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*Technical Communications Practices and the Use of Information
Technologies as Reported by Dutch and U.S. Aerospace Engineers*

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Technical Communications Practices and the Use of Information Technologies As Reported by Dutch and U.S. Aerospace Engineers

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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. A self-administered questionnaire was distributed to aerospace engineers and scientists at the National Aerospace Laboratory (The Netherlands), and NASA Ames Research Center (U.S.), and the NASA Langley Research Center (U.S.). This paper presents responses of the Dutch and U.S. participants to selected questions about four of the seven project objectives: determining the importance of technical communications to aerospace engineering professionals, investigating the production of technical communications, examining the use and importance of computer and information technology, and exploring the use of electronic networks.

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 better understand workplace culture, organization, and communication at the national and international levels, an exploratory study 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 Russia (Pinelli, et al., 1993), Israel (Barclay, et al., "An Analysis...", 1991), Japan (Kohl, et al. 1993; Pinelli, et al., "A Survey...", 1991), selected Western European countries (Barclay, et al., "Technical Communications...", 1991), and the U.S. (Holland, et al., 1991; Pinelli, et al., 1989).

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 scope of this paper permits the presentation of four of the seven objectives of the Dutch/U.S. study:

- To solicit the opinions of aerospace engineers and scientists regarding the importance of technical communications to their profession,
- To investigate the use and production of technical communications by aerospace engineers and scientists,
- To examine the use and importance to them of computer and information technology, and
- To explore their use of electronic networks.

Background

Aerospace engineering provides an excellent platform for studying technical communications in the international workplace. As the industry becomes more international in scope and increasingly collaborative in nature, international industrial alliances will contribute to the rapid diffusion of technology that will enhance innovation and increase productivity. Aerospace producers will feel pressure to push forward with new technological developments, to maximize their inclusion into the research and development (R&D) process, and to maintain and improve the professional competency of aerospace professionals. Meeting such objectives at a reasonable cost depends on many 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, little is known about how aerospace engineers and scientists find and use STI or how aerospace knowledge is diffused. To learn more about the process, researchers at the NASA Langley Research Center, the Indiana University Center for Survey Research, Rensselaer, and institutions in selected countries are studying aerospace knowledge diffusion in the *NASA/DoD Aerospace Knowledge Diffusion Research Project*. This Phase 4 study explores patterns of technical communication among non-U.S. aerospace engineers and scientists.

Research design and methodology

This 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 survey instrument had been used previously in several Western European countries Japan, and Russia. Questionnaires were distributed to 200 researchers at NLR during November - December 1992, and 109 were received by the cut-off date for a completion rate of 55 percent. Questionnaires were distributed to 558 researchers at the two NASA installations during July - August 1992, and 340 were received by the cut-off date for a completion rate of 61 percent. A follow-up survey containing additional questions about technical report use and language skills was distributed to the U.S. respondents in December 1992. Two hundred eighty-seven of the 340 U.S. respondents completed and returned the follow-up survey.

Presentation of the data

This paper presents selected results with demographic data presented first, followed by data on the importance of technical communications, workplace production of

technical communications, the use of computer and information technology, and electronic network use.

Demographic information about the survey respondents

Survey respondents were asked to provide information about their professional duties, years of work experience, educational preparation, current professional duties, and gender. A comparison shows that respondents are similar in terms of their professional duties, years of professional work experience, level of education and educational preparation, current duties, and gender. They differ in organizational affiliation and membership in a professional/technical society.

The following "composite" participant profiles were based on these data. The Dutch survey respondent works as a researcher (63%), has a graduate degree (80%), was trained as an engineer (74%) and currently works as an engineer (75%), and has an average of 12 years professional work experience. The U.S. survey respondent works as a researcher (80%), has a graduate degree (73%), was trained as an engineer (80%) and currently works as an engineer (69%), has an average of 17 years professional work experience, and belongs to a professional/technical society (78%).

Importance of and time spent on technical communication

Approximately 91% of the Dutch and 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.) Technical communication takes up 68% of the Dutch respondent's and 77% of the U.S. respondent's 40-hour work week. Dutch respondents spent an average of 15.6 hours per week communicating technical information to others and an average of 11.65 hours per week working with communications received from others. U.S. respondents spent an average of 16.98 hours per week communicating technical information to others and an average of 13.97 hours per week working with communications received from others.

Approximately 45% of the Dutch respondents indicated that, as they have advanced professionally, they 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.

The production of technical communications

Collaborative writing was examined as part of the study. Seventy-six percent of the Dutch respondents and 85% of the U.S. respondents write in groups of 2-8 people. Only 28% of the Dutch respondents and 33% of the U.S. respondents indicated that group writing is more productive than writing alone, however. Of those survey respondents who do not write alone, 49% of the Dutch group and 47% of the U.S. group work with the same persons when producing written technical communications

Both groups were asked to indicate the average number of communications they had prepared, alone or in groups, and used in the last six months. Individually the Dutch most frequently prepared letters (15), memos (4), drawings/specifications (4), A/V materials (3), and technical talks/presentations (3). Working in groups, the Dutch most frequently prepared letters (13), trade/promotional literature (4), drawings/specifications (3), in-house technical reports (2), and conference/meeting papers (2).

Individually the U.S. respondents most frequently prepared memos (16), letters (10), drawings/specifications (7), A/V materials (6), and technical talks/presentations (4). Working in groups, the U.S. respondents most frequently prepared letters (6), A/V

materials (6), memos (5), drawings/specifications (4), and technical talks/presentations (3).

The types of technical information most frequently produced by the Dutch study participants included basic scientific/technical information, in-house technical data, technical specifications, computer programs, and experimental techniques. Basic scientific/technical information, in-house technical data, experimental techniques, computer programs, and technical specifications were the kinds of technical information most frequently produced by the U.S. aerospace engineers and scientists in this study.

Use of computer and information technology

Survey respondents reported using a variety of computer and information technologies, and they indicated that these technologies had increased their ability to communicate technical information. A list of the most frequently used information technologies follows:

Dutch		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%

The following list includes the information technologies they do not use currently but may use in the future:

Dutch		U.S.	
Laser Disk/Video Disk/CD-ROM	59%	Laser Disk/Video Disk/CD-ROM	68%
Electronic Bulletin Boards	57%	Video Conferencing	54%
Desktop Publishing	51%	Electronic Bulletin Boards	48%
Electronic Mail	51%	Micrographics/forms	42%
Electronic Data Bases	50%	Electronic Data Bases	40%

Use of electronic networks

Approximately 65% of the Dutch and 89% of the U.S. respondents use electronic networks in performing their present duties. Based on a 40-hour work week, the Dutch group devotes an average 22% of the week to using networks; the U.S. group devotes an average 30% to their use. Thirty-six percent of the Dutch users find electronic networks important for performing professional duties, and 65% of the U.S. users find them important. When asked about the likelihood of using certain types of information in electronic format, the Dutch and U.S. respondents gave similar responses (Table 1).

When asked why they would not use these materials in electronic format, 48% of the Dutch and 27% of the U.S. respondents indicated a preference for printed formats. Eighteen percent of the Dutch and 34% of the U.S. respondents cited hardware or software incompatibility as a reason, and less than 15% of each group indicated that lack of computer access was the reason for non-use.

Table 1. Potential Use of Information in Electronic Formats

Type of Information	Netherlands		U.S.	
	%	(n)	%	(n)
Data tables/mathematical presentations	44	(48)	57	(194)
Computer program listings	51	(56)	56	(189)
Online system (full text and graphics) for technical papers	61	(66)	70	(237)
CD-ROM system (full text and graphics) for technical papers	52	(57)	58	(196)

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 more rigorous research design and methodology would be needed before any claims could be made. Nevertheless, the findings do permit the formulation of general statements regarding the technical communications practices of the aerospace engineers and scientists who participated in the studies.

- The ability to communicate technical information effectively is equally important to Dutch and U.S. aerospace engineers and scientists.
- As these Dutch and U.S. respondents have advanced professionally, the amount of time they spend producing and working with technical communications has increased for nearly one-half (45%) of the Dutch group and nearly two-thirds (65%) of the U.S. group.
- Both groups frequently produce the same types of materials whether they write as individual authors or as members of a group.
- Both groups of respondents show notable similarities in terms of the computer and information technologies they presently use and those they anticipate using in the future.

Despite the limitations of these studies, the findings contribute to our knowledge of technical communications practices among aerospace engineers and scientists at the national and international levels. The findings reinforce some of the conventional wisdom regarding the importance of effective communication and the types of communications produced in the workplace. They also provide insight into current uses of computer and information technology and electronic networks and the expectations of users for increased communications capabilities in a high-technology environment.

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