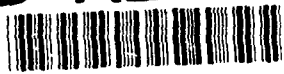


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NASA/DoD Aerospace Knowledge Diffusion Research Project

NASA Technical Memorandum 104085

Report Number 8

*Summary Report to Phase 3
Faculty and Student Respondents*

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THE NASA/DoD AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT

Report to Phase Three Respondents Faculty and Students

Introduction

This project, started in 1989, is designed to explore the diffusion of scientific and technical information (STI) throughout the aerospace industry. The increased international competition and cooperation in the industry promises to significantly affect the STI demands of U.S. aerospace engineers and scientists. Therefore, it is important to understand the aerospace knowledge diffusion process itself and its implications at the individual, organizational, national and international levels.

The project is planned in four phases. Phase 1 is designed to study the information-seeking methods of U.S. aerospace engineers and scientists. Phase 2 is concerned primarily with the transfer of scientific and technical information in industry and government and the role of librarians and technical information specialists in that transfer. Phase 3, reported in part here, examines the use of STI in the academic aerospace community. Phase 4 will examine knowledge, production, use and transfer of STI among non-U.S. aerospace organizations and aerospace engineers and scientists.

Part I

Data Collection Methods

Phase 3 of this project used three questionnaires that were sent to three groups in the academic aerospace community. The first group was information intermediaries in academic engineering libraries, the second group was faculty in aerospace departments, and the third group was students enrolled in a capstone design course.

The librarians surveyed were information intermediaries at engineering or aerospace libraries at institutions where a capstone design course was funded in 1989-90 by the University Space Research Association (USRA) and in universities with American Society of Engineering Education (ASEE) accredited aerospace programs. Libraries at each institution were called and the name of the librarian in charge of aerospace materials was obtained. This person was mailed the questionnaire. Of the 70 eligible respondents, 68 returned the questionnaire. Data collection began in late April, 1990 and continued through May, 1990. The results of this study will be reported separately.

The faculty sample was obtained primarily from institutions with USRA funded capstone courses in aerospace departments. Also included were some institutions with aerospace programs accredited by ASEE. Department chairs and USRA instructors were called and lists of their faculties were obtained when possible. The list was compared to a list of faculty surveyed for Phase 1 of this project, and those who had been surveyed previously were eliminated. Data collection began in mid-April of 1990 and continued through September 1990. Questionnaires were sent to 501 faculty, and 275 faculty responded to the survey.

The student sample was those students enrolled in an USRA-funded undergraduate capstone design course in Spring, 1990. Telephone calls and faxes to the course instructors enlisted the participation of the 39 eligible instructors who agreed to distribute the questionnaire. (Some instructors could not participate because they had taught their capstone course during the fall semester or did not have regularly scheduled meetings.) Data were collected during April and May, 1990. There were 640 student respondents from 29 institutions.

Descriptions of the Faculty and Students

We found that 16 percent of the students and three percent of the faculty were female. Most of each group (faculty, 83 percent; students, 95 percent) were U.S. citizens. Most students (92 percent) were seniors and 80



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percent were majoring in aeronautical or astronautical engineering. Over 60 percent of the students were members of student chapters of the American Institute of Aeronautics and Astronautics (AIAA). Twenty-one percent of the students did not belong to any national professional group. Two-thirds of the faculty belonged to AIAA and 36 percent belonged to the American Society of Mechanical Engineers.

Most faculty (69 percent) were trained as engineers and 89 percent had earned a Ph.D. Almost half were full professors (48 percent) and 64 percent were tenured. Seventeen percent of the faculty had authored a NASA technical report during the past three years. Two-thirds had some contact with NASA personnel as part of their faculty duties.

Part II

The Faculty and Student Questionnaires

Use and Rating of Information Resources

Most questions asked in the faculty survey were also asked in the student survey. There were some interesting differences between the two groups. The faculty rated their personal collections of STI as heavily used and very important in performing aerospace duties. Ninety-five percent said they used their collection frequently and an equal percentage said it was important. Among the students, 67 percent reported they used their collection frequently and 74 percent rated it as important. Eighty percent of the faculty reported they used journal articles frequently while only 52 percent of students did. And 74 percent of the faculty used conference and meeting papers frequently while 45 percent of the students did. Seventy-two percent of the students rated faculty members as an important information resource but only 54 percent of the faculty did.

Use and Importance of Information Sources and Products (percents)

Source	Used Frequently		Very Important	
	Faculty	Students	Faculty	Students
Personal Collection	94.8	67.4	94.8	51.2
Journals	80.0	52.0	87.0	58.2
Conference/Meeting Papers	73.9	44.8	80.6	48.7
Textbooks	65.9	77.3	71.3	NA
University Library	45.0	44.0	65.2	54.7
(Other) Faculty	41.3	54.8	53.8	72.2
Engineering Library	37.3	45.5	52.5	56.9
NASA Technical Reports	37.1	50.5	49.8	54.7
NACA Technical Reports	20.0	19.0	27.4	25.1
(Other) Students	18.9	65.4	22.2	67.4
AGARD Technical Reports	10.7	5.6	18.8	11.3
Librarian	8.7	12.1	23.3	21.9

Use of NASA and AGARD Reports

Both groups used NASA technical reports. Only 17 percent of the faculty and 16 percent of the students reported they had not used NASA reports during the preceding school year. Students tended to use NASA reports more often than the faculty did, with 50 percent of students reporting frequent use. Only 37 percent of the faculty reported frequent use. These students may make more extensive use of NASA reports due to their

enrollment in the USRA course. Neither group used AGARD reports much. Only 48 percent of the faculty and 15 percent of the students reported using AGARD reports at all during the preceding academic year.

The respondents were asked to rate NASA technical reports on several factors. The reports were rated fairly highly by both groups although students tended to give lower ratings. Both groups found the reports to be high in technical quality, and low expense. They differed on accessibility and ease of use.

**Rating of NASA Technical Reports
(percents)**

Factors	Faculty	Students
Accessibility	50.7	36.5
Ease of Use	62.1	46.4
Expense	61.6	68.1
Technical Quality	71.4	67.8
Comprehensiveness	53.6	54.1
Relevance	56.0	54.5

Both groups were asked how frequently they had encountered problems working with NASA Technical Reports. Students reported that they had problems obtaining NASA reports more often than did the faculty. The problems cited most often were 1) it was not owned by the library, 2) it was missing or 3) it was housed somewhere else on campus. The faculty had more problems with reports that had to be obtained from NTIS or NASA. Students reported less cooperation from the library staff although neither group had many problems with staff assistance. Table One showed, however, limited use of library staff by both groups. Neither faculty nor students reported many problems with the quality of the reports.

**Problems with NASA Technical Reports
(percents)**

Problems	Faculty	Students
The library didn't own the report	34.7	43.4
The library owned the report, but it was missing	16.7	22.2
The library owned the report, but it was someplace else on campus	10.8	14.0
The report had to be obtained from either NTIS or NASA	25.5	20.3
Illegible microfiche	10.3	8.4
Illegible graphics	8.8	15.6
Intellectual quality of the research	10.3	12.5

Electronic Applications, Databases, and Software Packages

Each group was asked how often they used various electronic applications and software packages. Both faculty and students reported frequent use of word processing packages (faculty, 88 percent; students, 96 percent). Spell checkers were also heavily used (faculty, 63 percent; students, 84 percent). Sixty-five percent of the faculty frequently used scientific graphics and 71 percent of students did. Both groups used desktop publishing programs (faculty, 43 percent; students, 41 percent). The faculty also indicated frequent use of FAX or TELEX equipment (57 percent) while few students used them (9 percent). Faculty were also more inclined to be frequent users

of electronic mail (42 percent) and electronic networks (36 percent) than students (14 percent and 16 percent respectively). Students and faculty use electronic databases at about the same rate (students, 53 percent; faculty, 52 percent), and about 45 percent of each group reported frequent library use.

Skills for Success

Both students and faculty were asked about skills that are important for students to succeed in their engineering careers. About 97 percent of each group ranked the "ability to communicate technical information" as important and about 90 percent of each group felt that an "understanding and knowledge of engineering information resources" was important.

Students were asked about instruction they received in five skill areas. As might be expected, instruction in skills related to the communication of technical information were more widely available and taken than courses skills related to the understanding and use of engineering information sources. About three-fourths of the students reported receiving instruction in technical writing (74 percent) and oral presentations (78 percent). Smaller proportions (52 percent) received instruction in library use and engineering information resources (43 percent). One-third (34 percent) were taught to use online databases. Most students who did not receive instruction related to 1) library usage, 2) understanding and knowledge of engineering information sources, and 3) using online databases reported that such courses were not available or that they did not know if the courses were available.

Courses Available To Students (percents)

Courses Taken

Technical Writing	73.8
Oral Presentation	78.4
Department/Engineering Library	52.2
Engineering Information Resources	43.0
Online Databases	33.5

Courses Not Taken	Available	Not Available	Don't Know
Technical Writing	14.7	7.5	4.0
Oral Presentation	8.0	6.4	7.2
Department/Engineering Library	7.5	21.0	19.3
Engineering Information Resources	3.9	28.7	24.4
Online Databases	5.7	32.2	28.6

Students who did not take courses in these five skill areas, but who could have were asked why they did not take them. A total of 150 students wrote an answer. Because the number of students answering any one of the five questions was modest, no percentages are provided and readers should be cautious in the interpretation of the following information. The reasons offered for not taking these courses generally were that they already had the necessary skills; they intended to take the courses soon; or the instruction was offered in elective courses (in some cases, non-credit) that were difficult to schedule. Some who did not receive training in oral presentations reported that they had avoided these courses because they feared making presentations.¹

¹Of the thirty-eight students who answered this question, only four reported fear of oral presentations as the primary reason to not take the course.

Part III

Summary

Phase 3 of the NASA/DoD Aerospace Knowledge Diffusion Research Project was designed in part to discern similarities and differences between students and faculty members in their use of STI. Some broad patterns have emerged.

First, students do not use their personal collections of information to the degree that faculty members do, nor do they rate them as important as the faculty. This, like many differences between the two groups, may ultimately be due to the students' relative youth in the field. Students probably have not accumulated a large personal collection and cannot rely on it as much as the faculty. However, these limitations on their access to informal STI places a greater burden on the formal information system.

Secondly, students are more likely than faculty to complain about problems obtaining resources via the formal system. They found NASA technical reports more difficult to obtain and use than did the faculty. This problem may stem from two areas. First, students do not receive (or do not take) formal courses in using information resources and materials. Second, they have less experience in using the formal system. Both faculty and student perceive that an understanding and knowledge of information resources is less important to success than the ability to communicate technical information. But, students may be suffering because of their more limited abilities to use the information resources available to them.

ADDITIONAL INFORMATION ON THIS PROJECT

Phase 1 of this project is concerned primarily with the use and rating of STI by aerospace engineers and scientists. AIAA members were asked to review several information sources and rate them and to describe the patterns they use to gather the information they need. Analysis of these data is underway.

Phase 2 of this project focuses on the role of industry and government information intermediaries, (librarians) and technical information specialists in the transfer of STI. Intermediaries from government and industry libraries with aerospace collections from across the United States and Canada were asked to evaluate many of the information sources reviewed by the AIAA members. In addition, they provided us with information about how information sources are used in their libraries. Analysis of these data is currently being conducted.

Phase 4 began in summer, 1990 with a pilot study in Europe and Japan. A study of aerospace engineers and scientists in Britain is scheduled to begin in February, 1991. Additional surveys in NATO countries and Japan are planned.

If you would like additional information about any phase of this study or copies of reports that examine these data in more detail, please contact:

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We welcome your comments and suggestions.

**NASA/DoD AEROSPACE KNOWLEDGE DIFFUSION
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- Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communications in Aeronautics: Results of an Exploratory Study.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101534, Report 1, Part 1. February 1989. 106 p. (Available from NTIS, Springfield, VA; 89N26772.)
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16. Abstract Phase 3 of a four part study was undertaken to investigate the use of scientific and technical information (STI) in the academic aerospace community. Phase 3 of this project used three questionnaires that were sent to three groups (i.e., faculty, librarians, and students) in the academic aerospace community. Specific attention was paid to the types of STI used and the methods in which academic users acquire STI. This report focuses on the responses of two of the three groups: faculty in aerospace departments and students enrolled in USRA-funded capstone design courses. Respondents in both groups relied heavily upon informal sources of information, although students were less inclined to regard their personal collections of STI as important. Both groups relied upon most formal sources of STI about the same, but students reported more difficulty in using the formal resources.					
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