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A Comparison of the Technical Communication Practices of Dutch and U.S. Aerospace Engineers and Scientists

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INTRODUCTION

Rapidly changing patterns of international cooperation and collaboration and revolutionary technological and managerial changes are combining to influence and transform the communication of technical information in the workplace. To contribute to our understanding of workplace culture, organization, and communications at the national and international levels, an exploratory study was conducted that investigated the technical communications practices of aerospace engineers and scientists at three similar research organizations in the Netherlands and the United States (U.S.). Previous work includes exploratory studies of the technical communications practices of aerospace engineers and scientists in Israel [1], Japan [2][3], selected Western European countries [4], Russia [5], and the U.S. [6][7].

The data reported herein were collected through self-administered questionnaires undertaken as a Phase 4 activity of the *NASA/DoD Aerospace Knowledge Diffusion Research Project*. The Dutch/U.S. study included the following objectives:

1. To solicit the opinions of aerospace engineers and scientists regarding the importance of technical communications to their profession,
2. To determine the use and production of technical communications by aerospace engineers and scientists,
3. To seek their views about the appropriate content of an undergraduate course in technical communications,
4. To determine their use of libraries and technical information centers,
5. To determine their use and importance of computer and information technology to them,
6. To determine their use of electronic networks, and
7. To determine their use of foreign and domestically produced technical reports.

BACKGROUND

Aerospace engineering exhibits particular characteristics which make it an excellent platform for studying technical communications in the international workplace. The aerospace industry is becoming more international in scope and increasingly collaborative in nature, thus creating a multinational manufacturing environment. International industrial alliances will result in a more rapid diffusion of technology in order to enhance innovation and increase productivity. Aerospace producers will feel growing pressure to push forward with new technological developments, to maximize the inclusion of those developments into the research and development (R&D) process, and to maintain and improve the professional competency of aerospace engineers and scientists. Meeting these objectives at a reasonable cost depends on a variety of factors, but largely on the ability of aerospace engineers and scientists to acquire, process, and communicate scientific and technical information (STI). Although studies indicate that access to STI can increase productivity and innovation and help aerospace engineers and scientists maintain and improve their professional skills, these same studies demonstrate that little is known about how aerospace engineers and scientists find and use STI or how aerospace knowledge is diffused. To learn more about this process, researchers at the NASA Langley Research Center, the Indiana University Center for Survey Research, Rensselaer Polytechnic Institute, and institutions in selected countries are studying aerospace knowledge diffusion. These studies comprise the *NASA/DoD Aerospace Knowledge Diffusion Research Project*. A project fact sheet appears in Appendix A.

Phase 1 of the project investigates the information-seeking behavior of U.S. aerospace engineers and scientists and places particular emphasis on their use of federally funded

aerospace R&D and U.S. government technical reports. Phase 2 examines the industry-government interface and emphasizes the role of information intermediaries in the aerospace knowledge diffusion process. Phase 3 concerns the academic-government interface and focuses on the relationships between and among the information intermediary, faculty, and students. Phase 4 explores patterns of technical communications among non-U.S. aerospace engineers and scientists in selected countries [8]. A list of *NASA/DoD Aerospace Knowledge Diffusion Research Project* publications appears in Appendix B.

RESEARCH DESIGN AND METHODOLOGY

The research was conducted at comparable aeronautical research facilities: the National Aerospace Laboratory (NLR) in the Netherlands, the NASA Ames Research Center in the U.S., and the NASA Langley Research Center in the U.S., using self-administered (self-reported) mail surveys. The instrument used to collect the data had been used previously in several Western European countries and Japan and in Russia in slightly adapted form. Questionnaires were distributed to 200 researchers at NLR, and 109 were received by the established cut off date for a completion rate of 55%. Questionnaires were distributed to 558 researchers at the two NASA installations, and 340 were received by the established cut off date for a completion rate of 61%. A follow-up survey containing additional questions about technical communications training, technical report use, and language skills was distributed to the U.S. respondents. (These questions were initially included in the Dutch survey.) Two hundred eighty-seven of the 340 U.S. respondents completed and returned the follow-up survey for an adjusted response rate of 84%. The survey at NLR was conducted during November and December of 1992, and the surveys at the NASA centers were

conducted during July and August of 1992 with the follow-up in December 1992. The survey instruments used in the Netherlands and the U.S appear in Appendixes C and D, respectively.

PRESENTATION OF THE DATA

This report presents selected results from the Dutch and U.S. studies, with the Dutch responses presented first, followed by the U.S. responses. Demographic data are presented first, followed by data dealing with the importance of technical communications, workplace use and production of technical communications, appropriate course content for an undergraduate course in technical communications, use of libraries and technical information centers, use of computer and information technology, use of electronic networks, and use of foreign and domestically produced technical reports.

Demographic Information About the Survey Respondents

Survey respondents were asked to provide information regarding their professional duties, years of professional work experience, educational preparation, current professional duties, and gender. These demographic findings appear in table 1. A comparison of the two groups reveals some differences and similarities. The two groups differ significantly in terms of organizational affiliation and professional/technical society membership; they are similar in years of professional work experience, current professional duties, amount and type of educational preparation, and gender.

The following "composite" participant profiles were based on the demographic data. The Dutch survey participant works as a researcher (63%), has a graduate degree (80%), was trained as an engineer (74%) and currently works as an engineer (75%), has an average of 12

Table 1. Demographic Findings

| | Netherlands | | U.S. | |
|--|-------------|-------|------|-------|
| | % | (n) | % | (n) |
| Professional Duties | | | | |
| Design/Development | 28 | (30) | 6 | (21) |
| Administration/Management | 3 | (3) | 11 | (37) |
| Research | 63 | (69) | 82 | (279) |
| Other | 6 | (17) | 1 | (3) |
| Organizational Affiliation | | | | |
| Government | 100 | (209) | 100 | (340) |
| Professional Work Experience | | | | |
| 1 - 5 years | 38 | (41) | 15 | (52) |
| 6 - 10 years | 15 | (17) | 22 | (74) |
| 11 - 20 years | 22 | (24) | 28 | (95) |
| 21 - 40 years | 25 | (27) | 34 | (115) |
| 41 or more years | 0 | (0) | 1 | (4) |
| | | | | |
| | Netherlands | U.S. | | |
| Mean | 12 | 17 | | |
| Median | 9 | 14 | | |
| Education | | | | |
| Bachelor's Degree Or Less | 20 | (22) | 27 | (91) |
| Graduate Degree | 80 | (87) | 73 | (249) |
| Educational Preparation | | | | |
| Engineer | 74 | (81) | 80 | (273) |
| Scientist | 25 | (27) | 17 | (58) |
| Other | 1 | (1) | 3 | (9) |
| Current Duties | | | | |
| Engineer | 75 | (82) | 69 | (234) |
| Scientist | 22 | (24) | 27 | (92) |
| Other | 3 | (3) | 4 | (14) |
| Member of A Professional/ Technical Society | 46 | (50) | 78 | (265) |
| Gender | | | | |
| Female | 4 | (4) | 15 | (50) |
| Male | 96 | (105) | 85 | (290) |

years professional work experience, and reads and speaks two foreign languages with considerable fluency. The U.S. survey participant works as a researcher (82%), has a graduate degree (73%), was trained as an engineer (80%), currently works as an engineer (69%), has an average of 17 years of professional work experience, and belongs to a professional/technical society (78%).

Survey respondents were also asked to provide information about their foreign language skills, specifically their reading and speaking competencies in the languages used by major international aerospace producers. These findings appear in table 2. All of the Dutch respondents (100%) read and speak English and German and read and speak French to a lesser extent (92%). The U.S. respondents reported little fluency in any foreign languages. Both groups reported little fluency in either Japanese and Russian. The mean (\bar{X}) ability to read and speak German and French was higher for the Dutch than for the U.S. group. The mean (\bar{X}) ability to read and speak Japanese and Russian, although low for both groups, was higher for the U.S. group.

Table 2. Foreign Language Fluency Among Dutch and U.S. Aerospace Engineers and Scientists

| Language | Netherlands n = 109 | | | U.S. n = 287 | | |
|----------|------------------------|---------|--------------------------------|-----------------|---------|--------------------------------|
| | Read % | Speak % | \bar{X} Ability ^a | Read % | Speak % | \bar{X} Ability ^a |
| English | 100 | 100 | ---- ---- | b | b | ---- ---- |
| French | 92 | 92 | 2.5 2.1 | 32 | 22 | 1.7 1.6 |
| German | 100 | 99 | 4.0 3.4 | 22 | 15 | 1.7 1.6 |
| Japanese | 7 | 6 | 1.0 1.0 | 4 | 5 | 1.7 1.7 |
| Russian | 8 | 5 | 1.0 1.0 | 7 | 5 | 1.6 1.6 |

^a A 1 to 5 scale was used to measure ability with "1" being passably and "5" being fluently; hence the higher the average (mean) the greater the ability of survey respondents to speak/read the language.

^b English is the native language for these respondents.

Importance of and Time Spent on Technical Communications

Approximately 91% of the Dutch respondents and 91% of the U.S. respondents indicated that the ability to communicate technical information effectively is important. (Importance was measured on a 5-point scale with 1 = very unimportant and 5 = very important; percentages = combined "4" and "5" responses.) The Dutch aerospace engineers and scientists spent an average of 15.6 hours per week communicating technical information to others; U.S. aerospace engineers and scientists spent an average of 16.98 hours per week. Dutch aerospace engineers and scientists spent an average of 11.65 hours per week, and U.S. aerospace engineers and scientists spent an average of 13.97 hours per week working with communications received from others (table 3). Considering both the time spent communicating information with others and working with communications received from others, technical communications takes up approximately 68% of the Dutch aerospace engineer's and scientist's 40-hour work week and 77% of the U.S. aerospace engineer's and scientist's work week.

Approximately 60% of the Dutch respondents and 70% of the U.S. respondents indicated that the amount of time they spent communicating technical information had increased over the

Table 3. Mean (Median) Number of Hours Spent Each Week By Dutch and U.S. Aerospace Engineers and Scientists Communicating Technical Information

| | Netherlands | U.S. |
|---|--------------------------|--------------------------|
| Communication With Others | 15.60 (15.00) hours/week | 16.98 (15.00) hours/week |
| Working with Communications Received From Others | 11.65 (10.00) hours/week | 13.97 (12.00) hours/week |
| Percent Of Work Week Devoted To Technical Communications* | 68% | 77% |

*Based on a 40-hour work week.

past 5 years (table 4). Thirty-five percent of the Dutch respondents and 24% of the U.S. respondents indicated that the amount of time they spent communicating technical information had stayed the same over the past 5 years. Only 5% of the Dutch respondents and 6% of the U.S. respondents indicated that the amount of time they spent communicating technical information had decreased over the past 5 years.

Table 4. Changes in the Past 5 Years in the Amount of Time Spent Communicating Technical Information by Dutch and U.S. Aerospace Engineers and Scientists

| | Netherlands | | U.S. | |
|-----------------|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Increased | 60 | (66) | 70 | (239) |
| Stayed The Same | 35 | (38) | 24 | (80) |
| Decreased | 5 | (5) | 6 | (21) |

As they have advanced professionally, 45% of the Dutch respondents have increased the amount of time they spend communicating technical information. Likewise, 65% of the U.S. respondents indicated that, as they have advanced professionally, they have increased the amount of time they spend communicating technical information (table 5).

Table 5. Changes in the Amount of Time Spent Communicating Technical Information as a Part of Professional Advancement by Dutch and U.S. Aerospace Engineers and Scientists

| | Netherlands | | U.S. | |
|-----------------|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Increased | 45 | (49) | 65 | (221) |
| Stayed The Same | 50 | (54) | 26 | (87) |
| Decreased | 5 | (6) | 9 | (32) |

The Production and Use of Technical Communications

The process of collaborative writing was examined as part of this study. Survey participants were asked whether they wrote alone or as part of a group (table 6). Approximately 24% of the Dutch respondents and 15% of the U.S. respondents write alone. Although a lower

Table 6. Collaborative Writing Practices of Dutch and U.S. Aerospace Engineers and Scientists

| | India | | | U.S. | | |
|---|-------------|----|------|-------------|----|-------|
| | $\bar{X}\%$ | %* | (n) | $\bar{X}\%$ | %* | (n) |
| I Write Alone | 64.8 | 24 | (26) | 61.1 | 15 | (50) |
| I Write With One Other Person | 20.1 | 65 | (71) | 20.7 | 72 | (246) |
| I Write With A Group Of Two To Five People | 12.6 | 49 | (54) | 15.6 | 61 | (208) |
| I Write With A Group Of More Than Five People | 2.5 | 10 | (11) | 2.1 | 14 | (47) |

* Percentages do not total 100

percentage of the Dutch than the U.S. respondents writes with a group of 2 to 5 people or with a group of more than 5 people, writing appears to be a collaborative process for both groups.

Dutch and U.S. aerospace engineers and scientists were asked to assess the influence of group participation on writing productivity (table 7). Only 28% of the Dutch respondents and 33% of the U.S. respondents indicated that group writing is more productive than writing alone. Nineteen percent of the Dutch respondents and 32% of the U.S. respondents found that group writing is about as productive as writing alone, and 25% of the Dutch respondents and 20% of the U.S. respondents found that writing in a group is less productive than writing alone.

Of the respondents who did not write alone, 49% of the Dutch group and 47% of the U.S. group worked with the same group when producing written technical communications (table 8). The average number of people in the Dutch group was $\bar{X} = 4.96$ and the average number of

Table 7. Influence of Group Participation on Writing Productivity
For Dutch and U.S. Aerospace Engineers and Scientists

| | Netherlands | | U.S. | |
|---|-------------|------|------|-------|
| | % | (n) | % | (n) |
| A Group Is More Productive Than Writing Alone | 28 | (31) | 32 | (110) |
| A Group Is About As Productive As Writing Alone | 19 | (21) | 31 | (107) |
| A Group Is Less Productive Than Writing Alone | 25 | (27) | 20 | (68) |
| Difficult To Judge | 4 | (4) | 2 | (5) |
| I Only Write Alone | 24 | (26) | 15 | (50) |

people in the U.S. group was $\bar{X} = 3.21$. Twenty-seven percent of the Dutch respondents worked in an average (mean) number of 2.87 groups, each group containing an average of 3.47 people.

Thirty-eight percent of the U.S. respondents worked in an average (mean) number of 2.82 groups, each group containing an average (\bar{X}) of 3.03 people.

Table 8. Production of Written Technical Communications
as a Function of Number of Groups and Group Size For
Dutch and U.S. Aerospace Engineers and Scientists

| | Netherlands | | U.S. | |
|--------------------------------|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Worked With Same Group | | | | |
| Yes | 49 | (53) | 47 | (161) |
| No | 27 | (30) | 38 | (129) |
| I Only Write Alone | 24 | (26) | 15 | (50) |
| Number of People in Group | | | | |
| Mean | 4.96 | (53) | 3.21 | (161) |
| Median | 3.00 | (53) | 3.00 | (161) |
| Number of Groups | | | | |
| Mean | 2.87 | (30) | 2.82 | (129) |
| Median | 2.00 | (30) | 3.00 | (129) |
| Number of People in Each Group | | | | |
| Mean | 3.47 | (30) | 3.03 | (129) |
| Median | 3.00 | (30) | 3.00 | (129) |

From a prepared list, both groups were asked to indicate the number of times they had prepared, either alone or as a member of a group, specific technical information products. As individual authors, the Dutch respondents most frequently prepared letters, memoranda, drawings/specifications, audio/visual materials, and technical talks/presentations (table 9). As part of a working group, these Dutch aerospace engineers and scientists most frequently prepared letters, trade/promotional literature, drawings/specifications, in-house technical reports, and conference/meeting papers. For these products, the mean number of persons per group ranged from a high of $\bar{X} = 5.00$ to a low of $\bar{X} = 2.29$.

Table 9. Mean (Median) Number of Technical Information Products Produced in the Past 6 Months by Dutch Aerospace Engineers and Scientists

| | Alone | | In a Group | | Average Number of Persons Per Group | |
|--------------------------------|-------|---------|------------|---------|-------------------------------------|--------|
| | Mean | Median | Mean | Median | Mean | Median |
| Abstracts | 1.97 | (2.00) | 1.71 | (1.00) | 2.71 | (2.50) |
| Journal Articles | 1.80 | (1.00) | 1.00 | (1.00) | 2.33 | (2.00) |
| Conference/Meeting Papers | 1.60 | (1.00) | 2.39 | (2.00) | 3.28 | (2.00) |
| Trade/Promotional Literature | 1.56 | (1.00) | 4.00 | (4.00) | 5.00 | (5.00) |
| Drawings/Specifications | 4.04 | (2.50) | 2.67 | (2.00) | 3.17 | (2.50) |
| Audio/Visual Material | 3.28 | (3.00) | 1.60 | (2.00) | 2.60 | (2.00) |
| Letters | 15.00 | (10.00) | 12.71 | (10.00) | 2.29 | (2.00) |
| Memoranda | 4.05 | (2.00) | 2.25 | (2.00) | 2.70 | (2.00) |
| Technical Proposals | 2.46 | (2.00) | 2.03 | (2.00) | 3.32 | (2.00) |
| Technical Manuals | 1.39 | (1.00) | 1.73 | (1.00) | 3.46 | (3.00) |
| Computer Program Documentation | 2.48 | (2.00) | 2.11 | (1.00) | 3.06 | (2.00) |
| In-house Technical Reports | 2.26 | (2.00) | 2.50 | (2.00) | 2.69 | (2.00) |
| AGARD Technical Reports | 1.33 | (1.00) | 2.00 | (2.00) | 3.50 | (3.50) |
| Technical Talks/Presentations | 2.66 | (2.00) | 1.50 | (1.00) | 2.40 | (2.00) |

As individual authors, U.S. respondents most frequently **prepared** memoranda, letters, drawings/specifications, audio/visual materials, and technical talks/presentations (table 10). As a group, U.S. aerospace engineers and scientists most frequently prepared letters, audio/visual materials, memoranda, drawings/specifications, and technical talks/presentations. For these products, the mean number of persons per group ranged from a high of $\bar{X} = 3.50$ to a low of $\bar{X} = 2.00$.

Table 10. Mean (Median) Number of Technical Information Products Produced in the Past 6 Months by U.S. Aerospace Engineers and Scientists

| | Alone | | In a Group | | Average Number of Persons Per Group | |
|--------------------------------|-------|--------|------------|--------|-------------------------------------|--------|
| | Mean | Median | Mean | Median | Mean | Median |
| Abstracts | 1.67 | (1.00) | 1.81 | (1.00) | 2.67 | (2.00) |
| Journal Articles | 1.33 | (1.00) | 1.75 | (1.00) | 2.74 | (2.00) |
| Conference/Meeting Papers | 1.90 | (1.00) | 1.54 | (1.00) | 2.79 | (3.00) |
| Trade/Promotional Literature | 2.00 | (1.00) | 1.00 | (1.00) | 2.50 | (2.50) |
| Drawings/Specifications | 7.21 | (3.00) | 3.83 | (3.00) | 3.02 | (2.00) |
| Audio/Visual Material | 5.73 | (4.00) | 5.82 | (2.00) | 2.95 | (2.00) |
| Letters | 9.96 | (6.00) | 5.95 | (3.00) | 2.32 | (2.00) |
| Memoranda | 16.06 | (9.00) | 5.14 | (3.50) | 2.55 | (2.00) |
| Technical Proposals | 2.17 | (2.00) | 2.64 | (1.50) | 2.61 | (2.00) |
| Technical Manuals | 2.11 | (1.00) | 2.11 | (1.00) | 3.11 | (3.00) |
| Computer Program Documentation | 3.43 | (2.00) | 2.20 | (1.50) | 2.35 | (2.00) |
| In-house Technical Reports | 2.34 | (2.00) | 1.80 | (1.00) | 2.89 | (2.00) |
| Technical Talks/Presentations | 3.54 | (2.00) | 3.07 | (2.00) | 3.46 | (3.00) |

Abstracts, journal articles, letters, drawings/specifications, and conference/meeting papers were the technical information products most frequently **used** by these Dutch aerospace engineers and scientists (table 11). On the average, they **used** 22 abstracts, 21 journal articles, 16 letters, 16 drawings/specifications, and 12 conference/meeting papers in a 6-month period. Technical pro-

posals, technical talks/presentations, AGARD technical reports, trade/promotional literature, and audio/visual materials were the technical information products least frequently used by these Dutch aerospace engineers and scientists during a 6-month period.

Memoranda, letters, journal articles, abstracts, and drawings/specifications were the technical information products most frequently used by U.S. aerospace engineers and scientists. On the average, they used 25 memoranda, 17 letters, 16 journal articles, 16 abstracts, and 15 drawings/specifications during a 6-month period. Technical proposals, in-house technical reports, technical manuals, technical talks/presentations, and drawings/specifications were the technical information products least frequently used by U.S. aerospace engineers and scientists during a 6-month period.

Table 11. Mean (Median) Number of Technical Information Products Used in the Past 6 Months by Dutch and U.S. Aerospace Engineers and Scientists

| | Netherlands | | U.S. | |
|--------------------------------|-------------|---------|-------|---------|
| | Mean | Median | Mean | Median |
| Abstracts | 22.20 | (10.00) | 16.45 | (10.00) |
| Journal Articles | 21.20 | (10.50) | 16.55 | (10.00) |
| Conference/Meeting Papers | 12.21 | (5.00) | 12.00 | (10.00) |
| Trade/Promotional Literature | 6.43 | (5.00) | 11.79 | (6.00) |
| Drawings/Specifications | 15.60 | (5.00) | 15.48 | (5.00) |
| Audio/Visual Material | 6.46 | (4.00) | 14.60 | (5.00) |
| Letters | 16.04 | (10.00) | 17.28 | (9.00) |
| Memoranda | 9.00 | (5.00) | 25.45 | (10.00) |
| Technical Proposals | 4.83 | (3.00) | 5.89 | (2.00) |
| Technical Manuals | 12.04 | (5.00) | 7.66 | (5.00) |
| Computer Program Documentation | 10.47 | (5.00) | 14.57 | (5.00) |
| In-house Technical Reports | 7.30 | (5.00) | 6.93 | (5.00) |
| Technical Talks/Presentations | 5.05 | (4.00) | 10.25 | (6.00) |

The types of technical information most frequently produced by the Dutch aerospace engineers and scientists included basic scientific and technical information, in-house technical

data, technical specifications, computer programs, and experimental techniques (table 12). The types of technical information least frequently **produced** by these Dutch aerospace engineers and scientists included patents and inventions, government rules and regulations, economic information, codes of standards and practices, and product and performance characteristics. Basic scientific and technical information, in-house technical data, experimental techniques, computer programs, and technical specifications were the kinds of technical information most frequently **produced** by U.S. aerospace engineers and scientists. Government rules and regulations, codes of standards and practices, economic information, patents and inventions, and product and performance characteristics were the kinds of technical information least frequently **produced** by U.S. aerospace engineers and scientists.

Table 12. Types of Information Produced by Dutch and U.S. Aerospace Engineers and Scientists
[n = 109; 340]

| | Netherlands % | U.S. % |
|--|------------------|-----------|
| Basic Scientific and Technical Information | 76 | 92 |
| Experimental Techniques | 53 | 65 |
| Codes of Standards and Practices | 23 | 9 |
| Computer Programs | 62 | 61 |
| In-house Technical Data | 71 | 86 |
| Product and Performance Characteristics | 48 | 32 |
| Technical Specifications | 65 | 45 |
| Patents and Inventions | 0 | 25 |
| Government Rules and Regulations | 0 | 4 |
| Economic Information | 3 | 9 |

The types of technical information most frequently **used** by the Dutch aerospace engineers and scientists included basic scientific and technical information, in-house technical data, technical specifications, computer programs, and product and performance characteristics (table 13). The

types of technical information least frequently **used** by these Dutch aerospace engineers and scientists included patents and inventions, economic information, and government rules and regulations. Basic scientific and technical information, in-house technical data, computer programs, experimental techniques, and technical specifications were the types of technical information most frequently **used** by U.S. aerospace engineers and scientists. Patents and inventions, economic information, and codes of standards and practices were the types of technical information least frequently **used** by the U.S. survey participants.

Table 13. Types of Information Used by Dutch and U.S. Aerospace Engineers and Scientists
[n = 109; 340]

| | Netherlands % | U.S. % |
|--|------------------|-----------|
| Basic Scientific and Technical Information | 90 | 97 |
| Experimental Techniques | 62 | 82 |
| Codes of Standards and Practices | 54 | 36 |
| Computer Programs | 73 | 89 |
| In-house Technical Data | 85 | 90 |
| Product and Performance Characteristics | 72 | 63 |
| Technical Specifications | 82 | 69 |
| Patents and Inventions | 3 | 12 |
| Government Rules and Regulations | 27 | 52 |
| Economic Information | 6 | 19 |

Content for an Undergraduate Course in Technical Communications

Dutch and U.S. survey participants were asked their opinions regarding an undergraduate course in technical communications for aerospace majors. Approximately 48% of the Dutch respondents and 71% of the U.S. respondents indicated that they had taken a course(s) in technical communications/writing. Approximately 13% of the Dutch participants had taken a course(s) as undergraduates, approximately 28% had taken a course(s) after

graduation, and about 6% had taken a course(s) both as undergraduates and after graduation. Approximately 20% of the U.S. respondents had taken a course(s) as undergraduates, approximately 19% had taken a course(s) after graduation, and 32% had taken a course(s) both as undergraduates and after graduation.

Of the 48% (52 respondents) of the Dutch engineers and scientists who had taken coursework in technical communications/writing, about 46% (50 respondents) of them indicated that doing so had helped them to communicate technical information. Of the 70% (241 respondents) of the U.S. engineers and scientists who had taken a course(s) in technical communications/writing, about 68% (233 respondents) indicated that doing so had helped them to communicate technical information.

Dutch and U.S. participants were asked their opinion regarding the desirability of undergraduate aerospace majors taking a course in technical communications. Approximately 88% (96 respondents) of the Dutch participants and 96% (276 respondents) of the U.S. participants indicated "yes," that aerospace majors should take such a course. Approximately 52% of the Dutch participants and about 80% of the U.S. participants indicated that the course should be taken for credit (table 14).

Table 14. Opinions Regarding an Undergraduate Course in Technical Communications for Aerospace Majors

| | Netherlands | | U.S. | |
|--|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Taken for Credit | 52 | (57) | 90 | (259) |
| Not Taken for Credit | 17 | (18) | 4 | (11) |
| Don't Know | 19 | (21) | 2 | (6) |
| Should Not Have to Take Course in Technical Communications | 12 | (13) | 4 | (11) |

The Dutch and U.S. participants were asked if undergraduate aerospace engineering and science majors should take a course in technical communications and, if so, how the course should be offered. About 64% of the Dutch respondents indicated that the course should be taken as part of a "required" course, about 16% thought the course should be taken as part of an "elective" course, about 7% did not have an opinion, but only 12% of the Dutch respondents indicated that undergraduate aerospace engineering and science students should **not have to take** a course in technical communications/writing. About 82% of the U.S. respondents indicated that the course should be taken as part of a "required" course, about 12% thought the course should be taken as part of an "elective" course, about 2% did not have an opinion, but only 4% of the U.S. respondents indicated that undergraduate aerospace engineering and science students should **not have to take** a course in technical communications/writing. About 45% of the Dutch and 51% of the U.S. respondents thought that technical communications/writing instruction should be taken as a separate course. Thirty-one percent of the Dutch respondents and 39% of the U.S. respondents thought it should be part of an engineering course.

Dutch and U.S. respondents were asked to select from similar lists appropriate principles for inclusion in an undergraduate technical communications course for aerospace engineering and science students. Table 15 shows their responses.

Both Dutch and U.S. respondents indicated that defining the purpose of the communication, organizing information, developing paragraphs, and assessing readers' needs were more important than matters of correctness such as word choice, note-taking and quoting, and writing at the sentence level. The process-oriented concerns such as organizing

information, defining purpose, and assessing readers' needs are typically stressed in U.S. undergraduate writing courses.

The Dutch and U.S. respondents also chose from a list of specific topics appropriate mechanics to be included in an undergraduate technical communications course for aerospace

Table 15. Recommended Principles for an Undergraduate Technical Communications Course for Aerospace Majors

| Principles | Netherlands | | U.S. | |
|--------------------------------------|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Organizing Information | 83 | (90) | 97 | (329) |
| Defining the Communication's Purpose | 89 | (97) | 91 | (310) |
| Developing Paragraphs | 89 | (97) | 87 | (296) |
| Assessing Reader's Needs | 83 | (90) | 87 | (295) |
| Choosing Words | 52 | (57) | 83 | (283) |
| Note Taking and Quoting | 41 | (45) | 44 | (149) |
| Editing and Revising | 62 | (67) | 87 | (295) |
| Writing Sentences | 60 | (62) | 72 | (245) |

majors. Their responses appear in table 16. Both groups of respondents placed references, symbols, punctuation, spelling, and abbreviations in the top five list for inclusion.

Given a list of 13 items, the Dutch and U.S. respondents were next asked to select appropriate on-the-job communications to be included in an undergraduate technical communications course. Their responses appear in table 17.

Both groups selected oral technical presentations, abstracts, use of information sources, conference/meeting papers, technical reports, technical instructions, journal articles, letters, and memoranda for inclusion, although not in the same order of appearance. It is interesting to note that more similarities than differences exist among their choices for the types of

written communications that students should learn to produce. These choices may reflect information acquisition and use patterns among aerospace professionals.

Table 16. Recommended Mechanics for an Undergraduate Technical Communications Course for Aerospace Majors

| Mechanics | Netherlands | | U.S. | |
|----------------|-------------|------|------|-------|
| | % | (n) | % | (n) |
| References | 63 | (69) | 80 | (272) |
| Symbols | 53 | (58) | 64 | (218) |
| Punctuation | 54 | (59) | 74 | (251) |
| Spelling | 58 | (63) | 55 | (187) |
| Abbreviations | 47 | (51) | 55 | (187) |
| Numbers | 33 | (36) | 48 | (163) |
| Capitalization | 31 | (34) | 54 | (182) |
| Acronyms | 39 | (45) | 52 | (176) |

Table 17. Recommended On-the-Job Communications To Be Taught in an Undergraduate Technical Communications Course for Aerospace Majors

| On-the-Job Communications | Netherlands | | U.S. | |
|------------------------------|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Oral Technical Presentations | 84 | (92) | 92 | (311) |
| Abstracts | 82 | (89) | 85 | (289) |
| Use of Information Sources | 72 | (78) | 72 | (244) |
| Conference/Meeting Papers | 54 | (59) | 67 | (228) |
| Technical Reports | 86 | (94) | 81 | (274) |
| Technical Instructions | 63 | (69) | 62 | (212) |
| Journal Articles | 49 | (53) | 64 | (217) |
| Letters | 50 | (55) | 61 | (208) |
| Technical Specifications | 56 | (61) | 45 | (152) |
| Literature Reviews | 38 | (42) | 50 | (169) |
| Memoranda | 66 | (72) | 60 | (204) |
| Technical Manuals | 60 | (65) | 43 | (147) |
| Newsletter/Paper Articles | 16 | (18) | 15 | (50) |

In an attempt to validate the findings, the top 10 on-the-job communications were paired with the top five (on average) communications "produced" and "used" by the respondents (table 18).

The on-the-job communications recommended by the Dutch respondents do not appear to closely reflect the types of communications they produce and use, nor do the responses of the

Table 18. Comparison of Dutch and U.S. Responses
Concerning Technical Information Products
Produced, Used, and Recommended

| Netherlands | U.S. |
|--|---|
| Produced Letters Memoranda Drawings/Specifications Audio/Visual Material Technical Talks/Presentations | Produced Memoranda Letters Drawings/Specifications Audio/Visual Material Technical Talks/Presentations |
| Used Abstracts Journal Articles Letters Drawings/Specifications Conference/Meeting Papers | Used Memoranda Letters Journal Articles Abstracts Drawings/Specifications |
| Recommended Technical Reports Oral Technical Presentations Abstracts Use of Information Sources Memoranda Technical Instructions Technical Manuals Technical Specifications Conference/Meeting Papers Letters | Recommended Oral Technical Presentations Abstracts Technical Reports Use of Information Sources Conference/Meeting Papers Journal Articles Technical Instructions Letters Memoranda Literature Reviews |

U.S. respondents appear to reflect the types of communications they produce and use. It is interesting to note that although neither group places technical reports in the top five category of communications produced or used, both groups recommended that report writing be taught.

Use of Libraries and Technical Information Centers

Almost all of the respondents indicated that their organization has a library or technical information center. Unlike the U.S. respondents (9%), about 44% of the Dutch respondents indicated that the library or technical information center was located in the building where they worked. About 56% of the Dutch and 88% of the U.S. respondents indicated that the library or technical information center was outside the building in which they worked and that it was located nearby where they worked. For 56% of the Dutch, the library or technical information center was located 1.0 kilometer or less from where they worked. For about 81% of the U.S. respondents, the library or technical information center was located 1.0 mile or less from where they worked.

Respondents were asked to indicate the number of times they had visited their organization's library or technical information center in the past 6 months (table 19). Overall, the Dutch respondents used their organization's library or technical information center more than their U.S. counterparts did. The average use rate for Dutch respondents was $\bar{X} = 18.5$ during the past 6 months compared to $\bar{X} = 9.2$ for the U.S. respondents. The median 6-month use rates for the two groups were 10.0 and 4.0, respectively.

Respondents were also asked to rate the importance of their organization's library or technical information center (table 20). Importance was measured on a 5-point scale with 1 = not at all important and 5 = very important. A majority of both groups indicated that their

Table 19. Use of the Organization's Library in Past 6 Months by Dutch and U.S. Aerospace Engineers and Scientists

| Visits | Netherlands | | U.S. | |
|-------------------------|-------------|------|------|-------|
| | % | (n) | % | (n) |
| 0 times | 5 | (5) | 11 | (37) |
| 1 - 5 times | 20 | (22) | 43 | (145) |
| 6 - 10 times | 28 | (30) | 21 | (72) |
| 11 - 25 times | 35 | (38) | 14 | (49) |
| 26 - 50 times | 6 | (7) | 7 | (22) |
| 51 or more times | 6 | (7) | 1 | (4) |
| Does Not Have A Library | 0 | (0) | 3 | (11) |
| Mean | 18.5 | | 9.2 | |
| Median | 10.0 | | 4.0 | |

Table 20. Importance of the Organization's Library to Dutch and U.S. Aerospace Engineers and Scientists

| | Netherlands | | U.S. | |
|-----------------------------------|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Very Important | 78.0 | (85) | 68.3 | (232) |
| Neither Important nor Unimportant | 15.6 | (17) | 15.6 | (53) |
| Very Unimportant | 6.5 | (7) | 12.9 | (44) |
| Do Not Have A Library | 0.0 | (0) | 3.2 | (11) |

organization's library or technical information center was important to performing their present professional duties. About 78% of the Dutch aerospace engineers and scientists indicated that their organization's library or technical information center was important or very important to performing their present professional duties. About 68% of the U.S. aerospace engineers and scientists indicated that their organization's library or technical information center was important or very important to performing their present professional duties. Approximately 6% of the Dutch and approximately 13% of the U.S. respondents

indicated that their organization's library or technical information center was not at all important to performing present professional duties.

From a list of information sources, survey participants were asked to indicate which ones they routinely used in problem solving (table 21). In addition to personal knowledge, upon which they rely greatly, the U.S. aerospace engineers and scientists in this study display information-seeking behavior patterns similar to those of U.S. engineers in general.

Table 21. Information Sources Used by Dutch and U.S. Aerospace Engineers and Scientists in Problem Solving
[n = 109; 340]

| | Netherlands | | U.S. | |
|--|-------------|-------|------|-------|
| | % | (n) | % | (n) |
| Personal Store Of Technical Information Spoke With A Coworker Or People Inside My Organization | 98 | (107) | 99 | (337) |
| Spoke With A Colleague Outside Of My Organization | 98 | (107) | 99 | (338) |
| Used Literature Resources Found In My Organization's Library | 79 | (86) | 94 | (318) |
| Spoke With A Librarian Or Technical Information Specialist | 95 | (104) | 91 | (310) |
| | 74 | (81) | 80 | (274) |

The information-seeking behavior of the Dutch respondents did not vary greatly from that of their American counterparts. U.S. participants used their personal store of technical information, coworkers in the organization, colleagues outside the organization, literature resources found in the organization's library, and a librarian or technical information specialist. Their Dutch counterparts used their personal stores of technical information, spoke with coworkers in the organization, used literature resources found in the organization's

library, spoke with a colleague outside the organization, and spoke with a librarian or technical information specialist.

Use and Importance of Computer and Information Technology

Survey participants were asked if they use computer technology to prepare technical information. Approximately 91% of the Dutch respondents use computer technology to prepare technical information. Almost all (98%) of the U.S. respondents use computer technology to prepare technical information. About 56% of the Dutch respondents and about 73% of the U.S. respondents "always" use computer technology to prepare technical information. A majority of both groups (83% and 98%) indicated that computer technology had increased their ability to communicate technical information. About 66% of the Dutch respondents and 80% of the U.S. respondents stated that computer technology had increased their ability to communicate technical information "a lot."

From a prepared list, survey respondents were asked to indicate which computer software they used to prepare written technical information (table 22). Word processing software was used most frequently by both groups. With the exception of **outliners and prompters** and **business graphics**, the U.S. respondents made slightly greater use of computer software for preparing written technical communications than did their Dutch counterparts.

Survey respondents were also given a list of information technologies and asked, "How do you view your use of the following information technologies in communicating technical information?" Their choices included "already use it"; don't use it, but may in the future"; and "don't use it and doubt if I will." (See table 23.)

Table 22. Use of Computer Software by Dutch and U.S. Aerospace Engineers and Scientists to Prepare Written Technical Communications

| Software | Netherlands | | U.S. | |
|----------------------------|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Word Processing | 89 | (97) | 96 | (327) |
| Outliners and Prompters | 20 | (22) | 14 | (46) |
| Grammar and Style Checkers | 24 | (26) | 30 | (103) |
| Spelling Checkers | 74 | (81) | 88 | (299) |
| Thesaurus | 35 | (38) | 37 | (127) |
| Business Graphics | 26 | (28) | 15 | (52) |
| Scientific Graphics | 61 | (66) | 91 | (308) |
| Desktop Publishing | 19 | (21) | 48 | (162) |

Table 23. Use, Nonuse, and Potential Use of Information Technologies by Dutch and U.S. Aerospace Engineers and Scientists

| Information Technologies | Already Use It | | Don't Use It, But May In Future | | Don't Use It, And Doubt If Will | |
|------------------------------------|----------------|--------|---------------------------------|--------|---------------------------------|--------|
| | Dutch % | U.S. % | Dutch % | U.S. % | Dutch % | U.S. % |
| Audio Tapes and Cassettes | 6 | 13 | 16 | 30 | 79 | 57 |
| Motion Picture Films | 4 | 17 | 21 | 29 | 75 | 55 |
| Videotape | 25 | 63 | 42 | 31 | 33 | 7 |
| Desktop/Electronic Publishing | 28 | 60 | 51 | 32 | 22 | 8 |
| Computer Cassettes/Cartridge Tapes | 45 | 44 | 24 | 32 | 31 | 24 |
| Electronic Mail | 37 | 83 | 51 | 15 | 13 | 2 |
| Electronic Bulletin Boards | 11 | 36 | 57 | 48 | 32 | 17 |
| FAX Or TELEX | 95 | 91 | 4 | 8 | 1 | 1 |
| Electronic Data Bases | 42 | 56 | 50 | 40 | 8 | 4 |
| Video Conferencing | 0 | 37 | 46 | 54 | 54 | 10 |
| Teleconferencing | 13 | 53 | 50 | 40 | 38 | 7 |
| Micrographics and Microforms | 30 | 23 | 16 | 42 | 54 | 34 |
| Laser Disk/Video Disk/CD-ROM | 11 | 19 | 59 | 68 | 30 | 14 |
| Electronic Networks | 58 | 76 | 35 | 19 | 7 | 5 |

The Dutch and U.S. aerospace engineers and scientists in this study use a variety of information technologies. The percentages of "I already use it" responses ranged from a high of 95% (FAX or TELEX) to a low of 0% (videoconferencing) for the Dutch respondents. Similarly, the U.S. responses ranged from a high of 91% (FAX or TELEX) to a low of 13% (audio tapes and cassettes).

A list, in descending order, follows of the information technologies most frequently used.

| Netherlands | | U.S. | |
|--|-----|---------------------|-----|
| FAX or TELEX | 95% | FAX or TELEX | 91% |
| Electronic Networks | 58 | Electronic Mail | 83 |
| Computer Cassettes/ Cartridge Tapes | 45 | Electronic Networks | 76 |
| Electronic Data Bases | 42 | Videotape | 63 |
| Electronic Mail | 37 | Desktop Publishing | 60 |

A list, in descending order, follows of the information technologies "that are not currently being used but may be used in the future."

| Netherlands | | U.S. | |
|----------------------------------|-----|----------------------------------|-----|
| Laser Disk/Video Disk/ CD-ROM | 59% | Laser Disk/Video Disk/ CD-ROM | 68% |
| Electronic Bulletin Boards | 57 | Video Conferencing | 54 |
| Desktop/Electronic Publishing* | 51 | Electronic Bulletin Boards | 48 |
| Electronic Mail* | 51 | Micrographics and Microforms | 42 |
| Electronic Data Bases* | 50 | Electronic Data Bases | 40 |
| Teleconferencing* | 50 | | |
| Video Conferencing | 46 | | |

* Denotes tie

Use and Importance of Electronic Networks

Survey participants were asked if they use electronic networks at their workplace in performing their present duties (table 24). Approximately 65% of the Dutch respondents use

electronic networks and about 35% either do not use or do not have access to electronic networks. About 89% of the U.S. respondents use electronic networks in performing their present duties and about 11% either do not use or do not have access to electronic networks.

Table 24. Use of Electronic Networks by Dutch and U.S. Aerospace Engineers and Scientists

| Percentage of a 40-hour Work Week | Netherlands | | U.S. | |
|--|-------------|------|------|-------|
| | % | (n) | % | (n) |
| 0 | 0.0 | (0) | 1.2 | (4) |
| 1 - 25 | 47.7 | (52) | 52.9 | (180) |
| 26 - 50 | 10.1 | (11) | 16.8 | (57) |
| 51 - 75 | 0.0 | (0) | 7.6 | (26) |
| 76 - 99 | 5.5 | (6) | 8.8 | (30) |
| 100 | 1.8 | (2) | 1.5 | (5) |
| Do Not Use or Have Access to Electronic Networks | 34.9 | (38) | 11.2 | (38) |
| Mean | 22.1 | | 30.1 | |
| Median | 10.0 | | 20.0 | |

Respondents were also asked to rate the importance of electronic networks in performing their present duties (table 25). Importance was measured on a 5-point scale with 1 = not at all important and 5 = very important. The U.S. respondents rated electronic networks almost twice as important as their Dutch counterparts did. U.S. participants were

Table 25. Importance of Electronic Networks to Dutch and U.S. Aerospace Engineers and Scientists

| | Netherlands | | U.S. | |
|--|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Very Important | 35.7 | (39) | 65.0 | (221) |
| Neither Important nor Unimportant | 21.1 | (23) | 11.2 | (38) |
| Very Unimportant | 8.3 | (9) | 12.6 | (43) |
| Do Not Use or Have Access to Electronic Networks | 34.9 | (38) | 11.2 | (38) |

less ambivalent about the importance (neither important nor unimportant) of electronic networks than were their Dutch counterparts (about 11% vs 21%). Respondents were asked how they accessed electronic networks (table 26): mainframe terminal, personal computers, and workstations. Access via personal computer was most frequently reported.

Table 26. How Dutch and U.S. Aerospace Engineers and Scientists Access Electronic Networks

| Access | Netherlands | | U.S. | |
|--|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Mainframe Terminal | 12.8 | (14) | 13.5 | (46) |
| Personal Computer | 26.6 | (29) | 49.1 | (167) |
| Workstation | 7.3 | (8) | 26.2 | (89) |
| Some Combination of the Above | 18.4 | (20) | a | a |
| Do Not Use or Have Access to Electronic Networks | 34.9 | (38) | 11.2 | (38) |

^a Not asked of U.S. participants.

Respondents using them were asked to indicate the purpose(s) for which they used electronic networks (table 27). Both the Dutch and U.S. respondents indicated that electronic file transfer, electronic mail, remote log in for design/computational tools, and connecting to geographically distant sites represented their greatest use of electronic networks. Also noticeable for both groups is the lack of electronic network use for accessing and searching library catalogs, acquiring (ordering) documents from the library, and searching (bibliographic) data bases.

Survey participants who used electronic networks were asked to identify the groups with whom they exchanged messages or files (table 28). The Dutch respondents displayed a consistent pattern of message and file exchange both within and outside of their organization.

Overall, the U.S. group exhibited higher percentages of network use for exchanging messages or files than did their Dutch counterparts. The U.S. respondents did not display as consistent a pattern of use as the Dutch respondents did.

Table 27. Use of Electronic Networks for Specific Purposes by Dutch and U.S. Aerospace Engineers and Scientists

| Purpose | Netherlands | | U.S. | |
|---|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Connect to geographically distant sites | 36.7 | (40) | 53.2 | (181) |
| Electronic mail | 33.9 | (37) | 81.5 | (277) |
| Electronic bulletin boards or conferences | 8.3 | (9) | 36.8 | (125) |
| Electronic file transfer | 58.7 | (64) | 83.5 | (284) |
| Log on to remote computers | 37.6 | (41) | 63.8 | (217) |
| Control remote equipment | 9.2 | (10) | 8.8 | (30) |
| Access/search the library's catalog | 10.1 | (11) | 29.1 | (99) |
| Order documents from the library | 3.7 | (4) | 9.4 | (32) |
| Search electronic (bibliographic) data bases | 11.9 | (13) | 33.5 | (114) |
| Information search and data retrieval | 24.8 | (27) | 35.9 | (122) |
| Prepare scientific and papers with colleagues at geographically distant sites | 19.3 | (21) | 32.9 | (112) |

Table 28. Use of Electronic Networks by Dutch and U.S. Aerospace Engineers and Scientists to Exchange Messages or Files

| Exchange With -- | Netherlands | | U.S. | |
|---|-------------|------|------|-------|
| | % | (n) | % | (n) |
| Members of Own Work Group | 37.6 | (41) | 81.5 | (277) |
| Others In Your Organization But Not In Your Work Group | 27.5 | (30) | 77.9 | (265) |
| Others In Your Organization, Not In Your Work Group, At A Geographically Distant Site | 33.9 | (37) | 56.8 | (193) |
| People Outside Your Organization | 33.0 | (36) | 58.8 | (200) |
| Do Not Use or Have Access to Electronic Networks | 34.9 | (38) | 11.2 | (38) |

Survey participants were asked about the likelihood of their using electronically formatted information that has traditionally appeared as paper products (table 29). Both groups are more likely to use online systems (with full text and graphics) for technical papers and CD-ROM systems (with full text and graphics) for technical papers than they are to use

Table 29. Attitudes Toward the Use of Information in Specified Formats by Dutch and U.S. Aerospace Engineers and Scientists

| Types of Information | Likely Use of Information in Electronic Format ^a | | | |
|--|---|------|------|-------|
| | Netherlands | | U.S. | |
| | % | (n) | % | (n) |
| Data Tables/Mathematical Presentations | 44.1 | (48) | 57.0 | (194) |
| Computer Program Listings | 51.4 | (56) | 55.6 | (189) |
| Online System (with Full Text and Graphics) for Technical Papers | 60.6 | (66) | 69.7 | (237) |
| CD-ROM System (with Full Text and Graphics) for Technical Papers | 52.3 | (57) | 57.6 | (196) |

^a Likely use was measured on a 1 to 5 point scale with "1" being very unlikely and "5" being very likely. Percentages include combined "4" and "5" responses.

computer program listings or data tables/mathematical presentations. When asked why they would not use these information products in electronic format, the survey respondents gave the following reasons: (1) 48% of the Dutch and 27% of the U.S. group prefer print (paper) formats; (2) 18% of the Dutch and 34% of the U.S. group cited hardware or software incompatibility; and (3) less than 15% of each group indicated that lack of computer access was the reason for non-use.

Use of Foreign and Domestically Produced Technical Reports

To better understand the transborder migration of STI via the technical report, survey participants were asked about their use of foreign and domestically produced technical reports (table 30) and the importance of these reports in performing their professional duties (table 31). Both groups make the greatest use of their own technical reports (96% of the Dutch use NLR reports and 97% of the U.S. group use NASA technical reports). Other than their own reports, the Dutch use NASA (82%); AGARD (71%); German DFVLR, DLR, and MBB (69%); and British ARC and RAE (50%) technical reports.

Table 30. Use of Foreign and Domestically Produced Technical Reports by Dutch and U.S. Aerospace Engineers and Scientists

| Country/Organization | Netherlands | | U.S. | |
|----------------------------|-------------|-------|------|-------|
| | % | (n) | % | (n) |
| AGARD | 70.6 | (77) | 82.2 | (236) |
| British ARC and RAE | 49.5 | (54) | 54.0 | (155) |
| ESA | 44.0 | (48) | 5.9 | (17) |
| Indian NAL | 7.3 | (8) | 6.3 | (18) |
| French ONERA | 43.1 | (47) | 41.1 | (118) |
| German DFVLR, DLR, and MBB | 68.8 | (75) | 36.2 | (104) |
| Japanese NAL | 11.0 | (12) | 11.5 | (33) |
| Russian TaAGI | 0.9 | (1) | 8.4 | (24) |
| Dutch NLR | 96.3 | (105) | 19.9 | (57) |
| U.S. NASA | 81.7 | (89) | 96.5 | (277) |

Other than their own reports, the U.S. group uses AGARD (82%) and British ARC and RAE (54%) technical reports. Neither group makes particular use of Japanese NAL, Indian NAL, or Russian TsAGI technical reports. Survey participants were also asked about their access to these technical reports series. Overall, the Dutch appear to have better access

to foreign technical reports than do their U.S. counterparts; the exception, of course, is access to NASA technical reports.

Technical report importance was measured on a 5-point scale with 1 = very unimportant and 5 = very important. Both groups were asked to rate the importance of selected foreign and domestic technical reports in performing their present professional duties. The average (mean) importance ratings are shown in table 31. The Dutch rated the importance of U.S. NASA reports ($\bar{X} = 3.69$) second only to their own ($\bar{X} = 4.32$) followed by German DFVLR, DLR, and MBB reports ($\bar{X} = 3.22$) and AGARD reports ($\bar{X} = 3.18$). The U.S. group rated NASA reports most important ($\bar{X} = 4.26$) followed by AGARD reports ($\bar{X} = 3.42$).

Table 31. Importance of Foreign and Domestically Produced Technical Reports to Dutch and U.S. Aerospace Engineers and Scientists

| Country/Organization | Netherlands | | U.S. | |
|----------------------------|----------------------------------|-------|----------------------------------|-------|
| | Rating ^a \bar{X} | (n) | Rating ^a \bar{X} | (n) |
| AGARD | 3.18 | (108) | 3.42 | (282) |
| British ARC and RAE | 2.87 | (105) | 2.89 | (266) |
| ESA | 2.35 | (108) | 1.44 | (242) |
| Indian NAL | 1.46 | (101) | 1.40 | (241) |
| French ONERA | 2.36 | (107) | 2.25 | (257) |
| German DFVLR, DLR, and MBB | 3.22 | (108) | 2.20 | (247) |
| Japanese NAL | 1.57 | (104) | 1.63 | (239) |
| Russian TaAGI | 1.31 | (97) | 1.60 | (231) |
| Dutch NLR | 4.32 | (109) | 1.81 | (246) |
| U.S. NASA | 3.69 | (108) | 4.26 | (285) |

^a A 1 to 5 point scale was used to measure importance with "1" being the lowest possible importance and "5" being the highest possible importance. Hence, the higher the average (mean) the greater the importance of the report series.

DISCUSSION

Given the limited purposes of this exploratory study, the overall response rates, and the research designs, no claims are made regarding the extent to which the attributes of the respondents in the studies accurately reflect the attributes of the populations being studied. A much more rigorous research design and methodology would be needed before any claims could be made. Nevertheless, the findings of the studies do permit the formulation of the following general statements regarding the technical communications practices of the aerospace engineers and scientists who participated in the two studies:

1. The ability to communicate technical information effectively is important to Dutch and U.S. aerospace engineers and scientists.
2. As the Dutch and U.S. aerospace engineers and scientists in these studies have advanced professionally, the amount of time they spend producing and working with technical communications has increased for almost one-half (45%) of the Dutch respondents and about two-thirds (65%) of the U.S. respondents.
3. The Dutch and U.S. aerospace engineers and scientists in these studies write more frequently in small groups than they write alone. A slightly higher percentage of the U.S. and Dutch respondents find collaborative writing more productive than individual writing. Both groups of respondents frequently produce the same types of materials whether they write as members of a group or as individuals.
4. Approximately 48% of the Dutch and 71% of the U.S. aerospace engineers and scientists in these studies had taken a course in technical communications; a majority of both groups indicated that such a course had helped them communicate technical information.
5. Although the percentages vary for each item, there was considerable agreement among the Dutch and U.S. aerospace engineers and scientists in these studies regarding the on-the-job communications to be included in an undergraduate technical communications course for aerospace and science students and less agreement on the appropriate principles and mechanics that should be included in such a course.
6. The Dutch and U.S. aerospace engineers and scientists in these studies make use of personal knowledge, discussions with colleagues within and outside their organization, and literature resources found within the organization's library for solving technical problems.

Neither group relies heavily on librarians or technical information specialists for information when problem solving.

7. Although important to both Dutch and U.S. aerospace engineers and scientists, libraries and technical information centers were used more by the Dutch respondents. More Dutch aerospace engineers and scientists had a library or technical information center located in their building than did their U.S. counterparts.

8. More U.S. respondents used computer technology to prepare technical information than did their Dutch counterparts although a majority of both groups indicated that computer technology had increased their ability to communicate technical information.

9. U.S. aerospace engineers and scientists made somewhat greater use of computer software than did their Dutch counterparts.

10. There were notable similarities between the two groups in terms of the information technologies presently being used and those that might be used in the future.

11. U.S. aerospace engineers and scientists made greater use of electronic networks than did their Dutch counterparts and rated the use of electronic networks twice as important as their Dutch counterparts rated electronic network use. Both groups reported similar types of use of electronic networks, which use did not include library and data base searching.

12. U.S. and Dutch respondents make the greatest use of domestically produced technical reports and rank them highly in terms of importance in performing their professional duties. The U.S. respondents indicated extensive use of AGARD reports (82%) and British ARC and RAE technical reports (54%). The Dutch also indicated extensive use of NASA reports (82%), AGARD reports (71%), German DFVLR, DLR, and MBB reports (69%), and British ARC and RAE reports (50%).

CONCLUDING REMARKS

Despite the limitations of this investigation, these findings contribute to our knowledge and understanding of the technical communications practices among aerospace engineers and scientists at the national and international levels. The findings reinforce some of the conventional wisdom regarding the nature and importance of technical communications and the amount of time that engineers and scientists devote to communicating technical information and raise questions about their use of information sources and resources,

particularly in light of current technologies. The results of this study should prove useful to R&D managers, library and information science professionals, curriculum developers, and technical communicators.

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APPENDIX A

AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT

Fact Sheet

A research study is investigating the production, transfer, and use of scientific and technical information (STI) in aerospace, a community which is becoming more interdisciplinary in nature and more international in scope. Sponsored by the National Aeronautics and Space Administration, the Aerospace Knowledge Diffusion Research Project is being conducted by the Indiana University Center for Survey Research, the NASA Langley Research Center, RPI, and selected universities in the U.S. and abroad.

This 4-phase project will provide descriptive and analytical data regarding the flow of STI at the individual, organizational, national, and international levels. It will examine both the channels used to communicate STI and the social system of the aerospace knowledge diffusion process. The results of the project should provide useful information to R&D managers, information managers, and others concerned with improving access to and utilization of STI. Phases 1 and 4 investigate the information-seeking habits and practices of U.S. and non-U.S. engineers, scientists, and engineering and science students. Phase 2 examines the industry-government interface and places particular emphasis on the role of the information intermediary in the knowledge diffusion process. Phase 3 explores the academic-government interface and places particular emphasis on the faculty-student-information intermediary relationship.

Empirically, little is known about the production, transfer, and use of aerospace STI in general and about the information-seeking behavior of engineers, scientists, and engineering and science students. Less is known about the effectiveness of information intermediaries and the roles they play in knowledge diffusion although their roles are generally assumed to be significant ones. However, a strong methodological base for measuring or assessing their effectiveness is lacking.

The ability of aerospace engineers and scientists to identify, acquire, and utilize STI is of paramount importance to the efficiency of the R&D process. An understanding of the process by which aerospace STI is communicated through certain channels over time among members of the social system would contribute to increasing productivity, stimulating innovation, and improving and maintaining the professional competence of engineers and scientists.

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APPENDIX B

NASA/DoD AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT PUBLICATIONS

REPORTS

Report No.

- 1
PART 1 Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communications in Aerospace: Results of Phase 1 Pilot Study.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101534. February 1989. 106 p. (Available from NTIS 89N26772.)
- 1
PART 2 Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communications in Aerospace: Results of a Phase 1 Pilot Study.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101534. February 1989. 83 p. (Available from NTIS 89N26773.)
- 2 Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communication in Aerospace: Results of Phase 1 Pilot Study -- An Analysis of Managers' and Nonmanagers' Responses.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101625. August 1989. 58 p. (Available from NTIS 90N11647.)
- 3 Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communication in Aerospace: Results of Phase 1 Pilot Study -- An Analysis of Profit Managers' and Nonprofit Managers' Responses.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101626. October 1989. 71 p. (Available from NTIS 90N15848.)
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- 12 Glassman, Nanci A. and Thomas E. Pinelli. **An Initial Investigation Into the Production and Use of Scientific and Technical Information (STI) at Five NASA Centers: Results of a Telephone Survey.** Washington, DC: National Aeronautics and Space Administration. NASA TM-104173. June 1992. 80 p. (Available from NTIS 92N27170.)
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APPENDIX C
DUTCH SURVEY INSTRUMENT

Technical Communications in Aerospace: An International Perspective

An Exploratory Study Conducted in the Netherlands
at the National Aerospace Laboratory (NLR)

Phase 4 of the Aerospace Knowledge Diffusion Research Project

1. In your work, how important is it for you to communicate (e.g., producing written materials or oral discussions) technical information effectively? (Circle number)

Very Unimportant 1 2 3 4 5 Very Important

2. In the past 6 months, about how many hours did you spend each week communicating technical information?

(output) ___ hours per week writing

___ hours per week communicating orally

3. Compared to 5 years ago, how has the amount of time you have spent **communicating** technical information changed? (Circle number)

1. Increased

2. Stayed the same

3. Decreased

4. In the past 6 months, about how many hours did you spend each week working with technical information received from others?

(input) ___ hours per week working with written information

___ hours per week receiving information orally

5. As you have advanced professionally, how has the amount of time you have spent working with technical information **received from others** changed? (Circle number)

1. Increased

2. Stayed the same

3. Decreased

6. What percentage of your written technical communications involve:

- Writing alone _____% → (If 100% alone, go to Question 9.)
- Writing with one other person _____%
- Writing with a group of 2 to 5 persons _____%
- Writing with a group of more than 5 persons _____%
- 100%

7. In general, do you find writing as part of a group more or less productive (i.e., producing more written products or producing better written products) than writing alone? (Circle number)

- 1. A group is less productive than writing alone
- 2. A group is about as productive as writing alone
- 3. A groups is more productive than writing alone
- 4. Difficult to judge; no experience preparing technical information

8. In the past 6 months, did you work with the same group of people when producing written technical communications? (Circle number)

- 1. Yes → About how many people were in the group: _____ number of people
- 2. No → With about how many groups did you work: _____ number of groups
↓
About how many people were in each group: _____ number of people

9. Approximately how many times in the past 6 months did you write or prepare the following alone or in a group? (If in a group, how many people were in each group?)

Times in Past 6 Months Produced

| | Alone | In a Group | |
|-----------------------------------|----------|------------|--------------------------|
| | ___Times | ___Times | ___Average No. of People |
| a. Abstracts | ___ | ___ | ___ |
| b. Journal articles | ___ | ___ | ___ |
| c. Conference/Meeting papers | ___ | ___ | ___ |
| d. Trade/Promotional literature | ___ | ___ | ___ |
| e. Drawings/Specifications | ___ | ___ | ___ |
| f. Audio/Visual materials | ___ | ___ | ___ |
| g. Letters | ___ | ___ | ___ |
| h. Memoranda | ___ | ___ | ___ |
| i. Technical proposals | ___ | ___ | ___ |
| j. Technical manuals | ___ | ___ | ___ |
| k. Computer program documentation | ___ | ___ | ___ |
| l. AGARD technical reports | ___ | ___ | ___ |
| m. In-house technical reports | ___ | ___ | ___ |
| n. Technical talks/Presentations | ___ | ___ | ___ |

10. Approximately how many times in the past 6 months did you use the following?

- | | | |
|-----------------------------------|----|------------------------|
| a. Abstracts | __ | Times used in 6 months |
| b. Journal articles | — | |
| c. Conference/Meeting papers | — | |
| d. Trade/Promotional literature | — | |
| e. Drawings/Specifications | — | |
| f. Audio/Visual materials | — | |
| g. Letters | — | |
| h. Memoranda | — | |
| i. Technical proposals | — | |
| j. Technical manuals | — | |
| k. Computer program documentation | — | |
| l. AGARD technical reports | — | |
| m. In-house technical reports | — | |
| n. Technical talks/Presentations | — | |

11. What types of technical information do you *USE* in your present job? (Circle appropriate numbers)

| | <u>Yes</u> | <u>No</u> |
|--|------------|-----------|
| Basic scientific and technical information | 1 | 2 |
| Experimental techniques | 1 | 2 |
| Codes of standards and practices | 1 | 2 |
| Computer programs | 1 | 2 |
| Government rules and regulations | 1 | 2 |
| In-house technical data | 1 | 2 |
| Product and performance characteristics | 1 | 2 |
| Economic information | 1 | 2 |
| Technical specifications | 1 | 2 |
| Patents | 1 | 2 |

12. What types of technical information do you *PRODUCE* (or expect to produce) in your present job? (Circle appropriate number)

| | <u>Yes</u> | <u>No</u> |
|--|------------|-----------|
| Basic scientific and technical information | 1 | 2 |
| Experimental techniques | 1 | 2 |
| Codes of standards and practices | 1 | 2 |
| Computer programs | 1 | 2 |
| Government rules and regulations | 1 | 2 |
| In-house technical data | 1 | 2 |
| Product and performance characteristics | 1 | 2 |
| Economic information | 1 | 2 |
| Technical specifications | 1 | 2 |
| Patents | 1 | 2 |

15. Have you ever taken a course in technical communications/writing? (Circle the appropriate number)

- 1. Yes, as an undergraduate
- 2. Yes, after graduation
- 3. Yes, both
- 4. Presently taking
- 5. No

16. How much did this course help you to communicate technical information? (Circle the appropriate number)

- 1. A lot
- 2. A little
- 3. Not at all

17. Do you think that undergraduate aerospace engineering and science students should have training or course work in technical communications (e.g., technical writing/oral presentations)? (Circle the appropriate number)

- 1. Yes
 - 2. No
 - 3. Don't know
- } → Go to Question 21.

If you answered "yes" to Question 17, please answer Questions 18, 19, and 20.

18. Do you think a technical communications course for undergraduate aerospace engineering and science students should be: (Circle the appropriate number)

- 1. Taken for academic credit
- 2. Not taken for academic credit
- 3. Don't know

19. Do you think the technical communications course should be: (Circle the appropriate number)

- 1. Taken as part of a required course
- 2. Taken as part of an elective course
- 3. Don't know

20. Do you think the technical communications course should be: (Circle the appropriate number)

- 1. Taken as part of an engineering course (e.g., Engineering 201)
- 2. Taken as a separate course (e.g., Technical Writing 101)
- 3. Taken as part of another course (i.e., neither Engineering or English)
- 4. Don't know

21. Which of the following **principles** should be included in an undergraduate technical communications course for aerospace engineers and scientists? (Circle the appropriate numbers)

| | <u>Yes</u> | <u>No</u> |
|---|------------|-----------|
| Defining the purpose of the communication | 1 | 2 |
| Assessing the needs of the reader | 1 | 2 |
| Organizing information | 1 | 2 |
| Developing paragraphs (introductions, transitions, and conclusions) | 1 | 2 |
| Writing sentences | 1 | 2 |
| Notetaking and quoting | 1 | 2 |
| Editing and revising | 1 | 2 |
| Choosing words (avoiding wordiness, jargon, slang, sexist terms) | 1 | 2 |
| Other (specify) _____ | | |

22. Which of the following **mechanics** should be included in an undergraduate technical communications course for aerospace engineers and scientists? (Circle the appropriate numbers)

| | <u>Yes</u> | <u>No</u> |
|--------------------------|------------|-----------|
| Abbreviations | 1 | 2 |
| Acronyms | 1 | 2 |
| Capitalization | 1 | 2 |
| Numbers | 1 | 2 |
| Punctuation | 1 | 2 |
| References | 1 | 2 |
| Spelling | 1 | 2 |
| Symbols | 1 | 2 |
| Other (specify) _____ | | |

23. Which of the following on-the-job skills should be included in an undergraduate technical communications course for aerospace engineers and scientists? (Circle the appropriate numbers)

| | <u>Yes</u> | <u>No</u> |
|--|------------|-----------|
| Abstracts | 1 | 2 |
| Letters | 1 | 2 |
| Memoranda | 1 | 2 |
| Technical instructions | 1 | 2 |
| Journal articles | 1 | 2 |
| Conference/Meeting papers | 1 | 2 |
| Literature reviews | 1 | 2 |
| Technical manuals | 1 | 2 |
| Newsletter/newspaper articles | 1 | 2 |
| Oral (technical) presentations | 1 | 2 |
| Technical specifications | 1 | 2 |
| Technical reports | 1 | 2 |
| Use of information sources | 1 | 2 |
| Other (specify) _____ | | |

24. Do you use computer technology to prepare technical information? (Circle the appropriate number)

- 1. Always
- 2. Usually
- 3. Sometimes
- 4. Never } \longrightarrow Go to Question 27.

If you answered "never" to Question 24, please skip to Question 27, otherwise, please answer Question 25.

25. How much has computer technology increased your ability to communicate technical information? (Circle the appropriate number)

- 1. Yes, a lot
- 2. Yes, a little
- 3. No, not really
- 4. No, not at all

26. Do you use any of the following software to prepare written technical information? (Circle the appropriate numbers)

| | <u>Yes</u> | <u>No</u> |
|--------------------------------------|------------|-----------|
| Word processing | 1 | 2 |
| Outliners and prompters | 1 | 2 |
| Grammar and style checkers | 1 | 2 |
| Spelling checkers | 1 | 2 |
| Thesaurus | 1 | 2 |
| Business graphics | 1 | 2 |
| Scientific graphics | 1 | 2 |
| Desktop publishing | 1 | 2 |

27. How do you view your use of the following electronic/information technologies in communicating technical information? (Circle the appropriate number)

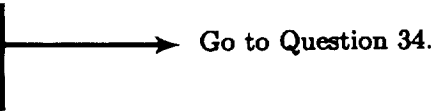
| Information Technologies | I already use it | I don't use it, but may in the future | I don't use it and doubt if I will |
|---|------------------|---------------------------------------|------------------------------------|
| Audio tapes and cassettes | 1 | 2 | 3 |
| Motion picture film | 1 | 2 |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

28. At your work place, do you use electronic networks in performing your present duties?

1. Yes

2. No

3. No because I do not have access to electronic networks



If you answered "yes" to Question 28, please answer Questions 29, 30, 31, 32, and 33.

29. At your work place, how do you access electronic networks?

1. By using a mainframe terminal

2. By using a personal computer

3. By using a workstation

30. How important is the use of electronic networks to performing your present duties?

Very Unimportant 1 2 3 4 5 Very Important

31. Based on a 40-hour work week, what percentage of your time do you use electronic networks?

_____ Percentage of the past work week

32. Do you use electronic networks for the following purposes?

| | <u>Yes</u> | <u>No</u> |
|--|------------|-----------|
| 1. To connect to geographically distant sites | 1 | 2 |
| 2. For <u>electronic mail</u> | 1 | 2 |
| 3. For <u>electronic bulletin boards or conferences</u> | 1 | 2 |
| 4. For <u>electronic file transfer</u> | 1 | 2 |
| 5. To log into remote computers for such things as computational analysis or to use design tools | 1 | 2 |
| 6. To control remote equipment such as laboratory instruments or machine tools | 1 | 2 |
| 7. To access/search the library's catalogue | 1 | 2 |
| 8. To order documents from the library | 1 | 2 |
| 9. To search electronic (bibliographic) data bases (e.g., ESA) | 1 | 2 |
| 10. For information search and data retrieval | 1 | 2 |
| 11. To prepare scientific and technical papers with colleagues at geographically distant sites | 1 | 2 |

33. Do you exchange electronic messages or files with:

| | <u>Yes</u> | <u>No</u> |
|--|------------|-----------|
| 1. Members of your work group | 1 | 2 |
| 2. Other people in your organization (at the same geographic site) who are not in your work group | 1 | 2 |
| 3. Other people in your organization (at a geographically different site) who are not in your work group | 1 | 2 |
| 4. People outside of your organization | 1 | 2 |

34. How likely would you be to use the following information if it was available in electronic format?

| | Very Unlikely | | | | Very Likely |
|--|------------------|---|---|---|----------------|
| 1. Data tables/mathematical presentations | 1 | 2 | 3 | 4 | 5 |
| 2. Computer program listings | 1 | 2 | 3 | 4 | 5 |
| 3. Online system (with full text and graphics) for technical papers | 1 | 2 | 3 | 4 | 5 |
| 4. CD-ROM system (with full text and graphics) for technical reports | 1 | 2 | 3 | 4 | 5 |

35. Which of the following best explains why you would not be using these materials in electronic format?

1. No/limited computer access
2. Hardware/software incompatibility
3. Prefer printed format
4. Other (specify) _____

36. Does your organization have a library/technical information center? (Circle the appropriate number)

- 1. Yes, in my building
- 2. Yes, but not in my building → ___Km
- 3. No | → Go to Question 39.

If you answered "yes" to Question 36, please answer Questions 37 and 38.

37. In the past six months, about how often did you use your organization's library/technical information center?

___Number of times in past 6 months

38. In terms of performing your present professional duties, how important is your organization's library/technical information center? (Circle the appropriate number)

Not at all important 1 2 3 4 5 Very important

39. When faced with solving a technical problem, which of the following sources do you usually consult?

↑
Please sequence these items (e.g., #1, #2, #3, #4, #5) and put an X beside the steps you did not use.

Sequence

- ___Used my personal store of technical information, including sources I keep in my office
- ___Spoke with co-workers or people inside by organization
- ___Spoke with colleagues outside my organization
- ___Spoke with a librarian or technical information specialist
- ___Used literature resources (e.g., conference papers, journals, technical reports) found in my organization's library)

(If you used none of the above steps, check here___.)

40. Do you use the following technical reports in performing your present professional duties? (Circle numbers)

| | Yes | No | Don't Have Access |
|--|-----|----|-------------------------|
| 1 AGARD reports | 1 | 2 | 9 |
| 2 British ARC and RAE reports | 1 | 2 | 9 |
| 3 ESA reports | 1 | 2 | 9 |
| 4 Indian NAL | 1 | 2 | 9 |
| 5 French ONERA reports | 1 | 2 | 9 |
| 6 German DFVLR, DLR, and MBB reports | 1 | 2 | 9 |
| 7 Japanese NAL reports | 1 | 2 | 9 |
| 8 Russian TsAGI reports | 1 | 2 | 9 |
| 9 Dutch NLR reports | 1 | 2 | 9 |
| 10 U.S. NASA reports | 1 | 2 | 9 |

41. How important are these reports in performing your present professional duties? (Circle numbers)

| | Very Unimportant | | | | | Very Important | | | | | Don't Have Access |
|----|------------------------------------|---|---|---|---|----------------|---|---|---|---|-------------------|
| 1 | AGARD reports | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 2 | British ARC and RAE reports | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 3 | ESA reports | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 4 | Indian NAL | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 5 | French ONERA reports | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 6 | German DFVLR, DLR, and MBB reports | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 7 | Japanese NAL reports | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 8 | Russian TsAGI reports | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 9 | Dutch NLR reports | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 10 | U.S. NASA reports | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |

42. Your native language:

_____ Please specify

43. How well do you read the following languages: (Circle numbers)

| | Passably | | | | | Fluently | | | | | Do not Read This Language |
|---|------------------------------|---|---|---|---|----------|---|---|---|---|---------------------------|
| 1 | English | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 2 | French | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 3 | German | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 4 | Japanese | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 5 | Russian | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 6 | Other (please specify) _____ | | | | | | | | | | |

44. How well do you speak the following languages: (Circle numbers)

| | Passably | | | | | Fluently | | | | | Do not Speak This Language |
|---|------------------------------|---|---|---|---|----------|---|---|---|---|----------------------------|
| 1 | English | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 2 | French | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 3 | German | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 4 | Japanese | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 5 | Russian | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 9 |
| 6 | Other (please specify) _____ | | | | | | | | | | |

These data will be used to determine whether people with different backgrounds have different technical communication practices.

45. Sex:

1. Female

2. Male

Over (please) →

46. Education:
1. No degree
 2. Bachelor
 3. Master
 4. Doctorate
 5. Other (specify) _____
47. Years of professional aerospace work experience:
- _____ years
48. Type of organization where you work: (Circle ONLY ONE number)
1. Academic
 2. Industrial
 3. Not-for-profit
 4. Government
 5. Other (specify) _____
49. Which of the following BEST describes your primary professional duties? (Circle ONLY ONE number)
- 01 Research
 - 02 Administration/Mgt
 - 03 Design/Development
 - 04 Teaching/Academic (may include research)
 - 05 Manufacturing/Production
 - 06 Private consultant
 - 07 Service/Maintenance
 - 08 Marketing/Sales
 - 09 Other (specify) _____
50. Was your academic preparation as an:
1. Engineer
 2. Scientist
 3. Other (specify) _____
51. In your present job, do you consider yourself primarily an:
1. Engineer
 2. Scientist
 3. Other (specify) _____
52. Are you a member of a professional (national) engineering, scientific, or technical society?
1. Yes
 2. No

APPENDIX D
U.S. SURVEY INSTRUMENT

Technical Communications in Aerospace: An International Perspective

An Exploratory Study Conducted at the NASA Langley Research Center

Phase 4 of the Aerospace Knowledge Diffusion Research Project

1. In your work, how important is it for you to communicate (e.g., producing written materials or oral discussions) technical information effectively? (Circle number)

Very Unimportant 1 2 3 4 5 Very Important

2. In the past 6 months, about how many hours did you spend each week communicating technical information?

(output) _____ hours per week writing

_____ hours per week communicating orally

3. In the past 6 months, about how many hours did you spend each week working with technical information received from others?

(input) _____ hours per week working with written information

_____ hours per week receiving information orally

4. Compared to 5 years ago, how has the amount of time you have spent **communicating** technical information changed? (Circle number)

1. Increased

2. Stayed the same

3. Decreased

5. As you have advanced professionally, how has the amount of time you have spent working with technical information **received from others** changed? (Circle number)

1. Increased

2. Stayed the same

3. Decreased

6. What percentage of your written technical communications involve:

- Writing alone _____% → (If 100% alone, skip to question 9.)
- Writing with one other person _____%
- Writing with a group of 2 to 5 persons _____%
- Writing with a group of more than 5 persons _____%
- 100%

7. In general, do you find writing as part of a group more or less productive (i.e., quantity/quality) than writing alone? (Circle number)

1. A group is less productive than writing alone
2. A group is about as productive as writing alone
3. A groups is more productive than writing alone
4. Difficult to judge; no experience preparing technical information

8. In the past 6 months, did you work with the same group of people when producing written technical communications? (Circle number)

1. Yes → About how many people were in the group: _____number of people
2. No → With about how many groups did you work: _____number of groups
↓
About how many people were in each group: _____number of people

9. Approximately how many times in the past 6 months did you write or prepare the following alone or in a group? (If in a group, how many people were in each group?)

Times in Past 6 Months Produced

| | Alone | In a group | |
|--------------------------------------|----------|------------|--------------------------|
| a. Abstracts | ___times | ___times | ___Average No. of people |
| b. Journal articles | ___ | ___ | ___ |
| c. Conference/Meeting papers | ___ | ___ | ___ |
| d. Trade/Promotional literature | ___ | ___ | ___ |
| e. Drawings/Specifications | ___ | ___ | ___ |
| f. Audio/Visual materials | ___ | ___ | ___ |
| g. Letters | ___ | ___ | ___ |
| h. Memoranda | ___ | ___ | ___ |
| i. Technical proposals | ___ | ___ | ___ |
| j. Technical manuals | ___ | ___ | ___ |
| k. Computer program documentation | ___ | ___ | ___ |
| l. AGARD technical reports | ___ | ___ | ___ |
| m. U.S. Government technical reports | ___ | ___ | ___ |
| n. In-house technical reports | ___ | ___ | ___ |
| o. Technical talks/Presentations | ___ | ___ | ___ |

10. Approximately how many times in the past 6 months did you use the following?

- | | | |
|--------------------------------------|----|------------------------|
| a. Abstracts | __ | Times used in 6 months |
| b. Journal articles | — | |
| c. Conference/Meeting papers | — | |
| d. Trade/Promotional literature | — | |
| e. Drawings/Specifications | — | |
| f. Audio/Visual materials | — | |
| g. Letters | — | |
| h. Memoranda | — | |
| i. Technical proposals | — | |
| j. Technical manuals | — | |
| k. Computer program documentation | — | |
| l. AGARD technical reports | — | |
| m. U.S. Government technical reports | — | |
| n. In-house technical reports | — | |
| o. Technical talks/Presentations | — | |

11. What types of technical information do you *USE* in your present job? (Circle appropriate numbers)

| | Yes | No |
|--|-----|----|
| Basic scientific and technical information | 1 | 2 |
| Experimental techniques | 1 | 2 |
| Codes of standards and practices | 1 | 2 |
| Computer programs | 1 | 2 |
| Government rules and regulations | 1 | 2 |
| In-house technical data | 1 | 2 |
| Product and performance characteristics | 1 | 2 |
| Economic information | 1 | 2 |
| Technical specifications | 1 | 2 |
| Patents | 1 | 2 |

12. What types of technical information do you *PRODUCE* (or expect to produce) in your present job? (Circle appropriate number)

| | Yes | No |
|--|-----|----|
| Basic scientific and technical information | 1 | 2 |
| Experimental techniques | 1 | 2 |
| Codes of standards and practices | 1 | 2 |
| Computer programs | 1 | 2 |
| Government rules and regulations | 1 | 2 |
| In-house technical data | 1 | 2 |
| Product and performance characteristics | 1 | 2 |
| Economic information | 1 | 2 |
| Technical specifications | 1 | 2 |
| Patents | 1 | 2 |

15. Have you ever taken a course in technical communications/writing? (Circle the appropriate number)

- 1. Yes, as an undergraduate
- 2. Yes, after graduation
- 3. Yes, both
- 4. Presently taking
- 5. No



16. How much did this course help you to communicate technical information? (Circle the appropriate number)



- 1. A lot
- 2. A little
- 3. Not at all

17. Do you think that undergraduate aerospace engineering and science students should take a course in technical communications? (Circle the appropriate number)

- 1. Yes
- 2. No
- 3. Don't know

If you answered "no" or "don't know" to Question 17, please skip to Question 21. If you answered "yes" to Question 17, please continue to Question 18.

18. Do you think a technical communications course for undergraduate aerospace engineering and science students should be: (Circle the appropriate number)

- 1. Taken for credit
- 2. Not taken for credit
- 3. Don't know

If you answered "not taken" or "don't know" to Question 18, please skip to Question 21. If you answered "taken" to Question 18, please answer Question 19.

19. Do you think the technical communications course should be: (Circle the appropriate number)

- 1. Taken as part of a required course
- 2. Taken as part of an elective course
- 3. Don't know

If you think the technical communications course should be taken as a separate course, please answer Question 20. Otherwise, please skip to Question 21.

20. Do you think the technical communications course should be: (Circle the appropriate number)

- 1. Taken as part of an engineering course
- 2. Taken as a separate course
- 3. Taken as part of another course
- 4. Don't know

21. Which of the following **principles** should be included in an undergraduate technical communications course for aerospace engineers and scientists? (Circle the appropriate numbers)

| | Yes | No |
|---|-----|----|
| Defining the purpose of the communication | 1 | 2 |
| Assessing the needs of the reader | 1 | 2 |
| Organizing information | 1 | 2 |
| Developing paragraphs (introductions, transitions, and conclusions) | 1 | 2 |
| Writing sentences | 1 | 2 |
| Notetaking and quoting | 1 | 2 |
| Editing and revising | 1 | 2 |
| Choosing words (avoiding wordiness, jargon, slang, sexist terms) | 1 | 2 |
| Other (specify) _____ | | |

22. Which of the following **mechanics** should be included in an undergraduate technical communications course for aerospace engineers and scientists? (Circle the appropriate numbers)

| | Yes | No |
|--------------------------|-----|----|
| Abbreviations | 1 | 2 |
| Acronyms | 1 | 2 |
| Capitalization | 1 | 2 |
| Numbers | 1 | 2 |
| Punctuation | 1 | 2 |
| References | 1 | 2 |
| Spelling | 1 | 2 |
| Symbols | 1 | 2 |
| Other (specify) _____ | | |

23. Which of the following on-the-job skills should be included in an undergraduate technical communications course for aerospace engineers and scientists? (Circle the appropriate numbers)

| | Yes | No |
|--|-----|----|
| Abstracts | 1 | 2 |
| Letters | 1 | 2 |
| Memoranda | 1 | 2 |
| Technical instructions | 1 | 2 |
| Journal articles | 1 | 2 |
| Conference/Meeting papers | 1 | 2 |
| Literature reviews | 1 | 2 |
| Technical manuals | 1 | 2 |
| Newsletter/newspaper articles | 1 | 2 |
| Oral (technical) presentations | 1 | 2 |
| Technical specifications | 1 | 2 |
| Technical reports | 1 | 2 |
| Use of information sources | 1 | 2 |
| Other (specify) _____ | | |

24. Do you use computer technology to prepare technical information? (Circle the appropriate number)

1. Always
2. Usually
3. Sometimes
4. Never

If you answered "never" to Question 24, please skip to Question 27, otherwise, please answer Question 25.

25. How much computer technology increased your ability to communicate technical information? (Circle the appropriate number)

1. Yes, a lot
2. Yes, a little
3. No, not really
4. No, not at all

26. Do you use any of the following software to prepare written technical information? (Circle the appropriate numbers)

| | Yes | No |
|--------------------------------------|-----|----|
| Word processing | 1 | 2 |
| Outliners and prompters | 1 | 2 |
| Grammar and style checkers | 1 | 2 |
| Spelling checkers | 1 | 2 |
| Thesaurus | 1 | 2 |
| Business graphics | 1 | 2 |
| Scientific graphics | 1 | 2 |
| Desktop publishing | 1 | 2 |

27. How do you view your use of the following electronic/information technologies in communicating technical information? (Circle the appropriate number)

| 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 |
|---|---------------------|---|--|
| Audio tapes and cassettes | 1 | 2 | 3 |
| Motion picture film | 1 | 2 | 3 |
| Video tape | 1 | 2 | 3 |
| Desk top/electronic publishing | 1 | 2 | 3 |
| Computer cassette/cartridge tapes | 1 | 2 | 3 |
| Electronic Mail | 1 | 2 | 3 |
| Electronic bulletin boards | 1 | 2 | 3 |
| FAX or TELEX | 1 | 2 | 3 |
| Electronic data bases | 1 | 2 | 3 |
| Video conferencing | 1 | 2 | 3 |
| Teleconferencing | 1 | 2 | 3 |
| Micrographics & microforms | 1 | 2 | 3 |
| Laser disc/video disc/CD-ROM | 1 | 2 | 3 |
| Electronic networks | 1 | 2 | 3 |

28. At your work place, do you use electronic networks in performing your present duties?

1. Yes
2. No
3. No because I do not have access to electronic networks

If you answered "no" to Question 28, please skip to Question 34. If you answered "yes" to Question 28, please continue to Question 29.

29. At your work place, how do you access electronic networks?

1. By using a mainframe terminal
2. By using a personal computer
3. By using a workstation

30. How important is the use of electronic networks to performing your present duties?

Very Unimportant 1 2 3 4 5 Very Important

31. Based on a 40-hour work week, what percentage of your time do you use electronic networks?

_____Percentage of the past work week

32. Do you use electronic networks for the following purposes?

| | Yes | No |
|--|-----|----|
| 1. To connect to geographically distant sites | 1 | 2 |
| 2. For electronic mail | 1 | 2 |
| 3. For electronic bulletin boards or conferences | 1 | 2 |
| 4. For electronic file transfer | 1 | 2 |
| 5. To log into remote computers for such things as computational analysis or to use design tools | 1 | 2 |
| 6. To control remote equipment such as laboratory instruments or machine tools | 1 | 2 |
| 7. To access/search the library's catalogue | 1 | 2 |
| 8. To order documents from the library | 1 | 2 |
| 9. To search electronic data bases (e.g., RECON) | 1 | 2 |
| 10. For information search and data retrieval | 1 | 2 |
| 11. To prepare scientific and technical papers which colleagues at geographically distant sites | 1 | 2 |

33. Do you exchange electronic messages or files with:

| | Yes | No |
|--|-----|----|
| 1. Members of your work group | 1 | 2 |
| 2. Other people in your organization (at the same geographic site) who are not in your work group | 1 | 2 |
| 3. Other people in your organization (at a geographically different site) who are not in your work group | 1 | 2 |
| 4. People outside of your organization | 1 | 2 |

34. How likely would you be to use the following information if it was available in electronic format?

| | Very Unlikely | | | | | Very Likely |
|---|---------------|---|---|---|---|-------------|
| 1. Data tables/mathematical presentations | 1 | 2 | 3 | 4 | 5 | |
| 2. Computer program listings | 1 | 2 | 3 | 4 | 5 | |
| 3. Online system (with full text and graphics) for NASA technical papers | 1 | 2 | 3 | 4 | 5 | |
| 4. CD-ROM system (with full text and graphics) for NASA technical reports | 1 | 2 | 3 | 4 | 5 | |

35. Which of the following best explains why you would not be using these materials in electronic format?

1. No/limited computer access
2. Hardware/software incompatibility
3. Prefer printed format
4. Other (specify) _____

36. Does your organization have a library/technical information center? (Circle the appropriate number)

- 1. Yes, in my building
- 2. Yes, but not in my building → ___Miles
- 3. No

If you answered "yes" to Question 36, please continue to Question 37. If you answered "no" to Question 36, please skip to Question 39.

37. In the past six months, about how often did you use your organization's library/technical information center?

___Number of times in past 6 months

38. In terms of performing your present professional duties, how important is your organization's library/technical information center? (Circle the appropriate number)

Not at all important 1 2 3 4 5 Very important

39. When faced with solving a technical problem, which of the following sources do you usually consult?

↑
Please sequence these items (e.g., #1, #2, #3, #4, #5) or put an X beside the steps you did not use.

Sequence

- ___Used my personal store of technical information, including sources I keep in my office
- ___Spoke with co-workers or people inside by organization
- ___Spoke with colleagues outside my organization
- ___Spoke with a librarian or technical information specialist
- ___Used literature resources (e.g., conference papers, journals, technical reports) found in my organization's library)

(If you used none of the above steps, check here ___.)

These data will be used to determine whether people with different backgrounds have different technical communication practices.

40. Sex:

- 1. Female
- 2. Male

41. Education:

1. No degree
2. Bachelors
3. Masters
4. Doctorate
5. Other (specify) _____

42. Years of professional aerospace work experience:

___ years

43. Type of organization where you work: (Circle ONLY ONE number)

1. Academic
2. Industrial
3. Not-for-profit
4. Government
5. Other (specify) _____

44. Which of the following BEST describes your primary professional duties? (Circle ONLY ONE number)

- 01 Research
- 02 Administration/Mgt
- 03 Design/Development
- 04 Teaching/Academic (may include research)
- 05 Manufacturing/Production
- 06 Private consultant
- 07 Service/Maintenance
- 08 Marketing/Sales
- 09 Other (specify) _____

45. Was your academic preparation as an:

1. Engineer
2. Scientist
3. Other (specify) _____

46. In your present job, do you consider yourself primarily an:

1. Engineer
2. Scientist
3. Other (specify) _____

47. Are you a member of a professional (national) engineering, scientific, or technical society?

1. Yes
2. No

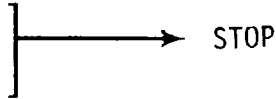
APPENDIX D
U.S. SURVEY INSTRUMENT
SUPPLEMENTAL QUESTIONS

17. Do you think that undergraduate aerospace engineering and science students should have training or course work in technical communications (e.g., technical writing/oral presentations)? (Circle the appropriate number)

1. Yes

2. No

3. Don't know



If you answered "yes" to Question 17, please answer Questions 18, 19, and 20.

18. Do you think a technical communications course for undergraduate aerospace engineering and science students should be: (Circle the appropriate number)

1. Taken for academic credit

2. Not taken for academic credit

3. Don't know

19. Do you think the technical communications course should be: (Circle the appropriate number)

1. Taken as part of a required course

2. Taken as part of an elective course

3. Don't know

20. Do you think the technical communications course should be: (Circle the appropriate number)

1. Taken as part of an engineering course (e.g., Engineering 201)

2. Taken as a separate course (e.g., Technical Writing 101)

3. Taken as part of another course (i.e., neither Engineering or English)

4. Don't know

40. Do you use the following technical reports in performing your present professional duties? (Circle numbers)

| | Yes | No | Don't Have Access |
|--|-----|----|-------------------|
| 1 AGARD reports | 1 | 2 | 9 |
| 2 British ARC and RAE reports | 1 | 2 | 9 |
| 3 ESA reports | 1 | 2 | 9 |
| 4 Indian NAL | 1 | 2 | 9 |
| 5 French ONERA reports | 1 | 2 | 9 |
| 6 German DFVLR, DLR, and MBB reports | 1 | 2 | 9 |
| 7 Japanese NAL reports | 1 | 2 | 9 |
| 8 Russian TsAGI reports | 1 | 2 | 9 |
| 9 Dutch NLR reports | 1 | 2 | 9 |
| 10 U.S. NASA reports | 1 | 2 | 9 |

41. How important are these reports in performing your present professional duties? (Circle numbers)

| | Very Unimportant | | | | Very Important | Don't Have Access |
|--|------------------|---|---|---|----------------|-------------------|
| 1 AGARD reports | 1 | 2 | 3 | 4 | 5 | 9 |
| 2 British ARC and RAE reports | 1 | 2 | 3 | 4 | 5 | 9 |
| 3 ESA reports | 1 | 2 | 3 | 4 | 5 | 9 |
| 4 Indian NAL | 1 | 2 | 3 | 4 | 5 | 9 |
| 5 French ONERA reports | 1 | 2 | 3 | 4 | 5 | 9 |
| 6 German DFVLR, DLR, and MBB reports | 1 | 2 | 3 | 4 | 5 | 9 |
| 7 Japanese NAL reports | 1 | 2 | 3 | 4 | 5 | 9 |
| 8 Russian TsAGI reports | 1 | 2 | 3 | 4 | 5 | 9 |
| 9 Dutch NLR reports | 1 | 2 | 3 | 4 | 5 | 9 |
| 10 U.S. NASA reports | 1 | 2 | 3 | 4 | 5 | 9 |

42. Your native language:

_____ Please specify

43. How well do you read the following languages: (Circle numbers)

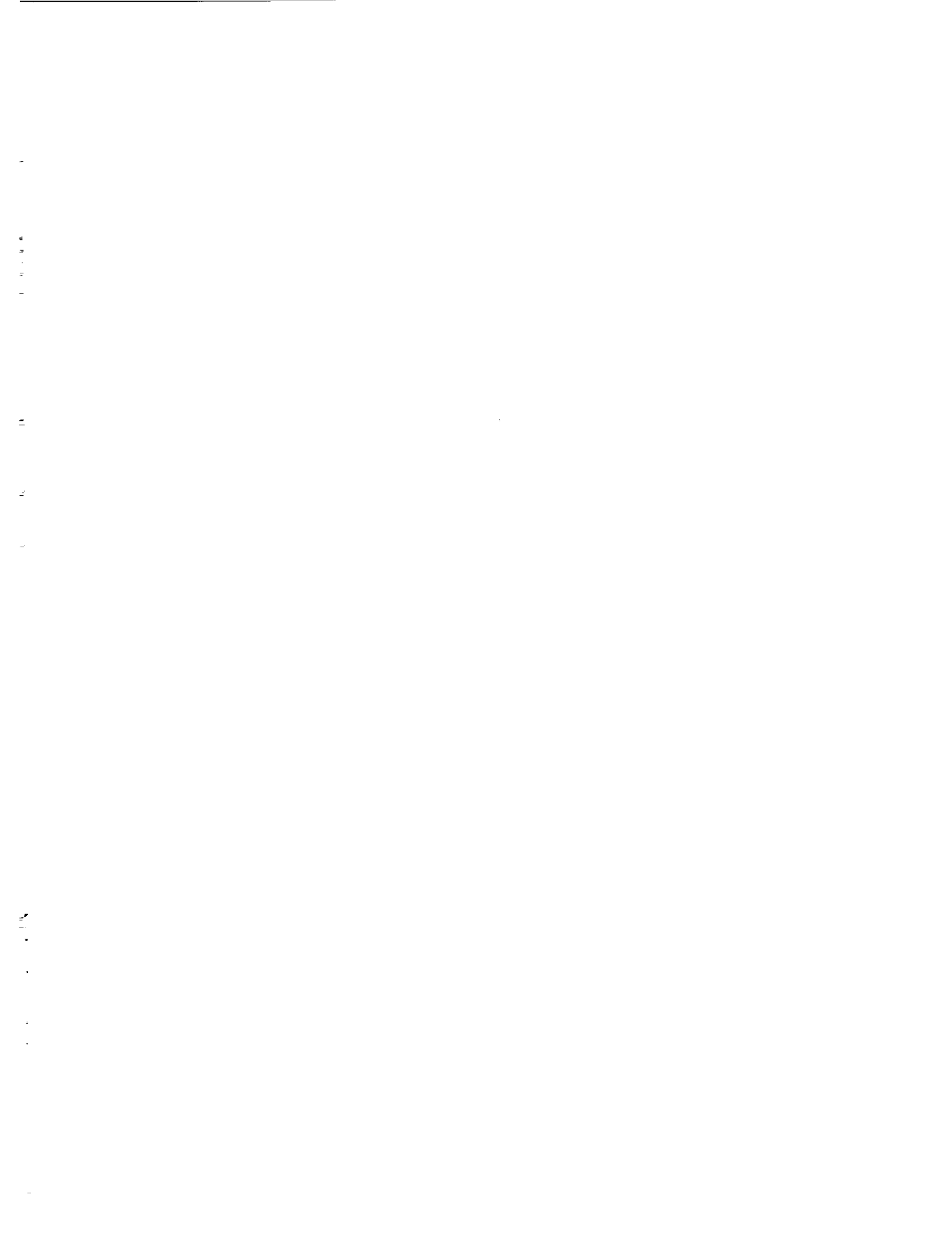
| | Passably | | | | Fluently | Do not Read This Language |
|--------------------------------|----------|---|---|---|----------|---------------------------|
| 1 English | 1 | 2 | 3 | 4 | 5 | 9 |
| 2 French | 1 | 2 | 3 | 4 | 5 | 9 |
| 3 German | 1 | 2 | 3 | 4 | 5 | 9 |
| 4 Japanese | 1 | 2 | 3 | 4 | 5 | 9 |
| 5 Russian | 1 | 2 | 3 | 4 | 5 | 9 |
| 6 Other (please specify) _____ | | | | | | |

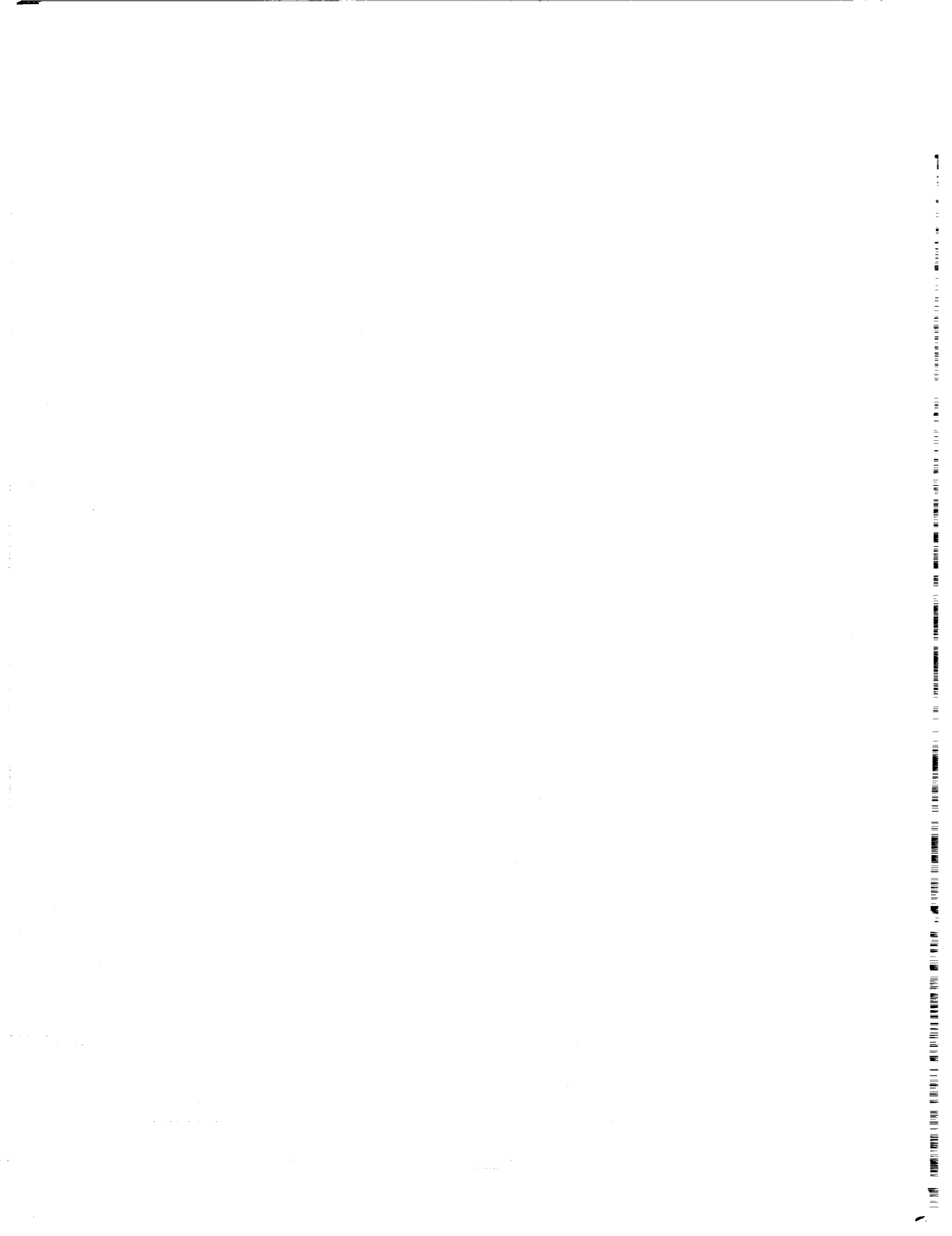
44. How well do you speak the following languages: (Circle numbers)

| | Passably | | | | Fluently | Do not Speak This Language |
|--------------------------------|----------|---|---|---|----------|----------------------------|
| 1 English | 1 | 2 | 3 | 4 | 5 | 9 |
| 2 French | 1 | 2 | 3 | 4 | 5 | 9 |
| 3 German | 1 | 2 | 3 | 4 | 5 | 9 |
| 4 Japanese | 1 | 2 | 3 | 4 | 5 | 9 |
| 5 Russian | 1 | 2 | 3 | 4 | 5 | 9 |
| 6 Other (please specify) _____ | | | | | | |



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| 6. AUTHOR(S) Rebecca O. Barclay, Thomas E. Pinelli, and John M. Kennedy | | | | |
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| 11. SUPPLEMENTARY NOTES *Report number 17 under the NASA/DoD Aerospace Knowledge Diffusion Research Project. Rebecca O. Barclay: Rensselaer Polytechnic Institute, Troy, NY; Thomas E. Pinelli: Langley Research Center, Hampton, VA; and John M. Kennedy: Indiana University, Bloomington, IN. | | | | |
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| 13. ABSTRACT (Maximum 200 words) As part of Phase 4 of the NASA/DoD Aerospace Knowledge Diffusion Research Project, two studies were conducted that investigated the technical communications practices of Dutch and U.S. aerospace engineers and scientists. Both studies have the same seven objectives: first, to solicit the opinions of aerospace engineers and scientists regarding the importance of technical communications to their profession; second, to determine the use and production of technical communications by aerospace engineers and scientists; third, to seek their views about the appropriate content of an undergraduate course in technical communications; fourth, to determine aerospace engineers' and scientists' use of libraries, technical information centers, and on-line data bases; fifth, to determine the use and importance of computer and information technology to them; sixth, to determine their use of electronic networks; and seventh, to determine their use of foreign and domestically produced technical reports. A self-administered questionnaire was distributed to aerospace engineers and scientists at the National Aerospace Laboratory (NLR), and NASA Ames Research Center, and the NASA Langley Research Center. The completion rates for the Dutch and U.S. surveys were 55 and 61 percent, respectively. Responses of the Dutch and U.S. participants to selected questions are presented in this report. | | | | |
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