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EXTERNAL INFORMATION SOURCES AND AEROSPACE R&D: THE USE AND IMPORTANCE OF TECHNICAL REPORTS BY U.S. AEROSPACE ENGINEERS AND SCIENTISTS

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This paper formulates and studies two propositions. Proposition 1 states that information that is external to the aerospace organization tends to be used less than internal sources of information; the more geographically removed the information is from the organization, the less likely it is to be used. Proposition 2 states that of the various sociometric variables assumed to influence the use of an information channel or source, perceived accessibility exerts the greatest influence; the greater the perceived accessibility, the greater the likelihood of an information channel or source being used. Preliminary analysis based on surveys supports Proposition 1. This analysis does not support Proposition 2, however. Evidence here indicates that reliability and relevance influence the use of an information source more than the idea of perceived accessibility. Keywords: Information sources

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INTRODUCTION

The ability of aerospace engineers and scientists to identify, acquire, and utilize scientific and technical information (STI) is of paramount importance to the efficiency of the research and development (R&D) process. Testimony to the central role of STI in the R&D process is found in numerous studies (Fischer, 1980). These studies show, among other things, that aerospace engineers and scientists devote more time, on the average, to the communication of technical information than to any other scientific or technical activity (Pinelli, et al., 1989). A number of studies have found strong relationships between the communication of STI and technical performance at both the individual (Allen, 1970; Hall and Ritchie, 1975; and Rothwell and Robertson, 1973) and group level (Carter and Williams, 1957; Rubenstein, et al., 1971; and Smith, 1970). Therefore, we concur with Fischer's (1980) conclusion that the "role of scientific and technical communication is thus central to the success of the innovation process, in general, and the management of R&D activities, in particular."

The R&D process can be simplified into two phases: idea formulation and problem solving (Myers and Marquis, 1969). The literature indicates that STI **external** to the organization plays a predominant role in the idea formulation, while STI **internal** to the organization plays the more important role in problem solving (Dewhirst, et al., 1978). This recommendation is supported by Project Sappho (1972) which reported that "one of the distinguishing characteristics of unsuccessful innovations was the poor utilization of external sources in idea formulation" and by Allen (1977) who found a strong positive correlation between the use of external sources and the technical quality of engineering proposals. For various institutional and behavioral reasons associated with "uncertainty," organizations and individuals tend to isolate themselves from and erect barriers to the outside world and to **external** STI.

Thus, we speculate that engineers and scientists engaged in the process of aerospace innovation display a bias in favor of **internal** STI and against **external** STI. This paper uses data collected as part of the **NASA/DOD Aerospace Knowledge Diffusion Research Project** to investigate this assumption by exploring the use of AGARD, DOD, and NASA technical reports by U.S. aerospace engineers and scientists.

Aerospace Innovation as Information Processing

Information processing in aerospace R&D (figure 1) is viewed as an ongoing problem-solving cycle involving each activity within the innovation process, the larger organization, and the external world For purposes of this paper, the aerospace innovation process is conceptualized as a process of related activities or units beginning with research at one end and service and maintenance on the other.[1]

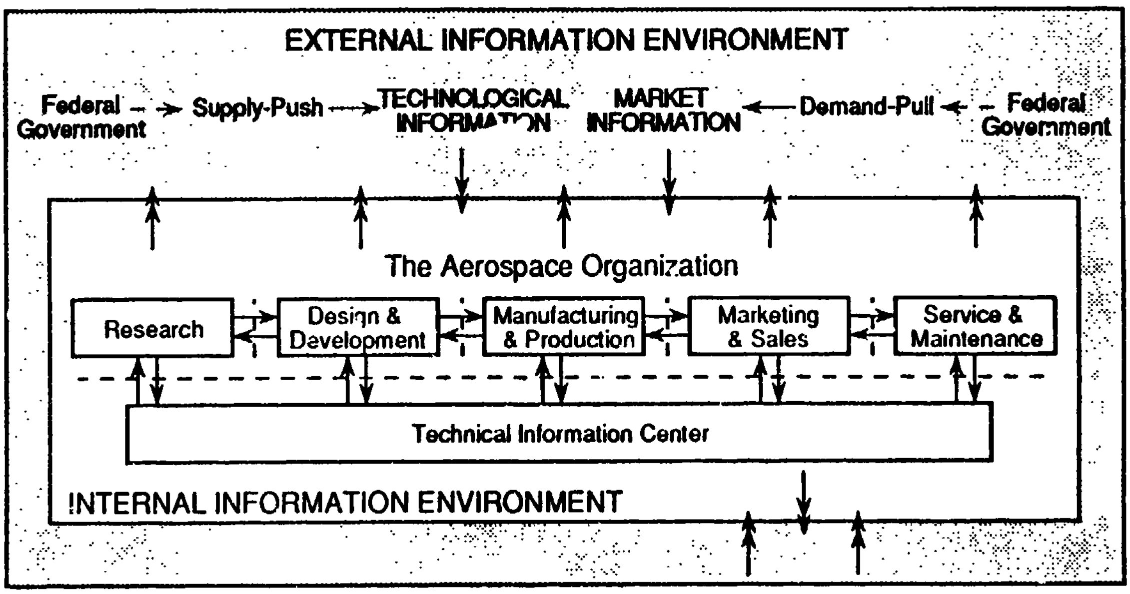

Figure 1. The Aerospace Innovation Process as an Information Processing System.

Throughout the entire process, ideas and knowledge are being pursued and transferred. The fact that these ideas and knowledge deal with hard technologies, or may be as Allen (1977) states "physically or hardware encoded," should not detract from the observation that, in aerospace, the innovation process is fundamentally an information processing activity.

The premise that the process of innovation in the aerospace industry can be viewed as an information processing activity represents an extension of the arguments developed by Tushman and Nadler (1980). These arguments trace their origins to, among others, Galbraith (1973) and Duncan (1973), who have conceptualized organizations as information processing systems. Uncertainty, defined as the difference between information possessed and information required to complete a task (Rosenbloom and Wolek, 1970), is central to the concept of organizations as information processing activities.

[1] The proposition that innovation is a linear process, a view presented by Myers and Marquis (1969), is not universally accepted. Langrish, et al., (1972) have rejected "linear models" of the innovation process as unrealistic.

Information processing can be viewed as an ongoing problem-solving cycle involving each activity within the innovation process, the larger organization, and the external information world. For any given task, each activity within the innovation process "must effectively import technical and market information from the external information world; new and established information must be effectively processed within the work area; decisions and solutions approaches must be worked on and coordinated within each activity and within the organization; and outputs, such as decisions and products, must effectively be transferred to the external environment" (Tushman and Nadler, 1980). Work areas must be sensitive to feedback and new information from internal and external sources. Finally, outputs of this process create conditions for another set of activities, thereby initiating another information processing cycle.

Organizations involved in innovation are open social systems which must deal with several sources of work-related uncertainty (Katz and Kahn, 1966). In particular, they must deal with uncertainty from technical areas outside of the organization as well as uncertainty concerning problem solving within the organization (Myers and Marquis, 1969; Utterback, 1974). The nature of organizations involved in innovation is such that uncertainty cannot be eliminated. To maintain stability, however, organizations involved in innovation must constantly strive to reduce uncertainty to a manageable level (Miller, 1971).

If organizations involved in innovation must deal with the several sources of work-related uncertainty, then a crucial task of these organizations is to gather, process, and export information throughout the work-related activities. Organizations must, therefore, develop information processing mechanisms capable of dealing with internal and external sources of work-related uncertainty (Tushman and Nadler, 1980).

However, the units that comprise the larger organization (fig. 1) are highly differentiated. They operate on different time frames, with different goals, and with varying professional orientations (Rosenbloom and Wolek, 1970). These differences in norms and values also carry with them different internal coding schemes which suggest that each unit may possess specific and unique information processing patterns. Each unit is likely to have different sources of effective feedback, evaluation, and support (Tushman and Nadler, 1980). Therefore, while the larger organization must continually import information from the external environment, this information must be processed with internal information and transferred within the organization and among the various work units. Therefore, the larger organization must be sensitive to the differences among and between units that comprise the innovation process. Specialized feedback, evaluation, and support may be required for each unit to process new information from internal and external sources (Gerstberger, 1971).

Relationship to External Information Sources

Three factors (task characteristics, task environment, and task interdependence) combine to influence the degree of uncertainty with which organizations involved in the innovation process must deal. Uncertainty increases as the task becomes less routine, as the environment becomes more dynamic, and as task interdependence becomes more complex. The greater the uncertainty, the greater the information processing requirements and the greater the need for information external to the organization (Rosenbloom and Wolek, 1970; Allen, 1970).

However, it is the nature of organizations engaged in innovation to isolate themselves from the outside world, to erect barriers to communications with their external environment, and to rely on information internal to the organization (Gerstenfeld and Berger, 1980). This behavior is due in large part to the need for organizations to exercise control over those situations in which they interact with the outside and because these organizations are frequently involved in activities of a proprietary nature (Fischer, 1980; Allen, 1970). Numerous studies have found a strong relationship between successful innovation, idea formulation, and information external to the organization (Dewhirst, et al., 1978; Allen, 1977; Project Sappho, 1972). The danger, then, for organizations engaged in innovation is to become isolated from their **external** environment and from information **external** to the organization (Fischer, 1980).

Proposition 1. Information that is **external** to the aerospace organization tends to be used less than **internal** sources of information. The more geographically removed the information is from the organization, the less likely it is to be used.

Studies of the innovation process indicate that the use of internal and external information sources is influenced by certain "sociometric" variables such as accessibility, ease of use, and technical quality. Allen's (1977) findings reveal an interesting relationship between the frequency of information (channel) use and information (channel) performance, which leads some to conclude the existence of a relationship between the "cost" and "efficiency" of an information source. Gerstberger and Allen (1968), in their study of engineers' choices of information channels, note:

> Engineers, in selecting among information channels, act in a manner which is intended not to maximize gain, but, rather, to minimize loss. The loss to be minimized is the cost in terms of effort, either physical or psychological, which must be expended in order to gain access to an information channel.

Their behavior appears to follow a "law of least effort" (Zipf, 1949). According to this law, individuals, when choosing among several paths to a goal, will base their decision upon the single criterion of "least average rate of probable work."

According to Gerstberger and Allen (1968), engineers appear to be governed or influenced by a principle closely related to this law. They attempt to minimize effort in terms of work required to gain access to an information channel or source. Perceived accessibility appears to be the primary determinant in an engineer's selection of an information source. This may help explain the preference for information **internal** to the organization and support the claim that the value of information is subjective and user driven. Further, if "effort" is perceived to be a "cost" associated with information and its value and use, then it is possible that psychological "cost," the fear of revealing one's "lack of knowledge," may also influence information channel selection and usage.

Consequently, improved quality or perceived performance of an information channel or source will not, in and of itself, lead to increased use. Engineers will simply not be attracted to an information channel or source by improving the performance and/or quantity of the information contained therein—quite the contrary. Investments designed to improve quality or performance will, for the most part, be wasted unless the information channel or source is made more accessible.

Proposition 2. Of the various sociometric variables assumed to influence the use of an information channel or source, **perceived accessibility** exerts the greatest influence. The greater the perceived accessibility, the greater the likelihood of an **information channel or source** being used.

NASA/DOD AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT

In terms of empirically derived data, very little is known about the diffusion of innovation in the aerospace industry both in terms of the channels used to communicate the ideas and the information-gathering habits and practices of the members of the social system (i.e., aerospace engineers and scientists). Most of the channel studies, such as the work by Gilmore, et al., (1967) and Archer (1962), have been concerned with the transfer of aerospace technology to non-aerospace industries.

Most of the studies involving aerospace engineers and scientists, such as the work by McCullough, et al., (1982) and Monge, et al., (1979), have been limited to the use of NASA STI products and services and have not been concerned with their information-gathering habits and practices. Although researchers such as Davis (1975) and Spretnak (1982) have investigated the importance of technical communications to engineers, it is not possible to determine from the published results if the study participants included aeronautical engineers and scientists. It is likely that an understanding of the process by which innovation in the aerospace industry is communicated through certain channels over time among the members of the social system would contribute to increasing productivity, stimulating innovation, and improving and maintaining the professional competence of U.S. aerospace engineers and scientists.

The NASA/DOD Aerospace Knowledge Diffusion Research Project, begun in 1988, is directed at achieving an understanding of the aerospace knowledge diffusion process with particular emphasis on the diffusion of knowledge resulting from federally funded aerospace R&D. The initial thrust of the project (fig. 2) is largely exploratory and focuses on the information channels; the information-seeking habits and practices of the members of the aerospace social system; and the relationships between knowledge producers, intermediaries, and users.

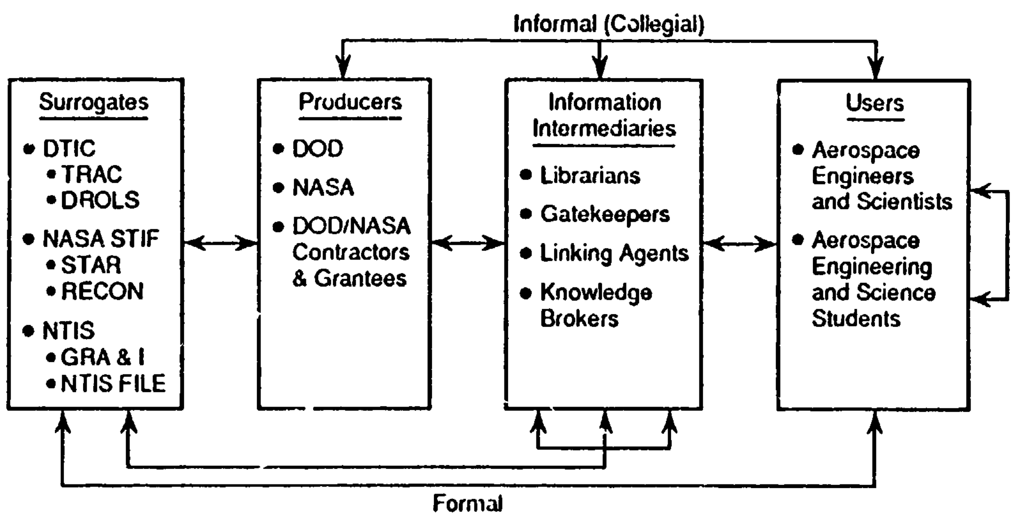

Figure 2. A Model Depicting the Transfer of Federally Funded Aerospace R&D.

Phase 1 of the project is concerned with the information-seeking habits and practices of U.S. aerospace engineers and scientists with particular emphasis being placed on their use of federally funded aerospace STI products and services. The approximately 30 000 professional members of the American Institute of Aeronautics and Astronautics (AIAA) served as the study population. Approximately 65 percent of the study population are affiliated with industry, approximately 20 percent are affiliated with government, and approximately 15 percent are affiliated with academia.

Approximately 20 percent of the membership was chosen for inclusion in the project. Three groups containing approximately 50 percent, 25 percent, and 25 percent of the sample were created. Each group received a separate questionnaire; the response rate for each of the three groups was approximately 65 percent.

Data from Phase 1 of the NASA/DOD Aerospace Knowledge Diffusion Project are presented in this paper. These reported data are specifically concerned with the use of AGARD, DOD, and NASA technical reports. For purposes of this presentation, the data reported herein are discussed in terms of management and nonmanagement responses. Managers were self-identified by their responses to a question about their present professional duties. Except for those who identified their primary duty as teaching or were retired, the remainder of the respondents were classified as nonmanagers. The data in Tables 1 and 2 were collected by the first questionnaire and the data in the remaining tables were collected by the second questionnaire.

Use of Internal and External Information Sources

To test **Proposition 1**, data were collected regarding the use and importance of in-house technical reports, conference/meeting papers, journal articles, DOD technical reports, NASA technical reports, AGARD technical reports, and technical translations (Table 1) and sources of information used in problem solving (Tables 2 & 3). In-house technical reports had the highest use rate (72%) of the seven information sources. In-house technical reports enjoyed their highest use rate among respondents having industrial affiliation and U.S. government technical reports enjoyed their highest use rate among respondents having government affiliation. In-house technical reports were more important to respondents having industrial affiliation and U.S. government technical reports were more important to respondents having government affiliation in terms of performing their present professional duties.

Table 1. Use of an Information Product by U. S. Aerospace Engineers and Scientists (Three or more times in past six months)

[n = 798]

Report type/Sources	Percent of cases
1. In-house technical reports	72
2. Conference/Meeting papers	56
3. Journal articles	56
4. DOD technical reports	55
5. NASA technical reports	55
6. AGARD technical reports	8
7. Technical translation	5

Tables 2 and 3 present the proportions of managers and nonmanagers who used various information sources in completing a recent technical project, task, or problem. The managers and nonmanagers in this study display a preference for personalized, informal information sources. Both groups identified an informal search for information using personal information sources and contacts as their primary method of solving technical problems. Only after they have used their personal information sources and personal contacts and have consulted formal information sources, do they turn to librarians and technical information specialists for assistance.

Table 2. Information Sources Used by Managers to Solve Technical Problems.

[n - 697 for managers]

Sources	Percent of cases
1. Used personal information sources	80
2. Discussed with colleague(s)	74
3. Spoke with in-house key person	64
4. Spoke with outside key person	**60**
5. Consulted library sources	57
6. Searched a database	50
7. Discussed with a supervisor	45
8. Checked with outside librarian	24
9. Checked with in-house librarian	23

Note: Responses are based on the proportion who used each source at any step in the project, task, or problem during the past six months.

Table 3. Information Sources Used by Nonmanagers to Solve Technical Problems.

[n = 942 for nonmanagers]

Sources	Percent of cases
1. Used personal information sources	87
2. Discussed with colleague(s)	79
3. Consulted library sources	70
4. Spoke with in-house key person	59
5. Discussed with supervisor	56
4. Spoke with outside key person	**50**
7. Searched a database	49
8. Checked with in-house librarian	40
9. Checked with outside librarian	25

Note: Responses are based on the proportion who used each source at any step in the project, task, or problem during the past six months.

Of particular significance is the use by the two groups of key persons outside of the organization. Managers turn to experts outside of the organization more frequently than do nonmanagers. Otherwise, there are few differences between managers and nonmanagers. Nonmanagers tend to use library resources more often. It is interesting to note, however, that the proportion of managers who use each information source is smaller than the proportion of nonmanagers who use each source, except for speaking with key persons inside and outside their organization.

Use and Importance of AGARD, DOD, and NASA Technical Reports

To this group of engineers and scientists, AGARD, DOD, and NASA technical reports constitute external information sources. The respondents were asked to indicate the number of times they had used these reports in the past six months. There is some indication in Table 4 that managers use these technical reports less often than nonmanagers use them. Neither group, however, could be classified as extensive users which indicates that U.S. aerospace engineers and scientists do not rely extensively on external STI. About 60 percent of the respondents used fewer than three technical reports in the six months prior to the survey. The data further reveal that engineers and scientists who are members of the AIAA infrequently use AGARD technical reports; however, nonmanagers are more likely than managers to use them.

Table 4. Use of AGARD, DOD, and NASA Technical Reports in Past Six Months.

[n = 326 for managers; n = 433 for nonmanagers]

Report type	Percent of managers		Percent of nonmanagers	
	1 or more used	Not used	1 or more used	Not used
AGARD	12	88	25	75
DOD	56	44	47	53
NASA	51	49	64	36

Note: The percentages are based on the number who gave usable responses to each question.

Respondents were asked to rate the importance of AGARD, DOD, and NASA technical reports in terms of performing their present professional duties. Respondents were asked to rate the importance of these reports on a scale from 1 to 5 where 1 is very important and 5 is not at all important. The data in Table 5 demonstrate the relative importance of these reports.

Table 5. Importance of AGARD, DOD, and NASA Technical Reports.

Report type	Percent of managers		Percent of nonmanagers	
	Important	Not important	Important	Not important
AGARD	9	57	18	44
DOD	43	23	41	24
NASA	42	21	52	15

Note: The percentages are based on the number who gave usable responses to each question. It might be assumed that non-respondents did not use the report. A 1 to 5 point scale was used to measure importance. The totals for "1" and "2" were combined to determine **important** and "5" for **not important**; hence, totals do not equal 100 percent.

Only a small proportion of the respondents rated AGARD technical reports as important to their work. Fewer than 10 percent of the managers and 20 percent of the nonmanagers assigned a "1" or "2" to the importance of AGARD technical reports. In contrast, over 43 percent and 41 percent of the managers and nonmanagers, respectively, assigned a "1" or "2" to the importance of DOD technical reports. The importance of NASA technical reports was about equal to that of DOD technical reports. Forty two percent and 52 percent of the managers and nonmanagers, respectively, assigned a "1" or "2" to the importance of NASA technical reports.

Table 6 contains some of the reasons that were listed in the questionnaire for not using AGARD, DOD, and NASA technical reports. The reason offered by the highest proportion of the AIAA members was that the reports were not relevant to their work. A smaller proportion indicated that the reports were not available. AGARD technical reports were most often mentioned by managers (30 percent) and nonmanagers (26 percent) as not being available. Few respondents indicated that the unreliability of AGARD, DOD, and NASA technical reports was the reason for non-use.

Table 6. Selected Reasons for Not Using AGARD, DOD, and NASA Technical Reports.

[n = 276, 128, 141 for managers; n = 310, 210, 142 for nonmanagers]

Report type/Reasons	Percent of managers	Percent of nonmanagers
AGARD		
Not relevant	37	44
Not available	30	26
Not reliable	2	2
DOD		
Not relevant	38	46
Not available	21	26
Not reliable	2	1
NASA		
Not relevant	47	48
Not available	15	18
Not reliable	2	1

Note: The percentages are based on the number who circled "yes" to the question. The question was asked only of those who did NOT use that report type in the past six months.

Awareness and Access to AGARD, DOD, and NASA Technical Reports

Table 7 contains some of the ways respondents learn about the availability of AGARD, DOD, and NASA technical reports. Both managers and nonmanagers find out about these reports primarily from citations in other publications, followed closely by referral by colleagues. Most respondents reported that librarians seldom or never refer them to AGARD, DOD, and NASA technical reports. Citations and colleagues as the most frequent sources of finding out about AGARD, DOD, and NASA technical reports would seem to indicate that both managers and nonmanagers take an active role in the search for information. This finding reinforces the data in Tables 2 and 3 which support the proposition that members of AIAA prefer personalized, informal approaches to information. No pattern of differences in awareness and access appears between managers and nonmanagers.

Table 7. How Users Found Out About AGARD, DOD, and NASA Technical Reports.

[n = 48, 50, 46; 189, 191, 182; 174, 177, 170 for managers;
n = 115, 114, 114; 215, 211, 208; 281, 280, 273 for nonmanagers]

Report type/Sources	Percent of managers		Percent of nonmanagers	
	Used	Not used	Used	Not used
AGARD				
Cited in publication	98	2	92	8
Referred by a colleague	88	12	87	13
Referred by a librarian	59	41	60	40
DOD				
Cited in publication	95	5	94	6
Referred by a colleague	92	8	90	10
Referred by a librarian	71	29	68	32
NASA				
Cited in publication	95	5	95	5
Referred by a colleague	92	8	91	9
Referred by a librarian	64	36	61	39

Note: The percentages are based on the number who responded to the question. The questions were asked ONLY of those who used that report type in the past six months.

The data in Table 8 illustrate how access requires that the user take active steps to obtain AGARD, DOD, and NASA technical reports. Many of the respondents indicated that they obtain AGARD, DOD, and NASA technical reports most often by requesting them from a library, followed very closely by colleagues providing them with the reports. To a lesser degree, respondents indicated that they accessed these reports through library referral. As in Table 7, managers and nonmanagers appear to use similar means to obtain access to AGARD, DOD, and NASA technical reports.

Table 8. How Users Acquired AGARD, DOD, and NASA Technical Reports.

[n = 49, 50, 46; 189, 191, 181; 173, 173, 168 for managers;
n = 116, 114, 111; 214, 212, 206; 285, 282, 271 for nonmanagers]

Report type/Sources	Percent of managers		Percent of nonmanagers	
	Use	Non-use	Use	Non-use
AGARD				
Requested from library	88	12	93	7
Obtained from a colleague	84	16	80	20
Routed by a librarian	41	59	36	64
DOD				
Requested from library	92	8	93	7
Obtained from a colleague	88	12	85	15
Routed by a librarian	46	54	39	59
NASA				
Requested from library	89	11	89	11
Obtained from a colleague	88	12	88	12
Routed by a librarian	42	58	36	64

Note: The percentages are based on the number who responded to the question. The questions were asked ONLY of those who used that report type in the past six months.

Quality of AGARD, DOD, and NASA Technical Reports

Certain of the reasons why AGARD, DOD, and NASA technical reports are not used by members of the sample are contained in Table 6. The data in Table 9 indicate how users of these reports rate them on selected characteristics. A substantial portion of managers and nonmanagers rate the quality of the information contained in AGARD, DOD, and NASA technical reports as **good** or **excellent**. There appears to be some concern, on the part of managers and nonmanagers regarding timeliness and advancing the "state of the art," for a large proportion of the sample rate the reports as "not so good" on these characteristics. Further, there are differences between managers and nonmanagers regarding the timeliness and advancing the "state of the art" of AGARD. About 45 and 61 percent of the managers and nonmanagers, respectively, indicated that the timeliness of AGARD technical reports was "excellent" or "good." Approximately 37 and 60 percent of the managers and nonmanagers, respectively, indicated that advancing the "state of the art" of AGARD technical reports was "excellent" or "good."

Table 9. Rating of AGARD, DOD, and NASA Technical Reports on Selected Characteristics.

[n = 50, 49, 49; 195, 195, 193; 182, 181, 177 for managers;
n = 119, 119, 118; 219, 218, 217; 288, 286, 283 for nonmanagers]

Report type/Characteristics	Percent of managers		Percent of nonmanagers	
	Excellent or Good	Fair or Poor	Excellent or Good	Fair or Poor
AGARD				
Quality of information	82	18	88	12
Timeliness	45	55	61	39
Advancing the "state-of-the-art"	37	63	60	40
DOD				
Quality of information	81	19	77	23
Timeliness	48	52	60	40
Advancing the "state-of-the-art"	50	50	55	45
NASA				
Quality of information	93	7	92	8
Timeliness	59	31	70	30
Advancing the "state-of-the-art"	62	38	67	33

Note: The percentages are based on the number who responded to the question. The questions were asked ONLY of those who used that report type in the past six months.

Factors Influencing Use of AGARD, DOD, and NASA Technical Reports

Data contained in Table 10 indicate the influence of certain sociometric variables on the use of AGARD, DOD, and NASA technical reports. Judging from the data, it appears that no one factor predominates. Relevance and accessibility appear to exert considerable influence regarding the use of these reports. To a lesser degree, reliability appears to influence decisions regarding use of AGARD, DOD, and NASA technical reports.

Table 10. Factors Affecting Use of AGARD, DOD, and NASA Technical Reports.

[n = 49, 49, 50; 191, 192, 192; 181, 181, 181 for managers;
n = 115, 115, 116; 217, 216, 216; 286, 288, 288 for nonmanagers]

Report type/ Characteristics	Percent of managers		Percent of managers	
	Greatly influenced	Little influence	Greatly influenced	Little influence
AGARD				
Accessibility	53	18	57	22
Relevance	56	10	70	7
Reliability	47	18	69	9
DOD				
Accessibility	70	10	73	0
Relevance	69	7	73	6
Reliability	50	14	58	9
NASA				
Accessibility	78	6	79	8
Relevance	71	4	82	5
Reliability	71	7	73	7

Note: The percentages are based on the number who responded to the question. The questions were asked ONLY of those who used that report type in the past six months. A 1 to 5 point scale was used to measure influence. The totals of "1" and "2" were combined to determine **greatly influenced** and "4" and "5" for **no influence**; hence, totals do not equal 100 percent.

CONCLUDING REMARKS

Many technical communicators and other information professionals believe that managers and nonmanagers have different technical communications and information use practices. This assumption of differences is based on the presumption that the duties of managers and nonmanagers are fundamentally different. Consequently, these two groups should develop different strategies that would, in turn, manifest themselves as distinctive technical communications and information practices.

Overall, there appear to be few differences between managers and nonmanagers in their evaluations of AGARD, DOD, and NASA technical reports. While nonmanagers use these technical reports more often than do nonmanagers, they do not offer different reasons for using them. It is, however, beyond the scope of this presentation to speculate further about the technical communications practices (similarities and differences) of aerospace managers and nonmanagers. We must stress that the data reported in this analysis are preliminary. Based on this preliminary analysis we do, however, find evidence to support **Proposition 1**. That is, information that is external to the organization tends to be used less than internal sources of information. Further, the more geographically removed the information is from the organization, the less likely it is to be used.

We did not however, find evidence to support **Proposition 2**. That is, of the various sociometric variables assumed to influence the use of an information channel or source, **perceived accessibility** exerts the greatest influence. Based on the preliminary analysis, it appears that reliability and relevance influence the use of an information source or channel insofar as AGARD, DOD, and NASA technical reports are concerned.

If this is true, then the implications of this finding are very important to R&D managers and to those who provide information services. Improved quality or perceived performance of an information channel will not, in and of itself, lead to increased use of that service. Conversely, increased accessibility will not, in and of itself, lead to increased use of that service. Engineers will simply not be attracted to an information system by improving the quality and/or quantity of the information contained therein--quite the contrary. Investments in an information system will, for the most part, be wasted unless the system contains quality information and becomes more accessible to the user.

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