits and practices of the members of the social system (i.e., aeronautical engineers and scientists). Most of the channel studies, such as the work by Gilmore (1967) and Archer (1962), have been concerned with the transfer of aerospace technology to non-aerospace industries.

Most of the studies involving aeronautical engineers and scientists, such as the work by McCullough (1982) and Pinelli (1982), have been limited to the use of NASA scientific and technical information products and services and have not been concerned with their information-gathering habits and practices. Although researchers such as Davis (1975) and Spretnak (1982) have investigated the importance of technical communications to engineers, it is not possible to determine from the published results if the study participants included aeronautical engineers and scientists.

Regarding the information-gathering habits and practices of engineers and scientists, Kaufman (1983), who quotes Allen (1977), states that in spite of the substantial amount of information regarding the information-seeking habits of engineers and scientists, "There are still very few studies directed exclusively and explicitly at the communication behavior of engineers." Allen (1977) also notes that the common practice of social scientists to lump engineers with scientists "is especially self-defeating in information studies because confusion over the characteristics of the sample has led to what would appear to be conflicting results and to a great difficulty in developing normative measures for improvement of the information systems in either science or technology."

It is likely that an understanding of the process by which innovation in the aerospace industry is communicated through certain channels over time among the members of the social system would contribute to increasing productivity, stimulating innovation, and improving and maintaining the professional competence of aeronautical engineers and scientists.

Furthermore, since the federal government provides a substantial portion of funds for U.S. aerospace R&D, it is likely that an understanding of the innovation process would be helpful to those federal agencies involved in developing aerospace

information policy and systems. As Menzel (1966) states

The way in which [aeronautical] engineers and scientists make use of information at their disposal, the demands that they put on them, the satisfaction achieved by their efforts, and the resultant impact on their future work are among the items of knowledge which are necessary for the wise planning of [engineering and] science information systems and policy.

Finally, it is likely that research regarding the information-gathering habits and practices of aeronautical engineers and scientists and their technical communications practices would hold significant implications not only for technical communicators but also for technical managers, engineering educators, information managers, library and technical information specialists, and curriculum developers.

#### ACRONYMS

ABET	Accreditation Board for Engineering and Technology
AIAA	American Institute of Aeronautics and Astronautics
ANOVA	Analysis of Variance
AV	Audio Visual
CD-ROM	Compact Disc Read-Only Memory
DOD	Department of Defense
ERIC	Educational Resources Information Center
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration

PC	Personal Computer
R&D	Research and Development
SPSS-X	Statistical Package for the Social Sciences-X
S&T	Scientific and Technical
STI	Scientific and Technical Information

### RELATED RESEARCH AND LITERATURE

The search for related research and literature included (1) print and computerized databases, including Engineering Index and the Educational Resources Information Center (ERIC); and (2) books, periodicals, reports, and conference proceedings. The search focused on user surveys specifically concerned with the roles of the engineering curriculum, the library and technical information center, and the use of computer and information technology in the creation and use of technical writing and communications among engineers. Data from these studies are included in this section under the corresponding study objective.

#### The Importance of Technical Communications

There is no consensus definition of technical communications. Most textbooks on the subject use the term to include the practices of technical writing and oral communications. For purposes of this study, technical communications is broadly defined and encompasses the skills



needed and the processes and institutions used by engineers to acquire, produce, transfer, and use scientific and technical (S&T) information.

Davis (1975) published the results of a survey to determine, among other things, the importance of technical communications to "successful" engineers. Davis sent a self-administered mail questionnaire to 348 individuals listed in the 1973 edition of Engineers of Distinction. A Who's Who in Engineering. The response rate was 73.8 percent or 245 valid questionnaires.

In response to the question of how important writing is and if the ability to write effectively is needed, approximately 96 percent (134 respondents) indicated that the writing they did was either very important (51 percent) or was critically important (45 percent) in their position. None of the respondents indicated that their writing was unimportant.

In response to the question of whether the ability to write can effectively delay or prevent advancement for an individual who is otherwise qualified, eighty-nine percent of the respondents stated that, other considerations aside, the ability to write is usually an important or a critical consideration when a subordinate is considered for advancement.

Spretnak (1982) conducted a survey in 1980, "Technical Communication and the Professional Engineer," which was mailed to 1,000 engineering alumni of the University of California, Berkeley. The population surveyed was randomly selected from a computerized roll of alumni from the classes of 1947-48 through 1977-78 with U.S. addresses. The survey, pretested on 28 randomly selected engineering alumni, was mailed to 1,000 alumni of whom 595 (59.5 percent) completed it.

In response to the question, "Do you have any general comments about the importance or relative unimportance of writing and speaking skills in engineering careers?", none of the respondents indicated that writing and speaking skills were unimportant. Excerpts from the responses to Spretnak's (1982) open-ended question appear below.

- o Technical communications is the key to success for every engineer.
- o Progression to upper levels is controlled, in great part, by an engineer's communication skills.
- o No doubt writing is the most important skill an engineer can possess.
- o Writing and speaking should receive the same attention as technical training.

Seventy-three percent reported that writing skills had aided their advancement. Ninety-five percent said they would consider writing ability in deciding whether to hire or promote an

engineer, while 42 percent of the total respondents said that they would weigh writing and presentation skills "greatly."

Respondents were asked to provide "any advice for engineering students regarding the importance or relative importance of studying technical writing." Excerpts from Spretnak's (1982) responses to the open-ended question appear below.

- o Get all of the writing and speaking training you can get as early as you can. Your technical training will be obsolete in ten years; your communication skills will last.
- o Take as many communication courses as possible. All upper-level/mid-level managers are either excellent writers or speakers or both.
- o Communication courses are the most important studies in an engineering curriculum. Anyone can work problems and draw; only a few can really communicate. Communication is the name of the game.
- o Success in engineering is far more dependent on communication skills than, say, on mathematics.

The importance of writing to engineering as well as science students is echoed by David (1982), who states

The single, greatest complaint our students make when polled about their undergraduate preparation consists of questions of the form: "Why didn't you teach us how to write?" They have found, much to their amazement, that one of their main jobs in the "real" world is writing, and that they are woefully unprepared to fulfill that part of their duties.

Davis (1975) reported that respondents to his study spent approximately 25 percent of their time writing technical communications and approximately 30 percent of their time working with technical communications prepared by others. Approximately 63 percent of the respondents reported that as their responsibilities increased, so too did the time they spent writing, and 94 percent of the respondents indicated that they spent more time working with written material as their responsibilities increased. According to Davis (1975), "As their responsibilities increased, respondents spent less of their time developing actual details of specific jobs and more time considering the work of others, making decisions from it, and inaugurating and carrying out appropriate action."

Spretnak (1982) reported that 79 percent of the respondents indicated that the amount of writing they did increased as they advanced in their careers. Thirty-two percent of the respondents said that the amount of writing they did "greatly" increased as they advanced in their careers. Approximately 62 percent of the respondents to the Spretnak study indicated that their writing was usually done under the pressure of deadlines. Almost all respondents reported not having as much time as they would prefer

to devote to their writing. Less than 5 percent of the respondents either had access to or chose to work with a technical writer/editor.

### Use and Production of Technical Communications

The review of related research and literature produced varying amounts of information on how engineers use and create specific kinds of technical information and technical information products and on the sources of information they use to solve technical problems. Respondents of the Davis (1975) study indicated they most frequently produced reports, memoranda, policies and procedures, and letters. Respondents to the Spretnak (1982) study reported the production of similar technical communication products. The review of related research and literature revealed little information regarding the kinds of technical information and technical information products used by engineers.

Allen (1977) reported that the technical report is the "principal written vehicle for transferring information in technology." In her study, Information Transfer in Engineering, Shuchman (1981) reported that 75 percent of the engineers surveyed used technical reports, that technical reports were important to engineers doing applied work, and that aerospace

engineers used technical reports more than any other group of engineers in the study.

There is considerable evidence to support the use of the technical report in aeronautics. Auger (1975) states that "the history of technical report literature in the U.S. coincides almost entirely with the development of aeronautics, the aviation industry, and the creation of the NACA, which issued its first technical report in 1915." According to Stohrer (1981), "a variety of information products and services are utilized by the Department of Defense (DOD) and NASA STI systems. Within both of these systems, the U.S. government technical report is used as a primary means of transferring the results of U.S. government (performed and sponsored) R&D to the aeronautical community."

However, McClure (1988) states that few information product studies have focused on the U.S. government technical report. On the subject of these studies, McClure (1988) states that "it is often unclear whether U.S. government technical reports, non-government technical reports, or both were included. Because of competing or unclear definitions, the results of many of these studies are noncomparable."

Shuchman (1981) sought to determine the specific kinds of information used and produced by engineers. The engineers in her study were employed in 89 different companies, were classified

into 14 industries, and performed both R&D and non-R&D activities. The engineers in her study represented the following major engineering disciplines: aeronautical, civil, chemical/environmental, electrical, industrial, and mechanical.

The kinds of information used and produced by the participants in Shuchman's (1981) study are presented for all engineers and aeronautical engineers as a subset of the sample population, in descending order of their use and production.

#### INFORMATION USED

##### All Engineers

Basic S&T knowledge  
 In-house technical data  
 Physical data  
 Product characteristics  
 Design methods

##### Aeronautical Engineers

Basic S&T knowledge  
 In-house technical data  
 Computer programs  
 Physical data  
 Design methods

#### INFORMATION PRODUCED

##### All Engineers

In-house technical data  
 New methods  
 Design methods  
 Physical data  
 Basic S&T data

##### Aeronautical Engineers

In-house technical data  
 Physical data  
 Basic S&T data  
 Design methods  
 New methods

With minor exceptions, the kinds of information used and produced by all engineers compared closely with the kinds of information used and produced by aeronautical engineers. The major difference between the two groups was in the use of computer programs by aeronautical engineers. Although both groups produced the same kinds of information, they differed in the order of production.

However, a comparison of the kinds of information used and produced by aeronautical engineers reveals some interesting differences. While basic S&T knowledge is the kind of information used most, it ranked third as the kind of information produced by aeronautical engineers. Likewise, while computer programs are the third most frequently used kind of information, they are absent from the list of information produced by aeronautical engineers. Shuchman (1981) made no attempt to correlate the kinds of technical information used and produced with the kinds of technical information products used and produced. While such a comparison would yield useful information, the data reported on "kinds of technical information used and produced" are useful, nevertheless, because they represent a departure from tradition by viewing both use and production as related processes.



Shuchman (1981) also sought to determine the sources of information used by engineers to solve technical problems. Her findings are presented for engineers as a group and for aeronautical engineers as a subset of the sample population in descending order of their use.

INFORMATION SOURCES USED  
WHEN SOLVING A TECHNICAL PROBLEM

<u>All Engineers</u>	<u>Aeronautical Engineers</u>
Internal sources	Internal sources
Texts	Government sources
Government sources	Texts
Sales materials	Professional sources
External sources	Market sources
Professional sources	External sources
Market sources	Sales material

The kinds of information sources used when solving a technical problem were identical except for their order of importance. Engineers as a group and aeronautical engineers as a subset of the group favored the use of internal sources which include conversations with colleagues, discussions with supervisors, and in-house technical reports. Aeronautical engineers next turned to government sources, which include information produced by government agencies, such as specifications and standards, regulations, and technical reports. Texts, which include handbooks and tables, were used next, followed by professional sources, which include dissertations, conference proceedings, and abstracting publications.

Market sources, which include information prepared by trade associations, registered patents, and information obtained from customers, were followed by external sources, which include information obtained from employees of other firms, external consultants, and from university employees. External sources, the least important information source, included catalogs, trade shows, advertisements, and sales representatives.

#### Content for an Undergraduate Course in Technical Communications

The question of what should be included in an undergraduate technical communications course has been the topic of considerable discussion by technical communicators. Kellner (1982) states that "there is no consensus or even close agreement about what constitutes a technical writing course." Feinberg and Goldman (1985) and Green and Nolan (1984) reported the results of a survey of technical communicators which, according to the authors of the two studies, could be used as the basis for designing the content of a technical communications course.

The overwhelming preponderance of the respondents to the Davis (1975) study indicated that all students in scientific and engineering curricula should either be required or encouraged to take a course in technical writing. Eighty-one percent of the respondents indicated that a course in technical writing should be required of all students and sixteen percent indicated that it

should be an elective, with all students encouraged to take it. Only four percent of the respondents differed from this position.

Respondents to the Davis (1975) study were then asked to select from a list of topics those that were essential, OK, or not important for inclusion in a technical writing course. "Clarity of expression" and "analyzing a situation and producing a communication to fit the reader's needs" were rated as "essential" by the respondents. Sixty-two of the respondents listed one or more additional suggestions for possible course content, the general topic of brevity (under a variety of names such as "directness," "conciseness," "economy," and "others") being most frequently mentioned.

Respondents were then asked, "What should be the main emphasis in such a course -- the most important thing that a student should learn or be able to do as a result of taking it?" Of the 245 respondents, 207 supplied specific answers to this question. The "top three categories" appear below.

- o clarity (directness, simplicity, unambiguousness, not to be misunderstood, comprehensibility, no ambiguity, etc.)

- o brevity (conciseness, compactness, no extraneous words, succinctness, etc.)

- o logical order (organization of ideas, continuity of thought, outline, not jump around, etc.)

Spretnak (1982) asked respondents to her survey, "What common problems do you notice in the writing of professional engineers?" Her thinking was that the common problems would form the basis for a course in technical writing. The most frequent responses included grammatical errors, lack of coherence, illogical ordering of ideas, choppy sentences, wordiness, overly long sentences, and a rambling style.

The Use of Libraries, Technical Information Centers, and On-Line Databases

The process by which engineers solve technical problems affects their use of libraries and technical information centers. The results of Shuchman's (1981) study, which are supported by the findings of several engineering information use studies, confirm this position. The steps the engineers in Shuchman's study followed in solving technical problems appear below.

**HOW ENGINEERS SOLVE TECHNICAL PROBLEMS**

<u>Steps in Solving Technical Problems</u>	<u>Percent of Cases</u>
1. Consulted personal store of technical information	93
2. Informal discussion with colleagues	87
3. Discussed problem with supervisor	61
4. Consulted internal technical reports	50
5. Consulted key person in firm who usually knows new information	38
6. Consulted library sources (e.g., technical journals, conference proceedings)	35
7. Consulted outside consultant	33
8. Used electronic databases	20
9. Consulted librarian/technical information specialist	14
10. No pattern in problem-solving	5

Herner (1954) found that engineers at Johns Hopkins University considered their personal knowledge and informal discussions with colleagues and with experts within their organization to be most useful when faced with solving a technical problem. Rosenbloom and Wolek (1970) found that engineers favored the use of interpersonal communications (e.g., discussions with colleagues within their organization) when faced with the need to solve a technical problem. These findings are supported by Kremer (1980) and Kaufman (1983). Only after they have exhausted their personal store of information and have consulted their colleagues will engineers turn to another information source, such as a library.

In Shuchman's study, libraries ranked sixth as the information source engineers used in solving a technical problem. The fact that librarians and technical information specialists ranked ninth as the information source engineers used in solving a technical problem tends to support the hypothesis that engineers tend to assume personal responsibility for fulfilling their information needs. This statement is supported by the engineers in Shuchman's study who attempted to find the information themselves in the library before soliciting the help of a librarian or technical information specialist.

Allen (1977) corroborated these findings, noting that although the library is an important source of information, rarely do engineers make full use of its potential. He too reported that engineers tend to search for library information themselves, only in "rare" instances seeking the services of a librarian or technical information specialist.

Other studies suggest several reasons why engineers do not seek technical information in libraries. Apart from their "personal" and "informally" directed approach to fulfilling their technical information needs, Frohman (1968), quoted by Allen (1977), states that the extent of library use is related inversely to the distance separating the user from the library. Allen (1977) summarized his discussion of library use by observing that "the value seen in using the library simply does not seem great enough to overcome the effort involved in either traveling to it or using it once the person is there."

Information on the use of electronic bibliographic databases by engineers is limited. Those engineers who participated in Shuchman's (1981) study made little use of on-line databases. In the steps used in solving a technical problem, databases ranked eighth, just before librarians and technical information specialists. Kaufman (1983) found that approximately

five percent of the engineers in his study used on-line databases when searching for the solution to a technical problem.

Engineers in Kaufman's (1983) study indicated that "accessibility" was the single most important criterion for determining the use of an on-line database. Furthermore, when the engineers in Kaufman's (1983) study did use on-line databases, they did so most frequently to define or redefine the technical problem and continued to use the databases for the duration of the attempt to solve the technical problem.

Finally, in analyzing the use of on-line databases by engineers, it is important to keep in mind that significant changes have occurred in on-line databases in the years since the Shuchman (1981) and Kaufman (1983) studies were conducted. Perhaps the single greatest change has been the proliferation of databases. Williams (1987) states that "more than two thousand databases are now publicly available in machine-readable form, searchable through optical disc technologies or through a telecommunications link to an on-line search service." Anderson (1987) lists 18 specialized engineering databases and states that their creation is due, in part, to the evolution of specialized engineering disciplines.

The impetus for many of these changes is attributable to a decrease in the cost of computer technology, the introduction of new information technologies such as CD-ROM and videodisc, and the availability of new information products. These changes, according to Harter and Jackson (1988), create exciting new opportunities for improving access to information via end-user searching but also raise a host of questions and issues relative to bibliographic databases. However, as Bikson et al. (1984) state, to take advantage of on-line databases, the user also has to be assured of the following.

- o Availability of a computer terminal
- o Adequate connect time
- o Subscriptions to an array of bibliographic services
- o Skill in using the services (either directly or via an intermediary)
- o Ability to acquire an item of information once it has been identified.
- o Funds to cover the expenses that these efforts entail (in labor, equipment, and services)

Finally, there is considerable interest, at least in the related literature, in end user searching of bibliographic databases. Mischo and Lee (1987) cite the following reasons for this increased interest.

- o The continued exponential growth of information and the demonstrated value of on-line information retrieval
- o The wide availability on-line full-text databases



- o The proliferation of microcomputer workstations with communications capabilities in both the workplace and home settings
- o The emphasis on computer literacy in education, office automation, professional occupations, and recreation
- o The inauguration of nonpeak-time, less expensive, more user friendly search systems
- o The growing awareness among the end-user population of the existence of on-line databases
- o The growing familiarity by library users of on-line catalogs and, by extension, on-line databases
- o The increase of workloads for intermediaries
- o The development of research and commercial front-end and gateway software packages to facilitate on-line searching by untrained users

#### Use and Importance of Computer and Information Technology

One of Shuchman's (1981) goals in investigating the use of computer and information technology by engineers was to "identify the attitudes [of engineers] toward and use patterns of computer and information technology in an effort to forecast the potential value of new information technologies." Overall, the survey results indicated that computer and information technology has "high" potential usefulness, but relatively low use among engineers. In analyzing this statement, it is important to keep in mind that the "state-of-the-art" in computer and information technology has changed dramatically in the seven years since the Shuchman (1981) study was released.

U.S. industry has invested heavily in computer and information technology for such purposes as enhancing the quality of managerial decision making and professional work products, improving efficiency and productivity, and increasing profitability. According to the U.S. Congress, Office of Technology Assessment (1988), "over 40 percent of all new investments in plant and equipment are now in a category called 'information technology' -- computers, communication equipment, and related information equipment. This is double its share in 1978." Since 1981, the cost of computer hardware and computer storage has decreased and computing power has significantly increased. Many new computer and information technology products have entered the market. However, according to Shuchman (1981), "such occurrences are of limited value unless management decisions are made that increase the accessibility and utility of computer and information technology."

In Shuchman's study, respondents were asked to indicate the use, non-use, and potential usefulness of 21 computer and information technologies. For purposes of data analysis, these 21 technologies have been arranged into the following four groups. The titles of the groups were contrived to provide a label for identification purposes only.

Computer Devices -- Group 1

Computations  
Keyboard  
Line printer  
Accessing data banks  
Video displays  
Computer-aided instruction  
Line printer-graphics

Information Transmission -- Group 2

Fast facsimile  
Teleconferencing  
Audio conference calls

Recorded/Prerecorded -- Group 3

Audio cassettes  
Audio with high speed playback  
Films  
Video disks

Advanced Technology -- Group 4

Video telephone  
Video closed circuit TV  
Audio recognition  
Text recognition  
Graphics recognition  
Speech synthesis

Data from Shuchman's study, which were used to make comparisons among the four computer and information technology groups and the six engineering disciplines, appear in Table A. Data are expressed in percentages of non-use, use, and potential usefulness.

**TABLE A**

Non-Use, Use, and Potential Usefulness of Computer and Information Technology by Engineering Disciplines\*  
(All Values are Percentages)

(1) **Group 1  
Computer Devices**

Engineering Discipline	Non Use	Use	Potential Usefulness	Total
Aeronautical n = 84	16	62	22	100
Civil n = 260	27	43	30	100
Chemical/ Environmental n = 97	24	42	34	100
Electrical n = 241	15	52	33	100
Industrial n = 155	20	51	29	100
Mechanical n = 237	25	44	31	100

(2) **Group 2  
Information Transmission**

Engineering Discipline	Non Use	Use	Potential Usefulness	Total
Aeronautical n = 84	17	57	26	100
Civil n = 260	35	39	26	100
Chemical/ Environmental n = 97	26	39	35	100
Electrical n = 241	30	38	32	100
Industrial n = 155	30	41	29	100
Mechanical n = 237	28	42	30	100

(3) **Group 3  
Recorded/Prerecorded**

Engineering Discipline	Non Use	Use	Potential Usefulness	Total
Aeronautical n = 84	34	25	31	100
Civil n = 260	41	25	34	100
Chemical/ Environmental n = 97	38	24	38	100
Electrical n = 241	46	22	32	100
Industrial n = 155	42	28	30	100
Mechanical n = 237	40	25	35	100

(4) **Group 4  
Advanced Technology**

Engineering Discipline	Non Use	Use	Potential Usefulness	Total
Aeronautical n = 84	52	8	40	100
Civil n = 260	65	4	31	100
Chemical/ Environmental n = 97	54	7	39	100
Electrical n = 241	57	6	37	100
Industrial n = 155	60	6	34	100
Mechanical n = 237	55	8	37	100

\*Source Shuchman (1981)

Computer and information technologies in Group 1 were used by half of the engineers in the study. As shown in Table A.1, almost two-thirds (62 percent) of the aeronautical engineers used Group 1 technologies. Next to electrical engineers (15 percent), aeronautical engineers had the lowest "non-use" (16 percent) of Group 1 technologies of the 6 engineering disciplines, while 22 percent of those aeronautical engineers surveyed indicated that Group 1 technologies had "potential usefulness."

As shown in Table A.2, a larger-than-average number of aeronautical engineers (57 percent) used Group 2 technologies. Of the six engineering disciplines, aeronautical engineers had the lowest "non-use" (17 percent) of Group 2 technologies, while 26 percent of those aeronautical engineers surveyed indicated that Group 2 technologies had "potential usefulness."

Group 3 technologies represent both traditional and evolving technologies. Slightly more than half of those engineers who responded used slides and viewgraphs, while only 4 percent of the respondents used high speed video. As shown in Table A.3, slightly more than one-third (35 percent) of the aeronautical engineers used Group 3 technologies. Of the 6 engineering disciplines, aeronautical engineers had the lowest "non-use" (34 percent) of the Group 3 technologies and 31 percent of those

aeronautical engineers surveyed indicated that Group 3 technologies had "potential usefulness."

Group 4 technologies, which contain some of the "newer" developments in computer and information technology, were used by a small percentage of the respondents. As shown in Table A.4, aeronautical and mechanical engineers represented the highest percentages of Group 4 technology users. Of the six engineering disciplines, aeronautical engineers had the lowest "non-use" (52 percent) of the Group 4 technologies and 40 percent of those aeronautical engineers surveyed indicated that Group 4 technologies had "potential usefulness."

### Discussion

The results of the Davis (1975) and Spretnak (1982) surveys indicate that the ability to communicate technical information effectively is an important dimension of the professional engineer's work. Conversely, the inability to communicate in written and oral form can hinder an engineer's on-the-job effectiveness and his or her advancement. The results of these two studies indicate that engineers spend a considerable portion of their on-the-job time communicating and that as their careers advance, so too does the amount of time they spend working with technical communications from others.

Judging from the comments offered by the engineers who participated in these two studies, it appears that technical communications should be incorporated into the undergraduate engineering curriculum. How many of the fifty-three accredited undergraduate aeronautical engineering programs require or encourage technical communications as an elective is unknown. If technical communications is required or encouraged as part of these programs, are such items as technical writing, oral presentations, library instruction, research skills, and computer skills incorporated? If technical communications is required or encouraged as part of these programs, it might be helpful to understand the rationale upon which its inclusion is based. Is it included for reasons of accreditation or because the need for such instruction has been confirmed by employers?

The question of what should be included in an undergraduate technical writing course or curriculum has been the topic of some discussion among technical communicators and practicing engineers. While there is some indication as to the topics that should be included in an undergraduate technical communications course, there is little guidance in terms of the on-the-job communications that should be included. Other than the technical report, the research and related literature provide little insight into the kinds of technical information used and produced

and the kinds of technical information products used and produced by aeronautical engineers. Although aeronautical engineers appear to use computer and information technology to a greater extent than other engineers, little is known regarding the actual extent of use.

Although libraries, technical information centers, and on-line databases are important sources of information, they tend not to be fully utilized by engineers. Does the same hold true for aeronautical engineers and scientists? When engineers do use the library or technical information center, they tend not to seek the services of a librarian or technical information specialist. Does the same hold true for aeronautical engineers and scientists? According to Allen (1977), library use by engineers is an inverse function of the distance separating the engineer from the library. Does the same hold true for aeronautical engineers and scientists?

#### PRESENTATION AND DISCUSSION OF THE DATA

The questionnaire used in this study (1989) contained 35 questions: 25 questions concerned technical communications in aeronautics, 8 questions concerned demographic information about the survey respondents, and 2 open-ended questions allowed survey respondents to comment on the topics covered in the questionnaire and to offer suggestions for improving technical communications



in aeronautics. The responses to each question are presented for each survey topic.

Demographic data are presented first, followed by data regarding technical communications in aeronautics, which are grouped according to the five study objectives. Each question is then followed by the aggregated tallies of responses to it. Of the 2,000 questionnaires mailed, 606 completed surveys (30.3 percent response rate) were received. The data were analyzed using the Statistical Package for the Social Sciences-X (SPSS-X) designed for use with a personal computer (PC). Appendix B contains the aggregated tallies for the 606 questionnaires.

Cross tabulations were prepared to explore the relationships between responses to the 25 questions and the respondents' organizational affiliation. Affiliations included academic, government (NASA and non-NASA), and industry. The "academic" category includes responses from academic and not-for-profit organizations.

The Chi-square and one-way ANOVA (Analysis of Variance) at the .05 level of statistical significance were used as the non-parametric and parametric tests for relationships between the responses to the 25 questions and the organizational affiliations of the respondents. Appendix C contains the cross tabulations

for the 25 questions. Those cross tabulations found to be statistically significant at .05 are presented in Part A of Appendix C. Responses to the open-ended questions are included as Appendix D.

#### Demographic Information About the Survey Respondents

Survey respondents were asked to provide information regarding their professional duties, type of organization, years of professional work experience, their AIAA interest group, their level of education, their educational preparation, whether American English was their first (native) language, and their gender.

Background data (Table B) collected as part of the survey revealed that approximately 38 percent of the respondents stated that their professional duties were design/development and approximately 24 percent indicated their professional duties involved administration/management (15.4 percent for profit and 8.4 percent not-for-profit). Approximately 20 percent indicated that their professional duties involved research.

**TABLE B**

Summary: Professional Duties	Number	Percentage
Research	118	19.5
Administration/Management(for profit)	93	15.4
Administration/Management(not-for-profit sector)	51	8.4
Design/Development	226	37.4
Teaching/Academic	35	5.8
Manufacturing/Production	10	1.7
Private Consultant	14	2.3
Service/Maintenance	1	0.2
Marketing/Sales	23	3.8
Other	33	5.5
	<u>604</u>	<u>100.0</u>

Approximately 62 percent of the respondents were affiliated with industrial organizations (Table C), followed by 16 percent who worked with government (non-NASA) organizations. About 12 percent of the respondents worked with NASA and about 7 percent were affiliated with academic organizations.

**TABLE C**

Summary: Type of Organization	Number	Percentage
Academic	4	6.8
Industrial	376	62.1
Not-for-Profit	17	2.8
Government (Non-NASA)	97	16.0
NASA	74	12.3
	<u>605</u>	<u>100.0</u>

Approximately 35 percent of the respondents had 10 or fewer years of professional work experience (Table D), and approximately 54 percent had 20 or fewer years of professional work experience. Approximately 77 percent had 30 or fewer years of professional work experience, an approximately 23 percent had 31 or more years of professional work experience.

**TABLE D**

Summary: Years of Professional Work Experience	Number	Percentage
0 to 5 years	107	17.7
6 to 10 years	105	17.4
11 to 15 years	59	9.8
16 to 20 years	57	9.4
21 to 30 years	141	23.4
31 or more years	<u>137</u>	<u>22.4</u>
	606	100.0

Approximately 31 percent of the respondents selected aerospace sciences as their AIAA interest group (Table E), followed by approximately 20 percent in propulsion and energy. The third and fourth most frequently selected AIAA interest groups were aircraft systems (13.7 percent) and structures, design, and test (13.7 percent). Eight percent selected aerospace and information systems 8 percent and about six percent of the respondents selected administration/management as their AIAA interest group.

**TABLE E**

Summary: AIAA Interest Group	Number	Percentage
Aerospace Science	183	30.6
Aircraft Systems	82	13.7
Structures, Design, and Test	82	13.7
Propulsion and Energy	120	20.1
Aerospace and Information Systems	48	8.0
Administration/Management	37	6.2
Other	46	7.7
	<u>598</u>	<u>100.0</u>

About one percent or four respondents reported having less than a bachelors degree (Table F), while approximately 33 percent of the respondents held a bachelors degree. Just over 66 percent of the respondents held graduate degrees, with about 44 percent having masters degrees and about 23 percent holding doctorates.

**TABLE F**

Summary: Level of Education	Number	Percentage
No degree	4	0.7
Bachelors	198	32.8
Masters	264	43.7
Doctorate	137	22.7
Other	1	0.1
	<u>604</u>	<u>100.0</u>

Approximately 90 percent of the respondents (Table G) indicated that they were engineers, and approximately 10 percent indicated that they were scientists.

**TABLE G**

Summary: Engineer or Scientist	Number	Percentage
Engineer	541	89.9
Scientist	61	10.1
	<hr/> 602	<hr/> 100.0

Approximately 94 percent of the respondents (Table H) indicated that American English was their first (native) language. Approximately six percent indicated that American English was not their first (native) language.

**TABLE H**

Summary: American English is First (Native) Language	Number	Percentage
Yes	567	93.6
No	39	6.4
	<hr/> 606	<hr/> 100.0

Approximately 95 percent of the respondents were male (Table I) and approximately five percent were female.

TABLE I

Summary: Gender	Number	Percentage
Male	577	95.2
Female	<u>29</u>	<u>4.8</u>
	606	100.0

Survey Objective 1: The Importance of Technical Communications

To determine the importance of technical communications in aeronautics, survey respondents were asked to indicate the importance of communicating technical information effectively, the number of hours spent each week communicating technical information to others, the number of hours spent each week working with technical communications received from others, and how their professional advancement has affected the amount of time they spend communicating technical information to others and working with technical communications from others.

Approximately 99 percent of the aeronautical engineers and scientists surveyed (Table J) indicate that the ability to communicate technical information effectively is important. Only .5 percent indicate that this ability is not important. These data correlate well with the results of the Davis (1975) and Spretnak (1982) studies.

TABLE J

Summary: Importance of Technical Communications	Number	Percentage
Very important	542	89.7
Somewhat important	59	9.8
Not at all important	3	0.5
	<u>604</u>	<u>100.0</u>

Respondents were asked to comment on the question, "What can be done to improve technical communications in aeronautics?"

Excerpts from the responses to this open-ended question follow.

o Technical communications needs to be stressed as part of the undergraduate engineering curriculum.

o Teach engineering students how to write for non-technical audiences, teach them how to present technical data to both technical and non-technical audiences, and the correct use of grammar.

o Teach engineering students how to communicate; effective communication is essential to the success of today's engineer.

o I cannot emphasize enough the need for engineers to be trained in English grammar, spelling, writing, and presentation skills.

Survey respondents spend an average of 13.95 hours per week communicating technical information to others (Table K). Based on a 40-hour work week, they spend approximately 35 percent of their work week communicating technical information to others. Respondents to the Davis (1975) study spent approximately 25 percent of their time producing (writing) technical communications.



**TABLE K**

Summary: Hours Spent Per Week Communicating Technical Information to Others	Number	Percentage
5 hours or less	102	17.1
6 to 10 hours	189	31.7
11 to 20 hours	237	39.8
21 hours or more	68	11.4
	<u>596</u>	<u>100.0</u>

Mean = 13.95 hours

Aeronautical engineers and scientists spend approximately 13 hours a week working with technical communications received from others (Table L). In a 40-hour work week, they spend approximately 31 percent of their week with such work. Respondents to the Davis (1975) study spent about 30 percent of their time working with technical communications received from others. Considering both the time spent working on the preparation of technical information and the time spent working with technical information received from others, technical communications takes up approximately 66 percent of the aeronautical engineer's and scientist's 40-hour work week.

**TABLE L**

Summary: Hours Spent Per Week Working With Technical Communications Received From Others	Number	Percentage
5 hours or less	126	21.1
6 to 10 hours	222	37.2
11 to 20 hours	197	33.0
21 hours or more	<u>52</u>	<u>8.7</u>
	597	100.0

Mean = 12.57 hours

Approximately 72 percent of the survey respondents indicate that as they advanced professionally, the amount of time they spent communicating technical information to others increased (Table M). Approximately 15 percent indicate that the amount of time spent communicating technical information to others stayed the same, and approximately 13 percent indicate that the amount of time they spent communicating technical information to others decreased as they advanced professionally. Approximately 63 percent of the respondents in the Davis (1975) study and 79 percent of the respondents in the Spretnak (1982) study reported that the amount of time they spent preparing (writing) technical communications increased as they advanced in their careers.

TABLE M

Summary: Professional Advancement -- Amount of Time Spent Communicating Technical Information to Others	Number	Percentage
Increased	433	71.7
Stayed the same	93	15.4
Decreased	78	12.9
	<u>604</u>	<u>100.0</u>

Approximately 61 percent of the respondents indicate that as they advanced professionally, the amount of time they spent working with technical communications received from others increased (Table N). Approximately 26 percent indicated that the amount of time spent working with technical communications received from others stayed the same as they advanced professionally, and approximately 13 percent indicate that the amount of time spent working with technical communications received from others decreased as they advanced professionally. Approximately 91 percent of the respondents to the Davis (1975) study indicated that they spend more time working with written materials as their responsibilities increased.

TABLE N

Summary: Professional Advancement -- Amount of Time Spent Working With Technical Communications Received From Others	Number	Percentage
Increased	367	61.2
Stayed the same	155	25.9
Decreased	<u>77</u>	<u>12.9</u>
	599	100.0

Survey Objective 2: The Use and Production of Technical Communications

To determine the use and production of technical communications, survey respondents were asked to indicate the volume and type of technical information they produced and the sources of help they sought in producing their information and in solving technical problems.

Memos, letters, and A/V (audio visual) materials are most frequently produced by aeronautical engineers and scientists (Table O). On the average, respondents produced approximately 29 memos, 22 letters, and 7 A/V materials in the past six months

TABLE O

Summary: Technical Information Product Production	None	1-5	6-10	11 and Above	Total %	Average
Letters	15.0	22.7	22.8	39.5	100	22.2
Memos	8.6	14.9	19.1	57.4	100	28.8
Technical reports-Government	60.9	31.7	5.6	1.8	100	1.6
Technical reports-Other	57.1	34.2	6.5	2.2	100	1.9
Proposals	47.4	46.4	4.2	2.0	100	1.8
Technical manuals	84.9	13.9	1.2	0.0	100	0.3
Computer program documentation	70.0	24.6	3.6	1.8	100	1.3
Journal articles	80.0	19.4	0.4	0.2	100	0.4
Conference/Meeting papers	62.8	33.9	1.8	1.5	100	1.1
Trade/Promotional literature	93.0	5.6	0.9	0.5	100	0.3
Press releases	90.0	9.3	0.2	0.5	100	0.3
Drawings/Specifications	71.8	17.8	3.3	7.1	100	3.2
Speeches	54.0	35.0	7.5	3.5	100	2.2
Audio/Visual materials	30.1	36.2	17.4	16.3	100	6.6

Other technical information products were produced far less frequently. Trade and promotional literature, press releases, and technical manuals were the technical information products produced least frequently. Based on average production, the five most frequently and least frequently produced products are summarized on the following page.

Most Frequently Produced  
6-month production

Memos  
Letters  
A/V materials  
Drawings/specifications  
Speeches

Least Frequently Produced  
6-month production

trade/promotional  
literature  
Press releases  
Technical manuals  
Journal articles  
Conference/meeting papers

A one-way ANOVA (Analysis of Variance) (Table P) was used to compare respondents' organizational affiliations with their production of technical information. Academic respondents

**TABLE P**

Comparison of the Average Number of Technical Information Products Used by Organizational Affiliation					
Product	Academic	Industrial	Government	NASA	Average Number
Letters	44.0	20.2	21.2	16.5	22.0
Government technical reports	.9	.9	1.4	2.1	1.6
Other technical reports	1.8	2.5	.5	.4	1.9
Proposals	2.3	2.2	.5	.5	1.8
Journal articles	1.3	.2	.3	.5	0.4

ANOVA is significant at  $P < .05$

produced significantly more letters, proposals, and journal articles than did respondents in the other groups. Industrial respondents produced significantly more nongovernmental technical reports than did respondents in the other groups. Similarly, NASA respondents produced significantly more government technical reports than did respondents in the other groups.

On the average, memos, letters, and drawings/specifications were the technical information products most frequently used by aeronautical engineers and scientists during a one-month period (Table Q).

**TABLE Q**

Summary: Technical Information Product Use	None	1-5	6-10	11 and Above	Total %	Average
Letters	18.7	30.4	20.5	30.4	100	16.7
Memos	10.3	27.7	17.5	44.5	100	24.3
Technical reports-Government	35.3	44.8	12.9	7.0	100	4.2
Technical reports-Other	34.5	46.3	11.0	8.2	100	4.5
Proposals	57.2	38.2	3.8	0.8	100	1.4
Technical manuals	60.9	31.1	4.8	3.2	100	2.2
Computer program documentation	55.7	34.5	5.3	4.5	100	3.0
Journal articles	34.9	36.8	14.9	13.4	100	6.7
Conference/Meeting papers	43.8	39.8	10.0	6.4	100	4.3
Trade/Promotional literature	54.1	27.6	9.1	9.2	100	5.7
Drawings/Specifications	56.3	23.7	8.5	11.5	100	7.9
Audio/Visual materials	47.0	33.4	11.9	7.7	100	5.5

The five most frequently and least frequently used (on the average) technical information products are summarized below.

Most Frequently Used  
1-month use

Memos  
Letters  
Drawing/specifications  
Journal articles  
Trade and promotional  
literature

Least Frequently Used  
1-month use

Proposals  
Technical manuals  
Computer program  
documentation  
Government technical  
reports  
Conference/meeting papers

Letters, memos, and drawings/specifications are frequently produced and used. Technical manuals are the least produced and used technical information products. Somewhat surprising is the lack of use and production of technical reports. The related research and literature indicate that technical reports are important technical information products in aeronautics. However, the study question was concerned with production and use, not importance. Technical reports did not appear on the list of either the most frequently produced or most frequently used information products.

A one way ANOVA (Table R) was used to compare respondents' organizational affiliations with their use of specific technical information products. NASA respondents used significantly more



**TABLE R**

Comparison of the Average Number of Technical Information Products Produced by Organizational Affiliation					
Product	Academic	Industrial	Government	NASA	Average Number
Government technical reports	2.8	3.6	5.1	7.3	4.2
A/V material	2.7	4.0	4.1	17.8	5.5

ANOVA is significant at  $P < .05$

government technical reports and A/V materials than did respondents in other groups.

Aeronautical engineers and scientists seek the help of both people and other information sources to prepare technical information products (Table S). Other colleagues, secretaries, a

**TABLE S**

Summary: Technical Information Production -- Sources of Help	Always		Usually		Sometimes		Never		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Other colleagues	68	11.3	240	39.8	278	46.2	16	2.7	602	100
Secretaries	141	23.4	168	27.9	216	35.8	78	12.9	603	100
Technical writers or editors	9	1.6	28	4.8	231	40.0	310	53.6	578	100
A thesaurus/dictionary	127	21.3	174	29.3	249	41.8	45	7.6	595	100
A style manual	9	1.6	27	4.7	205	35.5	336	58.2	577	100
A grammar hotline	1	0.2	4	0.7	31	5.4	533	93.7	569	100

thesaurus, and a dictionary are "always" or "usually" used. From the available data, it is difficult to determine if technical writers and editors are so little used because they are unavailable or for some other reason.

Aeronautical engineers and scientists prepare artwork for their visual aids in various ways (Table T). Most of them prepare their own artwork using a computer (34.4 percent), followed by those who use a combination of self and a graphics department (30.3 percent), followed by those who use the graphics department alone (16.7 percent). Approximately 10 percent of the respondents apparently prepare their own artwork, apparently manually.

**TABLE T**

Summary: Artwork -- How Produced	Number	Percentage
I do my own artwork without a computer	62	10.3
I do my own artwork with a computer	206	34.4
The graphics department does my artwork	100	16.7
Sometimes I do it and sometimes the graphics department does it	182	30.3
A secretary does it	38	6.3
The artwork is prepared elsewhere	12	2.0
	<u>600</u>	<u>100.0</u>

Aeronautical engineers and scientists were asked to identify the types of technical information they produce (Table U). The

**TABLE U**

Summary: Types of Technical Information Produced in Performance of Present Duties	Yes		No		Total	
	No.	%	No.	%	No.	%
Scientific and technical information	555	92.2	47	7.8	602	100
Experimental techniques	269	44.7	333	55.3	602	100
Codes of standards and practices	126	20.9	476	79.1	602	100
Design procedures and methods	282	47.0	318	53.0	600	100
Computer programs	344	57.1	258	42.9	602	100
Government rules and regulations	92	15.4	507	84.6	599	100
In-house technical data	511	84.9	91	15.1	602	100
Product and performance characteristics	350	58.2	251	41.8	601	100
Economic information	164	27.2	438	72.8	602	100
Technical specifications	359	59.6	243	40.4	602	100
Patents	109	18.1	493	81.9	602	100

five most frequently produced and least frequently produced types of technical information are shown below.

Most Frequently Produced

S&T information  
 In-house technical data  
 Technical specifications  
 Product and performance characteristics  
 Computer programs

Least Frequently Produced

Government rules and regulations  
 Patents  
 Codes of standards and practices  
 Economic information  
 Experimental techniques

Chi-square cross tabulations were used to compare respondents' organizational affiliation with their production of specific types of technical information (Table V). Academic

**TABLE V**

Comparison of the Types of Technical Information Produced by Organizational Affiliation										
Type of Technical Information	Academic		Industrial		Government		NASA		Total	Expected
	No.	%	No.	%	No.	%	No.	%	No.	%
Codes of standards and practices	6	10.3	82	22.0	27	27.8	11	14.9	126	20.9
Experimental techniques	33	56.9	155	41.6	40	41.2	41	55.4	269	44.7
Government rules and regulations	5	8.6	15	4.0	52	54.2	20	27.0	92	15.4
In-house technical data	36	62.1	329	88.2	84	86.6	62	83.8	511	84.9
Product and performance	19	32.8	251	67.3	51	53.1	29	39.2	350	58.2
Economic information	10	17.2	117	31.4	24	24.7	13	17.6	164	27.2
Technical specifications	23	39.7	248	66.5	49	50.5	39	52.7	359	59.6

Chi-square is significant at  $P < .05$

and NASA respondents are more likely to produce experimental techniques than expected. Government respondents are more likely

and academic and NASA respondents are less likely than expected, to produce codes of standards and practices. Government and NASA respondents were more likely and academic and industrial less likely than expected to produce government rules and regulations. Academic respondents are less likely than expected to produce in-house technical data. Industrial respondents are more likely and academic and NASA respondents less likely than expected to produce product and performance characteristics. Academic and NASA respondents are less likely than expected to produce economic information. Academic respondents are less likely than expected to produce technical specifications.

Aeronautical engineers and scientists were asked to identify the types of technical information they used (Table W). The five

**TABLE W**

Summary: Types of Technical Information Used to Perform Present Duties	Yes		No		Total	
	No.	%	No.	%	No.	%
Scientific and technical information	584	97.0	18	3.0	602	100
Experimental techniques	363	60.4	238	39.6	601	100
Codes of standards and practices	287	47.8	314	52.2	601	100
Design procedures and methods	336	55.9	265	44.1	601	100
Computer programs	486	80.7	116	19.3	602	100
Government rules and regulations	432	71.9	169	28.1	601	100
In-house technical data	545	90.5	57	9.5	602	100
Product and performance characteristics	435	72.3	167	27.7	602	100
Economic information	215	35.8	386	64.2	601	100
Technical specifications	463	76.9	139	23.1	602	100
Patents	85	14.1	517	85.9	602	100

most frequently used and least frequently used kinds of technical information are summarized below.

Most Frequently Used

S&T information  
 In-house technical data  
 Computer programs  
 Technical specifications  
 Product and performance characteristics

Least Frequently Used

Patents  
 Economic information  
 Codes of standards and practices  
 Design procedures and methods  
 Experimental techniques

Chi-square cross tabulations were used to compare respondents' organizational affiliation with their use of specific types of technical information (Table X). Academic

**TABLE X**

Comparison of the Types of Technical Information Used by Organizational Affiliation										
Type of Technical Information	Academic		Industrial		Government		NASA		Total	Expected
	No.	%	No.	%	No.	%	No.	%	No.	%
Codes of standards and practices	15	25.9	200	53.8	42	43.3	30	40.5	287	47.8
Design procedures	20	34.5	232	62.4	50	51.5	34	49.5	336	55.9
Government rules and regulations	20	34.5	275	73.7	81	84.4	56	75.7	432	71.9
In-house technical data	36	62.1	354	94.9	89	91.8	66	89.2	545	90.2
Product and performance	28	48.3	294	78.8	71	73.2	42	56.8	435	72.3
Economic information	18	31.0	151	40.6	28	28.9	18	24.3	215	35.8
Technical specifications	32	55.2	311	83.4	73	75.3	47	63.5	463	76.9
Patents	4	6.9	66	17.7	9	9.3	6	8.1	85	6.9

Chi-square is significant at  $P < .05$

respondents are less likely than expected to use codes of standards and practices, less likely than expected to use government rules and regulations, and less likely than expected to use in-house technical data. Academic and NASA respondents are less likely than expected to use product and performance characteristics and technical specifications. NASA respondents are less likely than expected to use economic information.

Data on the types of technical information produced and used by aeronautical engineers and scientists in this (1989) study were compared with the data reported for the aeronautical engineers in Shuchman's (1981) study. The five types of technical information most frequently produced and used are presented for comparison.

#### INFORMATION PRODUCED

##### Shuchman

In-house technical data  
Physical data  
S&T information  
Design methods  
Computer programs

##### Pinelli et al.

S&T information  
In-house technical data  
Technical specifications  
Product and performance characteristics  
Computer programs

#### INFORMATION USED

##### Shuchman

S&T information  
In-house technical data  
Computer programs  
Physical data  
Design methods

##### Pinelli et al.

S&T information  
In-house technical data  
Computer programs  
Technical specifications  
Product and performance characteristics

The sample sizes (Shuchman n=84 and Pinelli et al. n=606) and the research designs for the two studies affect the extent to which a valid comparison can be made between the two sets of data. Nevertheless, to the extent that such a comparison is valid, the types of technical information produced in both studies compare reasonably well. However, there is a much better fit between the types of technical information used.

As shown in Table Y, aeronautical engineers and scientists

TABLE Y

Summary: Solving a Technical Problem -- Source of Technical Information Used	Always		Usually		Sometimes		Never		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Personal knowledge	256	42.7	276	46.0	68	11.3	0	0.0	600	100
Informal discussions with colleagues	120	20.0	344	57.2	135	22.5	2	0.3	601	100
Discussions with supervisors	60	10.1	208	35.0	283	47.6	43	7.3	594	100
Discussions with experts in your organization	112	18.7	304	50.8	176	29.4	7	1.1	599	100
Discussions with experts outside of your organization	37	6.2	116	19.3	397	66.2	50	8.3	600	100
Technical reports-Government	35	5.8	166	27.7	363	60.5	36	6.0	600	100
Technical reports-Other	34	5.7	178	29.7	368	61.4	19	3.2	599	100
Professional journals/conference meeting papers	56	9.4	154	25.8	318	53.3	69	11.5	597	100
Textbooks	53	8.8	185	30.8	324	54.0	38	6.4	600	100
Handbooks and standards	40	6.8	164	27.7	331	55.9	57	9.6	592	100
Technical information sources such as on-line data bases, indexing and abstracting guides, CD-ROM, and current awareness tools	7	1.2	41	7.0	262	44.8	275	47.0	585	100
Librarians/technical information specialists	16	2.7	68	11.4	294	66.0	119	19.9	597	100



use a variety of information sources when solving a technical problem. The "always" and "usually" responses, which appear as percentages in Table Y, were combined to form the list of sources used to solve technical problems. They use, in decreasing order of frequency, the following sources.

**SOURCES USED BY AERONAUTICAL ENGINEERS AND SCIENTISTS  
TO SOLVE TECHNICAL PROBLEMS**

<u>Sources</u>	<u>Percent of Cases</u>
1. Personal knowledge	88.7
2. Informal discussion with colleagues	77.2
3. Discussions with experts within the organization	69.5
4. Discussions with supervisor	45.1
5. Textbooks	39.6
6. Technical reports	35.4
7. Journals and conference/meeting papers	35.2
8. Handbooks and standards	34.5
9. Government technical reports	33.5
10. Discussions with experts outside of the organization	25.5
11. Librarians/technical information specialists	14.1
12. Technical information sources such as on-line databases	8.2

The kinds of information sources used by aeronautical engineers and scientists in this study (1989) to solve technical problems compare favorably with the related research and literature. Like engineers in general, aeronautical engineers and scientists display the same preference for using personal knowledge and informal sources.

In an attempt to validate the findings, the sources used by the aeronautical engineers in this (1989) study were compared with the steps used by the engineers in Shuchman's study of Information Transfer in Engineering. (See page 20.) With minor exceptions, the aeronautical engineers and scientists in this study sought information from sources similar to the sources used by engineers in Shuchman's study. Both groups begin with what Allen (1977) calls an "informal search for information followed by the use of 'formal' information sources. Only as a last resort do they turn to librarians and technical information specialists and bibliographic tools for assistance."

### Survey Objective 3: Content for an Undergraduate Course in Technical Communications

To obtain the views of aeronautical engineers and scientists on the content for an undergraduate course in technical communications, survey respondents were asked if they had taken a course(s) in technical communications/writing, the degree to which the course(s) helped them communicate technical information, and their opinions regarding topics and on-the-job communications they recommended be included in an undergraduate technical communications course.

Approximately 24 percent of the respondents had taken at least one course in technical communications/writing as

undergraduates (Table Z). Approximately 20 percent of the

**TABLE Z**

Summary: Technical Communications/Writing Coursework Taken	Number	Percentage
Yes, as an undergraduate	148	24.4
Yes, after graduation	119	19.6
Yes, both	149	24.6
No	190	31.4
	<u>606</u>	<u>100.0</u>

respondents had taken such a course after graduation and approximately 25 percent had done so both as undergraduates and after graduation. Approximately 31 percent of the respondents indicated that they had taken no such course.

Approximately 97 percent of those respondents who had taken a course(s) in technical communications/writing indicated that doing so has helped them to communicate technical information (Table AA). The respondents are fairly evenly divided as to

**TABLE AA**

Summary: Technical Communications/Writing Coursework -- How Helpful	Number	Percentage
A lot	175	42.5
A little	223	54.1
Did not help	14	3.4
	<u>412</u>	<u>100.0</u>

whether the course(s) helped them "a lot" (42.5 percent) or "a little" (54.1 percent). Approximately four percent of the respondents indicate that their course(s) had not helped them.

The percentage of "yes" responses to the list of principles to be included in an undergraduate technical communications course range from a high of 96.5 percent (organizing information) to a low of 50 percent (notetaking and quoting). (See Table BB.) Eight of the ten topics (principles) received "yes" responses of

**TABLE BB**

Summary: Topics for an Undergraduate Technical Communications Course for Aeronautical Engineers and Scientists -- Principles	Yes		No		Total	
	No.	%	No.	%	No.	%
Defining the communication's purpose	547	90.7	56	9.3	603	100
Assessing readers' needs	490	81.7	110	18.3	600	100
Organizing information	582	96.5	21	3.5	603	100
Developing paragraphs (introductions, transitions, and conclusions)	520	86.2	83	13.8	603	100
Writing sentences (active vs. passive voice, parallel ideas, shifts in person or tense)	483	80.0	121	20.0	604	100
Using standard English grammar	469	77.8	134	22.2	603	100
Notetaking and quoting	299	50.0	299	50.0	598	100
Editing and revising	469	77.8	134	22.2	603	100
Choosing words (avoiding wordiness, jargon, slang, sexist terms)	491	81.4	112	18.6	603	100
Using information technology (video conferencing, electronic data bases, etc.)	365	60.7	236	39.3	601	100

greater than 75 percent. These eight topics are listed below in descending order of importance.

<u>Topic</u>	<u>Percentage Response</u>
Organizing information	96.5
Defining the communication's purpose	90.7
Developing paragraphs	86.2
Assessing readers' needs	81.7
Choosing words	81.4
Writing sentences	80.0
Editing and revising	77.8
Using standard English grammar	77.8

The percentage of "yes" responses to the list of mechanics to be included in an undergraduate technical communications course range from a high of 76.7 percent (references) to a low of 48.7 percent (numbers). (See Table CC.) Six of the eight topics

**TABLE CC**

Summary: Topics for an Undergraduate Technical Communications Course for Aeronautical Engineers and Scientists -- Mechanics	Yes		No		Total	
	No.	%	No.	%	No.	%
Abbreviations	304	51.4	288	48.6	592	100
Acronyms	295	49.7	298	50.3	593	100
Capitalization	361	61.0	231	39.0	592	100
Numbers	286	48.7	301	51.3	587	100
Punctuation	450	75.9	143	24.1	593	100
References	455	76.7	138	23.3	593	100
Spelling	386	65.1	207	34.9	593	100
Symbols	339	57.3	253	42.7	592	100

(mechanics) received "yes" responses of more than 50 percent. These six topics are listed below in descending order of importance.

<u>Topic</u>	<u>Percentage Response</u>
References	76.7
Punctuation	75.9
Spelling	65.1
Capitalization	61.0
Symbols	57.3
Abbreviations	51.4

The percentage of "yes" responses to the list of topics (on-the-job communications) to be included in an undergraduate technical communications course range from a high of 95.3 percent (oral presentations) to a low of 24.3 percent (newsletter articles). (See Table DD.) Seven of the 11 topics

**TABLE DD**

Summary: Topics for an Undergraduate Technical Communications Course for Aeronautical Engineers and Scientists -- On-the-Job Communications	Yes		No		Total	
	No.	%	No.	%	No.	%
Abstracts	406	69.0	182	31.0	588	100
Letters	412	69.4	182	30.6	594	100
Memos	463	77.8	132	22.2	595	100
Instructions	340	57.6	250	42.4	590	100
Journal articles	275	46.4	318	53.6	593	100
Literature reviews	220	37.3	370	62.7	590	100
Manuals	287	48.3	307	51.7	594	100
Newsletter articles	143	24.3	445	75.7	588	100
Oral presentations	567	95.3	28	4.7	595	100
Specifications	330	55.7	262	44.3	592	100
Use of information sources	468	79.1	124	20.9	592	100

(on-the-job communications) received "yes" responses of more than 50 percent. These seven topics are listed below in descending order of importance.

<u>Topic</u>	<u>Percentage Response</u>
Oral presentations	95.3
Use of information sources	79.1
Memos	77.8
Letters	69.4
Abstracts	69.0
Instructions	57.6
Specifications	55.7

Respondents were asked to consider specific types of technical reports for inclusion in an undergraduate technical communications course. The percentage of "yes" responses to the list range from a high of 79.1 percent (progress reports) to a low of 50.9 percent (trouble reports). (See Table EE.)

**TABLE EE**

Summary: Topics for an Undergraduate Technical Communications Course for Aeronautical Engineers and Scientists -- Types of Technical Reports	Yes		No		Total	
	No.	%	No.	%	No.	%
Feasibility	344	62.3	208	37.7	552	100
Investigative	368	66.7	184	33.3	552	100
Laboratory	392	70.9	161	29.1	553	100
Progress	440	79.1	116	20.9	556	100
Test	436	78.6	119	21.4	555	100
Trip	302	54.3	254	45.7	556	100
Trouble	282	50.9	272	49.1	554	100

Progress (79.1 percent) and test (78.6 percent) reports received the highest percentage of "yes" responses. Trip (54.3 percent) and trouble (50.9 percent) reports received the lowest percentage of "yes" responses.

In an attempt to validate these findings, the top five recommended on-the-job communications were compared with the top five (on the average) technical communications products "produced" and "used" by aeronautical engineers and scientists.

<u>Communications Produced</u>	<u>Communications Used</u>	<u>Communications Recommended</u>
Memos	Memos	Oral presentations
Letters	Letters	Use of information sources
A/V materials	Drawings/ specifications	Memos
Drawings/ specifications	Journal articles	Letters
Speeches	Trade/promotional literature	Abstracts

The recommended topics compared quite favorably with the technical communications products "produced" and "used" by aeronautical engineers and scientists. Memos and letters are included in all three lists. Oral presentations, which rank first on the list of recommended topics would include the use of A/V materials and the oral delivery (i.e., speech) of the content, which rank third and fifth, respectively, on the list of products "produced." Drawings and specifications rank sixth and seventh, respectively, on the list of recommended topics and fourth and third, respectively, on the list of products



"produced" and "used." Considered as a group, technical reports would make the recommended topics list. In terms of products "produced" they rank sixth and they ranked seventh in terms of products "used."

The inclusion and relative importance (i.e., second) of "use of information sources" on the list of recommended topics are of particular interest. This finding tends to support Allen's (1979) claim that "engineers tend to search for library information themselves." Knowing how to use information sources would decrease the likelihood of an engineer utilizing the services of the information professional.

#### Survey Topic 4: Use of Libraries, Technical Information Centers, and On-Line Databases

To determine the use of libraries, technical information centers, and on-line databases, survey respondents were asked three questions. They were asked to indicate how often they used a library or technical information center, their use of on-line databases, and how they search the databases.

Ninety-four percent of the respondents indicate that they use a library or technical information center (Table FF).

**TABLE FF**

Summary: Use of Library or Technical Information Center	Number	Percentage
Daily	12	2.0
Two to six times a week	60	10.0
Once a week	90	15.0
Two to three times a month	116	19.2
Once a month	102	16.9
Less than once a month	186	30.9
Do not use	<u>36</u>	<u>6.0</u>
	602	100.0

The frequency rates vary among respondents, with 27 percent using a library or technical information center one or more times a week. Approximately 36 percent of the respondents use a library or technical information center one or more times a month, while approximately 31 percent use a library or technical information center less than once a month. The use of libraries and technical information centers by aeronautical engineers and scientists in this (1989) study compares favorably with the use rate of libraries and technical information centers by engineers reported in the related research and literature.

Less than half or 44.1 percent of the survey respondents use on-line databases (Table GG). Of those survey respondents

**TABLE GG**

Summary : Use of Electronic Databases	Number	Percentage
Yes	265	44.1
No	<u>336</u>	<u>55.9</u>
	601	100.0

who use on-line databases, 23 percent do all or most of their own searches (Table HH). Approximately 65 percent use an intermediary to do most or all of their searches, while about 12 percent do half and the other half use an intermediary for searches.

**TABLE HH**

Summary: Use of Electronic Databases-- How Searched	Number	Percentage
Do all searches yourself	18	6.9
Do most searches yourself	42	16.1
Do half by yourself and half through an intermediary (e.g. librarian)	32	12.3
Do most searches through an intermediary (e.g. librarian)	92	35.2
Do all searches through an intermediary	<u>77</u>	<u>29.5</u>
	261	100.0

Based on Chi-square tabulations (see Appendix C), academic respondents are more likely to use (62.1 percent) on-line databases than expected (44.1 percent).

Survey Topic 5: Use and Importance of Computer and Information Technology

To determine the use and importance of computer and information technology, survey respondents were asked about their use of computer technology, whether computer technology has increased their ability to communicate technical information, and what types of computer and information technology they used.

Approximately 91 percent of the respondents use computer technology (Table II), while approximately 70 percent of the respondents "always" or "usually" use it, and approximately 22 percent "sometimes" use it.

**TABLE II**

Summary: Use of Computer Technology for Preparing Technical Communications	Number	Percentage
Always	232	38.3
Usually	191	31.5
Sometimes	131	21.6
Never	52	8.6
	<u>606</u>	<u>100.0</u>

Approximately 95 percent of those respondents who use computer technology indicate that it has increased their ability to communicate technical information (Table JJ).

**TABLE JJ**

Summary : Computer Technology--Increased Ability to Communicate Technical Information	Number	Percentage
A lot	342	61.7
A little	183	33.1
Not at all	29	5.2
	<u>554</u>	<u>100.0</u>

Aeronautical engineers and scientists use a variety of software for preparing written technical communications (Table KK). The percentage of "yes" responses ranges from a high

**TABLE KK**

Summary: Use of Software to Prepare Written Technical Communications	Yes		No		Total	
	No.	%	No.	%	No.	%
Word processing	520	94.4	31	5.6	551	100
Outliners and prompters	59	10.8	486	89.2	545	100
Grammar and style checkers	62	11.8	484	88.2	546	100
Spelling checkers	347	62.9	205	37.1	552	100
Thesaurus	174	31.8	373	68.2	547	100
Business graphics	197	36.0	350	64.0	547	100
Scientific graphics	353	64.4	195	35.6	548	100

of 94.4 percent (word processing) to a low of 10.8 percent (outliners and prompters). Word processing software is used most frequently (94.4 percent), followed by scientific graphics (64.4 percent), then by spelling checkers (62.9 percent). The least used software is outliners and prompters (10.8 percent).

Chi-square cross tabulations were used to compare the respondents' organizational affiliation with their use of specific kinds of software. Government (71 percent) and NASA (72.9 percent) respondents make greater use of spelling checkers than expected (62.8 percent). Government respondents (42.4 percent) are more likely than expected (31.9 percent) to use a thesaurus. NASA (80 percent) respondents are more likely to use scientific graphics than expected (64.5 percent).

Less than half of the respondents (45.5 percent) make use of an integrated graphics, text, and modeling engineering workstation for preparing written technical communications (Table LL).

TABLE LL

Summary: Use of An Integrated Graphics, Text, and Modeling Engineering Workstation for Preparing Written Technical Communications	Number	Percentage
Always	39	7.1
Usually	61	11.2
Sometimes	149	27.2
Never	298	54.5
	<u>547</u>	<u>100.0</u>

Of the respondents who do make use of such a workstation, approximately 18 percent "always" or "usually" use it, while approximately 27 percent "sometimes" use it in preparing written technical communications.

Approximately 59 percent of the respondents use electronic or desk-top publishing systems for preparing written technical communications (Table MM). Of the aeronautical engineers and

**TABLE MM**

Summary: Use of Electronic or Desk-Top Publishing Systems for Preparing Written Technical Communications	Number	Percentage
Always	65	11.9
Usually	112	20.4
Sometimes	147	26.8
Never	224	40.9
	548	100.0

scientists who do use electronic or desk top publishing, approximately 32 percent "always" or "usually" use it, while approximately 27 percent "sometimes" use it for preparing written technical communications.

Aeronautical engineers and scientists use a variety of information technologies to communicate technical information (Table NN). The percentage of "I already use it" responses

TABLE NN

Summary: Use, Non-Use, and Potential Use of Information Technologies to Communicate Technical Information	I already use it		I don't use it, but may in the future		I don't use it, and doubt if I will		Total	
	No.	%	No.	%	No.	%	No.	%
Audiotapes and cassettes	118	20.3	172	29.5	292	50.1	582	100
Motion picture film	118	20.5	142	24.7	315	54.8	575	100
Videotape	275	46.5	234	39.6	82	13.9	591	100
Desk-top/electronic publishing	272	46.5	243	41.5	70	12.0	585	100
Floppy disks	441	74.5	112	18.9	39	6.6	592	100
Computer cassette/cartridge tapes	129	22.7	222	39.0	218	38.3	569	100
Electronic mail	274	46.6	255	43.4	59	10.0	588	100
Electronic bulletin boards	148	25.7	308	53.6	119	20.7	575	100
FAX or TELEX	501	84.3	64	10.8	29	4.9	594	100
Electronic databases	290	50.3	233	40.4	54	9.3	577	100
Video conferencing	95	16.3	363	62.4	124	21.3	582	100
Teleconferencing	344	58.7	182	31.1	60	10.2	586	100
Micrographics and microforms	100	18.0	245	44.0	212	38.0	557	100
Laser disc/video disc/CD-ROM	35	6.1	370	64.9	165	29.0	570	100
Electronic networks	185	32.2	303	52.8	86	15.0	574	100



ranges from a high of 84.3 percent (FAX or TELEX) to a low of 6.1 percent (laser disc/video disc/CD-ROM). The most frequently used information technologies, in descending order of use, for communicating technical information follow.

<u>Information Technology</u>	<u>Percentage Use</u>
FAX or TELEX	84.3
Floppy disks	74.5
Teleconferencing	58.7
Electronic databases	50.3
Electronic mail	46.6
Videotape	46.5
Desk-top/electronic publishing	46.5

Chi-square cross tabulations were used to compare respondents' organizational affiliation with their use of specific information technologies. NASA respondents were more likely to use desk-top publishing (62.3 percent) than expected (46.6 percent) and electronic mail (72.6 percent) than expected (46.5 percent). They are more likely to use electronic bulletin boards (57.7 percent) than expected (25.8 percent). NASA respondents are also more likely to use video conferencing (31.9 percent) than expected (16.2 percent). They are also more likely to use teleconferencing (71.8 percent) and electronic networks (56.3 percent) than expected (58.5 percent and 32.1 percent).

A further look at Table NN reveals several information technologies for which a considerable number of "I don't use it, and doubt if I will" responses were recorded. The percentages of

these responses range from a high of 54.8 percent (motion picture film) to a low of 4.9 percent (FAX or TELEX).

The five information technologies receiving the highest percentage of the "don't use, and doubt if I will" responses appear below in descending order of non-use.

<u>Information Technology</u>	<u>Percentage Non-Use</u>
Motion picture film	54.8
Audiotapes and cassettes	50.1
Computer cassette/cartridge tapes	38.3
Micrographics and microforms	38.0
Laser disc/video disc/CD-ROM	29.0

Table WN also indicates several information technologies for which a considerable percentage of "I don't use it, but may in the future" responses were recorded. The percentages of these responses range from a high of 64.9 percent (laser disc/video disc/CD-ROM) to a low of 10.8 percent (FAX or TELEX). The five information technologies receiving the highest percentage of "I don't use it, but may in the future" appear below in descending order of potential use.

<u>Information Technology</u>	<u>Percentage Non-Use</u>
Laser disc/video disc/CD-ROM	64.9
Video conferencing	62.4
Electronic bulletin boards	53.6
Electronic networks	52.8
Micrographics and microforms	44.0

The aeronautical engineers and scientists in this study make considerable use of computer and information technology. Their use compares quite favorably with the use of information

technology by aeronautical engineers in Shuchman's (1981) study.

### SUMMARY AND IMPLICATIONS

This exploratory study investigated technical communications in aeronautics by surveying aeronautical engineers and scientists. The study had five specific objectives. The first, to solicit the opinions of aeronautical engineers and scientists regarding the importance of technical communications to their profession; the second, to determine their use and production of technical communications; the third, to seek their views in light of their technical communications experience on the appropriate content of an undergraduate course in technical communications; the fourth, to determine their use of libraries, technical information centers, and on-line databases; and fifth, to determine the use and importance of computer and information technology among the respondents.

Data were collected through a self-administered mail questionnaire that was pretested at three engineering organizations. Members of the American Institute of Aeronautics and Astronautics (AIAA) comprised the study population. The sample frame consisted approximately 25 000 AIAA members in the U.S. with either academic, government, or industrial affiliations. Simple random sampling was used to select 2,000 individuals from the sample frame to participate in the study.

Six hundred and six (606) usable questionnaires (30.3 percent response rate) were received by the established cut off date. The Chi-square and one-way ANOVA (Analysis of Variance) at the .05 level of statistical significance were used as the non-parametric and parametric tests for relationships between the responses to the 25 questions and the organizational affiliations of the respondents.

### Demographic Information

Survey respondents were asked to provide information regarding their professional duties, organizational affiliation, years of professional work experience, their AIAA interest group, whether American English was their first (native) language, and their gender. Approximately 38 percent stated that their professional duties were design/development, 24 percent administration/management, and 20 percent research.

Approximately 62 percent were affiliated with industry, 28 percent with government, and 7 percent with academia.

Approximately 35 percent had 10 or fewer years of professional work experience, 54 percent had 20 or fewer years, and 77 percent had 30 or fewer years of professional work experience.

Approximately 31 percent selected aerospace sciences as their AIAA interest group and 20 percent chose propulsion and energy.

Approximately 33 percent held a bachelor's degree, while just

over 66 percent held graduate degrees. Approximately 90 percent of the respondents were trained as engineers. American English was the first (native) language of approximately 94 percent and approximately 95 percent of the respondents were male.

#### Limitations of the Study

By definition, an exploratory study has certain limitations. It is often conducted when relatively little is known about a subject to test the feasibility of undertaking a more carefully planned study and to develop methods that could be used in such a study. While exploratory studies go beyond mere description and can clarify relationships between variables, they stop short of explaining or predicting why or how something happens.

This study was conducted to gather baseline data regarding several aspects of technical communications in aeronautics and to develop and validate questions that could be used in a future study concerned with the role of the U.S. government technical report in aeronautics. Given this limited purpose -- the low response rate (30.3 percent), which is fairly typical for mail surveys, and the limitations associated with "user" studies -- no claims are made regarding the extent to which the attributes of the respondents accurately reflect the attributes of the "non-respondents" or the attributes of the population being studied. A much more rigorous research design would be needed before such

claims could be made. However, because the demographic characteristics of the survey respondents closely approximate those of the AIAA membership, certain general statements regarding technical communications in aeronautics can be formulated.

Despite the limitations of this study, these findings add considerable information to the knowledge of technical communications practices among aeronautical engineers and scientists; reinforce some of the conventional wisdom about technical communications and question other widely-held notions; hold significant implications for technical communicators, information managers, research and development managers, and curriculum developers. The survey findings are summarized and implications are presented for each study objective.

#### Survey Objective 1: The Importance of Technical Communications

Summary. Previous studies have determined that the ability to communicate technical information effectively is important to engineers. While true for engineers in general, it is no less true for the aeronautical engineers and scientists in this study. Generally satisfied with the technical-knowledge preparation of entry-level engineers, industry officials worry about their writing and presentation skills. "If there is a significant problem with entry hires, it lies in their lack of training and

communications training required, encouraged, or neither required nor encouraged? What rationale underlies those aeronautical engineering programs in which technical communications training is either required or encouraged? Is inclusion of technical communications in the aeronautical engineering curriculum based, in part, on needs expressed by alumni and employers and/or program accreditation?

Implications. To what extent do technical managers emphasize technical communications education/training in the workplace? Do they emphasize the importance of effective communications by sponsoring in-house training such as courses and workshops? Do they support aeronautical engineers and scientists attending seminars and off-site workshops designed to promote effective communication skills? To what extent have technical communicators in the aerospace industry developed technical communications outreach programs by providing writing/editing and consultation services for aeronautical engineers and scientists? To what extent have they sought to develop and/or sponsor technical communications workshops, seminars, and courses for aeronautical engineers and scientists?

## Survey Objective 2: The Use and Production of Technical Communications

Summary. Memos, letters, and audio/visual (A/V) materials are the technical information products most frequently produced by the aeronautical engineers and scientists in this study. On the average, they produce 29 memos, 22 letters, and 7 A/V materials in a 6-month period. Memos, letters, and drawings/specifications are the technical information products most frequently used by survey respondents. On the average, they use 24 memos, 17 letters, and 8 drawings/specifications in a 1-month period.

The survey respondents seek the help of both people and reference materials when preparing technical communications. Other colleagues, secretaries, a dictionary, and a thesaurus are the sources used most frequently when they produce technical communications. However, the majority of them prepare artwork in one of two ways. For the most part they either prepare their own artwork using a computer or split the responsibility by sometimes doing it themselves and sometimes having a graphics department do it.

The aeronautical engineers and scientists in this study produce and use various types of technical information in performing their duties. For the most part they produce and use S&T information, in-house technical data, computer programs,



product and performance characteristics, and technical specifications. They also use a variety of information sources when solving technical problems. Like engineers in general, the aeronautical engineers and scientists in this study prefer to use their personal knowledge and informal sources to solve technical problems.

Implications. The results of the survey show little difference between the types of technical communications produced and used by aeronautical engineers and scientists. Somewhat surprising is the lack of production and use of technical reports. However, the questions were limited to production and use and did not deal with importance. It might be helpful for academics to know the relative importance of these technical communication products, including technical reports, for purposes of curriculum and course development.

The aeronautical engineers and scientists in this study seek the help of colleagues and secretaries when preparing technical information products. If colleagues and secretaries are used as consultants, what type of technical communications training do/should these individuals have? Why are technical writers and editors used so infrequently for this purpose? Does the modest use of technical writers and editors reflect a lack of availability/accessibility of such services, a lack of knowledge

about these services, or a preference not to use such services? It might be helpful to know the extent to which technical writing and editing services exist in the aerospace industry.

Approximately 34 percent of the aeronautical engineers and scientists in this study prepare their own artwork using a computer, followed by those who rely partially on themselves and on a graphics department (30.3 percent) for the preparation of their artwork.

Poorly designed visuals, that is, visuals that are not prepared according to generally accepted guidelines and standards, hinder and obscure the effective transfer of technical information. As Karten (1988) states, "PC graphics software makes it a breeze to create visuals. But although a picture may be worth a thousand words, too many of these computer-generated visuals require a thousand extra spoken words before they make any sense." Do guidelines and standards exist for PC-prepared visuals? Are technical communicators and aeronautical engineers and scientists aware of them? To what extent does the aerospace industry utilize these guidelines and how is their proper use enforced? Do/should aeronautical engineers and scientists receive training in or exposure to these guidelines and standards as part of their academic preparation?

The types of technical information produced and used by the aeronautical engineers and scientists in this study compare reasonably well with data from Shuchman's (1981) study. What is not known, however, is the relative importance of the types of technical information produced and used in relation to the professional duties performed by aeronautical engineers and scientists. Furthermore, how do the types of technical information produced and used compare with the types of technical information products produced and used?

According to Sayer (1965), "Engineering is a production system in which information is the raw material. Whatever the purpose of the engineering effort, the engineer is an information processor who is constantly faced with the problem of effectively acquiring and using data and information." The aeronautical engineers and scientists in this study used a variety of information sources when solving a technical problem. Their preference for the use of personal contacts over formal information sources confirms the findings of the related research and literature.

The aeronautical engineers and scientists in this study view themselves as ideal evaluators of information in their area of expertise. How did they become qualified to serve in this capacity? Is it because they receive training in the use of

information sources as part of their academic preparation? What kind of exposure to information sources, if any, do aeronautical engineers and scientists receive as part of their academic preparation? In terms of efficiency and productivity, does this individual approach to problem-solving constitute a wise use of engineering manpower? How effective can a formal engineering information system be if it does not take into account the information-seeking habits and preferences of the user? Could the efficiency of both the system and the user be increased by the addition of advocacy intermediaries (i.e., librarians and technical information specialists)?

### Survey Objective 3: Content for an Undergraduate Course in Technical Communications

Summary. About 70 percent of the survey respondents had taken a technical communications or technical writing course either at the undergraduate level, after graduation, or both. They were fairly evenly divided as to whether the course(s) had helped them "a lot" (42.5 percent) or "a little" (51.5 percent).

Respondents indicate that the following principles, mechanics, and on-the-job communications should be included in an undergraduate technical communications course for aeronautical engineers and scientists.

<u>Principles</u>	<u>Percentage Response</u>
Organizing information	96.5
Defining the communication's purpose	90.7
Developing paragraphs	86.2
Assessing readers' needs	81.7
Choosing words	81.4
Writing sentences	80.0
Editing and revising	77.8
Using standard English grammar	77.8

<u>Mechanics</u>	<u>Percentage Response</u>
References	76.7
Punctuation	75.9
Spelling	65.1
Capitalization	61.0
Symbols	57.3
Abbreviations	51.4

<u>On-the-Job Communications</u>	<u>Percentage Response</u>
Oral presentations	95.3
Use of information sources	79.1
Memos	77.8
Letters	69.4
Abstracts	69.0
Instructions	57.6
Specifications	55.7

The top five communications they recommended for coverage in a communication course are compared below with the top five (on the average) technical communications "produced" and "used" by aeronautical engineers and scientists on the job.

Communications  
Produced

Memos  
Letters  
A/V materials  
Drawings/  
specifications  
Speeches

Communications  
Used

Memos  
Letters  
Drawings/  
specifications  
Journal articles  
Trade/promotional  
literature

Communications  
Recommended

Oral presentations  
Use of information  
sources  
Memos  
Letters  
Abstracts

The recommended on-the-job communications compare quite favorably with the technical communications products "produced" and "used" by aeronautical engineers and scientists.

The aeronautical engineers and scientists in this study made various recommendations for the inclusion of certain principles, mechanics, and types of on-the-job communications to be included in an undergraduate technical communications course. Their recommendations compare quite favorably with the technical communications products the respondents produce and use.

Implications. What is the appropriate content for an undergraduate technical communications course and how should such a course be developed? To what extent should the views/opinions of "practitioners" be considered in developing curriculum content? Based on the findings, a convincing case can be made for including technical writing, oral presentation, skill in the preparation of artwork for visual aids, and use of information resources in an undergraduate technical communications course.

Should information resources and computer skills also be included?

Survey Objective 4: Use of Libraries, Technical Information Centers, and On-Line Databases

Summary. Although the frequency of use varies, approximately 94 percent of the aeronautical engineers and scientists in this study use a library or technical information center. Less than half use on-line databases. With minor exceptions, survey respondents seek information to solve technical problems from sources similar to those used by the engineers in Shuchman's (1981) study. Both groups begin with what Allen (1977) calls "informal research for information followed by the use of 'formal' information sources. Only as a last resort do they turn to librarians and technical information specialists and bibliographic tools for assistance."

Less than half of the aeronautical engineers and scientists in this study use on-line databases. Of those who do, 23 percent do all or most of their own searches, while approximately 65 percent use an intermediary to do most or all of their searches.

Implications. While 94 percent of the aeronautical engineers and scientists in this study use a library or technical information center, the frequency of use varies considerably

among respondents. Only after they exhausted their personal/informal search for information did they use a library/technical information center or seek the services of a librarian/technical information specialist.

To what extent is the use of libraries and intermediaries (e.g., librarians) by aeronautical engineers and scientists affected by the nature of technology and social enculturation? Is the relative ranking of the library and the librarian in the problem-solving process an indication of a deliberate preference not to use such services, or is it best explained by the existence of certain institutional or organizational variables? If aeronautical engineers and scientists were exposed to information sources as part of their educational preparation, would this affect their familiarity with and use of these services?

Less than half or 44.1 percent of the aeronautical engineers and scientists in this study use on-line databases. On-line databases rank last on the list of information sources consulted by aeronautical engineers and scientists when solving technical problems. Of those who use on-line databases, 23 percent did all or most of their own searches. Why does on-line database use rank so low in the problem-solving process? Is it a question of awareness? If so, would seminars, workshops, and other



promotional efforts by librarians and information specialists result in increased use by aeronautical engineers and scientists? Is it a question of accessibility; that is, are on-line databases available only through the library or technical information center? If so, would the ability to access these databases without coming to the library or technical information center result in increased use? Can other factors better explain the infrequent use of on-line databases? If so, do factors such as cost of use, skill in use, physical distance, and/or technical quality or reliability of the information retrieved better explain lack of on-line database use by aeronautical engineers and scientists?

#### Survey Objective 5: Use and Importance of Computer and Information Technology

Summary. Approximately 91 percent of the aeronautical engineers and scientists in this study use computer technology for preparing technical communications. They also use a variety of software tools for preparing written technical communications, with word processing and spelling checkers used most frequently. Less than half (45.5 percent) make use of an integrated graphics, text, and modeling engineering workstation, while approximately 59 percent use electronic or desk-top publishing for preparing written technical communications.

The aeronautical engineers and scientists in this study use a variety of information technologies to communicate technical information. The most frequently used information technologies, in descending order of use, for communicating technical information follow.

<u>Information Technology</u>	<u>Percentage Use</u>
FAX or TELEX	84.3
Floppy disks	74.5
Teleconferencing	58.7
Electronic databases	50.3
Electronic mail	46.6

The five information technologies receiving the highest percentage of the "I don't use it, and doubt if I will" responses appear below in descending order of non-use.

<u>Information Technology</u>	<u>Percentage Non-Use</u>
Motion picture film	54.8
Audiotapes and cassettes	50.1
Computer cassette/cartridge tapes	38.3
Micrographics and microforms	38.0
Laser disc/video disc/CD-ROM	29.0

The five information technologies receiving the highest percentage of "I don't use it, but may in the future" appear below in descending order of non-use.

<u>Information Technology</u>	<u>Percentage Non-Use</u>
Laser disc/video disc/CD-ROM	64.9
Video conferencing	62.4
Electronic bulletin boards	53.6
Electronic networks	52.8
Micrographics and microforms	44.0

The aeronautical engineers and scientists in this study make considerable use of computer and information technology. Their use compares quite favorably with the use of information technology by aeronautical engineers in Shuchman's study (1981).

Implications. The aeronautical engineers and scientists in this study make considerable use of computer technology (91 percent) and believe that the use of this technology has increased their ability to communicate technical information (95 percent). They also make considerable use of information technology. Their use compares quite favorably with the use of information technology by aeronautical engineers in Shuchman's (1981) study.

According to a report of the Committee on Science, Engineering, and Public Policy (1989), the use of computer and information technology has done much to improve the quality of research and scientific and technical productivity. However, while the development of new information technologies offers further opportunity for improvement, the widespread use of computer and information technology continues to be hampered by technical, financial, institutional, and behavioral constraints.

Institutional constraints include access and availability, and behavioral constraints include use, education, and training.

To what extent do aeronautical engineers and scientists have access to computer and information technology as part of their educational preparation? If skill in the use of computer and information technology will increase the productivity and efficiency of these individuals, where and how should they acquire this skill? Should they come to the workplace computer and information literate? Will they come to the workplace computer and information literate and not have access to computer and information technology?

## BIBLIOGRAPHY

- Aerospace Industries of America. Technology Diffusion: The Movement of Technology Between Aerospace and Other Industries. Washington, DC: Aerospace Industries of America. October 1985. 68 p. (Available from: Aerospace Industries of America, Washington, DC.)
- Allen, Thomas J. Managing the Flow of Technology: Technology Transfer and the Dissemination of Technological Information Within the R&D Organization. (Cambridge, MA: MIT Press, 1977.)
- Anderson, Virginia N. "Searching the Engineering Databases." Database 10:2 (April 1987): 23-27.
- Andrews, Karen L. and Wendy Culotta. "Computerized Retrieval of Data and Research Results by Engineers as End-User Searchers: The Engineering Student's Key to Maintaining Technical Competence in 2001," in 1987 Frontiers in Education Conference Proceedings held at Terra Haute, Indiana, October 24-27, 1987, Vol. 1. 174-177. Edited by Lawrence P. Grayson and Joseph M. Biedenbach and sponsored by the IEEE Education Society and the ASEE Educational Research and Methods Division. NY: Institute of Electrical and Electronics Engineers, 1987.
- Archer, John F. The Diffusion of Space Technology By Means of Technical Publications: A Report Based on the Distribution, Use, and Effectiveness of "Selected Welding Techniques." Boston: American Academy of Art and Sciences, November 1964. 33 p. (Available from: NTIS, Springfield, VA; 70N76955.)
- Auger, Charles P. Use of Technical Reports Literature. (Hamden, CN: Archon Books, 1975), 9.
- Barnum, Carol; and Robert Fischer. "Engineering Technologists as Writers: Results of a Survey." Technical Communication 31:2 (Second Quarter 1984): 9-11.
- Bikson, Tora K; Barbara E. Quint; and Leland L. Johnson. Scientific and Technical Information Transfer: Issues and Options. Santa Monica, CA: The Rand Corporation, March 1984. 124 p. (Available from: NTIS, Springfield, VA; PB-35-150357.)

- Committee on Science, Engineering, and Public Policy.  
Information Technology and the Conduct of Research: The User's View. Report of the Panel on Information Technology and the Conduct of Research. (Washington, DC: National Academy Press, 1989.)
- Cunningham, Donald H.; and Herman A. Estrin. eds. The Teaching of Technical Writing. (Urbana, IL: National Council of Teachers of English, 1975.)
- David, Carl W. "Why Didn't You Teach Me How to Write?" College Board Review 125 (Fall 1982): 10-11, 30.
- Davis, Richard M. "How Important is Technical Writing? -- A Survey of the Opinions of Successful Engineers." Technical Writing Teacher 4:3 (Spring 1977): 83-88.
- Davis, Richard M. Technical Writing: Its Place in Engineering Curricula -- A Survey of the Experience and Opinions of Prominent Engineers. Wright-Patterson Air Force Base, Ohio: Air Force Institute of Technology. AFIT TR 75-5. September 1975. 86 p. (Available from: NTIS, Springfield, VA; AD-A015 906.)
- Feinberg, Susan; and Jerry I. Goldman. "Content for a Course in Technical Communication." Technical Communication 32:2 (Second Quarter 1985): 21-25.
- Frohman, A. Polaroid Library Usage Study. Cambridge, MA: MIT, Sloan School of Management Term Paper, 1968.
- Gilmore, John S. et al., The Channels of Technology Acquisition in Commercial Firms, and the NASA Dissemination Program. Denver: Denver Research Institute, June 1967. 144 p. (Available from: NTIS, Springfield, VA; N67-31477.)
- Green, M. M. and T. D. Nolan. "A Systematic Analysis of the Technical Communicator's Job: A Guide for Educators." Technical Communication 31:4 (Fourth Quarter 1984): 9-12.
- Harter, Stephen P. and Susan M. Jackson. "Optical Disc Systems in Libraries: Problems and Issues." RQ 27:4 (Summer 1988): 516-527.
- Herner, Saul. "Information Gathering Habits of Workers in Pure and Applied Sciences." Industrial and Engineering Chemistry 46:1 (January 1954): 228-236.

- Kandebo, Stanley et al. "U.S. Faces Potential Shortage of Engineers." Aviation Week and Space Technology 129:23 (December 5, 1988): 36-42, 47-54, 61-62.
- Karten, Naomi. "How to Use Visuals in Your Presentation." Performance and Instruction 27:2 (March 1988): 9-10.
- Kaufman, Harold G. Factors Related to Use of Technical Information in Engineering Problem Solving. Brooklyn: Polytechnic Institute of New York, January 1983.
- Kellner, Robert S. "The Degeneration of Technical Writing: A Question of Teacher Competency." The ABCA Bulletin 45:3 (September 1982): 5-10.
- Kremer, Jeannette M. Information Flow Among Engineers in a Design Company. Ph.D. Diss., University of Illinois at Urbana-Champaign, 1980. Ann Arbor: UMI, 1980. 80-17965.
- McClure, Charles R. "The Federal Technical Report Literature: Research Needs and Issues." Government Information Quarterly 5:1 (1988): 29.
- McCullough, Robert A. et al. A Review and Evaluation of the Langley Research Center's Scientific and Technical Information Program. Results of Phase VI. The Technical Report: A Survey and Analysis. Washington, DC: National Aeronautics and Space Administration. NASA TM-83269. April 1982. 136 p. (Available from: NTIS, Springfield, VA; 87N70843.)
- Menzel, Herbert. "Information Needs and Uses in Science and Technology," in (1966) Annual Review of Information Science and Technology. Vol 1. Carlos A. Cuadra, Ed. 41-69. New York: John Wiley, 1966, 61.
- Mischo, William H. and Jounghyoun Lee. "End-User Searching of Bibliographic Databases," In (1987) Annual Review of Information Science and Technology. Vol. 22, Martha E. Williams, Ed. 227-263. NY: Elsevier Science Publishers, 1987.
- Mowery, David C. "Federal Funding of R&D in Transportation: The Case of Aviation." Paper commissioned for a workshop on The Federal Role in Research and Development, November 21-22, 1985, held in Washington, DC and sponsored by the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 13.

- Neway, Julie M. Information Specialist as Team Player in the Research Process. (Westport, CN: Greenwood Press, 1985.)
- Penrose, John M. "A Survey of the Perceived Importance of Business Communication and Other Business-Related Abilities." The Journal of Business Communication 13:2 (Winter 1976): 17-24.
- Pinelli, Thomas E.; Myron Glassman; and Virginia M. Cordle. Survey of Reader Preferences Concerning the Format of NASA Technical Reports. Washington, DC: National Aeronautics and Space Administration. NASA TM-84502. August 1982. 86 p. (Available from: NTIS, Springfield, VA; 82N34300.)
- Rogers, Everett M. Diffusion of Innovation. 3rd ed. (New York: The Free Press, 1983.)
- Rosenbloom, Richard S.; and Francis W. Wolek. Technology and Information Transfer: A Survey of Practices in Industrial Organizations. (Boston: Harvard University, 1970.)
- Sayer, John. "Do Present Information Services Serve the Engineer?" Data Processing Magazine 7:2 (February, 1965): 24-25, 64-65.
- Shapley, Deborah; and Rustom Roy. Lost at the Frontier: U.S. Science and Technology Policy Adrift. (Philadelphia: ISI Press, 1985), 85.
- Shuchman, Hedvah L. Information Transfer in Engineering. (Glastonbury, CT: The Futures Group, 1981.)
- Spretnak, Charlene M. "A Survey of the Frequency and Importance of Technical Communication in an Engineering Career." Technical Writing Teacher 9 (Spring 1982): 133-136.
- Stohrer, Freda F.; and Thomas E. Pinelli. "Marketing Information: The Technical Report As Product." Paper presented at the 32nd Annual Meeting of the Conference on College Composition and Communication, Dallas, TX, March 26-28, 1981, 1.
- U.S. Congress, Office of Technology Assessment. Technology and the American Economic Transition: Choices for the Future. Washington, DC: Congressional Office of Technology Assessment. OTA-TET-283. May 1988. (Available from U.S. Government Printing Office, DC: GPO 052-003-01096.)



U.S. Department of Commerce. 1987 U.S. Industrial Outlook:  
Prospects for Over 350 Manufacturing and Service Industries.  
(Washington, DC: U.S. Government Printing Office, January  
1987), 39-1.

Williams, Martha E., ed. Computer-Readable Data Bases: A  
Directory and Data Sourcebook. (Chicago: American Library  
Association, 1985); Directory of Online Databases. (Santa  
Monica, CA: Caudra Associates, Inc., July 1987.)

1. Report No. NASA TM-101534, Part 1		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Technical Communications in Aeronautics: Results of an Exploratory Study				5. Report Date February 1989	
				6. Performing Organization Code	
7. Author(s) Thomas E. Pinelli, Myron Glassman, Walter E. Oliu, and Rebecca O. Barclay				8. Performing Organization Report No.	
				10. Work Unit No. 505-90	
9. Performing Organization Name and Address NASA Langley Research Center Hampton, VA 23665-5225				11. Contract or Grant No.	
				13. Type of Report and Period Covered Technical Memorandum	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546-0001				14. Sponsoring Agency Code	
15. Supplementary Notes The survey was conducted under Task 28 of NAS1-18584 Thomas E. Pinelli: NASA Langley Research Center, Hampton, VA Myron Glassman: Old Dominion University, Norfolk, VA Walter E. Oliu: U.S. Nuclear Regulatory Commission, Washington, DC Rebecca O. Barclay: Rensselaer Polytechnic Institute, Troy, NY					
16. Abstract A study was undertaken that explored several aspects of technical communications in aeronautics. The study, which utilized survey research in the form of a self-administered questionnaire, was sent to 2,000 randomly selected members of the American Institute of Aeronautics and Astronautics (AIAA). Six hundred and six (606) usable questionnaires (30.3 percent) were received by the established cut off date. The study had five objectives. The first was to solicit the opinions of aeronautical engineers and scientists regarding the importance of technical communications to their profession; second, to determine their use and production of technical communications; third, to seek their views on the content of an undergraduate course in technical communications; fourth, to determine their use of libraries/technical information centers; and finally, to determine the use and importance of computer and information technology to them. The findings add considerable information to the knowledge of technical communications practices among aeronautical engineers and scientists and reinforce some of the conventional wisdom about technical communications and question other widely-held notions.					
17. Key Words (Suggested by Author(s)) Technical communications Computer and information technology Library and on-line system use Aeronautical engineers and scientists				18. Distribution Statement Unclassified - Unlimited  Subject Category 82	
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of pages 106	22. Price A06

**NASA Technical Memorandum 101534, Part 2**

**Technical Communications in Aeronautics:  
Results of an Exploratory Study**

**Thomas E. Pinelli, Myron Glassman,  
Walter E. Olliu, and Rebecca O. Barclay**

**FEBRUARY 1989**

**NASA**

107

58811057

**NASA Technical Memorandum 101534, Part 2**

**Technical Communications in Aeronautics:  
Results of an Exploratory Study**

**Thomas E. Pinelli**  
*Langley Research Center*  
*Hampton, Virginia*

**Myron Glassman**  
*Old Dominion University*  
*Norfolk, Virginia*

**Walter E. Olliu**  
*U. S. Nuclear Regulatory Commission*  
*Washington, DC*

**Rebecca O. Barclay**  
*Rensselaer Polytechnic Institute*  
*Troy, New York*

**NASA**

National Aeronautics  
and Space Administration

Langley Research Center  
Hampton, Virginia 23665

### Editorial Review Committee

Mary Jo V. Arnold  
The Ohio State University

Patricia Carlson, Ph.D.  
Rose-Hulman Institute of Technology

Maurita P. Holland  
University of Michigan

Michael L. Keene, Ph.D.  
University of Tennessee, Knoxville

Judith A. Ramey, Ph.D.  
University of Washington

Frank R. Smith, Ph.D. (retired)  
McDonnell Douglas Corporation

### Recommended Citation:

Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. *Technical Communications in Aeronautics: Results of an Exploratory Study*. Washington, DC: National Aeronautics and Space Administration. NASA TM-101534, Part 2, February 1989. 84 p. (Available from NTIS, Springfield, VA.)

## CONTENTS

### Part 1\*

LIST OF TABLES . . . . .	v
INTRODUCTION . . . . .	1
BACKGROUND . . . . .	2
ACRONYMS . . . . .	6
RELATED RESEARCH AND LITERATURE . . . . .	7
The Importance of Technical Communications . . . . .	7
Use and Production of Technical Communications . . . . .	12
Content for an Undergraduate Course in Technical Communications . . . . .	17
The Use of Libraries, Technical Information Centers, and On-Line Databases . . . . .	19
Use and Importance of Computer and Information Technology . . . . .	24
Discussion . . . . .	29
PRESENTATION AND DISCUSSION OF THE DATA . . . . .	31
Demographic Information About the Survey Respondents . . . . .	33
Survey Objective 1: The Importance of Technical Communications . . . . .	38
Survey Objective 2: The Use and Production of Technical Communications . . . . .	43
Survey Objective 3: Content for an Undergraduate Course in Technical Communications . . . . .	57
Survey Objective 4: Use of Libraries, Technical Information Centers, and On-Line Databases . . . . .	64

\* Published under separate cover

Survey Objective 5: Use and Importance of Computer and Information Technology . . . . .	67
SUMMARY AND IMPLICATIONS . . . . .	74
Demographic Information About the Survey Respondents . . . . .	75
Limitations of the Study . . . . .	76
Survey Objective 1: The Importance of Technical Communications . . . . .	77
Survey Objective 2: The Use and Production of Technical Communications . . . . .	79
Survey Objective 3: Content for an Undergraduate Course in Technical Communications . . . . .	83
Survey Objective 4: Use of Libraries, Technical Information Centers, and On-Line Databases . . . . .	86
Survey Objective 5: Use and Importance of Computer and Information Technology . . . . .	88
BIBLIOGRAPHY . . . . .	92
APPENDICES	
Part 2	
A. SURVEY INSTRUMENT. . . . .	97
B. AGGREGATE TOTALS . . . . .	103
C. CROSS TABULATIONS -- PART A . . . . .	109
C. CROSS TABULATIONS -- PART B . . . . .	131
D. OPEN-ENDED COMMENTS . . . . .	169

## LIST OF TABLES

Table

A	Non-Use, Use, and Potential Usefulness of Computer and Information Technology by Engineering Disciplines . . . . .	27
B	Summary: Professional Duties . . . . .	34
C	Summary: Type of Organization . . . . .	34
D	Summary: Years of Professional Work Experience	35
E	Summary: AIAA Interest Group . . . . .	36
F	Summary: Level of Education . . . . .	36
G	Summary: Engineer or Scientist . . . . .	37
H	Summary: American English is First (Native) Language . . . . .	37
I	Summary: Gender . . . . .	38
J	Summary: Importance of Technical Communications	39
K	Summary: Hours Spent Per Week Communicating Technical Information to Others . . . . .	40
L	Summary: Hours Spent Per Week Working With Technical Information received From Others . . .	41
M	Summary: Professional Advancement -- Amount of Time Spent Communicating Technical Information to Others . . . . .	42
N	Summary: Professional Advancement -- Amount of Time Spent Working With Technical Communications Received From Others . . . . .	43
O	Summary: Technical Information Product Production . . . . .	44
P	Comparison of the Average Number of Technical Information Products Used by Organizational Affiliation . . . . .	45



Q	Summary: Technical Information Product Use . . .	46
R	Comparison of the Average Number of Technical Information Products Produced by Organizational Affiliation . . . . .	48
S	Summary: Technical Information Production -- Sources of Help . . . . .	48
T	Summary: Artwork -- How Produced . . . . .	49
U	Summary: Types of Technical Information Produced in Performance of Present Duties . . . . .	50
V	Comparison of the Types of Technical Information Produced by Organizational Affiliation . . . . .	51
W	Summary: Types of Technical Information Used to Perform Present Duties . . . . .	52
X	Comparison of the Types of Technical Information Used by Organizational Affiliation . . . . .	53
Y	Summary: Solving a Technical Problem -- Source of Technical Information Used . . . . .	55
Z	Summary: Technical Communications/Writing Coursework Taken . . . . .	58
AA	Summary: Technical Communications/Writing Coursework -- How Helpful . . . . .	58
BB	Summary: Topics for an Undergraduate Technical Communications Course for Aeronautical Engineers and Scientists -- Principles . . . . .	59
CC	Summary: Topics for an Undergraduate Technical Communications Course For Aeronautical Engineers and Scientists -- Mechanics . . . . .	60
DD	Summary: Topics for an Undergraduate Technical Communications Course for Aeronautical Engineers and Scientists -- On-the-Job Communications . . .	61
EE	Summary: Topics for an Undergraduate Technical Communications Course for Aeronautical Engineers and Scientists -- Types of Technical Reports . .	62

FF	Summary: Use of Library or Technical Information Center . . . . .	65
GG	Summary: Use of Electronic Databases . . . . .	66
HH	Summary: Use of Electronic Databases -- How Searched . . . . .	66
II	Summary: Use of Computer Technology for Preparing Technical Communications . . . . .	67
JJ	Summary: Computer Technology -- Increase Ability to Communicate Technical Information . . . . .	68
KK	Summary: Use of Software to Prepare Written Technical Communications . . . . .	68
LL	Summary: Use of an Integrated Graphics, Text, and Modeling Engineering Workstation for Preparing Written Technical Communications . . . . .	69
MM	Summary: Use of Electronic or Desk-Top Publishing System for Preparing Written Technical Communications . . . . .	70
NN	Summary: Use, Non-Use, and Potential Use of Information Technologies to Communicate Technical Information . . . . .	71

APPENDIX A  
SURVEY INSTRUMENT

TECHNICAL COMMUNICATIONS IN AERONAUTICS

1. In your work, how important is it for *YOU* to communicate technical information effectively? Col
- <sub>1</sub> Very Important     
  <sub>2</sub> Somewhat Important     
  <sub>3</sub> Not at all Important 5
2. How many hours do *YOU* spend each week communicating technical information *TO* others? \_\_\_\_\_ Hours 6
3. How many hours do *YOU* spend each week working with technical communications *FROM* others? \_\_\_\_\_ Hours 89
4. As you have advanced professionally, how has the amount of time *YOU* spend communicating technical information *TO OTHERS* changed?
- <sub>1</sub> Increased     
  <sub>2</sub> Stayed the Same     
  <sub>3</sub> Decreased 10
5. As you have advanced professionally, how has the amount of time *YOU* spend working with technical communications received *FROM OTHERS* changed?
- <sub>1</sub> Increased     
  <sub>2</sub> Stayed the Same     
  <sub>3</sub> Decreased 11
6. Approximately how many times in the past *six months* did you write/prepare:
- |                                |                    |                              |       |    |
|--------------------------------|--------------------|------------------------------|-------|----|
| Letters                        | _____ times in the | Journal articles             | _____ | 12 |
|                                | past 6 months      |                              |       | 53 |
| Memos                          | _____              | Conference/Meeting papers    | _____ |    |
| Technical reports-Government   | _____              | Trade/Promotional literature | _____ |    |
| Technical reports-Other        | _____              | Press releases               | _____ |    |
| Proposals                      | _____              | Drawings/Specifications      | _____ |    |
| Technical manuals              | _____              | Speeches                     | _____ |    |
| Computer program documentation | _____              | Audio/Visual materials       | _____ |    |
7. How many times in the past *one month* did you use materials written/prepared by other people?
- |                                |                   |                              |       |    |
|--------------------------------|-------------------|------------------------------|-------|----|
| Letters                        | _____ # read/used | Journal articles             | _____ | 54 |
|                                | in past 1 month   |                              |       | 89 |
| Memos                          | _____             | Conference/Meeting papers    | _____ |    |
| Technical reports-Government   | _____             | Trade/Promotional literature | _____ |    |
| Technical reports-Other        | _____             | Drawings/Specifications      | _____ |    |
| Proposals                      | _____             | Audio/Visual materials       | _____ |    |
| Technical Manuals              | _____             |                              |       |    |
| Computer program documentation | _____             |                              |       |    |
8. When you write/prepare technical communications, do you receive help from:
- |                              | <i>Always</i> | <i>Usually</i> | <i>Sometimes</i> | <i>Never</i> |    |
|------------------------------|---------------|----------------|------------------|--------------|----|
| Other colleagues             | _____         | _____          | _____            | _____        | 90 |
| Secretaries                  | _____         | _____          | _____            | _____        | 95 |
| Technical writers or editors | _____         | _____          | _____            | _____        |    |
| A thesaurus/dictionary       | _____         | _____          | _____            | _____        |    |
| A style manual               | _____         | _____          | _____            | _____        |    |
| A grammar hotline            | _____         | _____          | _____            | _____        |    |
|                              | 1             | 2              | 3                | 4            |    |

## APPENDIX A

9. Which of the following statements *BEST* represents how the artwork for *YOUR* visual aids (charts, graphs) is prepared? (Check Only One)
- <sub>1</sub> I do my own artwork without a computer  
 <sub>2</sub> I do my own artwork with a computer  
 <sub>3</sub> The graphics department does my artwork  
 <sub>4</sub> Sometimes I do it and sometimes the graphics department does it  
 <sub>5</sub> A secretary does it  
 <sub>6</sub> The artwork is prepared elsewhere
10. Have you ever taken a course(s) in technical communications/writing?
- <sub>1</sub> Yes, as an Undergraduate     
  <sub>2</sub> Yes, after graduation     
  <sub>3</sub> Yes, both     
  <sub>4</sub> No (Skip to Q. 12)
11. How well did this course help *YOU* communicate technical information?
- <sub>1</sub> A Lot     
  <sub>2</sub> A Little     
  <sub>3</sub> Did not Help
12. In your opinion, which of the following topics should be included in an undergraduate technical communications course for aeronautical engineers and scientists?
- | Yes                      | No                       | <i>Principles</i>   | Yes                      | No                       | <i>Mechanics</i> |        |
|--------------------------|--------------------------|---|--------------------------|--------------------------|------------------|--------|
| <input type="checkbox"/> | <input type="checkbox"/> | Defining the communication's purpose  | <input type="checkbox"/> | <input type="checkbox"/> | Abbreviations    |        |
| <input type="checkbox"/> | <input type="checkbox"/> | Assessing readers' needs  | <input type="checkbox"/> | <input type="checkbox"/> | Acronyms         | 99-116 |
| <input type="checkbox"/> | <input type="checkbox"/> | Organizing information  | <input type="checkbox"/> | <input type="checkbox"/> | Capitalization   |        |
| <input type="checkbox"/> | <input type="checkbox"/> | Developing paragraphs (introductions, transitions, and conclusions)                     | <input type="checkbox"/> | <input type="checkbox"/> | Numbers          |        |
| <input type="checkbox"/> | <input type="checkbox"/> | Writing sentences (active vs. passive voice, parallel ideas, shifts in person or tense) | <input type="checkbox"/> | <input type="checkbox"/> | Punctuation      |        |
| <input type="checkbox"/> | <input type="checkbox"/> | Using standard English grammar  | <input type="checkbox"/> | <input type="checkbox"/> | References       |        |
| <input type="checkbox"/> | <input type="checkbox"/> | Notetaking and quoting  | <input type="checkbox"/> | <input type="checkbox"/> | Spelling         |        |
| <input type="checkbox"/> | <input type="checkbox"/> | Editing and revising  | <input type="checkbox"/> | <input type="checkbox"/> | Symbols          |        |
| <input type="checkbox"/> | <input type="checkbox"/> | Choosing words (avoiding wordiness, jargon, slang, sexist terms)                        | <input type="checkbox"/> | <input type="checkbox"/> |                  |        |
| <input type="checkbox"/> | <input type="checkbox"/> | Using information technology (video conferencing, electronic data bases, etc.)          | <input type="checkbox"/> | <input type="checkbox"/> |                  |        |
13. Which of the following on-the-job communications should be included in an undergraduate technical communications course for aeronautical engineers and scientists?
- | Yes                      | No                       |                            | Yes                      | No                       | <i>Reports:</i> |         |
|--------------------------|--------------------------|----------------------------|--------------------------|--------------------------|-----------------|---------|
| <input type="checkbox"/> | <input type="checkbox"/> | Abstracts                  | <input type="checkbox"/> | <input type="checkbox"/> | Feasibility     |         |
| <input type="checkbox"/> | <input type="checkbox"/> | Letters                    | <input type="checkbox"/> | <input type="checkbox"/> | Investigative   | 117-134 |
| <input type="checkbox"/> | <input type="checkbox"/> | Memos                      | <input type="checkbox"/> | <input type="checkbox"/> | Laboratory      |         |
| <input type="checkbox"/> | <input type="checkbox"/> | Instructions               | <input type="checkbox"/> | <input type="checkbox"/> | Progress        |         |
| <input type="checkbox"/> | <input type="checkbox"/> | Journal articles           | <input type="checkbox"/> | <input type="checkbox"/> | Test            |         |
| <input type="checkbox"/> | <input type="checkbox"/> | Literature reviews         | <input type="checkbox"/> | <input type="checkbox"/> | Trip            |         |
| <input type="checkbox"/> | <input type="checkbox"/> | Manuals                    | <input type="checkbox"/> | <input type="checkbox"/> | Trouble         |         |
| <input type="checkbox"/> | <input type="checkbox"/> | Newsletter articles        | <input type="checkbox"/> | <input type="checkbox"/> |                 |         |
| <input type="checkbox"/> | <input type="checkbox"/> | Oral presentations         | <input type="checkbox"/> | <input type="checkbox"/> |                 |         |
| <input type="checkbox"/> | <input type="checkbox"/> | Specifications             | <input type="checkbox"/> | <input type="checkbox"/> |                 |         |
| <input type="checkbox"/> | <input type="checkbox"/> | Use of information sources | <input type="checkbox"/> | <input type="checkbox"/> |                 |         |
14. Do *YOU* use computer technology to prepare technical communications?
- <sub>1</sub> Always     
  <sub>2</sub> Usually     
  <sub>3</sub> Sometimes     
  <sub>4</sub> Never (Skip to Q. 19)
15. Has computer technology increased *YOUR* ability to communicate technical information?
- <sub>1</sub> A Lot     
  <sub>2</sub> A Little     
  <sub>3</sub> Not at All

## APPENDIX A

16. Do *YOU* use any of the following software for preparing written technical communications?

Yes	No		Yes	No		
—	—	Word processing	—	—	Thesaurus	137-143
—	—	Outliners and prompters	—	—	Business graphics	
—	—	Grammar and style checkers	—	—	Scientific graphics	
— 1	— 2	Spelling checkers	— 1	— 2		

17. Do *YOU* use an integrated graphics, text, and modeling engineering workstation for preparing written technical communications?

— 1	Always	— 2	Usually	— 3	Sometimes	— 4	Never	144
--------	--------	--------	---------	--------	-----------	--------	-------	-----

18. Do *YOU* use electronic or desk-top publishing systems for preparing written technical communications?

— 1	Always	— 2	Usually	— 3	Sometimes	— 4	Never	145
--------	--------	--------	---------	--------	-----------	--------	-------	-----

19. How do *YOU* view your use of the following information technologies in communicating technical information?

<i>Information Technologies</i>	<i>I already use it</i>	<i>I don't use it, but may in the future</i>	<i>I don't use it, and doubt if I will</i>	
Audio tapes and cassettes	—	—	—	146-160
Motion picture film	—	—	—	
Video tape	—	—	—	
Desk-top/electronic publishing	—	—	—	
Floppy disks	—	—	—	
Computer cassette/cartridge tapes	—	—	—	
Electronic mail	—	—	—	
Electronic bulletin boards	—	—	—	
FAX or TELEX	—	—	—	
Electronic data bases	—	—	—	
Video conferencing	—	—	—	
Teleconferencing	—	—	—	
Micrographics and microforms	—	—	—	
Laser disc/video disc/CD-ROM	—	—	—	
Electronic networks	— 1	— 2	— 3	

20. When faced with solving a technical problem, do you get technical information from:

	<i>Always</i>	<i>Usually</i>	<i>Sometimes</i>	<i>Never</i>	
Personal knowledge	—	—	—	—	161-172
Informal discussions with colleagues	—	—	—	—	
Discussions with supervisors	—	—	—	—	
Discussions with experts <i>in</i> your organization	—	—	—	—	
Discussions with experts <i>outside</i> of your organization	—	—	—	—	
Technical reports-Government	—	—	—	—	
Technical reports-Other	—	—	—	—	
Professional journals/conference meeting papers	—	—	—	—	
Textbooks	—	—	—	—	
Handbooks and standards	—	—	—	—	
Technical information sources, such as on-line data bases, indexing and abstracting guides, CD-ROM, and current awareness tools	—	—	—	—	
Librarians/technical information specialists	— 1	— 2	— 3	— 4	

APPENDIX A

21. What types of technical information do you *USE* in performing your present duties?

Yes	No	
—	—	Scientific and technical information
—	—	Experimental techniques
—	—	Codes of standards and practices
—	—	Design procedures and methods
—	—	Computer programs
—	—	Government rules and regulations
—	—	In-house technical data
—	—	Product and performance characteristics
—	—	Economic information
—	—	Technical specifications
—	—	Patents
1	2	

173-183

22. What types of technical information do you *PRODUCE* (or expect to produce) in performing your present duties?

Yes	No	
—	—	Scientific and technical information
—	—	Experimental techniques
—	—	Codes of standards and practices
—	—	Design procedures and methods
—	—	Computer programs
—	—	Government rules and regulations
—	—	In-house technical data
—	—	Product and performance characteristics
—	—	Economic information
—	—	Technical specifications
—	—	Patents
1	2	

184-194

23. How often do you use the library or a technical information center? (Circle Choice)

- |                             |                                |
|-----------------------------|--------------------------------|
| 1 — Daily                   | 4 — Two to three times a month |
| 2 — Two to six times a week | 5 — Once a month               |
| 3 — Once a week             | 6 — Less than once a month     |
|                             | 7 — Do not use                 |

195

24. Do you use electronic data bases to find bibliographic citations and abstracts? 1 — Yes 2 — No (Skip to Q. 26)

196

25. Do you (Circle One):

- |  |  |
|--|--|
| 1 — Do <i>all</i> searches yourself  | 4 — Do <i>most</i> searches through an intermediary (e.g. librarian) |
| 2 — Do <i>most</i> searches yourself   | 5 — Do <i>all</i> searches through an intermediary                   |
| 3 — Do <i>half</i> by yourself and half through an intermediary (e.g. librarian) |  |

197

THIS DATA WILL BE USED TO DETERMINE WHETHER PEOPLE WITH DIFFERENT BACKGROUNDS HAVE DIFFERENT TECHNICAL COMMUNICATION PRACTICES.

26. What is your gender? 1 — Male 2 — Female

198

27. What is your level of education?

- |               |               |                 |
|---------------|---------------|-----------------|
| 1 — No degree | 3 — Masters   | 5 — Other _____ |
| 2 — Bachelors | 4 — Doctorate |                 |

199

28. How many years of professional work experience do you have? \_\_\_\_\_ Years

200-201

29. Type of organization where you work? (Circle Only One Number)

- |                    |                           |
|--------------------|---------------------------|
| 1 — Academic       | 4 — Government (Non-NASA) |
| 2 — Industrial     | 5 — NASA                  |
| 3 — Not-for-profit | 6 — Other _____           |

202

(OVER)

APPENDIX A

30. What are your present professional duties? (Circle Only One Number)

- |  |                               |      |
|--|-------------------------------|------|
| 01 — Research                                    | 06 — Manufacturing/Production | 203- |
| 02 — Administration/Mgt. (for profit)            | 07 — Private Consultant       | 204  |
| 03 — Administration/Mgt. (not-for-profit sector) | 08 — Service/Maintenance      |      |
| 04 — Design/Development                          | 09 — Marketing/Sales          |      |
| 05 — Teaching/Academic                           | 10 — Other _____              |      |

31. What is your AIAA interest group? (Circle Only One Number)

- |                                  |                                       |     |
|----------------------------------|---------------------------------------|-----|
| 1 — Aerospace Science            | 5 — Aerospace and Information Systems | 205 |
| 2 — Aircraft Systems             | 6 — Administration/Management         |     |
| 3 — Structures, Design, and Test | 7 — Other _____                       |     |
| 4 — Propulsion and Energy        |                                       |     |

32. Is American English your first (native) language? 1 — Yes 2 — No 206

33. Are you an Engineer or a Scientist? 1 — Engineer 2 — Scientist 207

34. Are there comments you would like to add about topics covered in this questionnaire?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

35. What can be done to improve technical communications in aeronautics?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Mail to: Dr. M. Glassman  
Dept. of Marketing  
Old Dominion University  
Norfolk, VA 23529-0218



APPENDIX B

AGGREGATE TOTALS

BLANK - 999

TECHNICAL COMMUNICATIONS IN AERONAUTICS

SKIP - 8

v1 1. In your work, how important is it for *YOU* to communicate technical information effectively?  
 $\frac{89.4}{1}$  Very Important       $\frac{9.7}{2}$  Somewhat Important       $\frac{.5}{3}$  Not at all Important      3 blank .4

v2 2. How many hours do *YOU* spend each week communicating technical information *TO* others?  $\bar{x} = 13.95$  Hours

v3 3. How many hours do *YOU* spend each week working with technical communications *FROM* others?  $\bar{x} = 12.57$  Hours

v4 4. As you have advanced professionally, how has the amount of time *YOU* spend communicating technical information *TO OTHERS* changed?  
 $\frac{71.5}{1}$  Increased       $\frac{15.3}{2}$  Stayed the Same       $\frac{12.9}{3}$  Decreased      2 blank .3

v5 5. As you have advanced professionally, how has the amount of time *YOU* spend working with technical communications received *FROM OTHERS* changed?  
 $\frac{60.6}{1}$  Increased       $\frac{25.6}{2}$  Stayed the Same       $\frac{12.7}{3}$  Decreased      7 blank 1.1

6. Approximately how many times in the past *six months* did you write/prepare: 995 - 1,000 times

v6 Letters	$\bar{x} = 22.2$ times in the past 6 months	v13 Journal articles	$\bar{x} = 0.4$
v7 Memos	$\bar{x} = 28.8$	v14 Conference/Meeting papers	$\bar{x} = 1.1$
v8 Technical reports-Government	$\bar{x} = 1.6$	v15 Trade/Promotional literature	$\bar{x} = 0.3$
v9 Technical reports-Other	$\bar{x} = 1.9$	v16 Press releases	$\bar{x} = 0.3$
v10 Proposals	$\bar{x} = 1.8$	v17 Drawings/Specifications	$\bar{x} = 3.2$
v11 Technical manuals	$\bar{x} = 0.3$	v18 Speeches	$\bar{x} = 2.2$
v12 Computer program documentation	$\bar{x} = 1.3$	v19 Audio/Visual materials	$\bar{x} = 6.6$

7. How many times in the past *one month* did you use materials written/prepared by other people?

v20 Letters	$\bar{x} = 16.7$ # read/used in past 1 month	v27 Journal articles	$\bar{x} = 6.7$
v21 Memos	$\bar{x} = 24.3$	v28 Conference/Meeting papers	$\bar{x} = 4.3$
v22 Technical reports-Government	$\bar{x} = 4.2$	v29 Trade/Promotional literature	$\bar{x} = 5.7$
v23 Technical reports-Other	$\bar{x} = 4.5$	v30 Drawings/Specifications	$\bar{x} = 7.9$
v24 Proposals	$\bar{x} = 1.4$	v31 Audio/Visual materials	$\bar{x} = 5.5$
v25 Technical Manuals	$\bar{x} = 2.2$		
v26 Computer program documentation	$\bar{x} = 3.0$		

8. When you write/prepare technical communications, do you receive help from:

	<i>Always</i>	<i>Usually</i>	<i>Sometimes</i>	<i>Never</i>		
v32 Other colleagues	$\frac{11.7}{1}$	$\frac{39.6}{2}$	$\frac{45.4}{3}$	$\frac{2.6}{4}$	4 blank	.7
v33 Secretaries	$\frac{23.3}{1}$	$\frac{27.7}{2}$	$\frac{35.6}{3}$	$\frac{12.9}{4}$	3 blank	.5
v34 Technical writers or editors	$\frac{1.5}{1}$	$\frac{4.2}{2}$	$\frac{38.1}{3}$	$\frac{51.2}{4}$	28 blank	4.6
v35 A thesaurus/dictionary	$\frac{21.0}{1}$	$\frac{28.7}{2}$	$\frac{41.1}{3}$	$\frac{7.4}{4}$	11 blank	1.8
v36 A style manual	$\frac{1.5}{1}$	$\frac{4.5}{2}$	$\frac{33.8}{3}$	$\frac{55.4}{4}$	29 blank	4.8
v37 A grammar hotline	$\frac{.2}{1}$	$\frac{.7}{2}$	$\frac{5.1}{3}$	$\frac{88.0}{4}$	37 blank	6.0



APPENDIX B

9. Which of the following statements *BEST* represents how the artwork for *YOUR* visual aids (charts, graphs) is prepared? (Check Only One)

- 1 10.2 I do my own artwork without a computer
- 2 34.0 I do my own artwork with a computer                      6 blank 1.0
- v38 3 16.5 The graphics department does my artwork
- 4 30.0 Sometimes I do it and sometimes the graphics department does it
- 5 6.3 A secretary does it
- 6 2.0 The artwork is prepared elsewhere

10. Have you ever taken a course(s) in technical communications/writing? 0 skip

- v39 24.4 Yes, as an Undergraduate                      19.6 Yes, after graduation                      24.6 Yes, both                      31.4 No (Skip to Q. 12)

11. How well did this course help *YOU* communicate technical information?

- v40 42.5 A Lot                      54.1 A Little                      2.7 Did not Help                      4 blank .7

12. In your opinion, which of the following topics should be included in an undergraduate technical communications course for aeronautical engineers and scientists?

Yes	No	Principles	Yes	No	Mechanics
v41 <u>90.3</u>	<u>9.2</u>	Defining the communication's purpose 3 blank .5	v51 <u>50.2</u>	<u>47.5</u>	Abbreviations 14 blank 2.3
v42 <u>80.9</u>	<u>18.1</u>	Assessing readers' needs 6 blank 1.0	v52 <u>48.7</u>	<u>49.2</u>	Acronyms 13 blank 2.1
v43 <u>96.0</u>	<u>3.5</u>	Organizing information 3 blank 0.5	v53 <u>59.6</u>	<u>38.1</u>	Capitalization 14 blank 2.3
v44 <u>85.8</u>	<u>13.7</u>	Developing paragraphs (introductions, transitions, and conclusions) 3 blank 0.5	v54 <u>47.2</u>	<u>49.7</u>	Numbers 19 blank 3.1
v45 <u>79.7</u>	<u>20.0</u>	Writing sentences (active vs. passive voice, parallel ideas, shifts in person or tense) 2 blank 0.3	v55 <u>74.3</u>	<u>23.6</u>	Punctuation 13 blank 2.1
v46 <u>77.4</u>	<u>22.1</u>	Using standard English grammar 3 blank 0.5	v56 <u>75.1</u>	<u>22.8</u>	References 13 blank 2.1
v47 <u>49.3</u>	<u>49.4</u>	Notetaking and quoting 8 blank 1.3	v57 <u>63.7</u>	<u>34.2</u>	Spelling 13 blank 2.1
v48 <u>77.4</u>	<u>22.1</u>	Editing and revising 3 blank 0.5	v58 <u>55.9</u>	<u>41.8</u>	Symbols 14 blank 2.3
v49 <u>81.0</u>	<u>18.5</u>	Choosing words (avoiding wordiness, jargon, slang, sexist terms) 3 blank 0.5			
v50 <u>60.3</u>	<u>38.9</u>	Using information technology (video conferencing, electronic data bases, etc.) 5 blank 0.8			

13. Which of the following on-the-job communications should be included in an undergraduate technical communications course for aeronautical engineers and scientists?

Yes	No	Abstracts	18 blank	3.0	Yes	No	Reports:
v59 <u>67.0</u>	<u>30.0</u>	Abstracts	18 blank	3.0	v70 <u>56.8</u>	<u>34.3</u>	Feasibility 54 blank 8.9
v60 <u>68.0</u>	<u>30.0</u>	Letters	12 blank	2.0	v71 <u>60.7</u>	<u>30.4</u>	Investigative 54 blank 8.9
v61 <u>76.4</u>	<u>21.8</u>	Memos	11 blank	1.8	v72 <u>64.7</u>	<u>26.6</u>	Laboratory 53 blank 8.7
v62 <u>56.1</u>	<u>41.3</u>	Instructions	16 blank	2.6	v73 <u>72.6</u>	<u>19.1</u>	Progress 50 blank 8.3
v63 <u>45.4</u>	<u>52.5</u>	Journal articles	13 blank	2.1	v74 <u>71.9</u>	<u>19.7</u>	Test 51 blank 8.4
v64 <u>36.3</u>	<u>61.1</u>	Literature reviews	16 blank	2.6	v75 <u>49.8</u>	<u>41.9</u>	Trip 50 blank 8.3
v65 <u>47.3</u>	<u>50.7</u>	Manuals	12 blank	2.0	v76 <u>46.5</u>	<u>44.9</u>	Trouble 52 blank 8.6
v66 <u>23.6</u>	<u>73.4</u>	Newsletter articles	18 blank	3.0			
v67 <u>93.6</u>	<u>4.6</u>	Oral presentations	11 blank	1.8			
v68 <u>54.5</u>	<u>43.2</u>	Specifications	14 blank	2.3			
v69 <u>77.2</u>	<u>20.5</u>	Use of information sources	14 blank	2.3			

14. Do *YOU* use computer technology to prepare technical communications? 52 skip

- v77 28.3 Always                      31.5 Usually                      21.6 Sometimes                      8.6 Never (Skip to Q. 19)

15. Has computer technology increased *YOUR* ability to communicate technical information?

- v78 56.4 A Lot                      30.2 A Little                      4.8 Not at All                      52 blank 8.6

APPENDIX B

16. Do YOU use any of the following software for preparing written technical communications?

Yes	No		52 skip	8.5	Yes	No		7 blank	1.2
v79 <u>85.8</u>	<u>5.1</u>	Word processing	3 blank	.5	v83 <u>28.7</u>	<u>61.6</u>	Thesaurus	7 blank	1.2
v80 <u>9.7</u>	<u>80.2</u>	Outliners and prompters	9 blank	1.5	v84 <u>32.5</u>	<u>57.8</u>	Business graphics	7 blank	1.2
v81 <u>10.2</u>	<u>79.9</u>	Grammar and style checkers	8 blank	1.5	v85 <u>58.3</u>	<u>32.2</u>	Scientific graphics	6 blank	1.0
v82 <u>57.3</u>	<u>33.8</u>	Spelling checkers	2 blank	.5					

17. Do YOU use an integrated graphics, text, and modeling engineering workstation for preparing written technical communications?

v86 <u>6.4</u>	Always	<u>10.1</u>	Usually	<u>24.6</u>	Sometimes	<u>49.2</u>	Never	52 skip	8.5
								7 blank	1.2

18. Do YOU use electronic or desk-top publishing systems for preparing written technical communications?

v87 <u>10.7</u>	Always	<u>18.5</u>	Usually	<u>24.3</u>	Sometimes	<u>37.0</u>	Never	52 skip	8.5
								6 blank	1.0

19. How do YOU view your use of the following information technologies in communicating technical information?

Information Technologies	I already use it	I don't use it, but may in the future	I don't use it, and doubt if I will		
v88 Audio tapes and cassettes	<u>19.5</u>	<u>28.4</u>	<u>48.2</u>	24 blank	3.9
v89 Motion picture film	<u>19.5</u>	<u>23.4</u>	<u>52.0</u>	31 blank	5.1
v90 Video tape	<u>45.4</u>	<u>38.6</u>	<u>13.5</u>	15 blank	2.5
v91 Desk-top/electronic publishing	<u>44.9</u>	<u>40.1</u>	<u>11.6</u>	21 blank	3.4
v92 Floppy disks	<u>72.8</u>	<u>18.5</u>	<u>6.4</u>	14 blank	2.3
v93 Computer cassette/cartridge tapes	<u>21.3</u>	<u>36.6</u>	<u>36.0</u>	37 blank	6.1
v94 Electronic mail	<u>45.3</u>	<u>42.1</u>	<u>9.7</u>	18 blank	2.9
v95 Electronic bulletin boards	<u>24.4</u>	<u>50.8</u>	<u>19.6</u>	31 blank	5.2
v96 FAX or TELEX	<u>82.7</u>	<u>10.6</u>	<u>4.8</u>	12 blank	1.9
v97 Electronic data bases	<u>47.9</u>	<u>38.4</u>	<u>8.9</u>	29 blank	4.8
v98 Video conferencing	<u>15.7</u>	<u>59.9</u>	<u>20.5</u>	24 blank	3.9
v99 Teleconferencing	<u>56.8</u>	<u>30.0</u>	<u>9.9</u>	20 blank	3.3
v100 Micrographics and microforms	<u>16.5</u>	<u>40.4</u>	<u>35.0</u>	49 blank	8.1
v101 Laser disc/video disc/CD-ROM	<u>5.8</u>	<u>61.1</u>	<u>27.2</u>	36 blank	5.9
v102 Electronic networks	<u>30.5</u>	<u>50.0</u>	<u>14.2</u>	32 blank	5.3

20. When faced with solving a technical problem, do you get technical information from:

	Always	Usually	Sometimes	Never		
v103 Personal knowledge	<u>42.5</u>	<u>45.5</u>	<u>11.2</u>	<u>1.0</u>	6 blank	0.8
v104 Informal discussions with colleagues	<u>19.8</u>	<u>56.8</u>	<u>22.3</u>	<u>.3</u>	5 blank	0.8
v105 Discussions with supervisors	<u>9.9</u>	<u>34.3</u>	<u>46.7</u>	<u>7.1</u>	12 blank	2.0
v106 Discussions with experts in your organization	<u>18.5</u>	<u>50.2</u>	<u>29.0</u>	<u>1.2</u>	7 blank	1.1
v107 Discussions with experts outside of your organization	<u>6.1</u>	<u>19.1</u>	<u>65.5</u>	<u>8.3</u>	6 blank	1.0
v108 Technical reports-Government	<u>5.8</u>	<u>27.4</u>	<u>59.9</u>	<u>5.9</u>	6 blank	1.0
v109 Technical reports-Other	<u>5.6</u>	<u>29.4</u>	<u>60.7</u>	<u>3.1</u>	7 blank	1.2
v110 Professional journals/conference meeting papers	<u>9.2</u>	<u>25.4</u>	<u>52.5</u>	<u>11.4</u>	9 blank	1.5
v111 Textbooks	<u>8.7</u>	<u>30.5</u>	<u>53.5</u>	<u>6.3</u>	6 blank	1.0
v112 Handbooks and standards	<u>6.6</u>	<u>27.1</u>	<u>54.6</u>	<u>9.4</u>	14 blank	2.3
v113 Technical information sources, such as on-line data bases, indexing and abstracting guides, CD-ROM, and current awareness tools	<u>.2</u>	<u>6.8</u>	<u>43.2</u>	<u>45.4</u>	21 blank	3.4
v114 Librarians/technical information specialists	<u>2.6</u>	<u>11.2</u>	<u>65.0</u>	<u>19.6</u>	9 blank	1.6

APPENDIX B

21. What types of technical information do you *USE* in performing your present duties?

	Yes	No			
v115	<u>96.4</u>	<u>3.0</u>	Scientific and technical information	4 blank	0.6
v116	<u>59.9</u>	<u>39.3</u>	Experimental techniques	5 blank	0.8
v117	<u>47.4</u>	<u>51.8</u>	Codes of standards and practices	5 blank	0.8
v118	<u>55.4</u>	<u>43.7</u>	Design procedures and methods	5 blank	0.9
v119	<u>80.2</u>	<u>19.1</u>	Computer programs	4 blank	0.7
v120	<u>71.3</u>	<u>27.9</u>	Government rules and regulations	4 blank	0.8
v121	<u>89.9</u>	<u>9.4</u>	In-house technical data	5 blank	0.7
v122	<u>71.8</u>	<u>27.6</u>	Product and performance characteristics	4 blank	0.6
v123	<u>35.5</u>	<u>63.7</u>	Economic information	5 blank	0.8
v124	<u>76.4</u>	<u>22.9</u>	Technical specifications	4 blank	0.7
v125	<u>14.0</u>	<u>85.3</u>	Patents	4 blank	0.7

22. What types of technical information do you *PRODUCE* (or expect to produce) in performing your present duties?

	Yes	No			
v126	<u>91.6</u>	<u>7.8</u>	Scientific and technical information	4 blank	0.6
v127	<u>44.4</u>	<u>55.0</u>	Experimental techniques	4 blank	0.6
v128	<u>20.8</u>	<u>78.5</u>	Codes of standards and practices	4 blank	0.7
v129	<u>46.5</u>	<u>52.5</u>	Design procedures and methods	6 blank	1.0
v130	<u>56.8</u>	<u>42.6</u>	Computer programs	4 blank	0.6
v131	<u>15.2</u>	<u>83.7</u>	Government rules and regulations	7 blank	1.1
v132	<u>84.3</u>	<u>15.0</u>	In-house technical data	4 blank	0.7
v133	<u>57.8</u>	<u>41.4</u>	Product and performance characteristics	5 blank	0.8
v134	<u>27.1</u>	<u>72.3</u>	Economic information	4 blank	0.6
v135	<u>59.2</u>	<u>40.1</u>	Technical specifications	4 blank	0.7
v136	<u>18.0</u>	<u>81.4</u>	Patents	4 blank	0.6

23. How often do you use the library or a technical information center? (Circle Choice)

	1 <u>2.0</u> Daily	4 <u>19.1</u> Two to three times a month	
v137	2 <u>9.9</u> Two to six times a week	5 <u>16.8</u> Once a month	4 blank 0.7
	3 <u>14.9</u> Once a week	6 <u>30.7</u> Less than once a month	
		7 <u>5.9</u> Do not use	

v138 24. Do you use electronic data bases to find bibliographic citations and abstracts? 1 43.7 Yes 2 55.4 No (Skip to Q. 26)  
5 blank 0.9

25. Do you (Circle One):

	1 <u>3.0</u> Do <i>all</i> searches yourself	4 <u>15.2</u> <i>most</i> searches through an intermediary (e.g. librarian)	
v139	2 <u>6.9</u> Do <i>most</i> searches yourself	5 <u>12.7</u> Do <i>all</i> searches through an intermediary	
	3 <u>5.3</u> Do <i>half</i> by yourself and half through an intermediary (e.g. librarian)		341 skip 56.3 4 blank 0.6

THIS DATA WILL BE USED TO DETERMINE WHETHER PEOPLE WITH DIFFERENT BACKGROUNDS HAVE DIFFERENT TECHNICAL COMMUNICATION PRACTICES.

v140 26. What is your gender? 1 95.2 Male 2 4.8 Female

27. What is your level of education?

	1 <u>0.7</u> No degree	3 <u>43.6</u> Masters	5 <u>0.4</u> Other	
v141	2 <u>32.7</u> Bachelors	4 <u>22.6</u> Doctorate		
				1-5 17.7 26-30 77.4 6-10 35.0 31-35 88.6

v142 28. How many years of professional work experience do you have? \_\_\_\_\_ Years  
11-15 44.7 36-40 96.7  
16-20 54.1 41-45 99.0  
21-25 63.2 46-99 100.0

29. Type of organization where you work? (Circle Only One Number)

	1 <u>6.8</u> Academic	4 <u>16.0</u> Government (Non-NASA)
v143	2 <u>62.0</u> Industrial	5 <u>12.2</u> NASA
	3 <u>2.8</u> Not-for-profit	6 <u>.2</u> Other

APPENDIX B

30. What are your present professional duties? (Circle Only *One* Number)

- |  |   |
|--|---|
| 01 <u>19.5</u> Research  | 06 <u>1.7</u> Manufacturing/Production            |
| 02 <u>15.3</u> Administration/Mgt. (for profit)                | 07 <u>2.3</u> Private Consultant                  |
| v144 03 <u>8.4</u> Administration/Mgt. (not-for-profit sector) | 08 <u>.2</u> Service/Maintenance      2 blank 0.3 |
| 04 <u>37.3</u> Design/Development                              | 09 <u>3.8</u> Marketing/Sales                     |
| 05 <u>5.8</u> Teaching/Academic                                | 10 <u>5.4</u> Other _____                         |

31. What is your AIAA interest group? (Circle Only *One* Number)

- |   |   |
|---|---|
| 1 <u>30.2</u> Aerospace Science                 | 5 <u>7.9</u> Aerospace and Information Systems          |
| 2 <u>13.5</u> Aircraft Systems                  | 6 <u>6.2</u> Administration/Management      8 blank 1.3 |
| v145 3 <u>13.5</u> Structures, Design, and Test | 7 <u>7.6</u> Other _____                                |
| 4 <u>19.8</u> Propulsion and Energy             |   |

v146 32. Is American English your first (native) language?    1 93.6 Yes    2 6.4 No

v147 33. Are you an Engineer or a Scientist?    1 89.2 Engineer    2 10.1 Scientist    4 blank 0.7

34. Are there comments you would like to add about topics covered in this questionnaire?

---

---

---

---

---

---

---

---

35. What can be done to improve technical communications in aeronautics?

---

---

---

---

---

---

---

---

Mail to: Dr. M. Glassman  
Dept. of Marketing  
Old Dominion University  
Norfolk, VA 23529-0218

APPENDIX C  
CROSS TABULATIONS  
PART A

Significant at  $P < .05$  with no more than 20% expected values less than 5

SPSS/PC+

Crosstabulation: V32 RECEIVE HELP FROM COLLEAGUES

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V32		1	2	4	5	
ALWAYS	1	4	39	12	13	68
		7.0	10.4	12.4	17.8	11.3
USUALLY	2	16	162	36	25	239
		28.1	43.3	37.1	34.2	39.8
SOMETIMES	3	30	164	49	35	278
		52.6	43.9	50.5	47.9	46.3
NEVER	4	7	9			16
		12.3	2.4			2.7
Column Total		57	374	97	73	601
		9.5	62.2	16.1	12.1	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
33.70301	9	.0001	1.517	3 DF 16 ( 18.8%)

Number of Missing Observations = 5  
SPSS/PC+

Crosstabulation: V33 HELP FROM SECRETARIES

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V33		1	2	4	5	
ALWAYS	1	13	103	11	14	141
		22.8	27.5	11.3	18.9	23.4
USUALLY	2	13	103	35	17	168
		22.8	27.5	36.1	23.0	27.9
SOMETIMES	3	24	122	35	34	215
		42.1	32.6	36.1	45.9	35.7
NEVER	4	7	46	16	9	78
		12.3	12.3	16.5	12.2	13.0
Column Total		57	374	57	74	602
		9.5	62.1	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
17.86622	9	.0368	7.385	None

Number of Missing Observations = 4

APPENDIX C

SPSS/PC+

Crosstabulation: V39 EVER TAKEN A TECH COMM COURSE

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V39		1	2	4	5	
YES, UNDERGRADUA	1	15	91	28	13	147
		25.9	24.2	28.9	17.6	24.3
YES, AFTER GRADU	2	9	74	16	20	119
		15.5	19.7	16.5	27.0	19.7
YES, BOTH	3	5	99	28	17	149
		8.6	26.3	28.9	23.0	24.6
NO	4	29	112	25	24	190
		50.0	29.8	25.8	32.4	31.4
Column Total		58	376	97	74	605
		9.6	62.1	16.0	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
20.28448	9	.0162	11.408	None

Number of Missing Observations = 1

SPSS/PC+

Crosstabulation: V59 ABSTRACTS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V59		1	2	4	5	
YES	1	49	234	68	55	406
		87.5	63.8	73.9	76.4	69.2
NO	2	7	133	24	17	181
		12.5	36.2	26.1	23.6	30.8
Column Total		56	367	92	72	587
		9.5	62.5	15.7	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
16.58825	3	.0009	17.267	None

Number of Missing Observations = 19

APPENDIX C  
SPSS/PC+

Crosstabulation: V62 INSTRUCTIONS

V143→	Count		ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col	Pct	NON-PROF	TRIAL			
			1	2	4	5	
V62							
YES	1		35	217	58	29	339
			61.4	59.5	60.4	40.8	57.6
NO	2		22	148	38	42	250
			38.6	40.5	39.6	59.2	42.4
Column Total			57	365	96	71	589
			9.7	62.0	16.3	12.1	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
9.32028	3	.0253	24.194	None

Number of Missing Observations = 17

SPSS/PC+

Crosstabulation: V63 JOURNAL ARTICLES

V143→	Count		ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col	Pct	NON-PROF	TRIAL			
			1	2	4	5	
V63							
YES	1		40	145	44	46	275
			70.2	39.4	46.3	63.9	46.5
NO	2		17	223	51	26	317
			29.8	60.6	53.7	36.1	53.5
Column Total			57	368	95	72	592
			9.6	62.2	16.0	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
29.05115	3	.0000	26.478	None

Number of Missing Observations = 14

APPENDIX C  
SPSS/PC+

Crosstabulation: V68 SPECIFICATIONS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V68		-----+				
YES	1	24	219	53	33	329
		42.1	59.7	55.8	45.8	55.7
NO	2	33	148	42	39	262
		57.9	40.3	44.2	54.2	44.3
	Column Total	57	367	95	72	591
		9.6	62.1	16.1	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
9.45637	3	.0238	25.269	None

Number of Missing Observations = 15

SPSS/PC+

Crosstabulation: V69 USE OF INFO SOURCES

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V69		-----+				
YES	1	43	301	77	47	468
		75.4	82.0	80.2	66.2	79.2
NO	2	14	66	19	24	123
		24.6	18.0	19.8	33.8	20.8
	Column Total	57	367	96	71	591
		9.6	62.1	16.2	12.0	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
9.59858	3	.0223	11.863	None

Number of Missing Observations = 15



APPENDIX C

SPSS/PC+

Crosstabulation: V70 FEASIBILITY REPORTS

V143→	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V70	-----+-----+-----+-----+-----+					
YES	1	20	223	60	40	343
		41.7	64.5	64.5	62.5	62.3
	-----+-----+-----+-----+-----+					
NO	2	28	123	33	24	208
		58.3	35.5	35.5	37.5	37.7
	-----+-----+-----+-----+-----+					
	Column Total	48	346	93	64	551
		8.7	62.8	16.9	11.6	100.0

<u>Chi-Square</u>	<u>D.F.</u>	<u>Significance</u>	<u>Min E.F.</u>	<u>Cells with E.F. &lt; 5</u>
9.57217	3	.0226	18.120	None

Number of Missing Observations = 55

SPSS/PC+

Crosstabulation: V75 TRIP REPORTS

V143→	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V75	-----+-----+-----+-----+-----+					
YES	1	20	195	59	27	301
		41.7	56.0	62.8	41.5	54.2
	-----+-----+-----+-----+-----+					
NO	2	28	153	35	38	254
		58.3	44.0	37.2	58.5	45.8
	-----+-----+-----+-----+-----+					
	Column Total	48	348	94	65	555
		8.6	62.7	16.9	11.7	100.0

<u>Chi-Square</u>	<u>D.F.</u>	<u>Significance</u>	<u>Min E.F.</u>	<u>Cells with E.F. &lt; 5</u>
10.48652	3	.0149	21.968	None

Number of Missing Observations = 51

APPENDIX C  
SPSS/PC+

Crosstabulation: V77 USE COMPUTER TECHNOLOGY

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	RIAL			
V77		1	2	4	5	
ALWAYS	1	25 43.1	120 31.9	42 43.3	44 59.5	231 38.2
USUALLY	2	14 24.1	127 33.8	35 36.1	15 20.3	191 31.6
SOMETIMES	3	13 22.4	91 24.2	16 16.5	11 14.9	131 21.7
NEVER	4	6 10.3	38 10.1	4 4.1	4 5.4	52 8.6
	Column Total	58 9.6	376 62.1	97 16.0	74 12.2	605 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
27.13709	9	.0013	4.985	1 OF 16 ( 6.3%)

Number of Missing Observations = 1

SPSS/PC+

Crosstabulation: V82 SPELLING CHECKERS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASP	Row Total
		NON-PROFIT	RIAL			
V82		1	2	4	5	
YES	1	28 54.9	201 59.6	66 71.0	51 72.9	346 62.8
NO	2	23 45.1	136 40.4	27 29.0	19 27.1	205 37.2
	Column Total	51 9.3	337 61.2	93 16.9	70 12.7	551 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
8.48464	3	.0370	18.975	None

Number of Missing Observations = 55

APPENDIX C  
SPSS/PC+

Crosstabulation: V83 THESAURUS

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	RIAL			
V83		1	2	4	5	
YES	1	12	107	39	16	174
		23.5	32.0	42.4	23.2	31.9
NO	2	39	227	53	53	372
		76.5	68.0	57.6	76.8	68.1
Column Total		51	334	92	69	546
		9.3	61.2	16.8	12.6	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
8.72396	3	.0332	16.253	None

Number of Missing Observations = 60

SPSS/PC+

Crosstabulation: V85 SCIENTIFIC GRAPHICS

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	RIAL			
V85		1	2	4	5	
YES	1	35	208	54	56	353
		67.3	62.5	58.7	80.0	64.5
NO	2	17	125	38	14	194
		32.7	37.5	41.3	20.0	35.5
Column Total		52	333	92	70	547
		9.5	60.9	16.8	12.8	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
9.48492	3	.0235	18.442	None

Number of Missing Observations = 59

APPENDIX C

SPSS/PC+

Crosstabulation: V86 USE AN INTEGRATED GRAPHICS TEXT

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V86		1	2	4	5	
ALWAYS	1	2	18	7	12	39
		3.8	5.4	7.6	17.6	7.1
USUALLY	2	5	33	11	12	61
		9.6	9.9	12.0	17.6	11.2
SOMETIMES	3	14	94	25	15	148
		26.9	28.1	27.2	22.1	27.1
NEVER	4	31	189	49	29	298
		59.6	56.6	53.3	42.6	54.6
Column Total		52	334	92	68	546
		9.5	61.2	16.8	12.5	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
19.03954	9	.0249	3.714	2 OF 16 ( 12.5%)

Number of Missing Observations = 60

SPSS/PC+

Crosstabulation: V89 MOTION PICTURE FILM

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V89		1	2	4	5	
ALREADY USE IT	1	16	56	26	20	118
		29.1	15.8	28.0	28.2	20.6
DON'T BUT MAY	2	17	90	19	16	142
		30.9	25.4	20.4	22.5	24.7
DOUBT IF I WILL	3	22	209	48	35	314
		40.0	58.9	51.6	49.3	54.7
Column Total		55	355	93	71	574
		9.6	61.8	16.2	12.4	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
15.95798	6	.0140	11.307	None

Number of Missing Observations = 32

APPENDIX C  
SPSS/PC+

Crosstabulation: V91 DESK-TOP/ELECTRONIC PUBLISHING

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V91		1	2	4	5	
ALREADY USE IT	1	20	165	44	43	272
		35.7	45.2	46.8	62.3	46.6
DO'N'T BUT MAY	2	25	155	42	20	242
		44.6	42.5	44.7	29.0	41.4
DOUBT IF I WILL	3	11	45	8	6	70
		19.6	12.3	8.5	8.7	12.0
Column Total		56	365	94	69	584
		9.6	62.5	16.1	11.8	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
12.63612	6	.0492	6.712	None

Number of Missing Observations = 22

SPSS/PC+

Crosstabulation: V94 ELECTRONIC MAIL

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V94		1	2	4	5	
ALREADY USE IT	1	27	147	46	53	273
		49.1	40.4	48.4	72.6	46.5
DO'N'T BUT MAY	2	22	176	41	16	255
		40.0	48.4	43.2	21.9	43.4
DOUBT IF I WILL	3	6	41	8	4	59
		10.9	11.3	8.4	5.5	10.1
Column Total		55	364	95	73	587
		9.4	62.0	16.2	12.4	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
26.07522	6	.0002	5.528	None

Number of Missing Observations = 19

APPENDIX C

SPSS/PC+

Crosstabulation: V95 ELECTRONIC BULLETIN BOARDS

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row
Col Pct	NON-PROFIT	TRIAL				Total
	1	2	4	5		
V95	-----+-----+-----+-----+-----+-----+-----					
ALREADY USE IT	1	14	67	26	41	148
	26.4	18.8	27.7	57.7		25.8
	-----+-----+-----+-----+-----+-----+-----					
DON'T BUT MAY	2	28	207	48	24	307
	52.8	58.1	51.1	33.8		53.5
	-----+-----+-----+-----+-----+-----+-----					
DOUBT IF I WILL	3	11	82	20	6	119
	20.8	23.0	21.3	8.5		20.7
	-----+-----+-----+-----+-----+-----+-----					
Column Total	53	356	94	71		574
	9.2	62.0	16.4	12.4		100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
47.74792	6	.0000	10.988	None

Number of Missing Observations = 32

SPSS/PC+

Crosstabulation: V97 ELECTRONIC DATA BASES

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row
Col Pct	NON-PROFIT	TRIAL				Total
	1	2	4	5		
V97	-----+-----+-----+-----+-----+-----+-----					
ALREADY USE IT	1	16	195	45	33	289
	29.6	54.6	47.9	46.5		50.2
	-----+-----+-----+-----+-----+-----+-----					
DON'T BUT MAY	2	33	129	40	31	233
	61.1	36.1	42.6	43.7		40.5
	-----+-----+-----+-----+-----+-----+-----					
DOUBT IF I WILL	3	5	33	9	7	54
	9.3	9.2	9.6	9.9		9.4
	-----+-----+-----+-----+-----+-----+-----					
Column Total	54	357	94	71		576
	9.4	62.0	16.3	12.3		100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
13.89786	6	.0308	5.063	None

Number of Missing Observations = 30

APPENDIX C  
SPSS/PC+

Crosstabulation: V98 VIDEO CONFERENCING

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	RIAL			
V98		1	1	2	4	5
ALREADY USE IT	1	3	59	9	23	94
		5.6	16.4	9.5	31.9	16.2
DON'T BUT MAY	2	30	231	59	43	363
		55.6	64.2	62.1	59.7	62.5
DOUBT IF I WILL	3	21	70	27	6	124
		38.9	19.4	28.4	8.3	21.3
Column Total		54	360	95	72	581
		9.3	62.0	16.4	12.4	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
34.48282	6	.0000	8.737	None

Number of Missing Observations = 25

SPSS/PC+

Crosstabulation: V99 TELECONFERENCING

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	RIAL			
V99		1	1	2	4	5
ALREADY USE IT	1	19	227	46	51	343
		33.9	62.5	48.4	71.8	58.6
DON'T BUT MAY	2	27	103	36	16	182
		48.2	28.4	37.9	22.5	31.1
DOUBT IF I WILL	3	10	33	13	4	60
		17.9	9.1	13.7	5.6	10.3
Column Total		56	363	95	71	585
		9.6	62.1	16.2	12.1	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
25.99568	6	.0002	5.744	None

Number of Missing Observations = 21

APPENDIX C

SPSS/PC+

Crosstabulation: V102 ELECTRONIC NETWORKS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	NASA	Row Total
		NON-PROFIT	TRIAL			
V102		1	2	4	5	
ALREADY USE IT	1	16	98	30	40	184
		29.6	27.6	32.3	56.3	32.1
DON'T BUT MAY	2	28	203	48	24	303
		51.9	57.2	51.6	33.8	52.9
DOUBT IF I WILL	3	10	54	15	7	86
		18.5	15.2	16.1	9.9	15.0
Column Total		54	355	93	71	573
		9.4	62.0	16.2	12.4	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
23.27959	6	.0007	8.105	None

Number of Missing Observations = 33

SPSS/PC+

Crosstabulation: V105 DISCUSSIONS WITH SUPERVISORS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	NASA	Row Total
		NON-PROFIT	TRIAL			
V105		1	2	4	5	
ALWAYS	1	2	40	10	8	60
		3.6	10.9	10.3	11.0	10.1
USUALLY	2	14	139	31	24	208
		25.5	37.8	32.0	32.9	35.1
SOMETIMES	3	23	169	51	39	282
		41.8	45.9	52.6	53.4	47.6
NEVER	4	16	20	5	2	43
		29.1	5.4	5.2	2.7	7.3
Column Total		55	368	97	73	593
		9.3	62.1	16.4	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
47.24618	9	.0000	3.988	1 OF 16 ( 6.3%)

Number of Missing Observations = 13



APPENDIX C

SPSS/PC+

Crosstabulation: V110 JOURNAL/MEETING PAPERS

V143-)	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V110		1	2	4	5	
ALWAYS	1	10	18	13	14	55
		17.5	4.9	13.5	19.2	9.2
USUALLY	2	23	85	21	25	154
		40.4	23.0	21.9	34.2	25.8
SOMETIMES	3	24	216	50	28	318
		42.1	58.4	52.1	38.4	53.4
NEVER	4		51	12	6	69
			13.8	12.5	8.2	11.6
Column Total		57	370	96	73	596
		9.6	62.1	16.1	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
45.22013	9	.0000	5.260	None

Number of Missing Observations = 10

SPSS/PC+

Crosstabulation: V111 TEXTBOOKS

V143-)	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V111		1	2	4	5	
ALWAYS	1	8	24	10	11	53
		14.3	6.5	10.3	14.9	8.8
USUALLY	2	26	104	30	24	184
		46.4	28.0	30.9	32.4	30.7
SOMETIMES	3	21	217	52	34	324
		37.5	58.3	53.6	45.9	54.1
NEVER	4	1	27	5	5	38
		1.8	7.3	5.2	6.8	6.3
Column Total		56	370	97	74	599
		9.3	62.1	16.2	12.4	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
20.60234	9	.0145	3.553	3 OF 16 ( 18.8%)

Number of Missing Observations = 7

APPENDIX C

SPSS/PC+

Crosstabulation: V114 LIBRARIANS/TECH INFO SPECIALISTS

V143-)	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V114		1	2	4	5	
ALWAYS	1	1	10	4	1	16
		1.8	2.7	4.1	1.4	2.7
USUALLY	2	4	40	7	17	68
		7.3	10.8	7.2	23.0	11.4
SOMETIMES	3	45	238	68	42	393
		81.8	64.3	70.1	56.8	65.9
NEVER	4	5	82	18	14	119
		9.1	22.2	18.6	18.9	20.0
Column Total		55	370	97	74	596
		9.2	62.1	16.3	12.4	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
20.24043	9	.0165	1.477	3 OF 16 ( 18.8%)

Number of Missing Observations = 10

SPSS/PC+

Crosstabulation: V117 CODES OF STANDARD AND PRACTICES

V143-)	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V117		1	2	4	5	
YES	1	15	200	42	30	287
		25.9	53.8	43.3	40.5	47.8
NO	2	43	172	55	44	314
		74.1	46.2	56.7	59.5	52.2
Column Total		58	372	97	74	601
		9.7	61.9	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
18.84074	3	.0003	27.697	None

Number of Missing Observations = 5

APPENDIX C

SPSS/PC+

Crosstabulation: V118 DESIGN PROCEDURES

V143-)	Count	ACADEMIC	INDUS-	GOVT	NASA	Row Total
	Col Pct	NON-PROFIT	RIAL			
		1	2	4	5	
V118		-----+				
YES	1	20	232	50	34	336
		34.5	62.4	51.5	45.9	55.9
		-----+				
NO	2	38	140	47	40	265
		65.5	37.6	48.5	54.1	44.1
		-----+				
	Column Total	58	372	97	74	601
		9.7	61.9	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
20.82106	3	.0001	25.574	None

Number of Missing Observations = 5

SPSS/PC+

Crosstabulation: V120 GOVT RULES AND REGULATIONS

V143-)	Count	ACADEMIC	INDUS-	GOVT	NASA	Row Total
	Col Pct	NON-PROFIT	RIAL			
		1	2	4	5	
V120		-----+				
YES	1	20	275	81	56	432
		34.5	73.7	84.4	75.7	71.9
		-----+				
NO	2	38	98	15	18	169
		65.5	26.3	15.6	24.3	28.1
		-----+				
	Column Total	58	373	96	74	601
		9.7	62.1	16.0	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
48.70339	3	.0000	16.309	None

Number of Missing Observations = 5

APPENDIX C  
SPSS/PC+

Crosstabulation: V121 IN-HOUSE TECH DATA

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	NASA	Row Total
		NON-PROFIT	RIAL			
V121		1	2	4	5	
YES	1	36 62.1	354 94.9	89 91.8	66 89.2	545 90.5
NO	2	22 37.9	19 5.1	8 8.2	8 10.8	57 9.5
	Column Total	58 9.6	373 62.0	97 16.1	74 12.3	602 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
63.46654	3	.0000	5.492	None

Number of Missing Observations = 4

SPSS/PC+

Crosstabulation: V122 PRODUCT AND PERFORMANCE CHARACTERISTICS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	NASA	Row Total
		NON-PROFIT	RIAL			
V122		1	4	5		
YES	1	28 48.3	294 78.8	71 73.2	42 56.8	435 72.3
NO	2	30 51.7	79 21.2	26 26.8	32 43.2	167 27.7
	Column Total	58 9.6	373 62.0	97 16.1	74 12.3	602 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
33.56801	3	.0000	16.390	None

Number of Missing Observations = 4

APPENDIX C

SPSS/PC+

Crosstabulation: V123 ECONOMIC INFORMATION

V143→	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V123		1	2	4	5	
YES	1	18	151	28	18	215
		31.0	40.6	28.9	24.3	35.8
NO	2	40	221	69	56	386
		69.0	59.4	71.1	75.7	64.2
Column Total		58	372	97	74	601
		9.7	61.9	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
10.56137	3	.0144	20.749	None

Number of Missing Observations = 5

SPSS/PC+

Crosstabulation: V124 TECHNICAL SPECIFICATIONS

V143→	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V124		1	2	4	5	
YES	1	32	311	73	47	463
		55.2	83.4	75.3	63.5	76.9
NO	2	26	62	24	27	139
		44.8	16.6	24.7	36.5	23.1
Column Total		58	373	97	74	602
		9.6	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
31.84762	3	.0000	13.392	None

Number of Missing Observations = 4

APPENDIX C

SPSS/PC+

Crosstabulation: V125 PATENTS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V125		-----+				
YES	1	4	66	9	6	85
		6.9	17.7	9.3	8.1	14.1
		-----+				
NO	2	54	307	88	68	517
		93.1	82.3	90.7	91.9	85.9
		-----+				
	Column Total	58	373	97	74	602
		9.6	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
10.50657	3	.0147	8.189	None

Number of Missing Observations = 4

SPSS/PC+

Crosstabulation: V127 EXPERIMENTAL TECHNIQUES

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V127		-----+				
YES	1	33	155	40	41	269
		56.9	41.6	41.2	55.4	44.7
		-----+				
NO	2	25	218	57	33	333
		43.1	58.4	58.8	44.6	55.3
		-----+				
	Column Total	58	373	97	74	602
		9.6	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
8.88488	3	.0309	25.917	None

Number of Missing Observations = 4

APPENDIX C

SPSS/PC+

Crosstabulation: V128 CODES OF STANDARDS AND PRACTICES

V143-)	Count	ACADEMIC	INDUS-	GOVT	NASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V128	-----+					
YES	1	6	82	27	11	126
		10.3	22.0	27.8	14.9	20.9
	-----+					
NO	2	52	291	70	63	476
		89.7	78.0	72.2	85.1	79.1
	-----+					
Column Total		58	373	97	74	602
		9.6	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
8.61661	3	.0348	12.140	None

Number of Missing Observations = 4

SPSS/PC+

Crosstabulation: V131 GOVT RULES AND REGULATIONS

V143-)	Count	ACADEMIC	INDUS-	GOVT	NASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V131	-----+					
YES	1	5	15	52	20	92
		8.6	4.0	54.2	27.0	15.4
	-----+					
NO	2	53	356	44	54	507
		91.4	96.0	45.8	73.0	84.6
	-----+					
Column Total		58	371	96	74	599
		9.7	61.9	16.0	12.4	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
157.53396	3	.0000	8.908	None

Number of Missing Observations = 7

APPENDIX C

SPSS/PC+

Crosstabulation: V132 IN-HOUSE TECH DATA

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V132		1	2	4	5	
YES	1	36	329	84	62	511
		62.1	88.2	86.6	83.8	84.9
NO	2	22	44	13	12	91
		37.9	11.8	13.4	16.2	15.1
Column Total		58	373	97	74	602
		9.5	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
27.02444	3	.0000	8.767	None

Number of Missing Observations = 4

SPSS/PC+

Crosstabulation: V133 PRODUCT AND PERFORMANCE CHARACTERISTICS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V133		1	2	4	5	
YES	1	19	251	51	29	350
		32.8	67.3	53.1	39.2	58.2
NO	2	39	122	45	45	251
		67.2	32.7	46.9	60.8	41.8
Column Total		58	373	96	74	601
		9.7	62.1	16.0	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
40.12593	3	.0000	24.223	None

Number of Missing Observations = 5



APPENDIX C

SPSS/PC+

Crosstabulation: V134 ECONOMIC INFORMATION

		Count	ACADEMIC	INDUS-	GOVT	INASA		
V143->	Col Pct	NON-PROFIT	TRIAL				Row	
		1	2	4	5	Total		
V134		-----+-----+-----+-----+-----						
	1	10	117	24	13	164		
YES		17.2	31.4	4.7	17.6	27.2		
		-----+-----+-----+-----+-----						
	2	48	256	73	61	438		
NO		82.8	68.6	75.3	82.4	72.8		
		-----+-----+-----+-----+-----						
	Column	58	373	97	74	602		
	Total	9.6	62.0	16.1	12.3	100.0		

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	----	-----	-----	-----
9.92916	3	.0192	15.801	None

Number of Missing Observations = 4

SPSS/PC+

Crosstabulation: V135 TECHNICAL SPECIFICATIONS

		Count	ACADEMIC	INDUS-	GOVT	INASA		
V143->	Col Pct	NON-PROFIT	TRIAL				Row	
		1	2	4	5	Total		
V135		-----+-----+-----+-----+-----						
	1	23	248	49	39	359		
YES		39.7	66.5	50.5	52.7	59.6		
		-----+-----+-----+-----+-----						
	2	35	125	48	35	243		
NO		60.3	33.5	49.5	47.3	40.4		
		-----+-----+-----+-----+-----						
	Column	58	373	97	74	602		
	Total	9.6	62.0	16.1	12.3	100.0		

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	----	-----	-----	-----
21.72406	3	.0001	23.412	None

Number of Missing Observations = 4

APPENDIX C  
SPSS/PC+

Crosstabulation: V138 USE ELECTRONIC DATA BASES TO FIND CITATI

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	RIAL			
V138		1	2	4	5	
YES	1	36	144	40	45	265
		62.1	38.7	41.2	60.8	44.1
NO	2	22	228	57	29	336
		37.9	61.3	58.8	39.2	55.9
Column Total		58	372	97	74	601
		9.7	61.9	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
20.68692	3	.0001	25.574	None

Number of Missing Observations = 5

APPENDIX C  
CROSS TABULATIONS  
PART B

Not statistically significant at  $P < .05$

SPSS/PC+

Crosstabulation: V1 IMPORTANCE OF COMMUNICATING TECH INFO IN

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFITRIAL				
		1	2	4	5	
VERY IMPORTANT	1	54	337	83	67	541
		93.1	89.9	85.6	91.8	89.7
SOMEWHAT IMPOR	2	3	38	13	5	59
		5.2	10.1	13.4	6.8	9.8
NOT AT ALL IMPOR	3	1		1	1	3
		1.7		1.0	1.4	.5
Column Total		58	375	97	73	603
		9.6	62.2	16.1	12.1	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
8.83476	6	.1831	.289	4 OF 12 ( 33.3%)

Number of Missing Observations = 3

SPSS/PC+

Crosstabulation: V2 HOURS/WEEK COMMUNICATING TO OTHER

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFITRIAL				
		1	2	4	3	
5 hrs or less	5	10	58	18	16	102
		17.2	15.7	18.8	22.2	17.1
6 to 10 hrs	10	12	125	26	26	189
		20.7	33.9	27.1	36.1	31.8
11 to 20 hrs	20	29	144	40	23	236
		50.0	39.0	41.7	31.9	39.7
21 hrs or more	21	7	42	12	7	68
		12.1	11.4	12.5	9.7	11.4
Column Total		58	369	96	72	595
		9.7	62.0	16.1	12.1	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
8.59357	9	.4756	6.629	None

Number of Missing Observations = 11

APPENDIX C

SPSS/PC+

Crosstabulation: V3 HOURS/WEEK WITH COMMUNICATIONS FROM OTHE

V143->	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V3		1	2	4	5	
5 hrs or less	5	15	76	21	14	126
		25.9	20.5	21.9	19.4	21.1
6 to 10 hrs	10	20	140	30	31	221
		34.5	37.8	31.3	43.1	37.1
11 to 20 hrs	20	19	127	30	21	197
		32.8	34.3	31.3	29.2	33.1
21 hrs or more	21	4	27	15	6	52
		6.9	7.3	15.6	8.3	8.7
Column Total		58	370	96	72	596
		9.7	62.1	16.1	12.1	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
9.47693	9	.3945	5.060	None

Number of Missing Observations = 10

SPSS/PC+

Crosstabulation: V4 CHANGE IN COMM TO OTHERS

V143->	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V4		1	2	4	5	
INCREASED	1	45	264	66	57	432
		77.6	70.6	68.0	77.0	71.6
STAYED THE SAME	2	10	56	15	12	93
		17.2	15.0	15.5	16.2	15.4
DECREASED	3	3	54	16	5	78
		5.2	14.4	16.5	6.8	12.9
Column Total		58	374	97	74	603
		9.6	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
7.51219	6	.2761	7.502	None

Number of Missing Observations = 3

APPENDIX C  
SPSS/PC+

Crosstabulation: V5 CHANGE IN COMM WITH OTHERS

V143-)	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Total	Row
V5		1	2	4	5		
INCREASED	1	34	225	57	50	366	61.2
		59.6	60.6	59.4	67.6		
STAYED THE SAME	2	18	92	25	20	155	25.9
		31.6	24.8	26.0	27.0		
DECREASED	3	5	54	14	4	77	12.9
		8.8	14.6	14.6	5.4		
Column Total		57	371	96	74	598	100.0
		9.5	62.0	16.1	12.4		

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. ( 5
6.48625	6	.3710	7.339	None

Number of Missing Observations = 8

SPSS/PC+

Crosstabulation: V34 HELP FROM TECH WRITERS

V143-)	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Total	Row
V34		1	2	4	5		
ALWAYS	1	1	3	2	3	9	1.6
		1.9	.8	2.1	4.3		
USUALLY	2	1	15	6	6	28	4.9
		1.9	4.2	6.4	8.7		
SOMETIMES	3	17	148	31	35	231	40.0
		31.5	41.1	33.0	50.7		
NEVER	4	35	194	55	25	309	53.6
		64.8	53.9	58.5	36.2		
Column Total		54	360	94	69	577	100.0
		9.4	62.4	16.3	12.0		

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. ( 5
18.59815	9	.0288	.842	6 OF 16 ( 37.5%)

Number of Missing Observations = 29

APPENDIX C  
SPSS/PC+

Crosstabulation: V35 HELP FROM THESAURUS/Dictionary

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row
Col Pct	INON-PROFIT	TRIAL				Total
	1	2	4	5		
V35	-----+-----+-----+-----+-----+-----+-----					
ALWAYS	1	13	67	27	20	127
		23.2	18.1	27.8	28.2	21.4
USUALLY	2	10	117	25	22	174
		17.9	31.6	25.8	31.0	29.3
SOMETIMES	3	27	152	42	27	248
		48.2	41.1	43.3	38.0	41.8
NEVER	4	6	34	3	2	45
		10.7	9.2	3.1	2.8	7.6
Column Total	56	370	97	71	594	
	9.4	62.3	16.3	12.0	100.0	

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
16.61311	9	.0551	4.242	1 OF 16 ( 6.3%)

Number of Missing Observations = 12

SPSS/PC+

Crosstabulation: V36 HELP FROM STYLE MANUAL

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row
Col Pct	INON-PROFIT	TRIAL				Total
	1	2	4	5		
V36	-----+-----+-----+-----+-----+-----+-----					
ALWAYS	1	1	6		2	9
		1.9	1.7		3.0	1.6
USUALLY	2	1	15	7	4	27
		1.9	4.2	7.4	6.0	4.7
SOMETIMES	3	21	124	40	20	205
		38.9	34.3	42.6	29.9	35.6
NEVER	4	31	216	47	41	335
		57.4	59.8	50.0	61.2	58.2
Column Total	54	361	94	67	576	
	9.4	62.7	16.3	11.6	100.0	

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
8.87830	9	.4486	.844	6 OF 16 ( 37.5%)

Number of Missing Observations = 30

APPENDIX C

SPSS/PC+

Crosstabulation: V37 HELP FROM A GRAMMAR HOTLINE

V143-)	Count	ACADEMIC	INDUS-	GOVT	NASA	Row Total
Col Pct	NON-PROFIT	TRIAL				
V37	1	2	4	5		
ALWAYS	1	.3				.2
USUALLY	2	.3	2.2	1.5		.7
SOMETIMES	3	3.9	5.0	7.5	6.0	5.5
NEVER	4	49	337	84	62	532
		96.1	94.4	90.3	92.5	93.7
Column Total	51	357	93	67	568	
	9.0	62.9	16.4	11.8	100.0	

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
6.48327	9	.6907	.090	10 OF 16 ( 62.5%)

Number of Missing Observations = 38

APPENDIX C

SPSS/PC+

Crosstabulation: V38 HOW IS YOUR ARTWORK PREPARED

V143->	Count	ACADEMIC	INDUS-	GOVT	NASA	Row
Col Pct	NON-PROFIT	TRIAL				Total
V38	1	4	45	10	3	62
DO OWN ARTWORK W	7.1	12.1	10.4	4.1		10.4
2	22	113	38	32		205
DO ARTWORK WITH	39.3	30.3	39.6	43.2		34.2
3	12	62	12	14		100
GRAPHICS DEPT DO	21.4	16.6	12.5	18.9		16.7
4	15	120	28	19		182
I & GRAPHICS DEP	26.8	32.2	29.2	25.7		30.4
5	2	24	6	6		38
SECRETARY DOES I	3.6	6.4	6.3	8.1		6.3
6	1	9	2			12
PREPARED ELSEWHE	1.8	2.4	2.1			2.0
Column Total	56	373	96	74		599
	9.3	62.3	16.0	12.4		100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
15.17671	15	.4388	1.122	5 OF 24 ( 20.8%)

Number of Missing Observations = 7



APPENDIX C

SPSS/PC+

Crosstabulation: V40 HOW HELPFUL WAS TECH COURSE

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V40		1	2	4	5	
A LOT	1	6	123	29	16	174
		20.7	47.3	40.3	32.0	42.3
A LITTLE	2	22	128	40	33	223
		75.9	49.2	55.6	66.0	54.3
DID NOT HELP	3	1	9	3	1	14
		3.4	3.5	4.2	2.0	3.4
Column Total		29	260	72	50	411
		7.1	63.3	17.5	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
11.47502	6	.0748	.988	3 OF 12 ( 25.0%)

Number of Missing Observations = 195

SPSS/PC+

Crosstabulation: V41 DEFINING COMM PURPOSE

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V41		1	2	4	5	
YES	1	47	346	8	66	546
		83.9	92.3	89.1	89.2	90.7
NO	2	9	29	10	8	56
		16.1	7.7	10.3	10.8	9.3
Column Total		56	375	97	74	602
		9.3	62.3	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
4.45165	3	.2166	5.209	None

Number of Missing Observations = 4

APPENDIX C  
SPSS/PC+

Crosstabulation: V42 ASSESSING READERS NEEDS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	NASA	Row Total
		NON-PROFIT	TRIAL			
V42		1	2	4	5	
YES	1	42	313	81	54	490
		75.0	83.9	83.5	74.0	81.8
NO	2	14	60	16	19	109
		25.0	16.1	16.5	26.0	18.2
Column Total		56	373	97	73	599
		9.3	62.3	16.2	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
6.05367	3	.1090	10.190	None

Number of Missing Observations = 7

SPSS/PC+

Crosstabulation: V43 ORGANIZING INFORMATION

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	NASA	Row Total
		NON-PROFIT	TRIAL			
V43		1	2	4	5	
YES	1	52	363	95	71	581
		91.2	96.8	99.0	95.9	96.5
NO	2	5	12	1	3	21
		8.8	3.2	1.0	4.1	3.5
Column Total		57	375	96	74	602
		9.5	62.3	15.9	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
6.59630	3	.0859	1.988	3 OF 8 ( 37.5%)

Number of Missing Observations = 4

APPENDIX C

SPSS/PC+

Crosstabulation: V44 DEVELOPING PARAGRAPHS

V143->	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V44		-----+				
YES	1	51	320	84	64	519
		89.5	85.3	87.5	86.5	86.2
		-----+				
NO	2	6	55	12	10	83
		10.5	14.7	12.5	13.5	13.8
		-----+				
	Column Total	57	375	96	74	602
		9.5	62.3	15.9	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
.89240	3	.8273	7.859	None

Number of Missing Observations = 4

SPSS/PC+

Crosstabulation: V45 WRITING SENTENCES

V143->	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V45		-----+				
YES	1	50	290	84	59	483
		87.7	77.3	86.6	79.7	80.1
		-----+				
NO	2	7	85	13	15	120
		12.3	22.7	13.4	20.3	19.9
		-----+				
	Column Total	57	375	97	74	603
		9.5	62.2	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
6.45241	3	.0916	11.343	None

Number of Missing Observations = 3

APPENDIX C

SPSS/PC+

Crosstabulation: V46 USING STANDARD ENGLISH GRAMMAR

V143->	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V46		1	2	4	5	
YES	1	49	283	79	58	469
		86.0	75.7	81.4	78.4	77.9
NO	2	8	91	18	16	133
		14.0	24.3	18.6	21.6	22.1
Column Total		57	374	97	74	602
		9.5	62.1	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
3.95342	3	.2665	12.593	None

Number of Missing Observations = 4

SPSS/PC+

Crosstabulation: V47 NOTETAKING AND QUOTING

V143->	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V47		1	2	4	5	
YES	1	32	180	50	37	299
		56.1	48.5	52.1	50.7	50.1
NO	2	25	191	46	36	298
		43.9	51.5	47.9	49.3	49.9
Column Total		57	371	96	73	597
		9.5	62.1	16.1	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
1.36449	3	.7139	28.452	None

Number of Missing Observations = 9

APPENDIX C  
SPSS/PC+

Crosstabulation: V48 EDITING AND REVISING

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V48		-----+-----+-----+-----+-----+				
YES	1	45	285	80	58	468
		78.9	76.2	82.5	78.4	77.7
		-----+-----+-----+-----+-----+				
NO	2	12	89	17	16	134
		21.1	23.8	17.5	21.6	22.3
		-----+-----+-----+-----+-----+				
	Column Total	57	374	97	74	602
		9.5	62.1	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
1.83224	3	.6079	12.688	None

Number of Missing Observations = 4

SPSS/PC+

Crosstabulation: V49 CHOOSING WORDS

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V49		-----+-----+-----+-----+-----+				
YES	1	46	311	79	55	491
		80.7	82.9	81.4	75.3	81.6
		-----+-----+-----+-----+-----+				
NO	2	11	64	18	18	111
		19.3	17.1	18.6	24.7	18.4
		-----+-----+-----+-----+-----+				
	Column Total	57	375	97	73	602
		9.5	62.3	16.1	12.1	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
2.37559	3	.4982	10.510	None

Number of Missing Observations = 4

APPENDIX C

SPSS/PC+

Crosstabulation: V50 USING INFO TECHNOLOGY

V143->	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V50		-----+				
YES	1	31	230	62	42	365
		54.4	61.8	63.9	56.8	60.8
		-----+				
NO	2	26	142	35	32	235
		45.6	38.2	36.1	43.2	39.2
		-----+				
	Column Total	57	372	97	74	600
		9.5	62.0	16.2	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
2.05229	3	.5616	22.325	None

Number of Missing Observations = 6

SPSS/PC+

Crosstabulation: V51 ABBREVIATIONS

V143->	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V51		-----+				
YES	1	28	187	58	31	304
		52.8	50.8	59.8	42.5	51.4
		-----+				
NO	2	25	181	39	42	287
		47.2	49.2	40.2	57.5	48.6
		-----+				
	Column Total	53	368	97	73	591
		9.0	62.3	16.4	12.4	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	-----	-----	-----	-----
5.16209	3	.1603	25.738	None

Number of Missing Observations = 15

APPENDIX C  
SPSS/PC+

Crosstabulation: V52 ACRONYMS

V143-)	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V52		1	2	4	5	
YES	1	26	182	52	35	295
		49.1	49.3	53.6	47.9	49.8
NO	2	27	187	45	38	297
		50.9	50.7	46.4	52.1	50.2
Column Total		53	369	97	73	592
		9.0	62.3	16.4	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
.70831	3	.8712	26.410	None

Number of Missing Observations = 14

SPSS/PC+

Crosstabulation: V53 CAPITALIZATION

V143-)	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V53		1	2	4	5	
YES	1	37	227	57	39	360
		69.8	61.5	59.4	53.4	60.9
NO	2	16	142	39	34	231
		30.2	38.5	40.6	46.6	39.1
Column Total		53	369	96	73	591
		9.0	62.4	16.2	12.4	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
3.63394	3	.3038	20.716	None

Number of Missing Observations = 15

APPENDIX C  
SPSS/PC+

Crosstabulation: V54 NUMBERS

V143→	Count		ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col	Pct	NON-PROFIT	TRIAL			
V54			1	2	4	5	
YES	1	54.7	29	181	47	29	286
							48.8
NO	2	45.3	24	182	50	44	300
							51.2
Column Total			53	363	97	73	586
			9.0	61.9	16.6	12.5	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
3.31685	3	.3453	25.867	None

Number of Missing Observations = 20

SPSS/PC+

Crosstabulation: V55 PUNCTUATION

V143→	Count		ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col	Pct	NON-PROFIT	TRIAL			
V55			1	2	4	5	
YES	1	84.9	45	275	74	55	449
							75.8
NO	2	15.1	8	94	23	18	143
							24.2
Column Total			53	369	97	73	592
			9.0	62.3	16.4	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
2.74599	3	.4325	12.802	None

Number of Missing Observations = 14



APPENDIX C

SPSS/PC+

Crosstabulation: V56 REFERENCES

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V56		-----+				
YES	1	44	279	78	53	454
		83.0	75.8	80.4	72.6	76.7
		-----+				
NO	2	9	90	19	20	138
		17.0	24.4	19.6	27.4	23.3
		-----+				
	Column Total	53	369	97	73	592
		9.0	62.3	16.4	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
2.86238	3	.4133	12.355	None

Number of Missing Observations = 14

SPSS/PC+

Crosstabulation: V57 SPELLING

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V57		-----+				
YES	1	38	247	62	39	386
		71.7	66.9	63.9	53.4	65.2
		-----+				
NO	2	15	122	35	34	206
		28.3	33.1	36.1	46.6	34.8
		-----+				
	Column Total	53	369	97	73	592
		9.0	62.3	16.4	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
6.00903	3	.1112	18.443	None

Number of Missing Observations = 14

APPENDIX C

SFSS/PC+

Crosstabulation: V58 SYMBOLS

V143→	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V58		1	2	4	5	
YES	1	31	214	57	37	339
		58.5	58.0	58.8	51.4	57.4
NO	2	22	155	40	35	252
		41.5	42.0	41.2	48.6	42.6
Column Total		53	369	97	72	591
		9.0	62.4	16.4	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
1.21609	3	.7491	22.599	None

Number of Missing Observations = 15

SPSS/PC+

Crosstabulation: V60 LETTERS

V143→	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V60		1	2	4	5	
YES	1	40	248	77	46	411
		70.2	67.4	80.2	63.9	69.3
NO	2	17	120	19	26	182
		29.8	32.6	19.8	36.1	30.7
Column Total		57	368	96	72	593
		9.6	62.1	16.2	12.1	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
7.01196	3	.0715	17.494	None

Number of Missing Observations = 13

APPENDIX C  
SPSS/PC+

Crosstabulation: V61 MEMOS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	NASA	Row Total
		NON-PROFIT	TRIAL			
V61		1	2	4	5	
YES	1	38 66.7	299 81.0	73 76.0	52 72.2	462 77.8
NO	2	19 33.3	70 19.0	23 24.0	20 27.8	132 22.2
	Column Total	57 9.6	369 62.1	96 16.2	72 12.1	594 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
7.78239	3	.0507	12.667	None

Number of Missing Observations = 12

SPSS/PC+

Crosstabulation: V64 LITERATURE REVIEWS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	NASA	Row Total
		NON-PROFIT	TRIAL			
V64		1	2	4	5	
YES	1	28 49.1	124 34.1	39 40.6	29 40.3	220 37.4
NO	2	29 50.9	240 65.9	57 59.4	43 59.7	369 62.6
	Column Total	57 9.7	364 61.8	96 16.3	72 12.2	589 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
5.75755	3	.1240	21.290	None

Number of Missing Observations = 17

APPENDIX C  
SPSS/PC+

Crosstabulation: V65 MANUALS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V65		-----+				
YES	1	23	181	53	30	287
		40.4	49.2	55.2	41.7	48.4
		-----+				
NO	2	34	187	43	42	306
		59.6	50.8	44.8	58.3	51.6
		-----+				
	Column Total	57	368	96	72	593
		9.6	62.1	16.2	12.1	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
4.65831	3	.1986	27.587	None

Number of Missing Observations = 13

SPSS/PC+

Crosstabulation: V66 NEWSLETTER ARTICLES

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V66		-----+				
YES	1	13	83	30	17	143
		22.8	22.9	31.3	23.6	24.4
		-----+				
NO	2	44	279	66	55	444
		77.2	77.1	68.8	76.4	75.6
		-----+				
	Column Total	57	362	96	72	587
		9.7	61.7	16.4	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
2.97252	3	.3959	13.886	None

Number of Missing Observations = 19

APPENDIX C  
SPSS/PC+

Crosstabulation: V67 ORAL PRESENTATIONS

V143->	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V67		-----+				
YES	1	52	353	93	69	567
		91.2	95.7	96.9	95.8	95.5
		-----+				
NO	2	5	16	3	3	27
		8.8	4.3	3.1	4.2	4.5
		-----+				
	Column Total	57	369	96	72	594
		9.6	62.1	16.2	12.1	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	----	-----	-----	-----
2.85423	3	.4146	2.591	3 OF 8 ( 37.5%)

Number of Missing Observations = 12

SPSS/PC+

Crosstabulation: V71 INVESTIGATIVE REPORTS

V143->	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
		1	2	4	5	
V71		-----+				
YES	1	27	236	60	44	367
		56.3	68.4	64.5	67.7	66.6
		-----+				
NO	2	21	109	33	21	184
		43.8	31.6	35.5	32.3	33.4
		-----+				
	Column Total	48	345	93	65	551
		8.7	62.6	16.9	11.8	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
-----	----	-----	-----	-----
3.03398	3	.3864	16.029	None

Number of Missing Observations = 55

APPENDIX C

SPSS/PC+

Crosstabulation: V72 LABORATORY REPORTS

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	RIAL			
		1	2	4	5	
V72		-----+				
YES	1	36	245	66	44	391
		75.0	70.8	71.0	67.7	70.8
		-----+				
NO	2	12	101	27	21	161
		25.0	29.2	29.0	32.3	29.2
		-----+				
Column:		48	346	93	65	552
Total		8.7	62.7	16.8	11.8	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
.71468	3	.8697	14.000	None

Number of Missing Observations = 54

SPSS/PC+

Crosstabulation: V73 PROGRESS REPORTS

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	RIAL			
		1	2	4	5	
V73		-----+				
YES	1	42	277	75	45	439
		87.5	79.6	79.8	69.2	79.1
		-----+				
NO	2	6	71	19	20	116
		12.5	20.4	20.2	30.8	20.9
		-----+				
Column		48	348	94	65	555
Total		8.6	62.7	16.9	11.7	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
0.95714	3	.1137	10.032	None

Number of Missing Observations = 51

APPENDIX C  
SPSS/PC+

Crosstabulation: V74 TEST REPORTS

V143-)	Count	IACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V74		1	2	4	5	
YES	1	33	281	74	47	435
		68.8	80.7	79.6	72.3	78.5
NO	2	15	67	19	18	119
		31.3	19.3	20.4	27.7	21.5
Column Total		48	348	93	65	554
		8.7	62.8	16.8	11.7	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
5.28803	3	.1519	10.310	None

Number of Missing Observations = 52

SPSS/PC+

Crosstabulation: V76 TROUBLE REPORTS

V143-)	Count	IACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V76		1	2	4	5	
YES	1	17	185	51	28	281
		35.4	53.3	54.8	43.1	50.8
NO	2	31	162	42	37	272
		64.6	46.7	45.2	56.9	49.2
Column Total		48	347	93	65	553
		8.7	62.7	16.8	11.8	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
7.5808	3	.0555	23.609	None

Number of Missing Observations = 53

APPENDIX C

SPSS/PC+

Crosstabulation: V78 HAS COMPUTER TECH INCREASED ABILITY TO C

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V78		1	2	4	5	
A LOT	1	30	200	63	49	342
		57.7	59.2	67.7	70.0	61.8
A LITTLE	2	18	120	24	20	182
		34.6	35.5	25.8	28.6	32.9
NOT AT ALL	3	4	18	6	1	29
		7.7	5.3	6.5	1.4	5.2
Column Total		52	338	93	70	553
		9.4	61.1	16.8	12.7	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with < 5
7.17442	6	.3050	2.727	3 OF 12 ( 25.0%)

Number of Missing Observations = 53

SPSS/PC+

Crosstabulation: V79 WORD PROCESSING

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		NON-PROFIT	TRIAL			
V79		1	2	4	5	
YES	1	48	309	92	70	519
		94.1	92.0	98.9	100.0	94.4
NO	2	3	27	1		31
		5.9	8.0	1.1		5.6
Column Total		51	336	93	70	550
		9.3	61.1	16.9	12.7	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
11.46137	3	.0095	2.875	2 OF 8 ( 25.0%)

Number of Missing Observations = 56



APPENDIX C

SPSS/PC+

Crosstabulation: V80 OUTLINERS AND PROMPTERS

V143→	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V80		1	2	4	5	
YES	1	4	41	7	7	59
		7.8	12.4	7.6	10.0	10.8
NO	2	47	290	85	63	485
		92.2	87.6	92.4	90.0	89.2
Column Total		51	331	92	70	544
		9.4	60.8	16.9	12.9	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
2.33716	3	.5054	5.531	None

Number of Missing Observations = 62

SPSS/PC+

Crosstabulation: V81 GRAMMAR AND STYLE CHECKERS

V143→	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V81		1	2	4	5	
YES	1	3	35	17	7	62
		5.9	10.5	18.5	10.0	11.4
NO	2	48	297	75	63	483
		94.1	89.5	81.5	90.0	88.6
Column Total		51	332	92	70	545
		9.4	60.9	16.9	12.8	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
6.49602	3	.0901	5.802	None

Number of Missing Observations = 61

APPENDIX C

SPSS/PC+

Crosstabulation: V84 BUSINESS GRAPHICS

V143→	Count Col Pct	ACADEMIC NON-PROFITRIAL	INDUS- 2	GOVT 4	INASA 5	Row Total
V84						
YES	1 31.4	16 39.6	132 60.4	33 64.1	16 77.1	197 36.1
NO	2 68.6	35 60.4	201 60.4	59 64.1	54 77.1	349 63.9
	Column Total	51 9.3	333 61.0	92 16.8	70 12.8	546 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
7.62830	3	.0544	18.401	None

Number of Missing Observations = 60

SPSS/PC+

Crosstabulation: V67 USE DESK-TOP PUBLISHING

V143→	Count Col Pct	ACADEMIC NON-PROFITRIAL	INDUS- 2	GOVT 4	INASA 5	Row Total
V67						
ALWAYS	1 7.7	4 11.1	37 11.1	10 10.9	14 20.3	65 11.9
USUALLY	2 21.2	11 20.4	68 20.4	18 19.6	15 21.7	112 20.5
SOMETIMES	3 25.0	13 27.2	91 27.2	23 25.0	20 29.0	147 26.9
NEVER	4 46.2	24 41.3	138 41.3	41 41.6	20 29.0	223 40.8
	Column Total	52 9.5	334 61.1	92 16.8	69 12.6	547 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
8.62859	9	.4722	6.179	None

Number of Missing Observations = 59

APPENDIX C

SPSS/PC+

Crosstabulation: V88 AUDIO TAPES/CASSETTES

V143→	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V88		1	2	4	5	
1	10	76	24	7	117	20.1
ALREADY USE IT	18.5	21.0	25.3	10.0		
2	18	109	22	23	172	29.6
DON'T BUT MAY	33.3	30.1	23.2	32.9		
3	26	177	49	40	292	50.3
DOUBT IF I WILL	48.1	48.9	51.6	57.1		
Column Total	54	362	95	70	581	100.0
	9.3	62.3	16.4	12.0		

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
7.75757	6	.2564	10.874	None

Number of Missing Observations = 25

SPSS/PC+

Crosstabulation: V90 VIDEO TAPE

V143→	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V90		1	2	4	5	
1	21	167	46	40	274	46.4
ALREADY USE IT	37.5	45.8	47.9	54.8		
2	27	150	32	25	234	39.7
DON'T BUT MAY	48.2	41.1	33.3	34.2		
3	8	48	18	8	82	13.9
DOUBT IF I WILL	14.3	13.2	18.8	11.0		
Column Total	56	365	96	73	590	100.0
	9.5	61.9	16.3	12.4		

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
7.10679	6	.3111	7.783	None

Number of Missing Observations = 16

APPENDIX C

SPSS/PC+

Crosstabulation: V92 FLOPPY DISKS

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		1	2	4	5	
V92						
1	40	268	76	56	440	
ALREADY USE IT	70.2	73.0	79.2	78.9	74.5	
2	13	74	17	8	112	
DON'T BUT MAY	22.8	20.2	17.7	11.3	19.0	
3	4	25	3	7	39	
DOUBT IF I WILL	7.0	6.8	3.1	9.9	6.6	
Column Total	57	367	96	71	591	
	9.6	62.1	16.2	12.0	100.0	

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
6.67502	6	.3519	3.761	2 OF 12 ( 16.7%)

Number of Missing Observations = 15

SPSS/PC+

Crosstabulation: V93 COMPUTER CASSETTE TAPES

V143-)	Count Col Pct	ACADEMIC	INDUS-	GOVT	INASA	Row Total
		1	2	4	5	
V93						
1	12	84	22	10	128	
ALREADY USE IT	22.6	23.8	23.4	14.7	22.5	
2	19	136	39	28	222	
DON'T BUT MAY	35.8	38.5	41.5	41.2	39.1	
3	22	133	33	30	218	
DOUBT IF I WILL	41.5	37.7	35.1	44.1	38.4	
Column Total	53	353	94	68	568	
	9.3	62.1	16.5	12.0	100.0	

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
3.54215	6	.734	11.944	None

Number of Missing Observations = 38

APPENDIX C

SPSS/PC+

Crosstabulation: V96 FAX OR TELEX

V143->	Count	ACADEMIC	INDUS-	GOVT	INASA	Row
Col Pct	NON-PROFIT	TRIAL				Total
V96	1	32	330	61	57	500
ALREADY USE IT	57.1	89.7	84.4	78.1	84.3	
2	16	25	10	13	64	
DON'T BUT MAY	28.6	6.8	10.4	17.8	10.8	
3	8	13	5	3	29	
DOUBT IF I WILL	14.3	3.5	5.2	4.1	4.9	
Column Total	56	368	96	73	593	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
43.29548	6	.0000	2.739	3 OF 12 ( 25.0%)

Number of Missing Observations = 13

SPSS/PC+

Crosstabulation: V100 MICROGRAPHICS/FORMS

V143->	Count	ACADEMIC	INDUS-	GOVT	INASA	Row
Col Pct	NON-PROFIT	TRIAL				Total
V100	1	9	63	14	13	99
ALREADY USE IT	16.7	18.3	15.7	19.1	17.8	
2	19	157	45	24	245	
DON'T BUT MAY	35.2	45.5	50.6	35.3	44.1	
3	26	125	30	31	212	
DOUBT IF I WILL	48.1	36.2	33.7	45.6	38.1	
Column Total	54	345	89	68	556	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
6.72515	6	.3470	9.615	None

Number of Missing Observations = 50

APPENDIX C

SPSS/PC+

Crosstabulation: V101 LASER/VIDEO DISC/CD-ROM

V143->	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V101		1	2	4	5	
ALREADY USE IT	1	3	17	8	7	35
		5.6	4.8	8.7	10.0	6.2
DON'T BUT MAY	2	34	232	59	45	369
		63.0	65.7	63.0	64.3	64.9
DOUBT IF I WILL	3	17	104	26	18	165
		31.5	29.5	28.3	25.7	29.0
Column Total		54	353	92	70	569
		9.5	62.0	16.2	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
4.24789	6	.6432	3.322	2 DF 12 (16.7%)

Number of Missing Observations = 37

SPSS/PC+

Crosstabulation: V103 PERSONAL KNOWLEDGE

V143->	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V103		1	2	4	5	
ALWAYS	1	25	147	46	37	255
		43.9	39.4	47.9	50.7	42.6
USUALLY	2	25	183	37	31	276
		43.9	49.1	38.5	42.5	46.1
SOMETIMES	3	7	43	13	5	68
		12.3	11.5	13.0	6.8	11.4
Column Total		57	373	96	73	599
		9.5	62.3	16.0	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
6.60523	6	.3589	6.471	None

Number of Missing Observations = 7

APPENDIX C

SPSS/P +

Crosstabulation: V104 INFORMAL DISCUSSIONS WITH COLLEAGUES

V143→	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V104		1	2	4	5	
ALWAYS	1	7 12.3	71 19.0	24 24.7	18 24.7	120 20.0
USUALLY	2	29 50.9	220 59.0	56 57.7	38 52.1	343 57.2
SOMETIMES	3	20 35.1	81 21.7	17 17.5	17 23.3	135 22.5
NEVER	4	1 1.8	1 .3			2 .3
Column Total		57 9.5	373 62.2	97 16.2	73 12.2	600 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
13.97314	9	.1233	.190	4 OF 16 ( 25.0%)

Number of Missing Observations = 6

SPSS/PC+

Crosstabulation: V106 WITH EXPERTS IN ORGANIZATIONS

V143→	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V106		1	2	4	5	
ALWAYS	1	9 16.4	69 18.4	16 16.7	18 24.7	112 18.7
USUALLY	2	18 32.7	196 52.4	53 55.2	37 50.7	304 50.8
SOMETIMES	3	27 49.1	106 28.3	24 25.0	18 24.7	175 29.3
NEVER	4	1 1.8	3 .8	3 3.1		7 1.2
Column Total		55 9.2	374 62.5	96 16.1	73 12.2	598 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
19.09896	9	.0244	.644	4 OF 16 ( 25.0%)

Number of Missing Observations = 8

APPENDIX C  
SPSS/PC+

Crosstabulation: V107 WITH EXPERTS OUTSIDE ORGANIZATION

V143->	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V107						
ALWAYS	1	4	22	6	5	37
		7.0	5.9	6.2	6.8	6.2
USUALLY	2	11	59	22	23	115
		19.3	15.9	22.7	31.5	19.2
SOMETIMES	3	35	257	65	40	397
		61.4	69.1	67.0	54.8	66.3
NEVER	4	7	34	4	5	50
		12.3	9.1	4.1	6.8	8.3
	Column Total	57	372	97	73	599
		9.5	62.1	16.2	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
14.40566	9	.1086	3.521	3 OF 16 ( 18.8%)

Number of Missing Observations = 7

SPSS/PC+

Crosstabulation: V108 TECH REPORTS-GOVT

V143->	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V108						
ALWAYS	1	5	11	13	6	35
		8.9	3.0	13.4	8.1	5.8
USUALLY	2	20	79	36	30	165
		35.7	21.2	37.1	40.5	27.5
SOMETIMES	3	30	250	45	38	363
		53.6	67.2	46.4	51.4	60.6
NEVER	4	1	32	3		36
		1.8	8.6	3.1		6.0
	Column Total	56	372	97	74	599
		9.3	62.1	16.2	12.4	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
49.89497	9	.0000	3.272	4 OF 16 ( 25.0%)

Number of Missing Observations = 7



APPENDIX C

SPSS/PC+

Crosstabulation: V109 TECH REPORTS-OTHER

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
Col	Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V109						
ALWAYS	1	4	12	11	7	34
		7.1	3.2	11.3	9.7	5.7
USUALLY	2	22	98	33	24	177
		39.3	26.3	34.0	33.3	29.6
SOMETIMES	3	30	253	47	38	368
		53.6	67.8	48.5	52.8	61.5
NEVER	4		10	6	3	19
			2.7	6.2	4.2	3.2
Column Total		56	373	97	72	598
		9.4	62.4	16.2	12.0	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. ( 5
27.49947	9	.0012	1.779	5 OF 16 ( 31.3%)

Number of Missing Observations = 8

SPSS/PC+

Crosstabulation: V112 HANDBOOKS AND STANDARDS

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row Total
Col	Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V112						
ALWAYS	1	3	25	5	7	40
		5.6	6.8	5.2	9.7	6.8
USUALLY	2	15	100	32	17	164
		27.8	27.1	33.3	23.6	27.7
SOMETIMES	3	32	210	48	40	330
		59.3	56.9	50.0	55.6	55.8
NEVER	4	4	34	11	8	57
		7.4	9.2	11.5	11.1	9.6
Column Total		54	369	96	72	591
		9.1	62.4	16.2	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. ( 5
4.58519	9	.8689	3.655	2 OF 16 ( 12.5%)

Number of Missing Observations = 15

APPENDIX C

SPSS/PC+

Crosstabulation: V113 TECH INFO SOURCES/DATA BASES

V143→	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V113		1	2	4	5	
ALWAYS	1	.8	3	4		7
USUALLY	2	7.7	28	6	7	41
SOMETIMES	3	51.0	163	33	40	262
NEVER	4	49.0	171	53	25	274
Column Total		51	365	96	72	584
		8.7	62.5	16.4	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
21.94697	9	.0090	.611	5 OF 16 ( 31.3%)

Number of Missing Observations = 22

SPSS/PC+

Crosstabulation: V115 USE SCIENTIFIC AND TECH INFO

V143→	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V115		1	2	4	5	
YES	1	100.0	58	360	92	74
NO	2		13	5		18
Column Total		58	373	97	74	602
		9.6	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
5.95074	3	.1140	1.734	3 OF 8 ( 37.5%)

Number of Missing Observations = 4

APPENDIX C

SPSS/PC+

Crosstabulation: V116 EXPERIMENTAL TECHNIQUES

V143-)	Count	ACADEMIC	INDUS-	GOVT	NASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V116		-----+				
YES	1	38	216	60	49	363
		65.5	58.1	61.9	66.2	60.4
		-----+				
NO	2	20	156	37	25	238
		34.5	41.9	38.1	33.8	39.6
		-----+				
	Column Total	58	372	97	74	601
		9.7	61.9	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
2.61584	3	.4547	22.968	None

Number of Missing Observations = 5

SPSS/PC+

Crosstabulation: V119 COMPUTER PROGRAMS

V143-)	Count	ACADEMIC	INDUS-	GOVT	NASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
		1	2	4	5	
V119		-----+				
YES	1	49	301	75	61	486
		84.5	80.7	77.3	82.4	80.7
		-----+				
NO	2	9	72	22	13	116
		15.5	19.3	22.7	17.6	19.3
		-----+				
	Column Total	58	373	97	74	602
		9.6	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
1.38846	3	.7082	11.176	None

Number of Missing Observations = 4

APPENDIX C  
SPSS/PC+

Crosstabulation: V126 PRODUCE SCIENTIFIC AND TECH INFO

V143-)	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V126		1	2	4	5	
YES	1	57	340	87	71	555
		98.3	91.2	89.7	95.9	92.2
NO	2	1	33	10	3	47
		1.7	8.8	10.3	4.1	7.8
Column Total		58	373	97	74	602
		9.6	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
5.83412	3	.1200	4.528	1 OF 8 ( 12.5%)

Number of Missing Observations = 4

SPSS/PC+

Crosstabulation: V129 DESIGN PROCEDURES AND METHODS

V143-)	Count Col Pct	ACADEMIC NON-PROFIT	INDUS- TRIAL	GOVT	INASA	Row Total
V129		1	2	4	5	
YES	1	22	189	41	30	282
		37.9	50.7	43.2	40.5	47.0
NO	2	36	184	54	44	318
		62.1	49.3	56.8	59.5	53.0
Column Total		58	373	95	74	600
		9.7	62.2	15.8	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
5.73458	3	.1253	27.260	None

Number of Missing Observations = 6

APPENDIX C  
SPSS/PC+

Crosstabulation: V130 COMPUTER PROGRAMS

V143→	Count	ACADEMIC	INDUS-	GOVT	NASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V130		1	2	4	5	
YES	1	39	211	52	42	344
		67.2	56.6	53.6	56.8	57.1
NO	2	19	162	45	32	258
		32.8	43.4	46.4	43.2	42.9
Column Total		58	373	97	74	602
		9.6	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
2.96485	3	.3971	24.857	None

Number of Missing Observations = 4

SPSS/PC+

Crosstabulation: V136 PATENTS

V143→	Count	ACADEMIC	INDUS-	GOVT	NASA	Row Total
	Col Pct	NON-PROFIT	TRIAL			
V136		1	2	4	5	
YES	1	11	75	8	15	109
		19.0	20.1	8.2	20.3	18.1
NO	2	47	298	89	59	493
		81.0	79.9	91.8	79.7	81.9
Column Total		58	373	97	74	602
		9.6	62.0	16.1	12.3	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
7.62811	3	.0544	10.502	None

Number of Missing Observations = 4

APPENDIX C

SPSS/PC+

Crosstabulation: V137 HOW OFTEN USE LIBRARY/TECH INFO CENTER

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA		Row
Col	Pct	NON-PROFIT	TRIAL				Total
V137		1	2	4	5		
DAILY	1	2	8	2			12
		3.4	2.1	2.1			2.0
2-6 TIMES A WEEK	2	11	32	12	5		60
		19.0	8.6	12.4	6.8		10.0
ONCE A WEEK	3	11	46	18	15		90
		19.0	12.3	18.6	20.3		15.0
2-3 TIMES A MONT	4	14	73	13	16		116
		24.1	19.6	13.4	21.6		19.3
ONCE A MONTH	5	10	60	20	12		102
		17.2	16.1	20.6	16.2		16.9
LESS THAN ONCE A	6	9	127	28	22		186
		15.5	34.0	28.5	29.7		30.9
DO NOT USE	7	1	27	4	4		36
		1.7	7.2	4.1	5.4		6.0
Column		58	373	97	74		602
Total		9.6	62.0	16.1	12.3		100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
26.26055	18	.0939	1.156	5 OF 28 ( 17.9%)

Number of Missing Observations = 4

APPENDIX C

SPSS/PC+

Crosstabulation: V139 HOW SEARCHES ARE DONE

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row
Col Pct	INON-PROFITRIAL	2	4	5	Total	
V139						
ALL MYSELF	1	4	12	1	1	18
		11.4	8.4	2.5	2.3	6.9
MOST MYSELF	2	9	24	6	3	42
		25.7	16.8	15.0	7.0	16.1
SELF/INTERMEDIAR	3	6	12	4	10	32
		17.1	8.4	10.0	23.3	12.3
MOST INTERMEDIAR	4	9	49	16	18	92
		25.7	34.3	40.0	41.9	35.2
ALL INTERMEDIARY	5	7	46	13	11	77
		20.0	32.2	32.5	25.6	29.5
Column		35	143	40	43	261
Total		23.4	54.8	15.3	16.5	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
18.56170	12	.0997	2.414	5 OF 20 ( 25.0%)

Number of Missing Observations = 345

SPSS/PC+

Crosstabulation: V140 GENDER

V143-)	Count	ACADEMIC	INDUS-	GOVT	INASA	Row
Col Pct	INON-PROFITRIAL	2	4	5	Total	
V140						
MALE	1	57	362	89	68	576
		98.3	96.3	91.8	91.9	95.2
FEMALE	2	1	14	8	6	29
		1.7	3.7	8.2	8.1	4.8
Column		58	376	97	74	605
Total		9.6	62.1	16.0	12.2	100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
6.45793	3	.0913	2.780	3 OF 8 ( 37.5%)

Number of Missing Observations = 1

## APPENDIX D

### OPEN-ENDED COMMENTS

Formal training during school, especially related to the requirements of the workplace (proposals, specifications, project reports, memos, technical papers and other documents that must be generated in the job environment). Oral communications is also important but probably is not as important as the writing.

Undergraduate engineer must be taught, then called upon to write technical articles and reports. Engineer must be able to accurately and efficiently communicate (spoken word, written word and via sketches) to other technical persons.

The process must start in elementary school. I see too many young engineers with poor writing and communication skills. This lack of ability prohibits adequate transfer of knowledge via communication, and it inhibits their own advancement in their careers.

Engineers need to acquire good oral presentation skills. A good way to accomplish this would be to (1) present a problem before a group of people (2) then present a resolution to the problem plus any alternatives.

Infinite pains should be taken to present concise, understandable information, especially in summaries and short (1/2 hour) oral presentations. Detailed and/or esoteric information should be reserved for articles, textbooks, or discussions among experts.

Most engineering students are not prepared to communicate in writing or orally - this includes those prepared in the U.S. as well as international students.

More emphasis during undergraduate studies on communication - oral and written. Much more emphasis on the basics - spelling, punctuation, sentence structure, report organization. Most new (and old) engineers are pathetic report writers - they must do better!

Expand and focus undergraduate coursework in the technical communications area. Importantly, such training should be put into actual practice in parallel and



## APPENDIX D

following-year work at both the undergraduate and graduate levels. Thesis requirements should probably be reemphasized.

Introduce undergrad course(s) in Technical Communication. Also, in laboratory courses correct the students' English.

Stress that effective communication is our most important and most difficult daily task.

Stress the importance of being able to communicate verbally as well as in writing in grammar and high school. One's ability to communicate will be what determines where one's career may go.

Stress undergrad course in written and oral communications.

Encourage engineering majors to read good works of literature and not just technical treatises.

In the past the engineering community has given de facto support to the proposition that engineers do not have to be well-developed communicators. This must stop. Providing more automated tools does little to improve the basic capability of a person to communicate effectively if he is already an adult who is functionally illiterate in English.

Provide on the job technical writing courses.

Teach engineers how to write effectively.

I strongly support a course (undergraduate level) which teaches organizational skills/techniques for report writing and oral presentations.

Part of the communication problem for young engineers is a "language barrier." What I learned at school and what I and my colleagues do at work are two completely different areas, requiring different "languages" and practices.

Ensure that engineers (especially) are literate in the English language. Many engineering curricula screen to downplay the humanities in general and English.

## APPENDIX D

composition in particular. Eschew Obfuscation eliminate unnecessary jargon (the same applies to our literature colleagues with long untranslated quotations from obscure and texts in "foreign" and often dead languages.

Have undergraduate students take more English classes.

It seems that I'm continually writing reports these days - I spend much time however, collaborating with my students on their theses and papers - I really wish some of them had a better background in general writing and grammar. This should be required for undergraduate engineers!! Certainly general rules of grammar and style should be "reviewed" (which are horribly lacking in high schools), and document organization should be called; i.e. figure out exactly what should be said and structure the document precisely such that it makes logical and sequential sense.

Include an effective communication course in the undergraduate school. Allow the master's thesis to be more real world and less realistic. Make undergraduates give technical papers as second author.

In my current position oral presentation is the most common and effective way of communicating my findings and analysis. Unfortunately, very little effort was made in my undergraduate career to prepare me for th's type of work. Aside from short presentations in my technical writing and engineering courses there were no courses available to teach the proper methods and techniques of public speaking. I feel ABET should require a public speaking course for engineering students. Very few people are comfortable speaking in front of an audience and the only way of overcoming this fear is by "doing."

Educate the technical community about technical communication. Reduce the use of specifications which outline how correspondence is to be formatted without concern for the specific purpose of the communication. Return the emphasis of communication to the transmission of information in the most timely, cost effective, secure and concise method possible rather than blind following of standards. IF: Make people think about what they write and why they write it.

Improve undergraduate education. My experience in supervising new college graduates is that they are very deficient in writing skills.

## APPENDIX D

Set some standards for the various communications media. This will make it easier to create/understand documentation. Do not make the standards so strict or complex that the documentation suffers, though.

Give engineering students more training in writing.

I believe the most important improvement to be made in communications is a simplification of language used in speaking, and writing. This could be accomplished by using jargon and acronyms less frequently.

Improve engineers and scientists writing and verbal communication and establish standards in terms of quality in paper and journal articles.

New engineers should be better trained in preparing technical information from analyses on testing. Too often information prepared is incomplete and poorly organized - with many assumptions, the objective, or conclusions missing.

Education at undergraduate level to improve organization of thoughts to effectively communicate information.

An emphasis needs to be put on educating college age students about clear, concise, and readable communication.

Upgrade presentation materials and presentations including written documents with purpose problem objective benefits of solution approach.

I believe that training at the college level is significantly below the tolerable minimum. Typically, communication type courses are electives while it is a technical requirement that the engineers and scientists of today effectively speak and present their ideas.

Foster technical publishing standards that are compatible with and accept output from personal computers.

Undergraduates could use some real-world experience in report writing.

## APPENDIX D

We should all write as much as possible while in school. Weekly reports on progress are often required at work. Perhaps a technical writing class could have 500 word weekly reports, in addition to normal assignments, on the students progress in other classes.

Require several technical writing courses for a BS degree.

Colleges must do a better job to prepare engineering students to write technical memos and reports. Private industry should also do a better job in training engineers to be excellent communicators.

Teaching people how to organize information and present it, recognizing the needs of people who receive the information.

Technical Writing and Speaking courses should be taught within technical curricula, not as adjuncts and not by "creative writing" types with no technical backgrounds.

Perhaps we are not specifically involved in a concerted, integrated effort to improve technical communications. Is AIAA doing anything in this field? I feel very insecure in this area although I am frustrated by inadequate communications on a daily basis. Hope that you can do something about the problem.

I do not control the computer technology available to me. Both business and scientific graphics capability would be most welcome, as would integrated workstations and electronic publishing. However, I (and my co-workers) just use what is provided to us.

Development of on-line data bases made easily available to workers in industry (at their computer), would greatly increase the number of sources an engineer could consider while looking for info. A standard computer "search" at the library is controlled by the librarian, is too costly, and too inconvenient for regular use.

Undergraduate emphasis on writings and oral skills. Courses in modern communication tools and techniques.

## APPENDIX D

Require courses in technical writing in the undergraduate curriculum.

I believe that in an undergraduate tech. comm. course the emphasis should be on presenting all necessary data in a clear and concise manner.



# Report Documentation Page

1. Report No. NASA TM-101534, Part 2		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Technical Communications in Aeronautics: Results of an Exploratory Study			5. Report Date February 1989		
			6. Performing Organization Code		
7. Author(s) Thomas E. Pinelli, Myron Glassman, Walter E. Oliu, and Rebecca O. Barclay			8. Performing Organization Report No.		
			10. Work Unit No. 505-90		
9. Performing Organization Name and Address NASA Langley Research Center Hampton, VA 23665-5225			11. Contract or Grant No.		
			13. Type of Report and Period Covered Technical Memorandum		
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546-0001			14. Sponsoring Agency Code		
			15. Supplementary Notes The survey was conducted under Task 28 of NAS1-18584 Thomas E. Pinelli: NASA Langley Research Center, Hampton, VA Myron Glassman: Old Dominion University, Norfolk, VA Walter E. Oliu: U.S. Nuclear Regulatory Commission, Washington, DC Rebecca O. Barclay: Rensselaer Polytechnic Institute, Troy, NY		
16. Abstract <p>A study was undertaken that explored several aspects of technical communications in aeronautics. The study, which utilized survey research in the form of a self-administered questionnaire, was sent to 2,000 randomly selected members of the American Institute of Aeronautics and Astronautics (AIAA). Six hundred and six (606) usable questionnaires (30.3 percent) were received by the established cut off date.</p> <p>The study had five objectives. The first was to solicit the opinions of aeronautical engineers and scientists regarding the importance of technical communications to their profession; second, to determine their use and production of technical communications; third, to seek their views on the content of an undergraduate course in technical communications; fourth, to determine their use of libraries/technical information centers; and finally, to determine the use and importance of computer and information technology to them. The findings add considerable information to the knowledge of technical communications practices among aeronautical engineers and scientists and reinforce some of the conventional wisdom about technical communications and question other widely-held notions.</p>					
17. Key Words (Suggested by Author(s)) Technical communications Computer and information technology Library and on-line system use Aeronautical engineers and scientists			18. Distribution Statement Unclassified - Unlimited  Subject Category 82		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of pages 83	22. Price A05

NASA FORM 1626 OCT 86

For sale by the National Technical Information Service, Springfield, Virginia 22161-2171

NASA-Langley, 1989