NASA/DoD Aerospace Knowledge Diffusion Research Project

111-82
38870
p.54

NASA Technical Memorandum 109164

Report Number 29

A Comparison of the Technical Communications Practices of Japanese and U.S. Aerospace Engineers and Scientists

Thomas E. Pinelli
NASA Langley Research Center
Hampton, Virginia

Rebecca O. Barclay
Rensselaer Polytechnic Institute
Troy, New York

John M. Kennedy
Indiana University
Bloomington, Indiana

December 1994

National Aeronautics and Space Administration

Department of Defense

INDIANA UNIVERSITY

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 in Japan and in the United States (U.S.). Previous work includes exploratory studies of the technical communications practices of aerospace engineers and scientists in Israel [1], selected Western European countries [2], Russia [3], and the Netherlands [4].

The data reported herein were collected through self-administered (self-reported) questionnaires undertaken as a Phase 4 activity of the *NASA/DoD Aerospace Knowledge Diffusion Research Project.* The Japanese/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 the importance of computer and information technology to them,

6. To determine their use of electronic networks, and

7. To determine their language (ability to read and speak) skills and 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 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*. The project fact sheet is 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 [5].

RESEARCH DESIGN AND METHODOLOGY

Data were collected through self-administered (self-reported) questionnaires. The instrument used to collect the data had been used previously in several Western European countries and in the Netherlands and Russia in slightly adapted form. The Japanese-language version of the instrument is Appendix B. English-language questionnaires were distributed to 558 aerospace engineers and scientists at the NASA Ames and NASA Langley Research Centers in the U.S., 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. Two hundred eighty-seven of the 340 U.S. respondents completed and returned the survey for an adjusted rate of 48%. The U.S. survey was conducted during July and August of 1992 with a follow-up in December 1992.

Japanese-language questionnaires were sent to 13 Japanese aerospace engineers and scientists. We sent multiple questionnaires to each member of the sample and asked that each recipient distribute the survey to colleagues. We received 94 of the 110 surveys by the established cut-off date. The Japanese survey was conducted during March and June of 1994.

PRESENTATION OF THE DATA

This report presents selected results from the Japanese and U.S. studies, with the Japanese responses presented first, followed by the U.S. responses. Demographic data are presented first, followed by data dealing with language proficiency, 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 more differences than similarities. The two groups differ significantly in terms of organizational affiliation, gender, and current professional duties; they are similar in years of professional work experience, academic preparation, and professional society membership.

The following "composite" participant profiles were based on the demographic data. The Japanese survey participant works as a researcher (33%), has a master's degree (45%), was trained as an engineer (95%) and currently works as an engineer (100%), has as an average of 15 years professional work experience, and is a member of a professional/technical society (89%). The U.S. survey participant works as a researcher (82%), has a master's degree (46%), 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%).

Table 1. Demographic Findings

Demographics	Japan %	Japan (n)	U.S. %	U.S. (n)
Professional Duties				
Design/Development	31	(29)	6	(21)
Administration/Management	4	(4)	11	(37)
Research	33	(31)	82	(279)
Service/Maintenance	0	(0)	1	(3)
Teaching/Academic	32	(30)	0	(0)
Organizational Affiliation				
Academic	46	(43)	0	(0)
Government	45	(42)	100	(340)
Industrial	9	(9)	0	(0)
Professional Work Experience				
1 - 5 years	16	(16)	15	(52)
6 - 10 years	26	(24)	22	(74)
11 - 20 years	32	(30)	25	(95)
21 - 40 years	26	(24)	34	(115)
41 or more years	0	(0)	1	(4)
Japan / U.S.				
Mean: Japan 15, U.S. 17				
Median: Japan 12, U.S. 14				
Education				
Doctorate	32	(39)	27	(91)
Master's Degree	45	(33)	46	(158)
Bachelor's Degree	23	(22)	27	(91)
Educational Preparation				
Engineer	95	(89)	80	(273)
Scientist	5	(5)	17	(58)
Mathematician	0	(0)	2	(7)
Computer Science	0	(0)	1	(2)
Current Duties				
Engineer	100	(94)	69	(234)
Scientist	0	(0)	27	(92)
Other	0	(0)	4	(14)
Member of A Professional/ Technical Society	89	(84)	78	(265)
Gender				
Female	1	(1)	85	(290)
Male	99	(93)	15	(50)

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. The Japanese respondents read and speak English. Both Japanese and U.S. respondents reported limited fluency in foreign languages. The mean ($\bar{X}$) ability to read and speak French and German was the same for both groups. The mean ($\bar{X}$) ability to read Russian, although low for both groups, was higher for the U.S. group, while the mean ($\bar{X}$) ability to speak Russian was slightly higher for the Japanese group.

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

	Japan n = 94				U.S. n = 340			
Language	Read %	Speak %	$\bar{X}$ Ability[a]		Read %	Speak %	$\bar{X}$ Ability[a]	
English	100	99	3.8	3.0	100[b]	100[b]	----	----
French	30	22	1.7	1.6	32	22	1.7	1.6
German	71	40	1.7	1.6	21	15	1.7	1.6
Japanese	100[b]	100[b]	----	----	3	5	1.7	1.7
Russian	18	10	1.3	1.6	6	5	1.6	1.5

[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] This is the native language for these respondents.

Importance of and Time Spent on Technical Communications

Approximately 94.7% of the Japanese respondents and 90.6% 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 Japanese aerospace engineers and scientists spent an average of 15.89 hours per week communicating technical information to others; U.S. aerospace engineers and scientists spent an average of 16.98 hours per week. Japanese aerospace engineers and scientists spent an average of 10.07 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).

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

Communication Activity	Japan	U.S.
Communication With Others	15.89 (14.00) hours/week	16.98 (15.00) hours/week
Working with Communications Received From Others	10.07 (10.00) hours/week	13.97 (12.00) hours/week

Approximately 60% of the Japanese respondents and 70% of the U.S. respondents indicated that the amount of time they spent communicating technical information had increased over the past 5 years (table 4). Twenty-five percent of the Japanese 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 15% of the Japanese 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 Japan and U.S. Aerospace Engineers and Scientists

Change	Japan		U.S.	
	%	(n)	%	(n)
Increased	60	(56)	70	(239)
Stayed The Same	25	(24)	24	(80)
Decreased	15	(14)	6	(21)

As they have advanced professionally, 35% of the Japanese respondents have increased the amount of time they spend communicating technical information. Conversely, 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 Japanese and U.S. Aerospace Engineers and Scientists

Change	Japan		U.S.	
	%	(n)	%	(n)
Increased	35	(33)	65	(221)
Stayed The Same	34	(32)	26	(87)
Decreased	31	(29)	9	(32)

<u>The Production and Use of Technical Communications</u>

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 21% of the Japanese respondents and 15% of the U.S. respondents write alone. Although a higher percentage of the U.S. respondents than the Japanese respondents writes with a group of

2 to 5 people or with a group of 5 or more people, writing appears to be a collaborative process for both groups.

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

Collaborative Practices	Japan			U.S.		
	$\bar{X}$%	%*	(n)	$\bar{X}$%	%*	(n)
I Write Alone	70.1	21	(20)	61.1	15	(50)
I Write With One Other Person	12.8	57	(54)	20.7	72	(246)
I Write With A Group Of Two To Five People	14.9	53	(50)	15.6	61	(208)
I Write With A Group Five Or More People	2.2	11	(10)	2.1	14	(47)

* Percentages do not total 100

Japanese and U.S. aerospace engineers and scientists were asked to assess the influence of group participation on writing productivity (table 7). Only 35% of the Japanese respondents and 32% of the U.S. respondents indicated that group writing is more productive than writing alone. Eighteen percent of the Japanese respondents and 32% of the U.S. respondents found that group writing is about as productive as writing alone, and 26% of the Japanese respondents and 20% of the U.S. respondents found that writing in a group is less productive than writing alone.

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

Group Participation	Japan		U.S.	
	%	(n)	%	(n)
A Group Is More Productive Than Writing Alone	35	(33)	32	(110)
A Group Is About As Productive As Writing Alone	18	(17)	32	(107)
A Group Is Less Productive Than Writing Alone	26	(24)	20	(68)
I Only Write Alone	21	(20)	15	(50)

Of the respondents who did not write alone, 48% of the Japanese 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 Japanese group was $\bar{X} = 5.11$ and the average number of people in the U.S. group was $\bar{X} = 3.21$. Thirty-one percent of the Japanese respondents worked in an average (mean) number of 3.10 groups, each group containing an average of 3.14 people. Forty percent of the U.S. respondents worked in an average (mean) number of 2.82 groups, each group containing an average (mean) of 3.03 people.

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

	Japan		U.S.	
Groups and Group Size	%	(n)	%	(n)
Worked With Same Group				
Yes	48	(45)	47	(161)
No	31	(29)	38	(129)
I Only Write Alone	21	(20)	15	(50)
Number of People in Group				
Mean	5.11	(45)	3.21	(161)
Median	3.00	(45)	3.00	(161)
Number of Groups				
Mean	3.10	(29)	2.82	(129)
Median	3.00	(29)	3.00	(129)
Number of People in Each Group				
Mean	3.14	(29)	3.03	(129)
Median	3.00	(29)	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 Japanese respondents most frequently **prepared** letters, trade/promotional literature, technical proposals, drawings/specifications, and in-house technical reports (table 9). As part of a working group, these Japanese aerospace engineers and scientists most frequently **prepared** in-house technical reports, drawings/specifications, letters, technical proposals, and technical manuals. For these products, the mean number of persons per group ranged from a high of $\bar{X}$ = 7.00 to a low of $\bar{X}$ = 2.20.

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

Information Product	Alone		In a Group		Average Number of Persons Per Group	
	Mean	Median	Mean	Median	Mean	Median
Abstracts	3.37	(2.00)	2.14	(1.00)	2.79	(2.50)
Journal Articles	1.62	(1.00)	2.62	(2.00)	2.62	(2.00)
Conference/Meeting Papers	2.21	(2.00)	3.53	(1.50)	2.66	(2.00)
Trade/Promotional Literature	10.60	(10.00)	2.88	(2.50)	2.75	(2.50)
Drawings/Specifications	8.22	(4.00)	8.62	(3.00)	3.28	(3.00)
Audio/Visual Materials	2.33	(1.00)	2.00	**	3.00	**
Letters	17.92	(10.00)	5.63	(3.00)	3.00	(2.50)
Memoranda	6.00	(4.00)	2.00	(2.00)	2.50	(2.50)
Technical Proposals	9.36	(3.00)	4.15	(2.00)	5.20	(3.00)
Technical Manuals	4.00	(2.00)	4.00	(2.00)	3.67	(3.00)
Computer Program Documentation	3.75	(2.00)	3.80	(5.00)	2.20	(2.00)
AGARD Technical Reports	5.50	(5.50)	2.00	**	7.00	**
In-house Technical Reports	6.05	(2.00)	9.86	(3.00)	3.72	(3.00)
Technical Talks/Presentations	1.69	(1.00)	3.80	(2.00)	3.15	(3.00)

** Median cannot be calculated.

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 audio/visual materials, letters, memoranda, drawings/specifications, and technical talks/presentations. For these products, the mean number of persons per group ranged from a high of $\bar{X} = 3.46$ to a low of $\bar{X} = 2.50$.

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

Information Product	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 Materials	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)
AGARD Technical Reports	1.08	(1.00)	1.43	(1.00)	3.43	(3.00)
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)
U.S. Government Technical Reports	1.20	(1.00)	1.57	(1.00)	2.73	(2.00)

Letters, conference/meeting papers, trade/promotional literature, computer program documentation, and drawings/specifications were the technical information products most frequently **used** by these Japanese aerospace engineers and scientists (table 11). On the average, they **used** 22 letters, 18 conference/meeting papers, 15 computer program documentation, 15 trade/promotional literature, 14 drawings/specifications in a 6-month period. Audio/visual material, technical talks/presentations, AGARD technical reports, abstracts, and U.S. government technical reports were the technical information products least frequently **used** by these Japanese aerospace engineers and scientists during a 6-month period.

Memoranda, letters, abstracts, journal articles, and conference/meeting papers 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 abstracts, 16 journal articles, and 15 drawings/specifications during a 6-month period. Agard, technical proposals, in-house technical reports, technical manuals, and U.S. government technical reports 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 Japanese and U.S. Aerospace Engineers and Scientists

Information Product	Japan		U.S.	
	Mean	Median	Mean	Median
Abstracts	7.77	(5.00)	16.43	(10.00)
Journal Articles	10.72	(5.00)	16.55	(10.00)
Conference/Meeting Papers	17.66	(10.00)	12.00	(10.00)
Trade/Promotional Literature	15.08	(10.00)	11.78	(6.00)
Drawings/Specifications	13.71	(5.00)	15.48	(5.00)
Audio/Visual Materials	3.50	(3.00)	14.60	(5.00)
Letters	22.28	(10.00)	17.28	(9.00)
Memoranda	10.38	(5.00)	25.45	(10.00)
Technical Proposals	10.28	(5.00)	5.89	(2.00)
Technical Manuals	11.63	(5.00)	7.66	(5.00)
Computer Program Documentation	14.84	(10.00)	14.57	(5.00)
AGARD Technical Reports	4.67	(3.00)	3.31	(3.00)
In-house Technical Reports	13.68	(5.00)	6.93	(5.00)
Technical Talks/Presentations	3.87	(3.00)	10.25	(6.00)
U.S. Government Technical Reports	9.70	(5.00)	8.05	(5.00)

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

Table 12. Types of Information Produced by Japanese and U.S. Aerospace Engineers and Scientists
[n = 94; 340]

Information Type	Japan %	U.S. %
Basic Scientific And Technical Information	70	92
Experimental Techniques	68	65
Codes Of Standards And Practices	17	9
Computer Programs	56	61
In-house Technical Data	2	4
Product and Performance Characteristics	63	86
Technical Specifications	42	32
Patents And Inventions	1	9
Government Rules And Regulations	57	45
Economic Information	37	25

The types of technical information most frequently **used** by the Japanese aerospace engineers and scientists included basic scientific and technical information, experimental techniques, computer programs, government rules and regulations, and product and performance characteristics (table 13). The types of technical information least frequently **used** by these Japanese aerospace engineers and scientists included patents and inventions, in-house technical data, codes of standards and practices, economic information, and technical specifications. Basic scientific and technical information, product and performance characteristics, computer programs, experimental techniques, and government rules and regulations were the types of technical information most frequently **used** by U.S. aerospace engineers and scientists. Economic information, patents and inventions, codes of standards and practices, in-house technical data, and technical specifications were the types of technical information least frequently **used** by the U.S. survey participants.

Table 13. Types of Information Used by Japanese and
U.S. Aerospace Engineers and Scientists
[n = 94; 340]

Information Type	Japan %	U.S. %
Basic Scientific And Technical Information	90	97
Experimental Techniques	72	82
Codes Of Standards And Practices	49	36
Computer Programs	69	89
In-house Technical Data	33	52
Product And Performance Characteristics	68	90
Technical Specifications	67	63
Patents And Inventions	15	19
Government Rules And Regulations	69	69
Economic Information	31	12

Content for an Undergraduate Course in Technical Communications

Japanese and U.S. survey participants were asked their opinions regarding an undergraduate course in technical communications for aerospace majors. Approximately 26% of the Japanese respondents and 71% of the U.S. respondents indicated that they had taken a course(s) in technical communications/writing. (Approximately 74% of the Japanese respondents and 29% of the U.S. respondents indicated they had not taken a course in technical communications/writing.) Approximately 2% of the Japanese participants had taken a course(s) as undergraduates, approximately 19% had taken a course(s) after graduation, and about 5% 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 26% (24 respondents) of the Japanese engineers and scientists who had taken coursework in technical communications/writing, all of them (24 respondents) indicated that doing so had helped them to communicate technical information. Of the 71% (241 respondents) of the U.S. engineers and scientists who had taken a course(s) in technical communications/writing, about 69% (233 respondents) indicated that doing so had helped them to communicate technical information.

Japanese and U.S. participants were asked their opinion regarding the desirability of undergraduate aerospace majors taking a course in technical communications. Approximately 71% of the Japanese respondents and 96% of the U.S. participants indicated that aerospace majors should take such a course. Approximately 44% of the Japanese participants and about 90% 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

Opinions	Japan %	Japan (n)	U.S. %	U.S. (n)
Taken For Credit	44	(41)	90	(259)
Not Taken For Credit	15	(14)	4	(11)
Don't Know	13	(12)	2	(6)
Should Not Have To Take Course In Technical Communications	28	(27)	4	(11)

The Japanese 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 71% (67 respondents) of the Japanese participants and 96% (276 respondents) of the U.S. participants indicated "yes," that students should take a course in technical communications. About 19% of the Japanese respondents indicated that the course should be taken as part of a "required" course, about 43% thought the course should be taken as part of an "elective" course, none thought it should be taken as a "separate" course, about 10% did not have an opinion, but only 29% of the Japanese 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, none thought it should be taken as a "separate" 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. A simple majority of both the U.S. respondents (51%) indicated that the technical communications/writing instruction should be taken as a separate course, while only 21% of the Japanese respondents indicated that the technical communications/writing instruction should be taken as a separate course.

Japanese 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. Japanese respondents indicated that developing paragraphs, writing at sentence level, organizing information, defining the purpose of the communication, and word choice were more important assessing the reader's needs, note-taking and quoting, and editing and revising. U.S. respondents indicated that organizing information, defining the purpose of the communication, assessing the reader's needs, editing and revising, and developing paragraphs were more important than note-taking and quoting, writing at sentence level, and word choice.

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

	Japan		U.S.	
Principles	%	(n)	%	(n)
Defining The Communication's Purpose	65	(61)	91	(310)
Assessing Reader's Needs	44	(41)	87	(295)
Organizing Information	75	(70)	97	(329)
Developing Paragraphs	90	(84)	87	(296)
Writing Sentences	85	(80)	72	(245)
Note Taking And Quoting	51	(48)	44	(149)
Editing And Revising	51	(48)	87	(295)
Choosing Words	64	(60)	83	(283)

The Japanese 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 majors. Their responses appear in table 16. Both groups of respondents placed references, symbols, punctuation, and abbreviations in the top five list for inclusion, although not in the same order of appearance. Japanese respondents included acronyms to complete their top five list, and U.S. respondents included spelling to complete their list.

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

Mechanics	Japan		U.S.	
	%	(n)	%	(n)
Abbreviations	66	(62)	55	(187)
Acronyms	64	(60)	52	(176)
Capitalization	50	(47)	54	(182)
Numbers	51	(48)	48	(163)
Punctuation	53	(50)	74	(251)
References	68	(64)	80	(272)
Spelling	44	(41)	55	(187)
Symbols	66	(62)	64	(218)

Given a list of 13 items, the Japanese 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 included oral technical presentations, use of information sources, conference/meeting papers, technical reports, conference/meeting papers among their top choices, 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 17. Recommended On-the-Job Communications To Be Taught in an Undergraduate Technical Communications Course for Aerospace Majors

On-the-Job Communications	Japan		U.S.	
	%	(n)	%	(n)
Abstracts	48	(45)	85	(289)
Letters	27	(25)	61	(208)
Memoranda	25	(23)	60	(204)
Technical Instructions	59	(55)	62	(212)
Journal Articles	48	(48)	64	(217)
Conference/Meeting Papers	78	(73)	67	(228)
Literature Reviews	21	(20)	50	(169)
Technical Manuals	56	(53)	43	(147)
Newsletter/Newspaper Articles	9	(8)	15	(50)
Oral Technical Presentations	72	(68)	92	(311)
Technical Specifications	60	(56)	45	(152)
Technical Reports	70	(66)	81	(274)
Use Of Information Sources	60	(56)	72	(244)

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 Japanese respondents do not appear to closely reflect the types of communications they produce and use, nor do the responses of the U.S. participants 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 technical report writing be taught.

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

Japan	U.S.
Produced Letters Trade/Promotional Literature Drawings/Specifications Technical Proposals In-house Technical Reports	Produced Memoranda Letters Drawings/Specifications Audio/Visual Materials Technical Talks/Presentations
Used Letters Conference Meeting Papers Trade/Promotional Literature Computer Program Documentation Drawings/Specifications	Used Memoranda Letters Journal Articles Abstracts Drawings/Specifications
Recommended Conference/Meeting Papers Oral Technical Presentations Technical Reports Technical Specifications* Use Of Information Sources* Technical Instructions Technical Manuals Abstracts Journal Articles* Letters*	Recommended Oral Technical Presentations Abstracts* Technical Reports* Use of Information Sources Conference/Meeting Papers Journal Articles Technical Instructions Letters Memoranda Literature Reviews

* indicates a tie

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 43% of the Japanese respondents indicated that the library or technical information center was located in the building where they worked. About 55% of the Japanese and 88% of the U.S. respondents indicated that the library or technical information center was outside the building in which they worked but was located nearby. For 52% of the Japanese group, the library or technical information center was located 1 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 Japanese respondents used their organization's library or technical information center more than their U.S. counterparts did. The average use rate for Japanese respondents was $\bar{X} = 20.9$ 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.

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

Visits	Japan		U.S.	
	%	(n)	%	(n)
0 Times	12	(11)	11	(37)
1 - 5 Times	16	(15)	43	(145)
6 - 10 Times	29	(27)	21	(72)
11 - 25 Times	19	(18)	14	(49)
26 - 50 Times	16	(15)	7	(22)
51 Or More Times	6	(6)	1	(4)
Does Not Have A Library	2	(2)	3	(11)
Mean	20.9*		9.2*	
Median	10.0		4.0	

* $p \leq .05$.

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 organization's library or technical information center was important to performing their present professional duties. About 73% of the Japanese 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 44% 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 7% of the Japanese respondents and approximately 13% of the U.S. respondents indicated that their organization's library or technical information center was very unimportant to performing their present professional duties.

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

	Japan		U.S.	
Importance	%	(n)	%	(n)
Very Important	73.4	(45)	44.4	(232)
Neither Important Nor Unimportant	17.0	(40)	68.2	(53)
Very Unimportant	7.4	(7)	12.9	(44)
Do Not Have A Library	2.1	(2)	3.2	(11)

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 Japanese and U.S. Aerospace Engineers and Scientists in Problem Solving
[n = 94; 340]

Source	Japan		U.S.	
	%	(n)	%	(n)
Personal Store Of Technical Information	97	(91)	99	(337)
Spoke With A Coworker Or People Inside My Organization	94	(88)	99	(338)
Spoke With A Colleague Outside Of My Organization	81	(76)	94	(318)
Used Literature Resources Found In My Organization's Library	72	(68)	91	(310)
Spoke With A Librarian Or Technical Information Specialist	50	(47)	81	(274)

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

Use and Importance of Computer and Information Technology

Survey participants were asked if they use computer technology to prepare technical information. Ninety-five percent of the Japanese and 99% of the U.S. respondents use computer technology to prepare technical information. About 35% of the Japanese respondents and about 73% of the U.S. respondents "always" use computer technology to prepare technical information. A majority of both groups (87% and 97%) indicated that computer technology had increased their ability to communicate technical information. About 59% of the Japanese 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 **business graphics**, the U.S. respondents made slightly greater use of computer software for preparing written technical communications than did their Japanese counterparts.

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

Software	Japanese		U.S.	
	%	(n)	%	(n)
Word Processing	94	(88)	96	(327)
Outliners And Prompters	12	(11)	14	(46)
Grammar And Style Checkers	23	(22)	30	(103)
Spelling Checkers	67	(63)	88	(299)
Thesaurus	14	(13)	37	(127)
Business Graphics	32	(30)	15	(52)
Scientific Graphics	49	(46)	91	(308)
Desktop Publishing	25	(23)	48	(162)

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.)

The Japanese 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 92% (FAX or TELEX) to a low of 1% (teleconferencing) for the Japanese respondents. Similarly, the U.S. responses ranged from a high of 91% (FAX or TELEX) to a low of 13% (audio tapes and cassettes).

Table 23. Use, Nonuse, and Potential Use of Information Technologies by Japanese 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	
	Japan %	U.S. %	Japan %	U.S. %	Japan %	U.S. %
Audio Tapes and Cassettes	16	13	36	30	48	57
Motion Picture Films	16	17	26	29	58	54
Videotape	70	63	26	31	4	6
Desktop/Electronic Publishing	29	60	65	32	6	8
Computer Cassettes/Cartridge Tapes	28	44	51	32	21	24
Electronic Mail	43	83	54	15	3	2
Electronic Bulletin Boards	23	36	68	48	9	16
FAX or TELEX	92	91	5	8	3	1
Electronic Data Bases	35	56	60	40	5	4
Video Conferencing	9	37	72	54	19	8
Teleconferencing	1	53	73	40	26	7
Micrographics and Microforms	67	23	18	42	15	25
Laser Disk/Video Disk/CD-ROM	30	19	66	68	4	13
Electronic Networks	34	76	63	19	3	5

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

Japan

FAX or TELEX	92%
Videotape	70
Micrographics and Microforms	67
Electronic Mail	43
Electronic Data Bases	35

U.S.

FAX or TELEX	91%
Electronic Mail	83
Electronic Networks	76
Videotape	63
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."

Japan

Teleconferencing	73%
Video Conferencing	72
Electronic Bulletin Boards	68
Laser Disk/Video Disk/ CD-ROM	66
Desktop/Electronic Publishing	65

U.S.

Laser Disk/Video Disk/ CD-ROM	68%
Video Conferencing	56
Electronic Bulletin Boards	48
Micrographics and Microforms	43
Teleconferencing	40

Use and Importance of Electronic Networks

Survey participants were asked if they use electronic networks at their workplace in performing their present duties. Approximately 55% of the Japanese respondents use electronic

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

Percentage of a 40-hour Work Week	Japan		U.S.	
	%	(n)	%	(n)
0	4	(4)	1	(4)
1 - 25	50	(47)	53	(180)
26 - 50	1	(1)	17	(57)
51 - 75	0	(0)	8	(26)
76 - 99	0	(0)	9	(30)
100	0	(0)	1	(5)
Do Not Use Or Have Access To Electronic Networks	45	(42)	12	(38)
Mean %	4.2*		30.1*	
Median %	1.5		20.0	

* $p \leq .05$.

networks and about 45% either do not use (30%) or do not have access to (15%) electronic networks (table 24). About 89% of the U.S. respondents use electronic networks in performing their present duties and about 12% either do not use (9%) or do not have access to (3%) electronic networks.

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

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

Importance	Japan		U.S.	
	%	(n)	%	(n)
Very Important	34.1	(32)	65.0	(221)
Neither Important Nor Unimportant	18.1	(17)	11.2	(38)
Very Unimportant	3.2	(3)	7.6	(43)
Do Not Use Or Have Access To Electronic Networks	44.7	(42)	16.2	(38)
Mean	3.8		4.1	

important and 5 = very important. The U.S. respondents rated electronic networks almost two times as important as their Japanese counterparts did. More Japanese (18.1%) than U.S. respondents (11.2%) indicated that electronic networks were neither important nor unimportant. Respondents were asked how they accessed electronic networks (table 26): mainframe terminal, personal computers, and workstations. Access via personal computer was most frequently reported.

Respondents using them were asked to indicate the purpose(s) for which they used electronic networks (table 27). Although not in the same order, both the Japanese 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.

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

Access	Japan		U.S.	
	%	(n)	%	(n)
Mainframe Terminal	0.0	(0)	13.5	(46)
Personal Computer	30.9	(29)	49.1	(167)
Workstation	13.8	(13)	26.2	(89)
Do Not Use Or Have Access To Electronic Networks	44.7	(42)	11.2	(38)

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

Purpose	Japan		U.S.	
	%	(n)	%	(n)
Connect To Geographically Distant Sites	29.8	(28)	53.2	(181)
Electronic Mail	42.6	(40)	81.5	(277)
Electronic Bulletin Boards Or Conferences	16.0	(15)	36.8	(125)
Electronic File Transfer	43.6	(41)	83.5	(284)
Log On To Remote Computers	37.2	(35)	63.8	(217)
Control Remote Equipment	5.3	(5)	8.8	(30)
Access/Search The Library's Catalog	21.3	(20)	29.1	(99)
Order Documents From The Library	5.3	(5)	9.4	(32)
Search Electronic (Bibliographic) Data Bases	22.3	(21)	33.5	(114)
Information Search And Data Retrieval	18.1	(17)	35.9	(122)
Prepare Scientific And Papers With Colleagues At Geographically Distant Sites	11.7	(11)	32.9	(112)

Survey participants who used electronic networks were asked to identify the groups with whom they exchanged messages or files (table 28). The Japanese respondents did not display 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 Japanese counterparts. The U.S. respondents displayed a fairly consistent pattern of use as did the Japanese respondents.

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

	Japan		U.S.	
Exchange With --	%	(n)	%	(n)
Members Of Own Work Group	31.9	(30)	81.5	(277)
Others In Your Organization But Not In Your Work Group	20.2	(19)	77.9	(265)
Others In Your Organization, Not In Your Work Group, At Geographically Distant Site	17.0	(16)	56.8	(193)
People Outside Your Organization	25.5	(24)	58.8	(200)
Do Not Use Or Have Access To Electronic Networks	44.7	(42)	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). With minor exception, 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 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) 25% of the Japanese and 28% of the U.S. group prefer print (paper) formats; (2) 21% of the Japanese and 34% of the U.S. group cited hardware or software incompatibility; and (3) 22% of the Japanese and 14% of the U.S. group indicated that lack of computer access was the reason for non-use.

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

	Likely Use of Information in Electronic Format[a]			
	Japan		U.S.	
Type of Information	%	(n)	%	(n)
Data Tables/Mathematical Presentations	53.2	(50)	57.0	(194)
Computer Program Listings	48.9	(46)	55.6	(189)
Online System (With Full Text And Graphics) For Technical Papers	73.4	(69)	69.7	(237)
CD-ROM System (With Full Text And Graphics) For Technical Papers	66.0	(62)	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.

Use of Foreign and Domestically Produced Technical Reports

To better understand the transborder migration of scientific and technical information (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 (87% of the Japanese respondents use NAL reports and 97% of the U.S. group use NASA technical reports). In addition to their own reports, the Japanese respondents use NASA (89%); AGARD (60%); German DFVLR, DLR, and MBB (53%); and British ARC and RAE (48%) technical reports.

In addition to their own reports, the U.S. group uses AGARD (82%) and British ARC and RAE (54%) technical reports. Neither group makes great use of Indian NAL, Dutch NLR, ESA,

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

Country/Organization	Japan %	Japan (n)	U.S. %	U.S. (n)
AGARD	59.6	(56)	82.2	(236)
British ARC And RAE	47.9	(45)	54.0	(155)
ESA	24.5	(23)	5.9	(17)
Indian NAL	3.2	(3)	6.3	(18)
French ONERA	39.4	(37)	41.1	(118)
German DFVLR, DLR, And MBB	53.2	(50)	36.2	(104)
Japanese NAL	87.2	(82)	11.5	(33)
Russian TsAGI	2.1	(2)	8.4	(24)
Dutch NLR	23.4	(22)	19.9	(57)
U.S. NASA	89.4	(84)	96.5	(277)

or Russian TsAGI technical reports. Survey participants were also asked about their access to these technical reports series. Overall, the U.S. group appears to have better access to foreign technical reports than do their Japanese counterparts. Both groups have about equal 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 Japanese respondents rated the importance of U.S. NASA reports ($\bar{X}$ = 4.46) followed by AGARD ($\bar{X}$ = 3.67), and German DFVLR, DLR, and MBB reports ($\bar{X}$ = 3.15). The U.S. group rated NASA reports most important ($\bar{X}$ = 4.26) followed by AGARD ($\bar{X}$ = 3.42) and British ARC and RAE reports ($\bar{X}$ = 2.89).

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

Country/Organization	Japan		U.S.	
	Rating[a] $\bar{X}$	(n)	Rating[a] $\bar{X}$	(n)
AGARD	3.67	(85)	3.42	(282)
British ARC And RAE	3.12	(85)	2.89	(266)
ESA	2.78*	(79)	1.44*	(242)
Indian NAL	2.02*	(52)	1.40*	(241)
French ONERA	2.97*	(79)	2.25*	(257)
German DFVLR, DLR, And MBB	3.15*	(84)	2.20*	(247)
Japanese NAL	3.94*	(93)	1.63*	(239)
Russian TsAGI	2.23*	(43)	1.60*	(231)
Dutch NLR	2.65*	(60)	1.81*	(246)
U.S. NASA	4.46	(92)	4.26	(285)

[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.

*$p \leq .05$.

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 Japanese and U.S. aerospace scientists and engineers.

2. As the Japanese 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 over one-third (35%) of the Japanese respondents and slightly less than two-thirds (65%) of the U.S. respondents.

3. The Japanese and U.S. aerospace engineers and scientists in these studies write more frequently in small groups than alone. The Japanese respondents find collaborative writing about as productive as individual writing, while the U.S. respondents find collaborative writing more productive than writing alone. Both groups of respondents frequently produce about the same types of materials whether they write as members of a group or as individuals.

4. Approximately 26% of the Japanese and 71% of the U.S. aerospace engineers and scientists in these studies had taken a course in technical communications. All of the Japanese and about 71% of the U.S. respondents 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 Japanese 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. There was also considerable agreement on the appropriate principles and mechanics that should be included in such a course.

6. The Japanese and U.S. aerospace engineers and scientists in these studies make use of personal knowledge, discussions with colleagues within their organization, and discussions with colleagues outside their organization for solving technical problems. The U.S. group, much more than the Japanese group, places greater reliance on librarians or technical information specialists for ascertaining information used in problem solving.

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

8. Both groups made considerable use of computer technology to prepare technical information. About 87% of the Japanese respondents, and 97% of the U.S. respondents indicated that computer technology had increased their ability to communicate technical information.

9. With the exception of business graphics, U.S. aerospace engineers and scientists made somewhat greater use of computer software than did their Japanese 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 Japanese counterparts and rated the use of electronic networks almost twice as important as their Japanese counterparts rated electronic network use. Both groups reported similar use of electronic networks. U.S. aerospace engineers and scientists made greater use of electronic networks to access/search the library's catalog, read electronic (bibliographic) data bases, and retrieve information than did their Japanese counterparts.

12. U.S. and Japanese respondents make the greatest use of NASA technical reports and rank them highest in terms of importance in performing their professional duties. Both groups make extensive use of (and consider important) AGARD technical reports.

13. Apart from English, both groups reported limited fluency (reading and speaking) in French, Dutch, German, and Russian.

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.

ACKNOWLEDGMENTS

The authors express their thanks to Dr. Robert A. Kilgore for his support of this research. The authors also express their thanks to the Japanese and U.S. aerospace engineers and scientists for their participation.

REFERENCES

[1] Barclay, R. O.; T. E. Pinelli; D. Elazar; and J. M. Kennedy. "An Analysis of the Technical Communications Practices Reported by Israeli and U.S. Aerospace Engineers and Scientists." Paper presented at the International Professional Communication Conference (IPCC), The Sheraton World Resort, Orlando, FL, November 1, 1991.

[2] Kohl, J. R.; R. O. Barclay; T.E. Pinelli; M. L. Keene; and J. M. Kennedy. "The Impact of Language and Culture on Technical Communication." *Technical Communication* 40:1 (First Quarter, February 1993): 66-79.

[3] Pinelli, T. E.; J. M. Kennedy; and R. O. Barclay. *A Comparison of the Technical Communications Practices of Russian and U.S. Aerospace Engineers and Scientists.* Washington, DC: National Aeronautics and Space Administration. NASA TM-107714, January 1993. (Available from NTIS, Springfield, VA; 93N18160.)

[4] Barclay, R. O.; T. E. Pinelli; and J. M. Kennedy. *A Comparison of the Technical Communication Practices of Dutch and U.S. Aerospace Engineers and Scientists.* Washington, DC: National Aeronautics and Space Administration. NASA TM-108987, July 1993. (NTIS Pending.)

[5] Pinelli, T. E.; J. M. Kennedy; and R. O. Barclay. "The NASA/DoD Aerospace Knowledge Diffusion Research Project." *Government Information Quarterly* 8:2 (1991): 219-233.

APPENDIX A

NASA/DoD AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT

Fact Sheet

The process of producing, transferring, and using scientific and technical information (STI), which is an essential part of aerospace research and development (R&D), can be defined as *Aerospace Knowledge Diffusion*. Studies tell us that timely access to STI can increase productivity and innovation and help aerospace engineers and scientists maintain and improve their professional skills. These same studies indicate, however, that we know little about aerospace knowledge diffusion or about how aerospace engineers and scientists find and use STI. To learn more about this process, we have organized a research project to study knowledge diffusion. Sponsored by NASA and the Department of Defense (DoD), the *NASA/DoD Aerospace Knowledge Diffusion Research Project* is being conducted by researchers at the NASA Langley Research Center, the Indiana University Center for Survey Research, and Rensselaer Polytechnic Institute. This research is endorsed by several aerospace professional societies including the AIAA, RAeS, and DGLR and has been sanctioned by the AGARD and AIAA Technical Information Panels.

This 4-phase project is providing descriptive and analytical data about the flow of STI at the individual, organizational, national, and international levels. It is examining both the channels used to communicate STI and the social system of the aerospace knowledge diffusion process. Phase 1 investigates the information-seeking habits and practices of U.S. aerospace engineers and scientists, in particular their use of government-funded aerospace STI. Phase 2 examines the industry-government interface and emphasizes the role of the information intermediary in the knowledge diffusion process. Phase 3 concerns the academic-government interface and emphasizes the information intermediary-faculty-student interface. Phase 4 explores the information-seeking behaviors of non-U.S. aerospace engineers and scientists from Western European nations, India, Israel, Japan, and the former Soviet Union.

The results of this research project will help us to understand the flow of STI at the individual, organizational, national, and international levels. The findings can be used to identify and correct deficiencies; to improve access and use; to plan new aerospace STI systems: and should provide useful information to R&D managers, information managers, and others concerned with improving access to and utilization of STI. These results will contribute to increasing productivity and to improving and maintaining the professional competence of aerospace engineers and scientists. The results of our research are being shared freely with those who participate in the study.

Dr. Thomas E. Pinelli
Mail Stop 180A
NASA Langley Research Center
Hampton, VA 23681-0001
(804) 864-2491
Fax (804) 864-8311
T.E.Pinelli@larc.nasa.gov

Dr. John M. Kennedy
Center for Survey Research
Indiana University
Bloomington, IN 47405
(812) 855-2573
Fax (812) 855-2818
kennedy@isrmail.soc.indiana.edu

Rebecca O. Barclay
Dept. of Language, Lit. & Communication
Rensselaer Polytechnic Institute
Troy, NY 12180
(804) 399-5666
Fax (804) 397-4635
barclay@infi.net

APPENDIX B

SURVEY INSTRUMENT

航空宇宙工学における技術的コミュニケーションとその国際的展望
日本における調査
航空宇宙工学知識普及調査計画第4段

1．あなたの仕事上、技術関連の文書や討論等の準備・作成を効果的に行うことは、どの程度重要ですか。（数字を○で囲む）

全く重要でない　1　2　3　4　5　非常に重要

2．過去6カ月の間に、技術情報の準備・作成に週平均どのくらい時間を費やしましたか。

文書作成　週平均______時間
口頭によるもの　週平均______時間

3．5年前と比較して、技術情報の準備・作成に費やす時間は、どの様に変化しましたか。（数字を○で囲む）

1　増えた
2　変わらない
3　減った

4．過去6カ月の間、収集した技術情報の調査等に、週平均どれくらい時間を費やしましたか。

文書によるもの　週平均______時間
口頭によるもの　週平均______時間

5．仕事上での経験を積むに従い、収集した技術情報の調査等に費やす時間はどの様に変化しましたか。（数字を○で囲む）

1　増えた
2　変わらない
3　減った

6．技術文書の作成に当たり、以下の場合はそれぞれ何パーセントですか。

自分一人で書く　＿＿＿＿%（もしこの答えが100%の場合、質問９へ）
２人で書く（自分を含む）　＿＿＿＿%
３～６人のグループで書く　＿＿＿＿%
７人以上のグループで書く　＿＿＿＿%
１００%

7．通常、文書作成においてグループの場合と一人の場合と、どちらが（質的・量的に）効率的だと思いますか。（数字を○で囲む）

1　一人の方が効率的
2　あまり変わらない
3　グループの方が効率的

8．過去６カ月、常に同じグループの人と一緒に技術文書を作成しましたか。（数字を○で囲む）

1　はい　→　それは何人のグループでしたか　＿＿＿＿人
2　いいえ　→　幾つのグループで仕事をしましたか　＿＿＿＿グループ
平均およそ何人のグループでしたか　＿＿＿＿人

９．過去６カ月の間、自分一人で、またはグループで以下の項目をそれぞれおよそ何回準備をしましたか。（グループの場合、人数をお書き下さい）

	一人で	グループで	平　均
a.妙録…………………………	＿＿回	＿＿回	＿＿人
b.学会誌の記事…………………	＿＿回	＿＿回	＿＿人
c.学会論文………………………	＿＿回	＿＿回	＿＿人
d.商用・業務促進用文書…………	＿＿回	＿＿回	＿＿人
e.図表・仕様書…………………	＿＿回	＿＿回	＿＿人
f.音声・映像物…………………	＿＿回	＿＿回	＿＿人
g.書簡…………………………	＿＿回	＿＿回	＿＿人
h.覚書…………………………	＿＿回	＿＿回	＿＿人
i.技術提案………………………	＿＿回	＿＿回	＿＿人
j.技術マニュアル………………	＿＿回	＿＿回	＿＿人
k.コンピュータプログラム関連文書..	＿＿回	＿＿回	＿＿人
l.ＡＧＡＲＤ技術報告書…………	＿＿回	＿＿回	＿＿人
m.組織内技術報告書……………	＿＿回	＿＿回	＿＿人
n.技術発表会……………………	＿＿回	＿＿回	＿＿人

１０．過去６カ月の間、以下の項目をそれぞれおよそ何回使用しましたか。

a.妙録………………………………＿＿回
b.学会誌の記事………………………＿＿回
c.学会論文……………………………＿＿回
d.商用・業務促進用文書………………＿＿回
e.図表・仕様書………………………＿＿回
f.音声・映像物………………………＿＿回
g.書簡………………………………＿＿回
h.覚書………………………………＿＿回
i.技術提案……………………………＿＿回
j.技術マニュアル……………………＿＿回
k.コンピュータプログラム関連文書……＿＿回
l.ＡＧＡＲＤ技術報告書………………＿＿回
m.米国政府の技術報告書………………＿＿回
n.組織内技術報告書…………………＿＿回
o.技術発表会…………………………＿＿回

１１．あなたの現在の職業において、どの様な技術情報を使用していますか。（数字を○で囲む）

	はい	いいえ
基本的科学技術情報……………………………	1	2
実験方法………………………………………	1	2
標準規格・実用規格……………………………	1	2
コンピュータプログラム………………………	1	2
政府規定・法規…………………………………	1	2
組織内技術データ………………………………	1	2
製品特性・性能特性……………………………	1	2
経済情報………………………………………	1	2
技術仕様書……………………………………	1	2
特許……………………………………………	1	2

１２．あなたの現在の職業において、どの様な技術情報を作成していますか（または、する予定ですか）。（数字を○で囲む）

	はい	いいえ
基本的科学技術情報……………………………	1	2
実験方法………………………………………	1	2
標準規格・実用規格……………………………	1	2
コンピュータプログラム………………………	1	2
政府規定・法規…………………………………	1	2
組織内技術データ………………………………	1	2
製品特性・性能特性……………………………	1	2
経済情報………………………………………	1	2
技術仕様書……………………………………	1	2
特許……………………………………………	1	2

１３．今までに技術情報交換または文書作成に関する講義を受けたことがありますか。（数字を○で囲む）

1　学部学生の時に受けた
2　卒業後に受けた
3　学部学生の時と卒業後の両方受けた
4　現在受けている ―― 質問１５へ
5　受けたことはない ―― 質問１５へ

１４．その講義は、技術情報の交換にどのくらい役に立ちましたか。（数字を○で囲む）

1　とても役に立った
2　少し役に立った
3　全然役に立たなかった

１５．航空宇宙関係の学部学生は技術情報の交換に関する講義またはトレーニングを受けるべきだと思いますか。（数字を○で囲む）

1　はい
2　いいえ ―― 質問１９へ
3　わからない ―― 質問１９へ

１６．航空宇宙関係の学部学生が受ける技術情報交換の科目は単位科目であるべきだと思いますか。（数字を○で囲む）

1　単位科目であるべき
2　単位外であるべき
3　わからない

１７．技術情報交換の講義は必修科目であるべきだと思いますか。（数字を○で囲む）

1　必修科目であるべき
2　選択科目であるべき
3　わからない

１８．技術情報交換の講義は独立した科目であるべきですか、それとも他の科目の一部であるべきであると考えますか。（数字を○で囲む）

1　工学科目の一部であるべき
2　独立した一つの科目であるべき
3　工学以外の科目の一部であるべき
4　わからない

１９．航空宇宙関係の学部学生のための技術情報交換の講義で、以下それぞれの基礎理論を教えるべきですか。（数字を○で囲む）

	はい	いいえ
情報伝達目的の定義	1	2
読者ニーズの査定	1	2
情報管理	1	2
文章構成（導入、経過、結論等）	1	2
文章表現	1	2
ノートの取り方・引用法	1	2
編集法・改訂法	1	2
用語選択	1	2
その他（明記して下さい）＿＿＿＿＿＿＿＿		

２０．技術英語に関して、以下の項目を航空宇宙関係の学部学生のための技術情報交換の講義で教えるべきですか。（数字を○で囲む）

	はい	いいえ
略記法	1	2
頭字語（例：ＮＡＳＡ）	1	2
大文字の選択法	1	2
数字の使用法	1	2
句読点	1	2
参考文献の列記法	1	2
スペリング	1	2
記号	1	2
その他（明記して下さい）＿＿＿＿＿＿＿＿		

２１．以下の項目に関する特定の技能を、航空宇宙関係の学部学生のための技術情報交換の講義で教えるべきですか。（数字を○で囲む）

	はい	いいえ
妙　録	1	2
書　簡	1	2
覚　書	1	2
技術説明書	1	2
学会誌の記事	1	2
学会論文	1	2
文献論評	1	2
技術マニュアル	1	2
時事通信・新聞記事	1	2
技術的内容の講演・発表	1	2
技術仕様書	1	2
技術報告書	1	2
情報源の利用法	1	2

その他（明記して下さい）＿＿＿＿＿＿＿＿＿＿

２２．あなたはコンピュータを利用して技術情報資料を作成しますか。（数字を○で囲む）

1　必ず使う
2　通常
3　ときどき
4　利用しない　→　質問２５へ

２３．コンピュータは技術情報交換にどの程度役に立っていますか。（数字を○で囲む）

1　非常に役に立っている
2　多少は役に立っている
3　ほとんど役に立っていない
4　全く役に立っていない

２４．技術情報の文書作成に下記のソフトウエアを利用していますか。（数字を○で囲む）

	はい	いいえ
ワードプロセッサ（日本語・英語）....................	1	2
アウトライナ・プロンプタ...........................	1	2
文法・構文チェッカー...............................	1	2
スペルチェッカー..................................	1	2
同意語チェッカー(THESAURUS).........................	1	2
ビジネスグラフィック..............................	1	2
サイエンスグラフィック............................	1	2
デスクトップパブリッシング.........................	1	2

２５．技術情報交換において、下記の電子情報技術の使用をどうお考えですか。（数字を○で囲む）

情報技術	既に利用している	将来利用するかも	将来も利用しない
オーディオテープ..........................	1	2	3
映画用フィルム............................	1	2	3
ビデオテープ..............................	1	2	3
デスクトップパブリッシング.................	1	2	3
コンピュータ補助記憶用 カセット・カートリッジ.................	1	2	3
電子メール(E-MAIL).........................	1	2	3
電子掲示板................................	1	2	3
ファックス・テレックス.....................	1	2	3
オンラインデータベース.....................	1	2	3
ビデオ会議................................	1	2	3
コンピュータ会議...........................	1	2	3
マイクロフィルム...........................	1	2	3
レーザーディスク・CD-ROM....................	1	2	3
電子ネットワーク...........................	1	2	3

２６．職場であなたの職務のために電子ネットワークを使用しますか。（数字を○で囲む）

1　はい
2　いいえ
3　ネットワークへのアクセスを持たない

（2、3の場合）質問３２へ

２７．職場でどの様に電子ネットワークにアクセスしますか。（数字を○で囲む）

1　メインフレームのターミナルから
2　パーソナルコンピュータから
3　ワークステーションから

２８．職業上、電子ネットワークの使用はどの程度重要ですか。（数字を○で囲む）

全く重要でない　1　2　3　4　5　非常に重要

２９．過去一週間の間に電子（コンピュータ）ネットワークを何時間位使用しましたか。

________時間

３０．あなたは電子ネットワークを以下のどの目的で使用しますか。（数字を○で囲む）

		はい	いいえ
1	遠隔地と連絡、接続するため	1	2
2	電子メールのやり取りをするため	1	2
3	電子掲示板・電子会議を使用するため	1	2
4	ファイル転送のため	1	2
5	大型コンピュータや特殊目的専用のコンピュータにアクセスするため	1	2
6	研究室の計器・機械等を制御するため	1	2
7	図書館の目録を検索するため	1	2
8	図書館から文書を取り寄せるため	1	2
9	オンラインデータベースを使用するため	1	2
10	情報・データ検索のため	1	2
11	遠隔地の人と共同で技術文書を作成するため	1	2

３１．どういう人たちとネットワーク上でメッセージやファイルのやり取りをしますか。（数字を○で囲む）

1 同じ仕事をするグループ内の人
2 同じ場所にいる組織内の人（グループ外）
3 違う場所にいる組織内の人（グループ外）
4 組織外の人

３２．もし以下の項目が電子フォーマットで利用可能なら、あなたの使用状況はどの様だと思いますか。（数字を○で囲む）

		全く使わないだろう				必ず使うだろう
1	理科学年表・数値表	1	2	3	4	5
2	コンピュータプログラムの一覧	1	2	3	4	5
3	全ての文書、図表を含む技術論文のオンラインシステム	1	2	3	4	5
4	全ての文書、図表を含む技術論文のＣＤ－ＲＯＭシステム	1	2	3	4	5

３３．上記の項目が利用可能でもあなたは使わないとしたら、その理由として一番近いものは下記のうちどれですか。（数字をひとつだけ○で囲む）

1　コンピュータがない、または使用が限られている
2　ハードウエア・ソフトウエアの互換性がない
3　印刷物の方を好む
4　その他（明記して下さい）＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

３４．あなたの所属する組織には図書館・技術情報センターがありますか。（数字を○で囲む）

1　同じ建物内にある
2　別の建物にある　→　その距離はおよそ＿＿＿＿km
3　ない　→　質問３７へ

３５．過去6カ月の間に、組織の図書館・技術情報センターを何回利用しましたか。

＿＿＿＿＿回

３６．あなたの職務上、組織の図書館・技術情報センターはどの程度重要ですか。（数字を○で囲む）

全く重要でない　1　2　3　4　5　非常に重要

３７．技術的問題を解くにあたり、以下の情報源を通常どの様な順序で使いますか。数字、または使用しないものには×印を空欄にお書き下さい。

＿＿＿＿オフィスにあるものも含め、自分の所有する技術情報
＿＿＿＿組織内の人に相談
＿＿＿＿組織外の人に相談
＿＿＿＿図書館員・技術情報の専門家に相談
＿＿＿＿図書館のオンラインデータベースを探す、または誰かに探してもらう
＿＿＿＿学会論文、学会誌、技術報告書等の組織の図書館にある文献
（＿＿＿＿上記のいずれも使用しない場合ここに×印を付けて下さい）

３８．あなたの職務上、次にあげる技術報告書を利用することがありますか。
（数字を○で囲む）

		はい	いいえ	利用できない
1	ＡＧＡＲＤレポート	1	2	9
2	英国のＡＲＣ及びＲＡＥレポート	1	2	9
3	ＥＳＡレポート	1	2	9
4	インドのＮＡＬレポート	1	2	9
5	フランスのＯＮＥＲＡレポート	1	2	9
6	ドイツのＤＦＶＬＲ、ＤＬＲ、及びＭＢＢレポート	1	2	9
7	日本のＮＡＬレポート	1	2	9
8	ロシアのＴｓＡＧＩレポート	1	2	9
9	オランダのＮＬＲレポート	1	2	9
10	米国のＮＡＳＡレポート	1	2	9

３９．あなたの職務上、以下の報告書はどの程度重要ですか。（数字を○で囲む）

		全く重要でない				非常に重要	利用できない
1	ＡＧＡＲＤレポート	1	2	3	4	5	9
2	英国のＡＲＣ及びＲＡＥレポート	1	2	3	4	5	9
3	ＥＳＡレポート	1	2	3	4	5	9
4	インドのＮＡＬレポート	1	2	3	4	5	9
5	フランスのＯＮＥＲＡレポート	1	2	3	4	5	9
6	ドイツのＤＦＶＬＲ、ＤＬＲ、及びＭＢＢレポート	1	2	3	4	5	9
7	日本のＮＡＬレポート	1	2	3	4	5	9
8	ロシアのＴｓＡＧＩレポート	1	2	3	4	5	9
9	オランダのＮＬＲレポート	1	2	3	4	5	9
10	米国のＮＡＳＡレポート	1	2	3	4	5	9

４０．あなたの母国語は何ですか。

＿＿＿＿＿＿＿＿＿＿語

４１．次のそれぞれの言語をどれくらい読解できますか。（数字を○で囲む）

		少し				流暢に	全く読めない
1	英語	1	2	3	4	5	9
2	フランス語	1	2	3	4	5	9
3	ドイツ語	1	2	3	4	5	9
4	日本語	1	2	3	4	5	9
5	ロシア語	1	2	3	4	5	9
6	その他（明記して下さい）＿＿＿＿＿＿＿＿						

４２．次のそれぞれの言語をどれくらい話せますか。（数字を○で囲む）

		少し				流暢に	全く話せない
1	英語	1	2	3	4	5	9
2	フランス語	1	2	3	4	5	9
3	ドイツ語	1	2	3	4	5	9
4	日本語	1	2	3	4	5	9
5	ロシア語	1	2	3	4	5	9
6	その他（明記して下さい）＿＿＿＿＿＿＿＿						

以下は個人の経歴と技術情報交換の状況の関連性を調査するための質問です。

４３．性別。（数字を○で囲む）

1　女性
2　男性

44．学歴。（数字を○で囲む）

1　学位無し
2　大学卒
3　修士了
4　博士了
5　その他（明記して下さい）＿＿＿＿＿＿＿＿

45．航空宇宙工学における仕事の経験年数。

＿＿＿＿年

46．勤務先。（数字を○で囲む）

1　学術界（大学、研究所等）
2　産業界
3　非営利目的の団体
4　政府機関
5　その他（明記して下さい）＿＿＿＿＿＿＿＿

47．以下の中であなたの職務に一番近いものをお選び下さい。（数字をひとつだけ○で囲む）

1　研究
2　経営・管理
3　設計・開発
4　教職（研究も含む）
5　製造
6　コンサルタント
7　サービス・メインテナンス
8　営業・販売
9　その他（明記して下さい）＿＿＿＿＿＿＿＿

４８．専攻。（数字を○で囲む）

1　工学系
2　理学系
3　その他（明記して下さい）＿＿＿＿＿＿＿＿＿＿＿＿＿＿

４９．現在の職務に近いのは。（数字を○で囲む）

1　工学系
2　理学系
3　その他（明記して下さい）＿＿＿＿＿＿＿＿＿＿＿＿＿＿

５０．現在あなたは自国内の工学系、理学系、または技術系学会の一員ですか。（数字を○で囲む）

1　はい
2　いいえ

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	December 1994	Technical Memorandum

4. TITLE AND SUBTITLE
A Comparison of the Technical Communications Practices of Japanese and U.S. Aerospace Engineers and Scientists*

5. FUNDING NUMBERS
WU 505-90

6. AUTHOR(S)
Thomas E. Pinelli, Rebecca O. Barclay, and John M. Kennedy

7. PERFORMING ORGANZATION NAME(S) AND ADDRESS(ES)
NASA Langley Research Center
Hampton, VA 23681-0001

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORIING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
National Aeronautics and Space Administration
Washington, DC 20546-0001

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
NASA TM-109164

11. SUPPLEMENTARY NOTES
*Report number 29 under the NASA/DoD Aerospace Knowledge Diffusion Research Project.
Thomas E. Pinelli: Langley Research Center, Hampton, VA; Rebecca O. Barclay: Rensselaer Polytechnic Institute, Troy, NY; and John M. Kennedy: Indiana University, Bloomington, IN.

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Unclassified—Unlimited
Subject Category 82
Availability: NASA CASI (301) 621-0390

12b. DISTRIBUTION CODE

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 Japanese 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 in Japan and at the NASA Ames Research Center and the NASA Langley Research Center. The completion rates for the Japanese and U.S. surveys were 85 and 61 percent, respectively. Responses of the Japanese and U.S. participants to selected questions are presented in this report.

14. SUBJECT TERMS
Knowledge diffusion; Aerospace engineer and scientist; Communication practices

15. NUMBER OF PAGES
53

16. PRICE CODE
A04

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102