NASA/DoD Aerospace Knowledge Diffusion Research Project

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Source Selection and Information Use by U.S. Aerospace Engineers and Scientists: Results of a Telephone Survey

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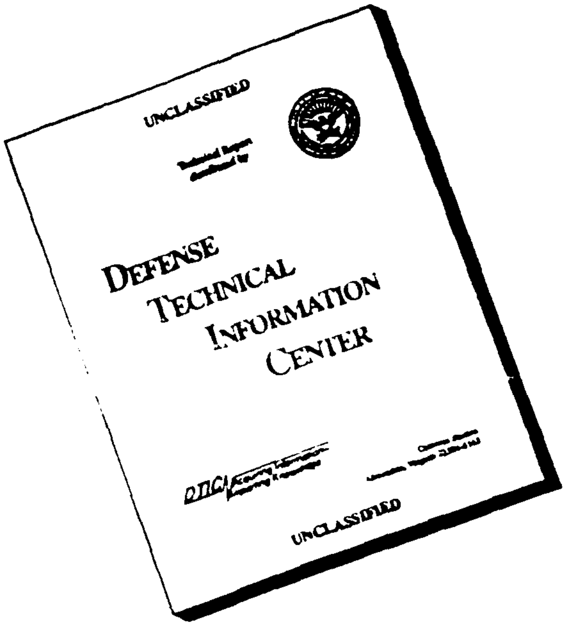

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INTRODUCTION

The production, transfer, and use of scientific and technical information (STI) is an essential part of aerospace research and development (R&D). For purposes of this discussion, we define STI production, transfer, and use as *Aerospace Knowledge Diffusion.* Studies indicate 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 demonstrate, however, how little is known about aerospace knowledge diffusion or about how aerospace engineers and scientists find and use STI. To learn more about this process, a research project has been organized to study knowledge diffusion. This research project is the *NASA/DoD Aerospace Knowledge Diffusion Research Project.*

This research project is being undertaken by researchers at the NASA Langley Research Center (LaRC), the Indiana University Center for Survey Research, and Rensselaer Polytechnic Institute (RPI). Several aerospace professional societies have endorsed this investigation, including the American Institute of Aeronautics and Astronautics (AIAA), and the Advisory Group for Aerospace Research and Development (AGARD), Technical Information Panel (TIP) has sanctioned it. This 4-phase project is providing descriptive and analytical data regarding the diffusion of aerospace knowledge at the individual, organizational, national, and international levels. It is examining both the channels used to communicate and the social system of the aerospace knowledge diffusion process.

Phase 1 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 (Pinelli, T. E.; J. M. Kennedy; and R. O. Barclay, 1991).

A list of *NASA/DoD Aerospace Knowledge Diffusion Research Project* publications appears in Appendix A.

BACKGROUND

Phase 1 of this research concerns the information-seeking behavior of U.S. aerospace engineers and scientists. The intent of Phase 1 is to describe, explain, and ultimately predict the information-seeking behavior of aerospace engineers and scientists. Literature regarding the information-seeking behavior of engineers is fragmented and superficial, and the results of previous work have not accumulated to form a significant body of knowledge that can be used by information professionals for designing and developing information systems and policy (Holland, M. P.; T. E. Pinelli; R. O. Barclay; and J. M. Kennedy, 1991).

The research reported herein was conducted as a Phase 1 activity. A telephone survey of aerospace engineers and scientists belonging to the Society of Automotive Engineers (SAE) was conducted between December 4, 1991 and January 5, 1992. U.S. aerospace engineers and scientists belonging to the AIAA served as the study population for previous Phase 1 studies. Self-administered mail questionnaires were used to collect data from the AIAA membership. The majority of the AIAA members selected research and design as their primary professional duties. The SAE was included as a study population to ensure representation among those U.S. aerospace engineers and scientists performing professional duties in development, manufacturing, and production. Combined, the two populations provide a cross section of the aerospace R&D process.

The SAE telephone survey was undertaken to (1) validate the telephone as an appropriate technique for collecting data from aerospace engineers and scientists; (2) collect information about how the results of NASA/DoD aerospace research are used by U.S. engineers and scientists performing professional duties in aerospace development, manufacturing, and production; (3) identify those selection criteria which affect the use of federally funded aerospace R&D; and (4) obtain information that could be used to develop a self-administered mail questionnaire for use with this same population. A review of the related research and literature indicates that telephone survey techniques have not been used to investigate the information-seeking behavior of U.S. engineers and scientists.

Methodology

The questionnaire used in the SAE telephone survey was jointly prepared by the Project team and representatives from Continental Research. After the survey was pretested, minor changes were made in wording to improve the flow of the instrument and the quality of the data collected. The final version took approximately 18 minutes to administer. The survey instrument appears in Appendix B.

A diskette supplying the sample frame list was provided by the SAE. Readers should note that the sample frame included the names of aerospace engineers and scientists who were on the SAE mailing list, not necessarily members of the SAE. A total of 2,000 names was included on the diskette; however, some names were deleted from the sample frame because their telephone numbers were not listed. The sample frame was separated according to time zone. The telephone numbers were reviewed to indicate whether they were business or home numbers. Interviews were conducted between 9:00 am and 9:00 pm (local time).

Before conducting the survey, each interviewer was thoroughly briefed on the purpose of the survey and how the questionnaire should flow. All interviewers role-played the questionnaire to become comfortable with the wording and format. The final version of the survey instrument was administered by a staff of trained telephone interviewers. All answers were recorded verbatim. Each interviewer's work was electronically monitored by a supervisor at least once per hour. After completion, each of the 407 completed surveys was edited, categorized, coded, and entered into the computer for analysis. The adjusted completion rate for the survey was 74 percent.

Sampling Variability Estimates

The term "sampling variability" is used when referring to the difference between what survey results report and what one would get if a complete census was conducted. It is expressed as the maximum percentage that a figure in this report could vary from what a full census would produce. With a sample size of 407 and assuming a dichotomous question, we are 95% certain than any percentage in the report would be within plus or minus 4.9 percentage points.

Data Comparison

Certain data contained in this report are compared with data from a previous Phase 1 study of AIAA members. The AIAA study concerned the relationship between the use of U.S. government technical reports and selected institutional and sociometric variables. The research methodology and design for the AIAA study are not reported here, but they are contained in the report that documents the results of the AIAA study (Pinelli, 1991).

Survey Demographics

Seven demographic questions were asked of the survey participants. Survey data for each demographic question appear in table 1. The following "composite" participant profile was based on these data. The survey participant works in industry (88.0%), has part of his current work funded by the federal government (73.0%), was educated (trained) as an engineer (90.7%), has a mean of 19.98 years (17.0 median) of professional work experience, works (current job involves performing duties) as an engineer (74.0%), works in design and development (55.8%), and is a male (97.8%).

PRESENTATION OF THE DATA

The questionnaire contained 20 closed ended questions. Responses to all but the 7 demographic questions were grouped and presented according to the following topics.

Importance of Internal and External Sources of Technical Information

The importance of internal (found inside your organization) and external (found outside your organization) sources of technical information was measured on a 4-point scale

Table 1. Survey Demographics

[$n = 407$]

Demographics	Number	Percentage
Do you currently work in:		
Industry	362	88.9
Government	42	10.3
Academia	0	0.0
Not-for-profit sector	3	0.7
Is any of your work currently funded by the federal government?		
Yes	297	73.0
No	110	27.0
Was your education primarily as:		
An Engineer	369	90.7
A Scientist	13	3.2
A Business Major	11	2.7
A Math/English/Education Major	5	1.2
Technician/Technical background	9	2.2
How many years of professional work experience do you have?		
1 to 5 years	15	3.7
6 to 10 years	97	23.8
11 to 15 years	81	19.9
16 to 20 years	45	11.1
21 to 25 years	40	9.8
26 to 30 years	48	11.8
31 to 35 years	36	8.8
36 to 40 years	33	8.1
41 or more years	12	2.9
Mean = 19.998 years		
Median = 17.0 years		
Does your current job involve working primarily as:		
An engineer	301	74.0
A scientist	10	2.5
An administrative manager	93	22.9
Other	3	0.7
Which best describes you? Are you in:		
Research	35	8.6
Design and development	227	55.8
Manufacturing and production	52	12.8
Administrative manager	93	22.9
Gender of respondent:		
Male	398	97.8
Female	9	2.2

(1.0 = not important; 4.0 = extremely important). The responses are presented in table 2. Both sources of technical information were considered important with "internal sources" scoring higher ($\overline{X}$ = 3.6) followed by "external sources" ($\overline{X}$ = 3.1). Respondents were also asked if they preferred to get needed information from "written" sources or "informal" (person) sources when working on a technical problem or task. Approximately two thirds of the respondents indicated a preference for written sources (i.e., professional literature) over colleagues and information specialists. Respondents also indicated that they had spent approximately 6.5 hours per week over the past 6 months using all kinds of technical information to perform their present professional duties. These findings are consistent with similar findings reported in the literature. (See, for example, Shuchman, 1981.)

Table 2. Importance of Internal and External Sources of Technical Information

[n = 407]

Source	Number	Percentage
Internal Information		
Extremely important	262	64.4
Quite important	131	32.2
Slightly important	12	2.9
Not at all important	2	0.5
Mean = 3.604		
External Information		
Extremely important	140	34.4
Quite important	176	43.2
Slightly important	79	19.4
Not at all important	12	2.9
Mean = 3.091		

Importance of Selected Technical Information Products

Survey participants were asked to rate the importance of 4 technical information products in the performance of their present professional duties. The technical information products included conference and meeting papers, journal articles, in-house (company) technical reports, and U.S. government technical reports. The importance of the 4 technical information products was measured on a 4-point scale (1.0 = not important; 4.0 = extremely important). The responses are presented in table 3. In-house (company) technical reports

Table 3. Importance of Four Technical Information Products

[$n = 407$]

Information product	Number	Percentage
Conference and meeting papers		
Extremely important	42	10.3
Quite important	129	31.7
Slightly important	195	47.9
Not at all important	41	10.1
Mean = 2.423		
Journal articles		
Extremely important	42	10.3
Quite important	135	33.2
Slightly important	202	49.6
Not at all important	28	6.9
Mean = 2.469		
In-house (company) technical reports		
Extremely important	139	34.2
Quite important	170	41.8
Slightly important	80	19.7
Not at all important	18	4.4
Mean = 3.057		
U.S. government technical reports		
Extremely important	67	16.5
Quite important	145	35.6
Slightly important	158	38.8
Not at all important	37	9.1
Mean = 2.595		

important). The responses appear in table 3. In-house (company) technical reports received the highest overall (mean) importance rating ($\overline{X}$ = 3.057) followed by U.S. government technical reports ($\overline{X}$ = 2.595), journal articles ($\overline{X}$ = 2.469), and conference and meeting papers ($\overline{X}$ = 2.423). These findings vary slightly from data collected from the Phase 1 AIAA study (Pinelli, 1991). In the AIAA study, in-house (company) technical reports received the highest overall (mean) importance rating ($\overline{X}$ = 3.84) followed by conference and meeting papers ($\overline{X}$ = 3.53), journal articles ($\overline{X}$ = 3.52), and U.S. government technical reports ($\overline{X}$ = 3.51).

Overall, participants in the AIAA study attributed higher ratings of importance to the 4 products than did participants in the SAE study. Further, the differences in the ratings of the 4 products were greater for the SAE participants than for the AIAA participants. Unlike the AIAA study, there is a clear distinction between the importance of internal information, as measured by the importance rating of in-house (company) technical reports, and external information, as measured by the importance of the 3 remaining technical information products.

Use of Selected Technical Information Products

Survey participants were asked to indicate their use of the 4 selected technical information products in the past 6 months. The mean (median) number of times these 4 technical information products were used appears in table 4. On average, in-house (company) technical reports were used to a greater extent ($\overline{X}$ = 22.63) than the remaining 3 technical information products. After in-house (company) technical reports, conference and meeting papers ($\overline{X}$ = 18.79) were used most frequently, followed by journal articles ($\overline{X}$ = 16.92) and U.S. government technical reports ($\overline{X}$ = 12.12). Overall, the mean ($\overline{X}$) use of the 4 technical information products was higher in the SAE study than in the AIAA study. (See table 5.)

Table 4. Mean (Median) Use of Four Technical Information Products

[n varies between 407 and 276]

Information product	Average number of times (median) product used in 6-month period	Number n
Conference and meeting papers		
Including zeros	14.543 (4.00)	407
Without zeros	18.790 (6.00)	315
Journal articles		
Including zeros	13.388 (4.00)	407
Without zeros	16.92 (6.00)	322
In-house (company) technical reports		
Including zeros	20.744 (8.00)	407
Without zeros	22.635 (10.00)	373
U.S. government technical reports		
Including zeros	8.221 (2.00)	407
Without zeros	12.123 (4.00)	276

Table 5. Mean (Median) Use of Four Technical Information Products by AIAA and SAE Study Participants

[n = 1,893; n varies between 407 and 276]

Information product	Average number of times (median) product used in 6-month period for respondents in—	
	AIAA	SAE
Conference-meeting papers	12.02 (4.00)	18.79 (6.00)
Journal articles	14.74 (5.00)	16.92 (6.00)
In-house (company) technical reports	20.30 (6.00)	22.63 (10.00)
U.S. government technical reports	11.45 (5.00)	12.12 (4.00)

Use of Computer Technology To Obtain Technical Information

Participants in the SAE study were asked if they would use a computer to obtain technical information if it was available through a computer. A 4-point scale (1 = always use; 4 = never use) served as the scale of measurement. About 59 percent indicated that they would "always" or "usually" prefer to obtain technical information by using a computer. About 41 percent indicated they would "sometimes" or "never" use a computer. Considering all respondents, about 98 percent indicated that they would prefer to use a computer to obtain technical information if that information were available via a computer.

Rating of Selected Technical Information Products

Using a 4-point scale (1.0 = not at all; 4.0 = extremely e.g., "ease to obtain"), survey participants were asked to rate conference and meeting papers, journal articles, in-house (company) technical reports, and U.S. government technical reports on 8 factors. Their responses appear in table 6. Conference/meeting papers and U.S. government technical reports were rated highest on technical quality. Journal articles and in-house (company) technical reports were rated highest on reasonably priced.

Table 6. Mean Rating of Four Technical Information Products

[*n* varies between 379 and 407]

Factors	Conference and meeting papers	Journal articles	In-house (company) technical reports	U.S. government technical reports
Easy to obtain	2.466	2.816	3.346	2.475
Easy to use	2.581	2.837	3.162	2.473
Reasonably priced	2.683	2.919	3.654	2.821
Familiar to you	2.631	2.778	3.251	2.578
Contain reliable data and information	2.778	2.792	3.256	2.889
Technically accurate	2.897	2.852	3.285	2.946
Contain comprehensive data and information	2.614	2.649	3.076	2.768
Relevant to your work	2.591	2.612	3.236	2.587

The highest ratings were recorded for in-house (company) technical reports followed by journal articles, U.S. government technical reports, and conference and meeting papers.

For in-house (company) technical reports, the highest mean ($\overline{X}$) rating scores were for "reasonably priced" ($\overline{X}$ = 3.654) followed by "easy to obtain" ($\overline{X}$ = 3.346) and "technical accuracy" ($\overline{X}$ = 3.285). For journal articles, the highest mean ($\overline{X}$) rating scores were "reasonably priced" ($\overline{X}$ = 2.919) followed by "technical accuracy" ($\overline{X}$ = 2.852) and "easy to obtain" ($\overline{X}$ = 2.816). For U.S. government technical reports, the highest mean ($\overline{X}$) rating scores were for "technical accuracy" ($\overline{X}$ = 2.946) followed by "reliable data and information" ($\overline{X}$ = 2.889) and "reasonably priced" ($\overline{X}$ = 2.821). For conference and meeting papers, the highest mean ($\overline{X}$) rating scores were for "technical accuracy" ($\overline{X}$ = 2.897) followed by "reasonably priced" ($\overline{X}$ = 2.683) and "comprehensive data and information" ($\overline{X}$ = 2.614). Considering the 3 highest ratings for each of the 4 products ($4 \times 3 = 12$), the ratings were evenly divided; 6 were accessibility factors and 6 were technical quality factors.

Factors Influencing Use

Using a 4-point scale (1.0 = not at all; 4.0 = extremely influencial), survey participants were asked to indicate the extent to which these same 8 factors influenced their use of conference and meeting papers, journal articles, in-house (company) technical reports, and U.S. government technical reports. Their responses are summarized in table 7.

Table 7. Mean Factors Affecting the Use of Four Technical Information Products

[*n* varies between 405 and 407]

Factors	Conference and meeting papers	Journal articles	In-house (company) technical reports	U.S. government technical reports
How easy they are to obtain	2.472	2.455	2.361	2.501
How easy they are to use	2.381	2.391	2.383	2.378
How reasonably priced they are	1.921	1.990	1.742	1.985
How familiar they are to you	2.538	2.504	2.600	2.522
How reliable are the data and information	3.034	3.047	3.182	3.027
How technically accurate they are	3.130	3.148	3.268	3.066
How comprehensive are the data/information	2.936	2.978	3.074	2.894
How relevant they are to your work	3.249	3.182	3.351	3.192

The highest group of ratings were recorded for in-house (company) technical reports followed by journal articles, conference and meeting papers, and U.S. government technical reports. For in-house (company) technical reports, the highest mean ($\overline{X}$) rating scores were for "relevance" ($\overline{X} = 3.351$) followed by "technical accuracy" ($\overline{X} = 3.268$) and "reliable data and information" ($\overline{X} = 3.182$). For journal articles, the highest mean ($\overline{X}$) rating scores were for "relevance" ($\overline{X} = 3.182$) followed by "technical accuracy" ($\overline{X} = 3.148$) and "reliable data and information" ($\overline{X} = 3.047$). For conference and meeting papers, the highest mean ($\overline{X}$) rating scores were for "relevance" ($\overline{X} = 3.249$) followed by "technical accuracy" ($\overline{X} = 3.130$) and "reliable data and information" ($\overline{X} = 3.034$). For U.S. government technical reports, the highest mean ($\overline{X}$) rating scores were for "relevance" ($\overline{X} = 3.192$) followed by "technical accuracy" ($\overline{X} = 3.066$), and "reliable data and information" ($\overline{X} = 3.027$). The technical quality factors exerted the greatest influence on use for each of the 4 technical information products.

A slightly modified version of the factors "influencing use" question was included in the survey of AIAA members. (Seven factors were included in the AIAA study. Reliability was the missing factor.) A comparison of the AIAA and SAE "factors influencing use" data appears in table 8.

Overall, participants in the AIAA study attributed higher influence ratings to the factors than did participants in the SAE study. Further, the differences between the ratings of the 8 factors were greater for the SAE participants than for the AIAA participants. Unlike the SAE study, accessibility factors influenced the use of the 4 technical information products by U.S. aerospace engineers and scientists belonging to the AIAA.

Table 8. Mean Factors Affecting the Use of Four Technical Information Products by AIAA and SAE Study Participants

[$n = 1839$; $n = 407$]

Factors	Conference and meeting papers		Journal articles		In-house (company) technical reports		U.S. government technical reports	
	AIAA	SAE	AIAA	SAE	AIAA	SAE	AIAA	SAE
Accessibility	3.79	2.47	3.88	2.45	4.01	2.36	3.65	2.50
Ease of use	3.43	2.38	3.51	2.39	3.61	2.38	3.38	2.37
Expense	2.50	1.92	2.64	1.99	2.50	1.74	2.51	1.98
Familiarity	3.56	2.53	3.58	2.50	3.78	2.60	3.52	2.52
Reliability	—	3.03	—	3.04	—	3.18	—	3.02
Technical quality	3.74	3.13	4.03	3.14	3.77	3.26	3.73	3.06
Comprehensiveness	3.38	2.93	3.59	2.97	3.51	3.07	3.55	2.89
Relevance	3.97	3.24	3.87	3.18	4.15	3.35	3.90	3.19

— Not asked of AIAA participants

Finally, correlation coefficients (r) were calculated using data from the SAE study. The correlation compared "use levels" by "ratings" for each of the 4 technical information products. A positive and significant correlation[a] was found between the use of the 4 products and the following rating factors:

Conference and meeting papers

	r
• ease of use	.1178
• familiarity	.1409
• relevance	.2325

Journal articles

	r
• ease of use	.1634
• familiarity	.2313
• reliable data and information	.1491
• relevance	.1972

In-house (company) technical reports

	r
• familiarity	.1316
• comprehensiveness	.1231
• relevance	.1894

U.S. government technical reports

	r
• ease of use	.1168
• familiarity	.2078
• technical accuracy	.1191
• relevance	.2581

[a]All r values are statistically significant

CONCLUDING REMARKS

The SAE telephone survey was undertaken to (1) validate the telephone as an appropriate technique for collecting data from U.S. aerospace engineers and scientists; (2) collect information about how the results of NASA/DoD aerospace research are used by engineers and scientists performing professional duties in aerospace development, manufacturing, and production; (3) identify those selection criteria which affect the use of federally funded aerospace R&D; and (4) obtain information that could be used to develop a self-administered mail questionnaire for use with this same population. Based on these results, telephone survey techniques were judged to be an appropriate technique for collecting data from U.S. aerospace engineers and scientists. Data obtained from this telephone survey were successfully used to construct the self-administered mail survey that was used with the same population.

Both internal and external sources of technical information are important to survey participants with internal sources being rated "more important" than external sources of technical information. By comparison, in-house (company) technical reports ($\overline{X} = 3.057$) (internal sources of information) were rated "more important" than conference/meeting papers, journal articles, and U.S. government technical reports (external sources of information). Further, the mean/median use rate in a 6-month period, was considerably higher for in-house (company) technical reports ($\overline{X} = 20.30$) than for conference/meeting papers, journal articles, and U.S. government technicap reports.

Survey participants were asked to rate conference/meeting papers, journal articles, in-house (company) technical reports, and U.S. government technical reports on 8 factors. The 8 factors were almost evenly divided between ratings of accessibility and technical quality. Conference/meeting papers and U.S. government technical reports were rated higher on the technical quality factors. Journal articles and in-house (company) technical reports were rated higher on the accessibility factors. In terms of factors influencing use, all 4 products were rated higher on the technical quality than on the accessibility factors by survey participants. Finally, a correlation coefficient (r) was calculated. The correlation compared "use levels" by "rating" for each of the 4 technical information products. A positive and significant correlation was found for use and "familiarity" and "relevance" each of the 4 products. These findings indicate that accessibility alone does not ensure the use of federally-funded aerospace R&D. The results of federally funded aerospace R&D must also be relevent, reliable, and technically accurate. Information products chosen/used to disseminate the results of federally funded aerospace R&D should be familiar to the user which bodes well for staying with a proven format/package rather than making excessive changes or changes only to promote a new look or image.

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Appendix A

NASA/DoD Aerospace Knowledge Diffusion Research Project Publications

REPORTS

<u>Report No.</u>

1 PART 1 Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communications in Aerospace: Results of Phase 1 Pilot Study.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101534. February 1989. 106 p. (Available from NTIS 89N26772.)

1 PART 2 Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communications in Aerospace: Results of a Phase 1 Pilot Study.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101534. February 1989. 83 p. (Available from NTIS 89N26773.)

2 Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communication in Aerospace: Results of Phase 1 Pilot Study -- An Analysis of Managers' and Nonmanagers' Responses.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101625. August 1989. 58 p. (Available from NTIS 90N11647.)

3 Pinelli, Thomas E.; Myron Glassman; Walter E. Oliu; and Rebecca O. Barclay. **Technical Communication in Aerospace: Results of Phase 1 Pilot Study -- An Analysis of Profit Managers' and Nonprofit Managers' Responses.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101626. October 1989. 71 p. (Available from NTIS 90N15848.)

4 Pinelli, Thomas E.; John M. Kennedy; and Terry F. White. **Summary Report to Phase 1 Respondents.** Washington, DC: National Aeronautics and Space Administration. NASA TM-102772. January 1991. 8 p. (Available from NTIS 91N17835.)

5 Pinelli, Thomas E.; John M. Kennedy; and Terry F. White. **Summary Report to Phase 1 Respondents Including Frequency Distributions.** Washington, DC: National Aeronautics and Space Administration. NASA TM-102773. January 1991. 53 p. (Available from NTIS 91N20988.)

6 Pinelli, Thomas E. **The Relationship Between the Use of U.S. Government Technical Reports by U.S. Aerospace Engineers and Scientists and Selected Institutional and Sociometric Variables.** Washington, DC: National Aeronautics and Space Administration. NASA TM-102774. January 1991. 350 p. (Available from NTIS 91N18898.)

7 Pinelli, Thomas E.; John M. Kennedy; and Terry F. White. **Summary Report to Phase 2 Respondents Including Frequency Distributions.** Washington, DC: National Aeronautics and Space Administration. NASA TM-104063. March 1991. 42 p. (Available from NTIS 91N22931.)

8 Pinelli, Thomas E.; John M. Kennedy; and Terry F. White. **Summary Report to Phase 3 Faculty and Student Respondents.** Washington, DC: National Aeronautics and Space Administration. NASA TM-104085. June 1991. 8 p. (Available from NTIS 91N24943.)

9 Pinelli, Thomas E.; John M. Kennedy; and Terry F. White. **Summary Report to Phase 3 Faculty and Student Respondents Including Frequency Distributions.** Washington, DC: National Aeronautics and Space Administration. NASA TM-104086. June 1991. 42 p. (Available from NTIS 91N25950.)

10 Pinelli, Thomas E.; John M. Kennedy; and Terry F. White. **Summary Report to Phase 3 Academic Library Respondents Including Frequency Distributions.** Washington, DC: National Aeronautics and Space Administration. NASA TM-104095. August 1991. 42 p. (Available from NTIS 91N33013.)

11 Pinelli, Thomas E.; Madeline Henderson; Ann P. Bishop; and Philip Doty. **Chronology of Selected Literature, Reports, Policy Instruments, and Significant Events Affecting Federal Scientific and Technical Information (STI) in the United States.** Washington, DC: National Aeronautics and Space Administration. NASA TM-101662. January 1992. 130 p. (Available from NTIS 92N17001.)

12 Glassman, Nanci A. and Thomas E. Pinelli. **An Initial Investigation Into the Production and Use of Scientific and Technical Information (STI) at Five NASA Centers: Results of a Telephone Survey.** Washington, DC: National Aeronautics and Space Administration. NASA TM-104173. June 1992. 80 p. (Available from NTIS 92N27170.)

PAPERS

Paper No.

1 Pinelli, Thomas E.; Myron Glassman; Rebecca O. Barclay; and Walter E. Oliu. **The Value of Scientific and Technical Information (STI), Its Relationship to Research and Development (R&D), and Its Use by U.S. Aerospace Engineers and Scientists.** Paper presented at the European Forum "External Information: A Decision Tool" January 19, 1990, Strasbourg, France. (Available from AIAA 90A21931.)

2 Blados, Walter R.; Thomas E. Pinelli; John M. Kennedy; and Rebecca O. Barclay. **External Information Sources and Aerospace R&D: The Use and Importance of Technical Reports by U.S. Aerospace Engineers and Scientists.** Paper prepared for the 68th AGARD National Delegates Board Meeting, 29 March 1990, Toulouse, France. (Available from NTIS 90N30132.)

3 Kennedy, John M. and Thomas E. Pinelli. **The Impact of a Sponsor Letter on Mail Survey Response Rates.** Paper presented at the Annual Meeting of the American Association for Public Opinion Research, May 1990, Lancaster, PA. (Available from NTIS 92N28112.)

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Appendix B

SAE Telephone Survey Instrument

Hi, my name is _______ with Continental Research in Norfolk, VA. We are conducting a survey tonight with engineers and scientists and we would like to include your opinion.

1. To perform your professional duties, is __(fill in)__ Extremely, Quite, Slightly, or Not At All Important?

Extremely Important	Quite Important	Slightly Important	Not At All Important	
4	3	2	1	Technical information found outside of your organization
4	3	2	1	Technical information found inside of your organization
4	3	2	1	Conference and meeting papers
4	3	2	1	Journal articles
4	3	2	1	Technical reports produced in-house at your company
4	3	2	1	U.S. government technical reports

2. In the past six months, how many times, if any, did you use __(fill in)__ in your work?

Times Used	
________	Conference and meeting papers
________	Journal articles
________	Technical reports produced in-house at your company
________	U.S. government technical reports

3. If technical information were available through a computer, would you prefer to use the computer: (READ CHOICES)

   1-Always 2-Usually 3-Sometimes, or 4-Never when you need technical information?

4. How would you rate CONFERENCE AND MEETING PAPERS in terms of __being easy to obtain__? Are they Extremely, Quite, Slightly, or Not At All __easy to obtain__?

Extremely	Quite	Slightly	Not At All	
4	3	2	1	Easy to obtain?
4	3	2	1	Are they easy to use?
4	3	2	1	Are they reasonably priced?
4	3	2	1	Are they familiar to you?
4	3	2	1	Do they contain reliable data and information?
4	3	2	1	Are they technically accurate?
4	3	2	1	Do they contain comprehensive data and information?
4	3	2	1	Are they relevant to your work?

5. Are JOURNAL ARTICLES:

Extremely	Quite	Slightly	Not At All	
4	3	2	1	Easy to obtain?
4	3	2	1	Are they easy to use?
4	3	2	1	Are they reasonably priced?
4	3	2	1	Are they familiar to you?
4	3	2	1	Do they contain reliable data and information?
4	3	2	1	Are they technically accurate?
4	3	2	1	Do they contain comprehensive data and information?
4	3	2	1	Are they relevant to your work?

6. Now, let's talk about TECHNICAL REPORTS PRODUCED IN-HOUSE AT YOUR COMPANY. Are they:

Extremely	Quite	Slightly	Not At All	
4	3	2	1	Easy to obtain?
4	3	2	1	Are they easy to use?
4	3	2	1	Are they reasonably priced?
4	3	2	1	Are they familiar to you?
4	3	2	1	Do they contain reliable data and information?
4	3	2	1	Are they technically accurate?
4	3	2	1	Do they contain comprehensive data and information?
4	3	2	1	Are they relevant to your work?

7. And how about U.S. GOVERNMENT TECHNICAL REPORTS? Are they:

Extremely	Quite	Slightly	Not At All	
4	3	2	1	Easy to obtain?
4	3	2	1	Are they easy to use?
4	3	2	1	Are they reasonably priced?
4	3	2	1	Are they familiar to you?
4	3	2	1	Do they contain reliable data and information?
4	3	2	1	Are they technically accurate?
4	3	2	1	Do they contain comprehensive data and information?
4	3	2	1	Are they relevant to your work?

8. When you decide to use or not use CONFERENCE AND MEETING PAPERS in your work, is your decision Extremely, Quite, Slightly, or Not At All influenced by how easy they are to obtain ?

Extremely Influenced	Quite Influenced	Slightly Influenced	Not At All Influenced	
4	3	2	1	How easy they are to obtain?
4	3	2	1	How easy they are to use?
4	3	2	1	How reasonably priced they are?
4	3	2	1	How familiar they are to you?
4	3	2	1	How reliable the data and information is?
4	3	2	1	How technically accurate it is?
4	3	2	1	How comprehensive the data and information is?
4	3	2	1	How relevant to your work it is?

9. When you decide to use or not use JOURNAL ARTICLES, is your decision influenced by:

Extremely Influenced	Quite Influenced	Slightly Influenced	Not At All Influenced	
4	3	2	1	How easy they are to obtain?
4	3	2	1	How easy they are to use?
4	3	2	1	How reasonably priced they are?
4	3	2	1	How familiar they are to you?
4	3	2	1	How reliable the data and information is?
4	3	2	1	How technically accurate it is?
4	3	2	1	How comprehensive the data and information is?
4	3	2	1	How relevant to your work it is?

10. Now, let's talk about TECHNICAL REPORTS PRODUCED IN-HOUSE AT YOUR COMPANY. When you decide to use or not use them, is your decision influenced by:

Extremely Influenced	Quite Influenced	Slightly Influenced	Not At All Influenced	
4	3	2	1	How easy they are to obtain?
4	3	2	1	How easy they are to use?
4	3	2	1	How reasonably priced they are?
4	3	2	1	How familiar they are to you?
4	3	2	1	How reliable the data and information is?
4	3	2	1	How technically accurate it is?
4	3	2	1	How comprehensive the data and information is?
4	3	2	1	How relevant to your work it is?

11. And how about U.S. GOVERNMENT TECHNICAL REPORTS? When you decide to use or not use them, is your decision influenced by:

Extremely Influenced	Quite Influenced	Slightly Influenced	Not At All Influenced	
4	3	2	1	How easy they are to obtain?
4	3	2	1	How easy they are to use?
4	3	2	1	How reasonably priced they are?
4	3	2	1	How familiar they are to you?
4	3	2	1	How reliable the data and information is?
4	3	2	1	How technically accurate it is?
4	3	2	1	How comprehensive the data and information is?
4	3	2	1	How relevant to your work it is?

12. In the past six months, approximately how many hours did you spend using all kinds of technical resource information (like the various types we've been discussing)?

____________ hours used in past six months

13. When you're working on a technical problem or task, do you prefer to get needed information from written technical resources or informally from other people?

1 - Prefers written sources (ASK Q. 13a)   2 - Prefers people (ASK Q. 13b)

13a. Would that be more the: (READ CHOICES)

1 - The professional literature in your discipline, or
2 - Other kinds of written materials?
(GO TO Q. 14)

13b. Would that be: (READ CHOICES)

1 - Colleagues and co-workers, or
2 - Information specialists...like librarians?

14. Do you currently work in: (READ CHOICE)

1 - Industry,
2 - Government,
3 - Academia,
4 - The non-for-profit sector, or
5 - Another type of organization? ____________ (SPECIFY)

15. Is any of your work currently funded by the federal government? 1 - Yes 2 - No

16. Was your education primarily as: (READ CHOICES)

1 - An engineer   2 - A scientist, or   3 - Something else? ____________ (SPECIFY)

17. How many years of professional work experience do you have? ________ years

18. Does your current job involve working primarily as: (READ CHOICES)

1 - An engineer
2 - A scientist
3 - An administrative manager, or (SKIP TO END)
4 - Something else? ______________________ (SPECIFY)

19. Which best describes you? Are you in: (READ CHOICES)

1 - Research 2 - Design and development, or 3 - Manufacturing and production?

Thank you so much for your time. I really appreciate it!

RECORD: 1 - Male 2 - Female

NAME OF RESPONDENT: ______________________

COMPANY: ______________________

STATE: ______________________ PHONE #: ______________________
(area code)

INTV: __________ DATE: ______________

COMMENTS

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13. ABSTRACT *(Maximum 200 words)*

A telephone survey of U.S. aerospace engineers and scientists belonging to the Society of Automotive Engineers (SAE) was conducted between December 4, 1991 and January 5, 1992. The survey was undertaken to (1) validate the telephone survey as an appropriate technique for collecting data from U.S. aerospace engineers and scientists; (2) collect information about how the results of NASA/DoD aerospace research are used in the R&D process; (3) identify those selection criteria which affect the use of federally-funded aerospace R&D; and (4) obtain information that could be used to develop a self-administered mail questionnaire for use with the same population. The average rating of importance of U.S. government technical reports was 2.5 (on a 4-point scale); The mean/median number of times U.S. government technical reports were used per 6 months was 8/2. Factors scoring highest for U.S. government technical reports were technical accuracy (2.9), reliable data and technical information (2.8), and contains comprehensive data and information (2.7) on a 4-point system. The factors scoring highest for influencing the use of U.S. government technical reports were relevance (3.1), technical accuracy (3.06), and reliable data/information (3.02). Ease of use, familiarity, technical accuracy, and relevance correlated with use of U.S. government technical reports. Survey demographics, survey questionnaire, and the NASA/DoD Aerospace Knowledge Diffusion Research Project publications list are included.

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