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U.S. Academic Librarians and Technical Information Specialists as Information Intermediaries: Results of the Phase 3 Survey

Thomas E. Pinelli
NASA Langley Research Center
Hampton, Virginia

Rebecca O. Barclay
Rensselaer Polytechnic Institute
Troy, New York

John M. Kennedy
Indiana University
Bloomington, Indiana

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U.S. AEROSPACE ACADEMIC LIBRARIANS AND TECHNICAL INFORMATION SPECIALISTS AS INFORMATION INTERMEDIARIES: RESULTS OF THE PHASE 3 SURVEY

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ABSTRACT

The U.S. government technical report is a primary means by which the results of federally funded research and development (R&D) are transferred to the U.S. aerospace industry. However, little is known about this information product in terms of its actual use, importance, and value in the transfer of federally funded R&D. Little is also known about the intermediary-based system that is used to transfer the results of federally funded R&D to the U.S. aerospace industry. To help establish a body of knowledge, the U.S. government technical report is being investigated as part of the *NASA/DoD Aerospace Knowledge Diffusion Research Project*. In this report, we summarize the literature on technical reports, present a model that depicts the transfer of federally funded aerospace R&D via the U.S. government technical report, and present the results of research that investigated aerospace knowledge diffusion vis-à-vis U.S. aerospace academic librarians and technical information specialists as information intermediaries.

INTRODUCTION

NASA and the DoD maintain scientific and technical information (STI) systems for acquiring, processing, announcing, publishing, and transferring the results of government-performed and government-sponsored research. Within both the NASA and DoD STI systems, the U.S. government technical report is considered a primary mechanism for transferring the results of this research to the U.S. aerospace community. However, McClure (1988) concludes that we actually know little about the role, importance, and impact of the technical report in the transfer of federally funded R&D because little empirical information about this product is available. The NASA and DoD STI systems are intermediary-based systems that rely on librarians and technical information specialists to complete the knowledge transfer process. To date, empirical findings on the effectiveness of information intermediaries and the role(s) they play in knowledge transfer are sparse and inconclusive (Beyer and Trice, 1982).

We are examining the system(s) used to diffuse the results of federally funded aerospace R&D as part of the *NASA/DoD Aerospace Knowledge Diffusion Research Project*. This project investigates, among other things, the information-seeking behavior of U.S. aerospace engineers and scientists and the role of academia- and industry-affiliated information intermediaries in the aerospace knowledge diffusion process (Pinelli, Kennedy, and Barclay, 1991; Pinelli, Kennedy, Barclay, and White, 1991). The results of this investigation could (1) advance the development of practical theory, (2) contribute to the design and development of aerospace information systems, and (3) have practical implications for transferring the results of federally funded aerospace R&D to the U.S. aerospace community. The project fact sheet is Appendix A.

In this report, we summarize the literature on technical reports, provide a model that depicts the transfer of federally funded aerospace R&D through the U.S. government technical report, and present the results of a survey of U.S. academic libraries, librarians, and technical information specialists. We summarize the findings of the survey and close with some thoughts regarding the role of U.S. academic librarians and technical information in the aerospace knowledge diffusion process.

THE U.S. GOVERNMENT TECHNICAL REPORT

Although they have the potential for increasing technological innovation, productivity, and economic competitiveness, U.S. government technical reports may not be utilized because of limitations in the existing transfer mechanism. According to Ballard, et al. (1986), the current system "virtually guarantees that much of the Federal investment in creating STI will not be paid back in terms of tangible products and innovations." They further state that "a more active and coordinated role in STI transfer is needed at the Federal level if the results of this investment are to be better utilized."

Characteristics of Technical Reports

The definition of the technical report varies because the report serves different roles in communication within and between organizations. The technical report has been defined etymologically, according to report content and method (U.S. Department of Defense, 1964); behaviorally, according to the influence on the reader (Ronco, et al., 1964); and rhetorically, according to the function of the report within a system for communicating STI (Mathes and Stevenson, 1976). The boundaries of technical report literature are difficult to establish because of wide variations in the content, purpose, and audience being addressed. The nature of the report -- whether it is informative, analytical, or assertive -- contributes to the difficulty.

Fry (1953) points out that technical reports are heterogenous, appearing in many shapes, sizes, layouts, and bindings. According to Smith (1981), "Their formats vary; they might be brief (two pages) or lengthy (500 pages). They appear as microfiche, computer printouts or vugraphs, and often they are loose leaf (with periodic changes that need to be inserted) or have a paper cover, and often contain foldouts. They slump on the shelf, their staples or prong fasteners snag other documents on the shelf, and they are not neat."

Technical reports may exhibit some or all of the following characteristics (Gibb and Phillips, 1979; Subramanyam, 1981):

- Publication is not through the publishing trade.
- Readership/audience is usually limited.
- Distribution may be limited or restricted.

• Content may include statistical data, catalogs, directions, design criteria, conference papers and proceedings, literature reviews, or bibliographies.

• Publication may involve a variety of printing and binding methods.

The SATCOM report (National Academy of Sciences - National Academy of Engineering, 1969) lists the following characteristics of the technical report:

• It is written for an individual or organization that has the right to require such reports.

• It is basically a stewardship report to some agency that has funded the research being reported.

• It permits prompt dissemination of data results on a typically flexible distribution basis.

• It can convey the total research story, including exhaustive exposition, detailed tables, ample illustrations, and full discussion of unsuccessful approaches.

History and Growth of the U.S. Government Technical Report

The development of the [U.S. government] technical report as a major means of communicating the results of R&D, according to Godfrey and Redman (1973), dates back to 1941 and the establishment of the U.S. Office of Scientific Research and Development (OSRD). Further, the growth of the U.S. government technical report coincides with the expanding role of the Federal government in science and technology during the post World War II era. However, U.S. government technical reports have existed for several decades. The Bureau of Mines *Reports of Investigation* (Redman, 1965/66), the *Professional Papers of the United States Geological Survey*, and the *Technological Papers of the National Bureau of Standards* (Auger, 1975) are early examples of U.S. government technical reports. Perhaps the first U.S. government publications officially created to document the results of federally funded (U.S.) R&D were the technical reports first published by the National Advisory Committee for Aeronautics (NACA) in 1917.

Auger (1975) states that "the history of technical report literature in the U.S. coincides almost entirely with the development of aeronautics, the aviation industry, and the creation of the NACA, which issued its first report in 1917." In her study, *Information Transfer in Engineering*, Shuchman (1981) reports that 75 percent of the engineers she surveyed used technical reports; that technical reports were important to engineers doing applied work; and that aerospace engineers, more than any other group of engineers, referred to technical reports. However, in many of these studies, including Shuchman's, it is often unclear whether U.S. government technical reports, non-U.S. government technical reports, or both are included.

The U.S. government technical report is a primary means by which the results of federally funded R&D are made available to the scientific community and are added to the literature of science and technology (President's Special Assistant for Science and Technology, 1962). McClure (1988) points out that "although the [U.S.] government technical report has been variously reviewed, compared, and contrasted, there is no real knowledge base regarding the role, production, use, and importance [of this information product] in terms of accomplishing this task." Our analysis of the literature supports the following conclusions reached by McClure:

- The body of available knowledge is simply inadequate and noncomparable to determine the role that the U.S. government technical report plays in transferring the results of federally funded R&D.

- Further, most of the available knowledge is largely anecdotal, limited in scope and dated, and unfocused in the sense that it lacks a conceptual framework.

- The available knowledge does not lend itself to developing "normalized" answers to questions regarding U.S. government technical reports.

THE TRANSFER OF FEDERALLY FUNDED AEROSPACE R&D AND THE U.S. GOVERNMENT TECHNICAL REPORT

Three paradigms -- appropriability, dissemination, and diffusion -- have dominated the transfer of federally funded (U.S.) R&D (Ballard, et al., 1989; Williams and Gibson, 1990). Whereas variations of them have been tried within different agencies, overall Federal (U.S.) STI transfer activities continue to be driven by a *"supply-side," dissemination model.*

The Appropriability Model

The **appropriability model** emphasizes the production of knowledge by the Federal government that would not otherwise be produced by the private sector and competitive market pressures to promote the use of that knowledge. This model emphasizes the production of basic research as the driving force behind technological development and economic growth and assumes that the Federal provision of R&D will be rapidly assimilated by the private sector. Deliberate transfer mechanisms and intervention by information intermediaries are viewed as unnecessary. Appropriability stresses the supply (production) of knowledge in sufficient quantity to attract potential users. Good technologies, according to this model, sell themselves and offer clear policy recommendations regarding Federal priorities for improving technological development and economic growth. This model incorrectly assumes that the results of federally funded R&D will be acquired and used by the private sector, ignores the fact that most basic research is irrelevant to technological innovation, and dismisses the process of technological innovation within the firm.

The Dissemination Model

The **dissemination model** emphasizes the need to transfer information to potential users and embraces the belief that the production of quality knowledge is not sufficient to ensure its fullest use. Linkage mechanisms, such as information intermediaries, are needed to identify useful knowledge and to transfer it to potential users. This model assumes that if these mechanisms are available to link potential users with knowledge producers, then better opportunities exist for users to determine what knowledge is available, acquire it, and apply it to their needs. The strength of this model rests on the recognition that STI transfer and use are critical elements of the process of technological innovation. Its weakness lies in the fact that it is passive, for it does not take users into consideration except when they enter the system and request assistance. The **dissemination model** employs one-way, source-to-user transfer procedures that are seldom responsive in the user context. User requirements are seldom known or considered in the design of information products and services.

The Knowledge Diffusion Model

The **knowledge diffusion model** is grounded in theory and practice associated with the diffusion of innovation and planned change research and the clinical models of social research and mental health. Knowledge diffusion emphasizes "active" intervention as opposed to dissemination and access; stresses intervention and reliance on interpersonal communications as a means of identifying and removing interpersonal barriers between users and producers; and assumes that knowledge production, transfer, and use are equally important components of the R&D process. This approach also emphasizes the link between producers, transfer agents, and users and seeks to develop user-oriented mechanisms (e.g., products ana services) specifically tailored to the needs and circumstances of the user. It makes the assumption that the results of federally funded R&D will be under utilized unless they are relevant to users and ongoing relationships are developed among users and producers. The problem with the knowledge diffusion model is that (1) it requires a large Federal role and presence and (2) it runs contrary to the dominant assumptions of established Federal R&D policy. Although U.S. technology policy relies on a "dissemination-oriented" approach to STI transfer, other industrialized nations, such as Germany and Japan, are adopting "diffusion-oriented" policies which increase the power to absorb and employ new technologies productively (Branscomb, 1991; Branscomb, 1992).

The Transfer of (U.S.) Federally-Funded Aerospace R&D

A model depicting the transfer of federally funded aerospace R&D through the U.S. government technical report appears in figure 1. The model is composed of two parts -- the **informal** that relies on collegial contacts and the **formal** that relies on surrogates, information producers, and information intermediaries to complete the "producer to user" transfer process.

When U.S. government (i.e., NASA) technical reports are published, the initial or primary distribution is made to libraries and technical information centers. Copies are sent to surrogates for secondary and subsequent distribution. A limited number of copies are set aside to be used by the author for the "scientist-to-scientist" exchange of information at the collegial level.

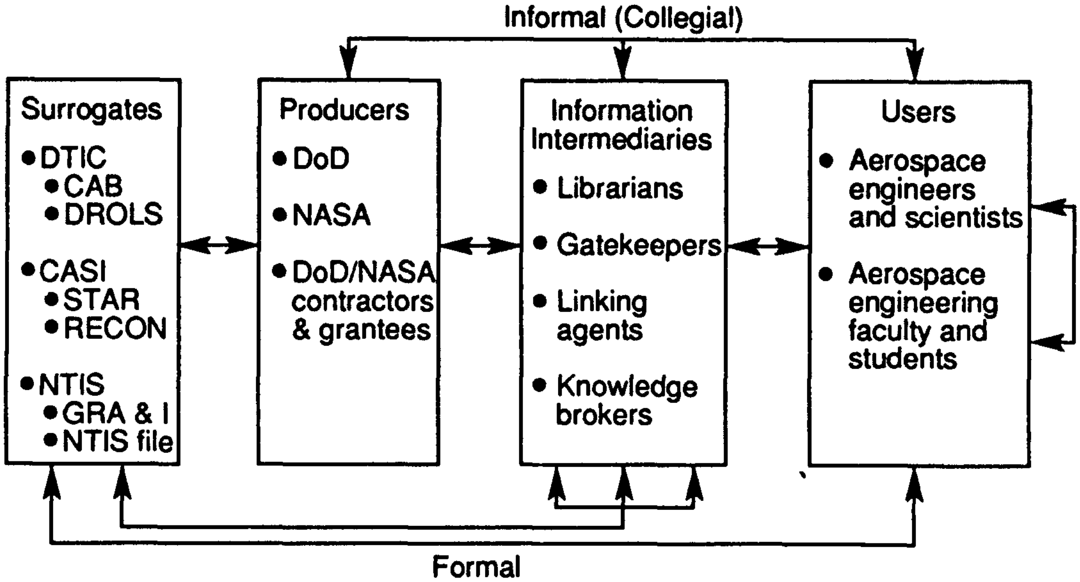

Figure 1. The U.S. Government Technical Report in
a Model Depicting the Dissemination of Federally Funded Aerospace R&D.

Surrogates serve as technical report repositories or clearinghouses for the producers and include the Defense Technical Information Center (DTIC), the NASA Center for Aero Space Information (CASI), and the National Technical Information Service (NTIS). These surrogates have created a variety of technical report announcement journals such as *CAB* (Current Awareness Bibliographies), *STAR* (Scientific and Technical Aerospace Reports), and *GRA&I* (Government Reports Announcement and Index) and computerized retrieval systems such as *DROLS* (Defense RDT&E Online System), *RECON* (REsearch CONnection), and NTIS *On-line* that permit online access to technical report data bases. Information intermediaries are, in large part, librarians and technical information specialists in academia, government, and industry. Those representing the producers serve as what McGowan and Loveless (1981) describe as "knowledge brokers" or "linking agents." Information intermediaries connected with users act, according to Allen (1977), as "technological entrepreneurs" or "gatekeepers." The more "active" the intermediary, the more effective the transfer process becomes (Goldhor and Lund, 1983). Active intermediaries move information from the producer to the user, often utilizing interpersonal (i.e., face-to-face) communication in the process. Passive information intermediaries, on the other hand, "simply array information for the taking, relying on the initiative of the user to request or search out the information that may be needed" (Eveland, 1987).

The overall problem with the total Federal STI system is that "the present system for transferring the results of federally funded STI is passive, fragmented, and unfocused;" effective knowledge transfer is hindered by the fact that the Federal government "has no coherent or systematically designed approach to transferring the results of federally funded R&D to the user" (Ballard, et al., 1986). In their study of issues and options in Federal STI, Bikson and her colleagues (1984) found that many of the interviewees believed "dissemination activities were afterthoughts, undertaken without serious commitment by Federal agencies whose primary concerns were with [knowledge] production and not with knowledge transfer;" therefore, "much of what has been learned about [STI] and knowledge transfer has not been incorporated into federally supported information transfer activities."

Problematic to the **informal** part of the system is that knowledge users can learn from collegial contacts only what those contacts happen to know. Ample evidence supports the claim that no one researcher can know about or keep up with all the research in his/her area(s) of interest. Like other members of the scientific community, aerospace engineers and scientists are faced with the problem of too much information to know about, to keep up with, and to screen. Further, information is becoming more interdisciplinary in nature and more international in scope.

Two problems exist with the **formal** part of the system. First, the **formal** part of the system employs one-way, source-to-user transmission. The problem with this kind of transmission is that such formal one-way, "supply side" transfer procedures do not seem to be responsive to the user context (Bikson, et al., 1984). Rather, these efforts appear to start with an information system into which the users' requirements are retrofit (Adam, 1975). The consensus of the findings from the empirical research is that interactive, two-way communications are required for effective information transfer (Bikson, et al., 1984).

Second, the **formal** part relies heavily on information intermediaries to complete the knowledge transfer process. However, a strong methodological base for measuring or assessing the effectiveness of the information intermediary is lacking (Beyer and Trice, 1982). In addition, empirical data on the effectiveness of information intermediaries and the role(s) they play in knowledge transfer are sparse and inconclusive. The impact of information intermediaries is likely to be strongly conditional and limited to a specific institutional context.

According to Roberts and Frohman (1978), most Federal approaches to knowledge utilization have been ineffective in stimulating the diffusion of technological innovation. They claim that the numerous Federal STI programs are "highest in frequency and expense yet lowest in impact" and that Federal "information dissemination activities have led to little documented knowledge utilization." Roberts and Frohman also note that "governmental programs start to encourage utilization of knowledge only after the R&D results have been generated" rather than during the idea development phase of the innovation process. David (1986), Mowery (1983), and Mowery and Rosenberg (1979) conclude that successful [Federal] technological innovation rests more with the transfer and utilization of knowledge than with its production.

THE INFORMATION INTERMEDIARY AND AEROSPACE KNOWLEDGE DIFFUSION

The formal part of the aerospace knowledge transfer mechanism relies on producer surrogates, information products, and information intermediaries to complete the producer-to-user transfer process. Although information intermediaries play a significant role in the diffusion of this knowledge, their contributions to the knowledge diffusion infrastructure are poorly understood. Furthermore, a strong methodological base for measuring or assessing the effectiveness of the information intermediary is lacking. Finally, empirical findings on the role played by libraries in completing the knowledge transfer process are sparse and inconclusive (Kitchen, March 1989).

The related literature produced some noteworthy findings. In her review, Auster (1985) viewed the librarian as an intermediary in the information transfer process. In her approach, the information transfer process consists of a resource, a user, and a mode of access that links the two together. In their review, Drenth, Morris, and Tseng (1991) looked at expert systems as information intermediaries. The review of environmental scanning by Choo and Auster (1993) provides useful background regarding organizational information use and intermediaries. Similarly, the review of information gatekeepers by Metoyer-Duran (1993) provides useful information regarding the role(s) of human gatekeepers in the information transfer process. King and his colleagues (1984), using a value added approach, investigated the contributions that information intermediaries and libraries make to the value of DoE information.

RESULTS OF THE PHASE 3 SURVEY

U.S. academic libraries in four-year Accreditation Board for Engineering Education (ABET) accredited colleges and universities served as the population for the Phase 3 survey. The sample consisted of the 75 libraries in those colleges and universities participating in the 1990 NASA/USRA (University Space Research Association) capstone design programs. Of the 75 libraries, three were dropped from consideration because personnel working in these libraries were directly involved in preparing the questionnaire. Two additional libraries were deleted because aerospace resources (e.g., books, journals, and technical reports) were not included in the library's collection. The remaining 70 libraries were surveyed; 68 libraries submitted completed questionnaires. The adjusted response rate was 97 percent. The survey was conducted between April and May 1990.

A group of academic librarians worked with the project team to compile the list of survey questions. The questions were pretested before distribution. The questionnaire, which is Appendix B, was organized around the following topical objectives: librarian and library demographics, NASA technical reports, bibliographic tools and electronic data bases, information technology, NASA information products and services, the end-user-intermediary interface, library outreach, and the producer-intermediary interface. Data are presented for each of the topical objectives.

Demographics

The following **librarian composite participant profile** was based on Phase 3 survey demographic data which appear in table 1: is female (63.6%), has about 16 years of library/information experience, has about 9 years of professional experience in her present position, holds an

Table 1. U.S. Academic Librarian Survey Demographics
[N = 68]

Demographics	Percentage	Number
Gender		
Female	63.6	42
Male	36.4	24
Years of library/information experience		
1 to 10	30.3	20
11 to 20	43.9	29
21 to 30	21.2	14
31 to 40+	4.5	3
Mean = 15.9 years Median = 16.0 years		
Years in present position		
1 to 10	67.7	44
11 to 20	27.7	18
21 to 30	4.6	3
31 to 40+	---	----
Mean = 8.5 years Median = 6.0 years		
Education Level		
BA/BS	79.4	54
MLS	88.2	60
Other Master's Degree	33.8	23
Ph.D.	2.9	2
Other	4.4	3
Professional (National) Library/Information Membership		
No	7.4	5
Yes	92.6	63
ALA	60.3	41
ASEE	26.5	18
ASIS	4.4	3
SLA	41.2	28
Other	11.8	8
Percentage of Time Devoted to Aerospace Information Activities		
1 to 25	91.9	57
26 to 50	6.5	4
51 to 75	----	----
76 to 100	1.6	1
U.S. Citizen		
Yes	98.5	64
No	1.5	1

MLS (88.0%), belongs to a professional national library/information society (92.6%), devotes between 1 and 25 percent of her time to aerospace information activities (91.9%), and is a U.S. citizen (98.5%).

The following **library composite profile** was based on Phase 3 survey demographic data appearing in table 2: is either a university (main) library (47.1%) or an engineering or engineering/science library (17.6%)(19.1%) and is a Superintendent of Documents (SoD) depository library (79.1%).

Table 2. U.S. Academic Library Demographics

Demographics	Percentage	Number
Type of Library		
Departmental Library	1.5	1
Aeronautical/Astronautical Library	4.4	3
Engineering Library	17.6	12
Engineering/Science Library	19.1	13
Branch Library	5.9	4
University (Main) Library	47.1	32
Other	4.4	3
Superintendent of Documents (SoD) Depository Library		
Yes	79.1	53
No	20.9	14

Technical Reports

Survey participants were asked about their libraries' collection of domestic and foreign technical reports (tables 3 and 4). About 71% of the libraries had a NASA technical report collection; 36.2% had DoD technical reports; 62.5% had AGARD technical reports; and 29.1% had AIAA papers (table 3). About 28% of the participants' libraries also had collections of U.S. aerospace company reports. About 53% of the participants' libraries also had U.S. university technical reports and about 36% also had FAA technical reports. For the most part, the domestic technical reports were held as microfiche as opposed to paper products.

Survey participants were asked if the aeronautical engineering department in their university held a collection of NASA technical reports. Less than 10% responded in the affirmative; about 21% stated that they did not know and 70% answered no.

Few of the U.S. academic libraries had foreign technical report collections (table 4). About 21% the libraries held British and about 16% held ESA technical reports. About 11 percent of the U.S. academic libraries had collections of German and Japanese technical reports.

Table 3. Technical Reports in U.S. Academic Libraries -- Domestic Holdings

Library Holdings	Paper	Fiche
	% (n)	% (n)
AGARD Technical Reports	62.5 (35)	43.9 (25)
AIAA Papers	29.1 (16)	32.1 (18)
DoD Technical Reports	36.2 (21)	44.1 (26)
FAA Technical Reports	35.8 (19)	50.0 (27)
NASA Technical Reports	71.4 (45)	91.0 (61)
U.S. Aerospace Company Technical Reports	28.1 (16)	-----
U.S. University Technical Reports	52.6 (30)	-----
Aeronautical Department Holdings -- NASA Technical Reports	%	(n)
Yes	9.0	6
No	70.1	47
Don't Know	20.9	14

Table 4. Technical Reports in U.S. Academic Libraries -- Foreign Holdings

Holdings	Percentage	Number
British ARC/RAE Technical Reports	21.2	14
ESA Technical Reports	15.6	10
French ONERA Technical Reports	7.8	5
German DFVLR, DLR, and MBB Technical Reports	10.9	7
Japanese NAL Technical Reports	10.9	7
Swedish NAL Technical Reports	8.1	5
Other	7.4	5

NASA Technical Reports. Of the U.S. academic libraries that held a collection of NASA technical reports, 63.2% indicated they receive (acquire) these technical reports directly from NASA and 57.4% indicated they obtained NASA technical reports from GPO (table 5).

About 16% indicated they received NASA technical reports from NTIS; about 4.4% indicated that they do not routinely receive NASA technical reports.

<u>NASA Technical Report Use</u>. Use of NASA technical reports was measured on a 1 to 5 point scale with "1" being heavily used and "5" being no use (table 6). About 38% indicated that NASA technical reports were heavily used.

Table 5. How U.S. Academic Libraries
Acquire NASA Technical Reports

Source	Percentage	Number
Directly From NASA	63.2	43
From NTIS	16.2	11
From GPO	57.4	39
Other	5.9	4
Do Not Routinely Receive NASA Technical Reports	4.4	3

Table 6. Use of NASA Technical Reports
in U.S. Academic Libraries

Item	Percentage*	Do Not Know	Percent (Number) With No NASA Technical Report Collection
NASA Technical Reports	38.2	-----	4.4 (3)

*The percentage report combined "1" and "2" responses on a 5 point scale with "1" being heavily used.

<u>Access</u>. Survey participants were asked a series of questions regarding access to NASA technical reports (table 7). Most academic libraries provide a variety of access mechanisms including printed directories such as NASA *STAR* (100%), the card catalog (59.2%), and an Online Public Access Catalog (OPAC) (49.0%). Bibliographic access was provided by corporate source (94.1%), subject (94.1%), author (90.6%), report number (88.3%), and report title (86.0%). Physical access to NASA technical reports was open (84.6%). About 90% of the NASA technical reports were physically arranged by report number and series; about 45% were individually cataloged. About 62% of NASA technical reports were housed with the government documents collection.

How Obtained. Survey participants were asked to identify the number of times a specific sources was used during the past 6 months to obtain NASA technical reports not held in the collection (table 8). NTIS was most often ($\bar{X}$ = 14.2) by U.S. academic libraries to obtain NASA technical reports followed by other university libraries ($\bar{X}$ = 6.9), NASA field center libraries ($\bar{X}$ = 3.5), U.S. aerospace industry libraries ($\bar{X}$ = 3.4), and DTIC ($\bar{X}$ = 3.2). NASA STIF (now the Center for Aero Space Information -- CASI) and NASA authors are seldom used to obtain copies of NASA reports. The median numbers indicate that some of these sources were not used to obtain copies of NASA technical reports during the 6-month period.

Table 7. How U.S. Academic Libraries Provide Access to NASA Technical Reports

Access	Percentage	Number
Mechanism		
Card Catalog	59.2	29
Printed Directories (e.g. NASA *STAR*)	100.0	65
OPAC (Online Public Access Catalog)	49.0	24
COMCAT (Computer Output Microfiche Catalog)	4.9	2
Other	33.8	22
Bibliographic Access		
Author	90.6	48
Title	86.0	43
Report Number	88.3	53
Subject	94.1	48
Corporate Source	94.1	48
Contract/Grant number	80.4	41
Key Words	85.7	42
Other	13.8	9
Physical Access		
Open	84.6	55
Closed	18.5	12
Other	4.6	3
Physical Arrangement		
Individually Cataloged	44.9	22
Arranged By Report Numbers and Report Series	89.7	52
Housed With Engineering Materials	30.6	15
Housed With Government Documents Collection	61.5	32
Kept In Storage	25.0	11
Other	16.9	11

Reasons NASA Reports Could Not Be Obtained. Survey participants were asked if a NASA technical report had been requested by a patron but could not be obtained from the library for a specific reason. Survey participants were asked to identify the reason(s) (table 9). The "library did not own the report" was the most frequently selected reason ($\bar{X}$ = 27.8) followed by the "report was in a *STAR* category not automatically distributed by NASA" ($\bar{X}$ = 16.1).

Table 8. Sources Used By U.S. Academic Libraries To Obtain NASA Technical Reports

Source	Mean (Median) Number of Times Source Used in Past 6 Months	Number	Don't Know
NTIS	14.2 (6.0)	46	14
NASA STIF	2.7 (0.0)	30	17
DTIC	3.2 (0.0)	31	17
NASA Field Center Library	3.5 (0.0)	28	22
NASA Author	0.1 (0.0)	24	22
Another University Library	6.9 (3.0)	36	18
DDS or Broker	2.0 (0.0)	26	19
Aerospace Industry Library	3.4 (0.0)	29	18
Other	---- ----	8	----

Reasons Libraries Would Discontinue Receipt of NASA Reports. Survey participants were asked why they would consider discontinuing automatically receiving NASA technical reports (table 10). Three reasons predominate: (1) subscription cost (52.4%), "problems with distribution and receipt of NASA technical reports" (23.3%), and "not all NASA technical reports were useful" (13.3%).

Factors Influencing Use. Survey participants were asked three questions about the use of NASA technical reports. In two questions, they were asked to give their opinions about the extent to which 10 factors influenced the use of NASA technical reports by (1) **engineering faculty** and (2) **engineering students.** Influence was measured on a 1 to 5 point scale with "1" being the lowest possible influence and "5" being the highest possible influence of the factor. The third question asked survey participants (i.e., **information intermediaries**) to rate NASA technical reports on the same 10 factors. In questions one and two, the influence of accessibility, for example, was measured as "1" not influenced and "5" greatly influenced. In the third question, accessibility was measured as "1" not at all accessible and "5" very accessible. Their responses appear in table 11.

In the case of **engineering faculty**, survey participants think that their decision to use NASA technical reports is influenced by (1) relevance, (2) technical quality or reliability, (3) familiarity, or experience, (4) accessibility, (5) comprehensiveness, and (6) timeliness. In the case of **engineering students**, survey participants think that their decision to use NASA technical reports is influenced by (1) accessibility, (2) relevance, (3) technical quality or reliability, (4) familiarity or experience, (5) physical proximity, and (6) comprehensiveness.

As **information intermediaries**, survey participants rated NASA technical reports highest for (1) accessibility ($\bar{X}$ = 4.2) (i.e., the ease of getting to the information source), followed by, (2) relevance ($\bar{X}$ = 4.2) (i.e., the expectation that a high percentage of the information retrieved would be used), (3) familiarity or experience ($\bar{X}$ = 3.9) (i.e., prior knowledge or previous use),

(4) physical proximity (i.e., distance to the information source) ($\bar{X}$ = 3.8), (5) technical quality or reliability ($\bar{X}$ = 3.8) (i.e., the information was expected to be the best in terms of quality, accuracy, and reliability), and (6) timeliness ($\bar{X}$ = 3.7) (i.e., the time allocated or available to produce a solution).

Table 9. Reasons NASA Reports Could Not Be Obtained By U.S. Academic Librarians

Reasons	Mean (Median) Number of Times Reason Occurred in Past 6 Months	Number	Do Not Know
Library Did Not Own Report	**27.8 (15.0)**	42	21
Library Owned Report But It Was Missing or Could Not Be Found	5.0 (2.0)	34	25
Report Was In A *STAR* Category Not Received By Library	6.4 (0.0)	17	34
Report Was Distributed In Fiche Only And Library Receives Paper Copy In That *STAR* Category	0.1 (0.0)	21	27
Report Was Distributed In Paper Only And Library Receives Fiche Copy In That *STAR* Category	1.1 (0.0)	15	34
Report Was Listed In *STAR* But Was Not Automatically Distributed By NASA	**16.1 (5.0)**	31	27
Report Was In a *STAR* Category You Automatically Receive But You Never Received It	6.8 (0.0)	17	34
Report Was Referenced As a NASA Publication But Was Not In The NASA System	3.1 (2.0)	28	29
Report Was Classified, Restricted, Or Limited Distribution Document	1.5 (0.0)	27	28
Report Was Available Only From NASA Center Of Origin	1.0 (0.0)	20	34
Report Was Available Only From Author Or Technical Monitor	0.4 (0.0)	17	35
Insufficient Bibliographic Information; Did Not Know Where Or How To Obtain Report	3.4 (2.0)	28	28
Other	--- ----	2	---

Table 10. Reasons U.S. Academic Libraries Would Consider Discontinuing Receipt of NASA Technical Reports

Reason	Percentage	Number
Automatic Distribution (Subscription) Too Costly	**52.4**	33
NASA Technical Reports Duplicate Other Sources of Needed Information	8.5	5
Information Contained in NASA Technical Reports Is Not Timely	3.3	2
Not All Reports Received Were Useful	**13.3**	8
Problems With Distribution and Receipt Of NASA Technical Reports	**23.3**	1[illegible]
NASA Contract/Grant Completed; No Longer Needed NASA Reports	3.4	2
Other	4.6	3

Table 11. Factors Influencing Use of NASA Technical Reports: Librarians' Perceptions of Influence and Librarians' Ratings

Factors	Overall Mean[a] (Number) Influence of Factors on Use By --		
	U.S. Engineering Faculty	U.S.Engineering Students	U.S. Academic Librarians and Technical Information Specialists
Accessibility	**3.9 (63)**	**4.0 (65)**	**4.2 (64)**
Ease of Use	3.0 (59)	3.1 (59)	3.4 (61)
Expense	2.3 (62)	2.5 (60)	3.0 (62)
Familiarity or Experience	**4.0 (62)**	**3.5 (63)**	**3.9 (62)**
Technical Quality or Reliability	**4.0 (53)**	**3.6 (54)**	**3.8 (55)**
Comprehensiveness	**3.7 (53)**	**3.5 (59)**	**3.7 (56)**
Relevance	**4.2 (56)**	**3.9 (60)**	**4.2 (57)**
Physical Proximity	3.4 (60)	**3.5 (63)**	**3.8 (61)**
Skill in Use	3.1 (57)	3.4 (61)	3.6 (57)
Timeliness	**3.6 (55)**	**3.5 (56)**	**3.7 (57)**

[a] A 1 to 5 point scale was used to measure influence, with "1" being the lowest possible influence and "5" being the highest possible influence; hence, the higher the average (mean), the greater the influence of the factor.

Bibliographic (Print) Tools

Survey participants were asked a series of questions about their use (one or more times) in the past 6 months of selected bibliographic tools in their libraries. They were asked about the use and importance of selected print sources that were grouped in three categories -- (1) science-general, (2) engineering-general, and (3) aerospace. Their responses appear in (table 12).

Use. **Engineering-general** print sources were used most, followed by **aerospace** and **science-general.** Within engineering-general, *Engineering Index* and *Applied Science and Technology Index* were used about equally (86.6% and 86.2%). Within aerospace, NASA *STAR* was used most (87.7%), followed by NTIS *GRA&I* (83.3%) and AIAA *IAA* (72.3%). NASA *SCAN* was used by 10.4% of the survey participants. About 61% of the participants used *Science Citation Index.*

Importance. Importance was measured on a 5 point scale with "1" being the lowest possible importance and "5" being the highest possible importance. *Engineering Index* ($\bar{X}$ = 4.7) was rated highest followed by *Applied Science and Technology Index* ($\bar{X}$ = 4.3), NASA *STAR* ($\bar{X}$ = 4.2), AIAA *IAA* ($\bar{X}$ = 4.1), and NTIS *GRA&I* ($\bar{X}$ = 4.0). The print products having the highest use rate, *Engineering Index* and *Applied Science and Technology Index,* also had the highest importance rating.

Electronic Data Bases

Survey participants were asked a series of questions about their use (one or more times) in the past 6 months of selected electronic data bases in their libraries. They were asked about the use and importance of selected electronic data bases that were grouped in four categories -- (1) general, (2) science-general, and (3) engineering-general, and (4) aerospace. Their responses appear in table 13.

Use. Overall, electronic data bases were used less frequently than the bibliographic (print) tools perhaps because fewer libraries have them. Engineering-general data bases were used most followed by aerospace, science-general, and general data bases. Within engineering-general, *COMPENDEX* and *INSPEC* were used equally (75%). Within aerospace, NTIS *Online* was used by most (71.9%) followed by AIAA *Aerospace Data Base* (53.3%), NASA *RECON* (22.7%), and DTIC *DROLS* (7.5%). *SCISEARCH* and *Wilson Line Index* were used by 60% and 20.3% of the survey participants, respectively.

Importance. Importance was measured on a 1 to 5 point scale with "1" being the lowest possible importance and "5" being the highest possible importance. Within **engineering-general,** *COMPENDEX* and *INSPEC* were rated most important ($\bar{X}$ =4.7) ($\bar{X}$ = 4.6). Within **science,** *SCISEARCH* had an average (mean) importance rating of ($\bar{X}$ = 3.7). Within **aerospace,** NTIS *Online* was rated most important ($\bar{X}$ = 4.2) followed by the AIAA *Aerospace Data Base* ($\bar{X}$ = 3.9), NASA *RECON* ($\bar{X}$ = 3.7), and DTIC *DROLS* ($\bar{X}$= 2.0). *Wilson Line Index* was given a average (mean) importance rating of ($\bar{X}$ = 3.0).

Cost Approach. Survey participants were asked which **COST** approach was used for providing searching of (online) electronic data bases (table 14). About 12% of the respondents indicated that the "user **pays nothing** for service; library absorbs **all** costs." About 71% indicated that the user pays either a **reduced** cost (33.8%) or **all** costs (36.8%) associated with searching electronic (online) data bases.

Search Approach. Survey participants were asked which approach was used in performing searches of electronic (online) data bases (table 15). About 54% of the intermediary respondents indicated they did **all** searches and about 22% indicated that they did **most** of the searches. About 8% of the respondents indicated that the user did **all** or **most** of the searches of electronic (online) data bases.

Table 12. Use and Importance of Selected Announcement, Current Awareness, and Bibliographic Tools By U.S. Academic Librarians -- Print Sources

Sources	Percent (Number) Using One or More Times In Past 6 Months	Average[a] (Mean) Importance Rating	Percent (Number) Do Not Have
Science - General			
Science Citation Index	60.7 (37)	3.8	25.8 (17)
Engineering - General			
Applied Science and Technology Index	86.2 (56)	4.3	7.4 (5)
Engineering Index	86.6 (58)	4.7	10.3 (7)
Aerospace			
Government Reports Announcement and Index (GRA&I)	83.3 (55)	4.0	14.7 (10)
International Aerospace Abstracts (IAA)	72.3 (47)	4.1	19.1 (13)
NASA SCAN	10.4 (7)	2.6	58.7 (37)
NASA SP-7037 (Aerospace Engineering: A Continuing Bibliography)	31.8 (21)	2.5	28.8 (19)
NASA STAR	87.7 (57)	4.2	9.0 (6)

[a] A 1 to 5 point scale was used to measure importance, with "1" being the lowest possible importance and "5" being the highest possible importance; hence, the higher the average (mean), the greater the importance of the product.

Table 13. Use and Importance of Selected Announcement, Current Awareness, and Bibliographic Tools By U.S. Academic Librarians -- Electronic Data Bases

Sources	Percent (Number) Using One or More Times In Past 6 Months	Average[a] (Mean) Importance Rating	Percent (Number) Do Not Have
General			
Wilson Line Index	20.3 (13)	3.0	46.4 (26)
Engineering - General			
COMPENDEX	75.0 (48)	4.7	6.6 (4)
INSPEC	75.0 (48)	4.6	6.6 (4)
Science			
SCISEARCH	60.0 (39)	3.7	8.6 (5)
Aerospace			13.8 (8)
Aerospace Data Base	52.3 (34)	3.9	
DTIC DROLS	7.5 (5)	2.0	67.2 (39)
NASA RECON	22.7 (15)	3.7	49.1 (27)
NTIS Online	71.9 (46)	4.2	9.7 (6)

[a] A 1 to 5 point scale was used to measure importance, with "1" being the lowest possible importance and "5" being the highest possible importance; hence, the higher the average (mean), the greater the importance of the product.

Table 14. Approaches Used By U.S. Academic Librarians To Pay For Searching of (Online) Electronic Data Bases

Approach	Percentage	Number
Not Offered	2.9	2
User Pays **Nothing** For Service; Library Absorbs **All** Costs	11.8	8
User Pays **Reduced** Cost; Library Absorbs **Some** of the Costs	33.8	23
User Pays **All** Costs	36.8	25
Other	14.7	10

Computer and Information Technology

Survey participants were asked to indicate their use of seven computer and information technologies (table 16). Survey respondents made the greatest use of electronic data bases

(73.1%) followed by laser and video disk/CD-ROM products (68.2%) and E-Mail (50%). Desktop publishing (15.4%) and electronic bulletin boards (18.5%), respectively, were used least frequently by survey respondents.

Table 15. Approaches Used By U.S. Academic Librarians For Searching (Online) Electronic Data Bases

Approach	Percentage	Number
Not Offered	4.5	3
Users Do **All** Searches	----	----
Users Do **Most** Searches	7.5	5
Users Do **Half** of the Searches By Themselves and **Half** Through an Intermediary	4.5	3
Users Do **Most** Searches Through an Intermediary	22.4	15
Users Do **All** Searches Through an Intermediary	53.7	36
Other	7.5	5

Table 16. Use of Computer and Information Technology by U.S. Academic Librarians

Technology	Percentage*	Number
Electronic Data Bases	73.1	49
Laser and Video Disks/CD-ROM Products	68.2	45
Desktop Publishing	15.4	10
Electronic Bulletin Boards	18.5	12
E-Mail	50.0	33
Electronic Networks	33.4	22
Fax/Telex	33.4	22

*The percentages report combined "1" and "2" responses on a 5 point scale with "1" being the most frequent use.

NASA Information Products and Services

Survey participants were asked to evaluate selected NASA information products and services. They were asked to indicate the extent to which they agree with statements designed to assess each product or service according to specific characteristics. Agreement was measured on a 1 to 5 point scale with "5" being the highest possible agreement and "1" being the lowest possible agreement. The responses appear in table 17.

Overall assessments were highest for *STAR*, followed by *IAA*, *SCAN*, and *RECON*. Survey participants agreed that the coverage in NASA *STAR* is adequate (91.5%) and the abstracts in NASA *STAR* are adequate (88.1%). Survey participants agreed that the coverage of *IAA* is adequate (92%) and that the abstracts in *IAA* are adequate (85.7%). For *SCAN*, survey participants agreed that the announcements in *SCAN* are current enough (92.9%), that *SCAN* is timely (78.6%), and that the print quality adequate (56.3%). Survey participants agreed that the coverage of *RECON* is adequate (90.5%) and that the data base is current (83.3%). Seventy-five percent of the respondents indicated that *RECON* searches are sufficient when compared to searches of other data bases. On the other hand, 52.6% of the survey participants indicated that NASA *RECON* is easy to use.

Table 17. Perceptions of U.S. Academic Librarians
Concerning Selected NASA Information Products

NASA Information Products	Percentage*	Number
About *STAR*:		
Coverage Is Adequate	91.5	54
Category Scheme Is Adequate	75.0	42
Announcements Are Current	75.5	40
Abstracts Are Adequate	88.1	52
About *IAA*:		
Coverage Is Adequate	92.0	46
Category Scheme Is Adequate	74.5	35
Announcements Are Current	76.1	35
Abstracts Are Adequate	85.7	42
About *SCAN*:		
Announcements In *SCAN* Are Current Enough	92.9	13
SCAN Is Easy To Use	73.3	11
SCAN Is Timely	78.6	11
Print Quality Is Adequate	56.3	9
About *RECON*:		
Coverage Is Adequate	90.5	19
RECON Is Easy To Use	52.6	10
RECON Data Base Is Current	83.3	15
Searches On *RECON* Meet User's Research Requirements	75.0	15

*The percentages report combined "1" and "2" responses on a 5-point scale with "1" being the strongest possible agreement.

Survey participants were asked to indicate how likely they would be to use selected aerospace information in electronic format (table 18). Likely use was measured on a 1 to 5 point scale with "5" being the "most likely" to use and "1" being the "least likely" to use. A majority (i.e., 51%) of academia-affiliated information intermediaries indicated a willingness to use all of the selected aerospace information in electronic format except for images (photographs) on CD-ROM and computer program listings on CD-ROM. The highest "willingness to use" was recorded for *STAR* on CD-ROM (83.3%), followed by full text of NASA technical reports on CD-ROM (57.6%), numerical/factual data on CD-ROM (57.1%), and an online system (full text and graphics) for NASA technical reports (56.9%). Except for *STAR* on CD-ROM, the overall "willingness to use" selected aerospace information on CD-ROM products was less than compelling.

Table 18. Likely Use of Selected Aerospace Information in Electronic Format by U.S. Academic Librarians

Item	Percentage*	Number
STAR on CD-ROM	83.3	50
Full Text of NASA Reports on CD-ROM	57.6	34
Computer Program Listings on CD-ROM	37.7	20
Numerical/Factual Data on CD-ROM	57.1	32
Images (Photographs) on CD-ROM	34.6	18
RECON Front-End	52.6	20
Online System (Full Text and Graphics) for NASA Technical Reports	56.9	33

* The percentages report combined "1" and "2" responses on a 5-point scale with "1" being the "most likely" to use.

The End User-Intermediary Interface

Information intermediaries (i.e., librarians and technical information specialists) representing the end-user have been described as gatekeepers. The more active, the more effective the intermediary is in completing the STI producer-to-user process. Survey participants were asked a number of questions to learn more about their role as gatekeepers and to determine some measure of their effectiveness in completing the STI production, transfer, and use process.

<u>Outreach</u>. Survey participants were asked to identify the kinds of outreach programs offered by their libraries. The number of outreach activities offered could be used to gauge the "pro-activity" of academic information intermediaries. The responses appear in table 19.

<u>Faculty</u>. The responses indicate that fewer outreach programs are offered to engineering faculty than to engineering students. About 30% of the respondents indicated that they offered a tour of the library to engineering faculty in the past 6 months. About 22% offered a tour of

the engineering library. About 18% offered either a library presentation as part of an engineering course or offered engineering information resources and materials instruction. About 5% offered library skills instruction for faculty.

Students. About 69% of the respondents indicated that they offered a tour of the library and made a library presentation as part of an engineering course. About 61% of the respondents indicated that they offered engineering information resources and materials instruction. About 49% offered a tour of the engineering library and about 35% offered library skills instruction.

Table 19. Outreach Programs Provided By U.S. Academic Libraries

Programs	Faculty: Percentage (Number) Providing One or More Times In Past 6 Months	Students: Percentage (Number) Providing One or More Times In Past 6 Months	Do Not Provide
Tour Of Library	30.2 (19)	68.9 (42)	16
Library Presentation As Part Of Engineering Course	18.2 (12)	68.8 (44)	17
Library Skills Instruction	4.5 (3)	35.4 (23)	33
Tour of Engineering Library	22.4 (15)	49.2 (32)	29
Engineering Information Resources And Materials Instruction	18.2 (12)	60.9 (39)	21

User Needs. Exploring the end-user-intermediary interface, survey participants were asked how they learned of user needs. Survey participants were asked to select from a list of activities those that they used as part of their library program. Their responses appear in table 20.

All of the participants (100%) indicated that they learned about the needs of the users from the requests that the users submitted and from one-on-one interviews (presumably when the user comes to the library) to determine user needs. Those activities that would most likely be initiated by the information intermediary were used least. For example, surveys (31.0%) and in-house publications such as library bulletins (43.3%), were used by less than half of the survey participants.

Table 20. How U.S. Academic Libraries
Learn About User Needs

Item	Percentage	Number
Requests Received	100.0	67
Curriculum Guides	54.0	34
In-house Publications	43.3	26
Survey Questionnaires	31.0	18
One-on-One Interviews	100.0	66
Library Staff Meetings	83.1	49
Other Meetings	79.7	47
Other	57.1	8

Services Provided. Academic intermediaries were asked to identify the services that their libraries provide to aerospace engineering faculty and students (table 21). Most of the academic libraries offered what might be thought of as the traditional services such as document order and delivery (86.2%/81.0%), assistance in locating sources (100%), identifying documents (97.1%), and acquiring information (98.5%). On the other hand, very few of the aerospace industry libraries offered or participated in what might be thought of as the non-traditional services.

Sources of Competition. Survey participants were asked to identify those factors they considered to be sources of competition, those factors that might serve to lessen the influence or the ability of the library to service the user population (table 22). Survey participants identified personal collections (85.9%), the "old boy" network (77.0%), and department or project libraries (not a part of their library) (64.5%) as competition. Direct user access to outside information was not widely viewed as competition. Likewise, user access to computer and information technology was not widely viewed as competition.

Self-Assessment. Academic librarians were asked to perform a self-assessment according to four major criteria: funding, staffing, services to users, and interaction with users (table 23). A 1 to 5 point scale was used with "1" being excellent and "5" being poor.

Funding. With the exception of funding for searching online (54.6%), survey participants recorded relatively low marks for funding. Of the six funding factors, funding for salaries scored lowest (19.7%).

Staffing. About 23% of the survey participants indicated that the size of their staff was excellent. About 42% indicated that the science backgrounds of their was excellent and about 19% indicated that the aerospace experience of the staff was excellent.

Service to Users. About 80% of the respondents thought they did an excellent job of supplying requested information. About 21% indicated that they did an excellent job of alerting

Table 21. Services Provided By U.S. Academic Libraries

Services	Faculty		Students	
	Percentage	Number	Percentage	Number
Alerting Service	50.0	31	18.6	11
Bibliographic Instruction	82.0	50	100.0	66
Document Order and Delivery	86.2	56	81.0	51
Electronic Reference Services	78.5	51	76.9	50
Handouts and Library Guides	95.4	62	97.0	64
In-house SDI and Routing Services	39.7	25	11.3	7
Mediated Online Data Base Searching	96.9	63	96.9	63
NASA *SCAN*	23.8	15	16.1	10
Other	40.0	4	22.2	2
Time Saving Assistance In				
Locating Sources	100.0	66	97.0	64
Identifying Documents	98.5	65	97.0	64
Acquiring Information	98.5	65	97.0	64
Expert Help In Learning/Using Information	84.1	53	85.9	55
Data Base Development	16.7	10	13.1	8
Downloading	72.7	48	70.1	47
Remote Online Access To Library Catalog	83.6	56	82.4	56
CD-ROM Workstation(s) In Library	78.8	52	79.1	53
Cooperative Cost Sharing Services				
Group Contract For Online Services	25.8	16	26.6	17
Coordinated Access To Networks	23.8	15	22.6	14
Other	----	----	----	----
Acquisition Of Data Bases For Searching Online Through Campus Computer Facilities				
AIAA *Aerospace Data Base*	15.0	9	14.8	9
NTIS *Online*	25.4	16	25.0	16
NTIS *Federal Research In Progress*	11.9	7	11.5	7
(FEDRIP)	13.1	8	12.9	8
DoE Energy Data Base	20.0	7	19.4	7
Other				
Acquisition Or Development Of User-Friendly				
Front-End Systems For Searching Data Bases	62.9	39	61.5	40
Library Online Catalog Searching				
Gateway Searching of Multiple	19.7	12	18.8	12
Data Bases	13.0	3	11.5	3
Other				

Table 22. Factors Considered By U.S. Academic Librarians to be Competition in Providing Services to Users

Factors	Faculty		Students	
	Percentage	Number	Percentage	Number
The "Old Boy" Network	77.0	47	32.2	19
Personal Collections	85.9	55	24.2	15
Other Units Within The Organization				
Research Assistants Attached To Projects				
Department or Project	44.1	26	25.0	15
"Libraries" Not A Part Of				
Your Library	64.5	40	42.6	26
Other	----	----	----	----
Direct User Access To Outside				
Information Sources				
Information Brokers	19.7	12	3.4	2
Publishers	32.3	20	6.6	4
Online Vendors	27.0	17	9.8	6
NASA/STIF	19.7	12	6.6	4
NTIS	19.7	12	9.8	6
Other	13.8	4	7.7	2
Direct Use of National Computer				
Communications Networks				
APRANET	23.3	14	6.7	4
INTERNET/NSFNET	37.3	22	13.6	8
Other	13.3	4	----	----
Direct Use of Regional Computer				
Communications Networks	35.5	22	14.3	9
Direct Use Of Campus Network (LAN)				
Online Access To Your Library Catalog	45.2	28	40.3	25
Online Access To Other Campus Libraries				
Other	23.0	14	18.0	11
Transmission Of Text	5.0	1	5.0	1
Office Facsimile Transmission				
Electronic Mail	38.3	23	13.3	8
Manuscript Preparation And Delivery	34.4	21	16.9	10
(Electronic Publishing)				
Data Base Creation By Users	24.6	14	12.3	7
Information Collection,				
Storage, And Use				
Downloading Data To Personal Files	33.9	21	16.1	10
Electronic Transmission Of Data	39.7	25	22.2	14
	33.9	21	19.4	12

users and 44% thought that the turnaround (the time it takes to fill a request for information) was excellent.

Interaction with Users. Fifty-seven percent of the survey participants indicated that they do an excellent job providing user orientation and instruction. About 27% indicated that they do an excellent job surveying (determining) user needs. About 18% indicated that they do an excellent job of attending user (e.g., faculty/departmental) meetings.

Table 23. Self-Assessment of U.S. Academic Libraries

Factors	Percentage*	Number	No Opinion
Funding			
Staff Salaries	19.7	13	1
Materials/Equipment	24.2	16	----
Searching Online	54.6	36	----
CD-ROM	36.9	24	3
Innovation	40.0	26	1
Other	----	----	5
Staffing			
Staff Size	22.8	15	----
Aerospace Experience	18.5	12	1
Science Background	41.5	27	----
Services To Users			
Information Supplied On Request	80.3	53	----
Alerting	21.2	14	3
Turnaround Time	43.9	29	1
State-Of-The-Art	42.4	28	4
Other	----	----	6
Interaction With Users			
User Needs Surveyed	27.3	18	3
User Meetings Attended	17.5	11	5
Orientation/Instruction	57.0	37	----

* The percentages report combined "1" and "2" responses on a 5 point scale with "1" being excellent and "5" being poor.

Library and Engineering Information Instruction. Survey participants were asked if they offered instruction in (1) the use of library resources and services and (2) the use of engineering information resources and materials. If the instruction was offered, survey participants were asked to describe the instruction in terms of credit/non-credit, required/elective, and part of an engineering/separate course. Their responses appear in table 24.

Library Instruction. Ninety-seven percent of the libraries offered instruction in the use of library resources and services. Fifty percent of the respondents indicated that the instruction was non-credit, about 59% indicated that the instruction was an elective course; about 70% indicated the instruction was offered as part of an engineering course and about 60% indicated that the instruction was offered as part of another course.

Engineering Information Resources Instruction. Eight-four percent of the libraries offered engineering information resources and materials instruction. Sixty-three percent of the respondents indicated that the instruction was non-credit, about 72% indicated that the instruction was offered as an elective course; 84% indicated that the instruction was offered as part of an engineering course and about 53% indicated that the instruction was offered as part of another course.

Table 24. Instruction Provided by Academic Librarians
In Library and Engineering Information Use

Factors	Use Of Library Resources And Services		Use Of Engineering Information Resources And Materials	
	Percentage*	Number	Percentage*	Number
Instruction Offered	97.1	66	84.1	53
Instruction Was --				
A Credit Course	35.1	20	25.5	12
A Non-Credit Course	50.0	29	63.0	29
A Required Course	32.8	19	21.7	10
An Elective Course	59.3	35	71.7	32
Part Of An Engineering Course	69.5	41	84.0	42
Part of Another Course	59.6	34	53.3	24
A Separate Course	36.5	19	20.9	9

* Percentages do not total 100 because librarians could select more than one response.

Proactivity. As information intermediaries, survey participants were asked two questions. They were asked to rate their knowledge of the technical information needs of the engineering faculty and students in their respective universities (table 25a) and to rate how active they are in transferring NASA-produced knowledge to the engineering faculty and students in their respective universities (table 25b).

About 43%/50% stated that they had an extensive knowledge of the technical information needs of the aerospace engineering faculty and students in their respective universities. On the other hand, about 37%/36% indicated that they are "very active" in transferring NASA-produced knowledge to the aerospace engineering faculty and students in their respective universities.

Table 25a. Knowledge of Engineering Faculty and Students Technical Information Needs by U.S. Academic Librarians -- Self Assessment

	Faculty			Students		
Item	Percentage*	Number	Don't Know	Percentage*	Number	Don't Know
Knowledge of Engineering Faculty and Students Technical Information Needs	43.1	28	1	50.0	33	0

* The percentage report combined "1" and "2" responses on a 5 point scale with "1" being extensive and "5" being none.

Table 25b. U.S. Academic Librarians as "Active" Transfer Agents of NASA-Produced Knowledge to Engineering Faculty and Students -- Self Assessment

	Faculty			Students		
Item	Percentage*	Number	Don't Know	Percentage*	Number	Don't Know
Role in Transferring NASA-Produced Knowledge to Engineering Faculty and Students	37.5	24	2	35.9	23	2

* The percentage report combined "1" and "2" responses on a 5-point scale with "1" being very active and "5" being very passive.

Survey participants were asked to identify actions taken to "actively transfer" NASA-produced knowledge to engineering faculty and students in their respective universities (table 26). About 34%/28% stated that they screened NASA-produced knowledge and about 10%/12% indicated they interpreted NASA-produced knowledge for the engineering faculty and students in their respective universities.

Table 26. Actions Taken by U.S. Academic Librarians To "Actively" Transfer NASA-Produced Knowledge to Engineering Faculty and Students -- Self-Assessment

Item	Faculty		Students	
	Percentage	Number	Percentage	Number
Actions Taken To Actively Transfer NASA-Produced Knowledge				
Screening Information	34.4	22	27.7	18
Interpreting Data	9.5	6	12.3	8
Other	----	----	----	----

The Producer-Intermediary Interface

Survey participants were asked a series of questions designed to illuminate the interface between U.S. academic librarians and technical information specialists as information intermediaries and NASA as a producer of aerospace knowledge. From their perspective as information intermediaries, survey participants were asked to rate NASA's knowledge of the technical information needs of their respective engineering faculty and students (table 27a). About 33%/24% of the survey respondents think that NASA has an excellent understanding the of technical information needs of their respective engineering faculty and students.

Table 27a. NASA's Knowledge of Engineering Faculty and Students Technical Information Needs -- Librarians' Perceptions

Item	Faculty			Students		
	Percentage*	Number	Don't Know	Percentage*	Number	Don't Know
Knowledge of Faculty and Students Technical Information Needs	32.5	13	25	23.7	9	27

* The percentage report combined "1" and "2" responses on a 5-point scale with "1" being very active and "5" being very passive.

Survey participants were asked to rate the amount of effort devoted by NASA to understanding the technical information needs of "your user community." Their responses appear in table 27b. About 27%/23% of the respondents indicated that NASA devotes extensive effort to understanding the technical information needs of their respective user communities.

Table 27b. Effort Devoted by NASA To Understanding the Technical Information Needs of Engineering Faculty and Students -- Librarians' Perceptions

Item	Faculty			Students		
	Percentage*	Number	Don't Know	Percentage*	Number	Don't Know
Effort Devoted to Understanding Faculty and Students Technical Information Needs	27.3	12	21	22.7	10	21

* The percentage report combined "1" and "2" responses on a 5 point scale with "1" being very active and "5" being very passive.

As information intermediaries, each respondent was asked to rate the amount of effort devoted by NASA to involving U.S. academic information intermediaries in transferring the results of NASA research to their respective user communities (table 27c.) Thirteen percent of the respondents indicated that NASA devoted extensive effort to involving U.S. academic librarians and technical information specialists in transferring the results of NASA research to their respective user communities.

Table 27c. Effort Devoted by NASA to Involving U.S. Academic Librarians In Transferring Results of NASA Research to Engineering Faculty and Students -- Librarians' Perceptions

Item	Faculty			Students		
	Percentage*	Number	Don't Know	Percentage*	Number	Don't Know
Effort Devoted to Involving Academic Librarians in Transferring Results of NASA Research	13.0	6	20	12.8	6	19

* The percentage report combined "1" and "2" responses on a 5-point scale with "1" being extensive and "5" being none.

To further explore the producer-intermediary interface, survey participants were asked, in the performance of their professional duties, how many times in the past year they had contacted or had been contacted by NASA personnel about transferring the results of NASA-produced research (table 28). The responses indicate very little contact between U.S. academic librarians and technical information specialists and NASA.

Table 28. Communication Between U.S. Academic Librarians and NASA

Item	Mean (Median) Number of Contacts In Past Year
YOU Contacted NASA	1.5 (0.0)
NASA Contacted YOU	0.4 (0.0)

FINDINGS

Readers should note that the data contained in this report reflect responses from 68 U.S. academic libraries. Further, the survey was conducted in April-May 1990, about 4 years ago. Some U.S. university engineering libraries have undergone significant changes in the years since the survey was undertaken. Finally, the findings, and the data upon which the findings are based, may not be generalizable to all U.S. academic engineering libraries.

1. The "average" U.S. academic librarian is a female, has about 16 years of library/ information experience, has about 9 years of professional work experience in her present position, holds an MLS, belongs to a professional national library/information society, and is a U.S. citizen.

2. The "average" U.S. academic library is either a university (main) library, or engineering or engineering/science library, and is a SOD depository library.

3. About 71% of the libraries surveyed had technical report collections composed primarily of NASA, AGARD, and U.S. university technical reports. For the most part, these reports were held in microfiche rather than paper format.

4. Slightly more than 20% of the libraries surveyed held collections of foreign technical reports.

5. U.S. academic libraries receive NASA technical reports primarily from NASA and GPO. NTIS and other university libraries are used most often to obtain copies of NASA technical reports.

6. About 38% of the survey respondents indicated that NASA technical reports were heavily used.

7. Survey participants gave the following three reasons why they would discontinue receiving NASA technical reports: cost, problems with distribution and receipt of NASA technical reports, and relevance (usefulness) of the reports.

8. Survey participants indicated their belief that the use of NASA technical reports by **engineering faculty** is influenced by **relevance** followed by **familiarity or experience,** and **technical quality or reliability.**

9. Survey participants indicated their belief that the use of NASA technical reports by **engineering students** is influenced by **accessibility, relevance,** and **technical quality or reliability.**

10. U.S. aerospace industry librarians and technical information specialists rated NASA technical reports highest for **accessibility, relevance,** and **familiarity or experience.**

11. Selected announcement, current awareness, and bibliographic tools in paper format were used more than those same tools in electronic format; the same tools in paper format were given a higher importance rating than were their electronic format counterparts.

12. About 12% of the survey respondents indicated that the library absorbed all costs associated with the searching of (online) electronic data bases; about 34% indicated that the user paid a reduced cost and that the library absorbed some of the cost.

13. About 86% of the respondents indicated that the searching of (online) electronic data bases was done entirely or mostly through an intermediary.

14. A simple majority (i.e., 51%) of the survey respondents used three information technologies: electronic data bases, laser and video disk/CD-ROM, and E-Mail.

15. U.S. academic librarians and technical information specialists rated *STAR, IAA, SCAN,* and *RECON* high on all characteristics. The ease of using *RECON* was the notable exception.

16. About 57% of the survey respondents indicated a willingness to use either a CD-ROM or an online system (with full text and graphics) for NASA technical reports.

17. The number of U.S. academic libraries offering outreach programs was low; U.S. academic librarians and technical information specialists learned about user needs through requests from users and one-on-one interviews with users.

18. Almost all of the U.S. academic libraries offered what we define as the traditional library services such as document order and delivery. Few, however, offered what we defined as innovative or proactive services.

19. Survey respondents considered personal collections, the "old boy" network, and libraries not part of the university's library to be competition in providing services to users.

20. As a self-assessment, about 43%/50% of the survey respondents stated that they had an extensive knowledge of the technical information needs of the engineering faculty and students. On the other hand, about 28% indicated that they took an active role in transferring NASA-produced knowledge to the engineering faculty and students.

21. About 33%/24% of the survey respondents stated that NASA's knowledge of the technical information needs of their respective engineering faculty and students was extensive. Furthermore, about 27% of the respondents indicated that NASA devoted extensive efforts to understanding the technical information needs of their respective engineering faculty and students.

22. Thirteen percent of the survey respondents indicated that the effort devoted by NASA to involving U.S. academic librarians and technical information specialists in transferring the results of NASA research was extensive.

23. Very little communication takes place between the U.S. academic libraries and NASA.

CONCLUDING REMARKS

In large part, the results of the Phase 3 survey also support the two assumptions: NASA technical reports are used by and are important to U.S. engineering faculty and students. The results also confirm the essentially passive nature of the system used to transfer the results of federally funded aerospace R&D. The findings also appear to confirm the essentially passive role of U.S. academic libraries and librarians in the aerospace STI production, transfer, and use process. On the academic (user) side, the passive nature is due, in large part, to philosophy and a lack of support (funding). On the NASA (producer) side, the passive nature is due, for the most part, to the lack of effort devoted by NASA to involving U.S. academic librarians and information intermediaries in the producer-to-user transfer process or to giving this group of individuals a specific role or responsibilities for completing the aerospace STI production, transfer, and use process.

U.S. academic libraries, librarians, and technical information specialists do play an important role in completing the aerospace STI production, transfer, and use process. However, their impact does appear to be strongly conditional and limited to a specific context. Their role in completing the process could be enhanced by increasing their involvement (proactivity) and responsibility in the process. Increased involvement in the aerospace STI production, transfer, and use process requires greater recognition, responsibility, and support from the engineering programs (departments) and NASA.

Phase 3 of the *NASA/DoD Aerospace Knowledge Diffusion Research Project* is concerned with the academic-government interface. As a Phase 3 activity, we have surveyed academic information intermediaries. In Report 23, we report the results of the Phase 3 survey of U.S. engineering faculty and students.

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NASA/DoD AEROSPACE KNOWLEDGE DIFFUSION RESEARCH PROJECT

Fact Sheet

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

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

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

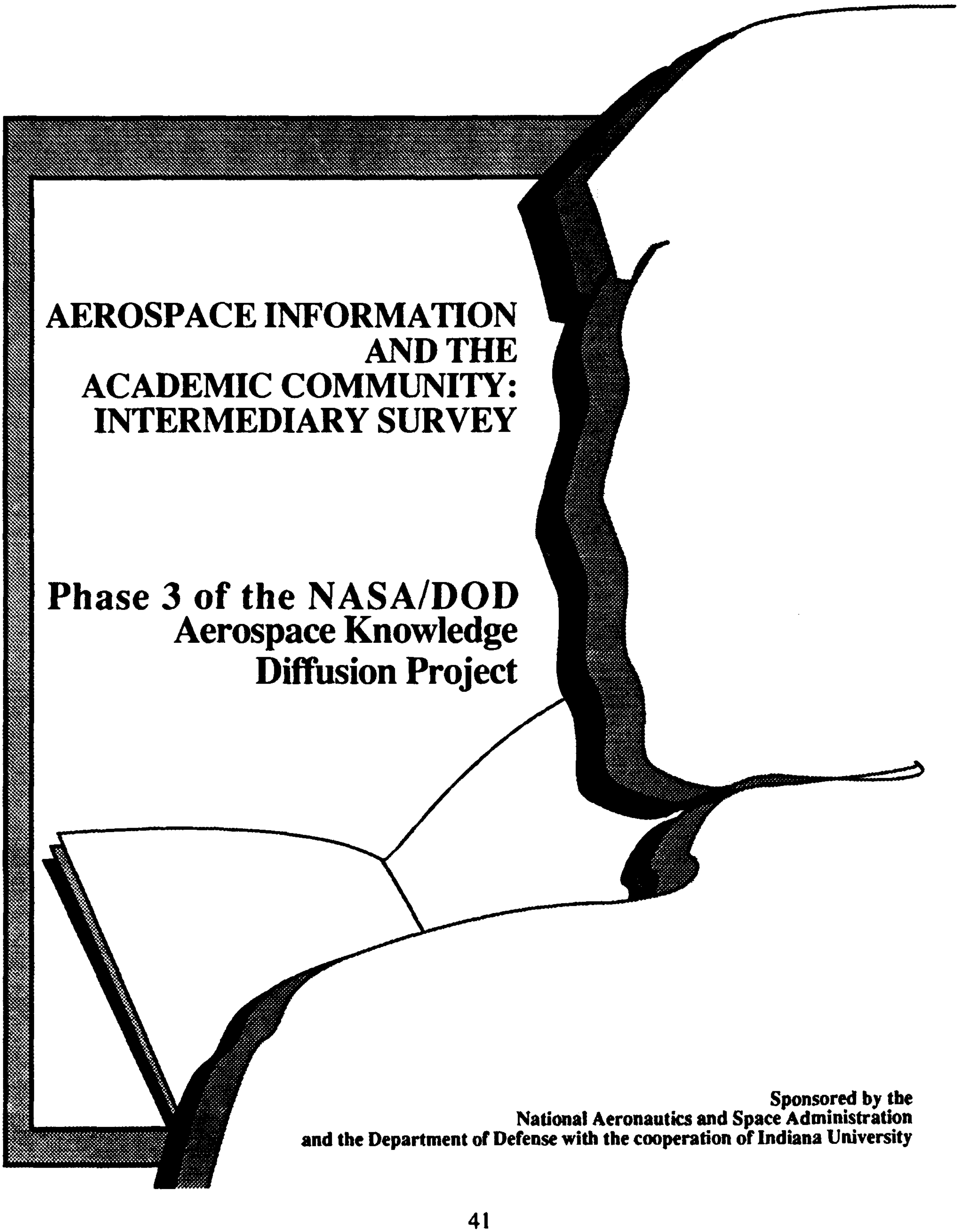
Dr. Thomas E. Pinelli
Mail Stop 180A
NASA Langley Research Center
Hampton, VA 23681-0001
(804) 864-2491
Fax (804) 864-8311
T.E.Pinelli@larc.nasa.gov

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

Rebecca O. Barclay
Dept. of Language, Lit. & Communication
Rensselaer Polytechnic Institute
Troy, NY 12180
(804) 399-5666
(518) 276-8983
Fax (518) 276-6783

APPENDIX B

Phase 3 Academic Intermediary Questionnaire



AEROSPACE INFORMATION AND THE ACADEMIC COMMUNITY: INTERMEDIARY SURVEY

Phase 3 of the NASA/DOD Aerospace Knowledge Diffusion Project

Sponsored by the
National Aeronautics and Space Administration
and the Department of Defense with the cooperation of Indiana University

These data will provide us with some background about your library.

1. Which of the following best describes your library? (Circle number)

    1. Departmental library
    2. Aeronautical/astronautical library
    3. Engineering library
    4. Engineering/science library
    5. Branch library
    6. University (main) library
    7. Other (specify)________________________

2. Is your library a Superintendent of Document (SOD) depository library? (Circle number)

    1 Yes
    2 No
    3 Don't know

These data will help us understand how your library deals with technical reports.

3. Does your library subscribe to, automatically receive, purchase, or otherwise obtain the following? (Circle numbers)

	Yes	No	Don't Know
NASA technical reports in paper	1	2	9
NASA technical reports in fiche	1	2	9
DOD technical reports in paper	1	2	9
DOD technical reports in fiche	1	2	9
FAA technical reports in paper	1	2	9
FAA technical reports in fiche	1	2	9
AGARD technical reports in paper	1	2	9
AGARD technical reports in fiche	1	2	9
U. S. aerospace company technical reports	1	2	9
U. S. university technical reports	1	2	9
AIAA papers in hard copy	1	2	9
AIAA papers in fiche	1	2	9

4. Does your library subscribe to, automatically receive, purchase, or otherwise obtain the following foreign (non-U.S.) technical reports? (Circle numbers)

	Yes	No
British ARC and RAE reports	1	2
ESA reports	1	2
French ONERA reports	1	2
German DFVLR, DLR and MBB reports	1	2
Japanese NAL reports	1	2
Swedish NAL reports	1	2
Other (specify)________________________		

5. **Does the aeronautical/astronautical engineering department maintain a NASA technical report collection separate from that which is kept in your library? (Circle number)**

1 Yes
2 No
3 Don't know

These data will help us understand the use of NASA technical reports in your library.

6. Which of the following **best** describes how your library routinely receives NASA technical reports? (Circle numbers)

1 Directly from NASA
2 From NTIS
3 From GPO
4 Does not routinely receive NASA technical reports
5 Other (specify)____________________

7. Which of the following **best** characterizes the use of the NASA technical reports in your library? (Circle number)

Heavily Used				Not Used At All	Don't Know	Don't Have a NASA Technical Report Collection
1	2	3	4	5	7	9 → Go to Q17 on page 6

8. How is **bibliographic access** provided to your NASA technical report collection? (Circle all that apply)

	Yes	No
Card catalog	1	2
Printed directories (e.g., NASA STAR)	1	2
OPAC	1	2
COMCAT	1	2
Other (specify)____________________		

9. How is **bibliographic access** provided to the NASA technical reports in your library? (Circle all that apply)

	Yes	No
Author	1	2
Title	1	2
Report number	1	2
Subject	1	2
Corporate source	1	2
Contract/grant number	1	2
Key words	1	2
Other (specify)____________________		

10. Which of the following describes how **physical access** to your NASA/NACA technical report collection is provided? (Circle all that apply)

NASA	NACA
1 Open	1 Open
2 Closed	2 Closed
3 Other (specify)________________	3 Other (specify)________________

11. Which of the following describes how the NASA/NACA technical reports in your library, (excluding NASA special publications) are arranged? (Circle all that apply)

NASA	Yes	No	NACA	Yes	No
1 Individually cataloged	1	2	1 Individually cataloged	1	2
2 Arranged by report numbers, by report series	1	2	2 Arranged by report numbers, by report series	1	2
3 Housed with the engineering materials	1	2	3 Housed with the engineering materials	1	2
4 Housed with the government documents collection	1	2	4 Housed with the government documents collection	1	2
5 Kept in storage	1	2	5 Kept in storage	1	2
6 Other (specify)________________			6 Other (specify)________________		

12. Approximately how many times in the **past six months** has your library utilized the following sources to obtain NASA technical reports **not in your** collection?

	Times in the Past Six Months	Don't Know(✓)
NTIS	____	( )
NASA STIF	____	( )
DTIC	____	( )
NASA field center library	____	( )
NASA author	____	( )
Another university library	____	( )
Aerospace industry library	____	( )
DDS or broker	____	( )
Other (specify) ________________		

13. Approximately how many times in the **past six months** has a NASA technical report been requested by one of **your** patrons but could not be obtained from your library for each of the following reasons?

	Times in the Past Six Months	Don't Know(✓)
Your library did not own the report	____	( )
Your library owned the report but it was missing or could not be found	____	( )
The report was in a STAR category not received by your library	____	( )
The report was distributed in fiche only and your library received paper copy in that STAR category	____	( )
The report was distributed in paper only and your library receives fiche copy in that STAR category	____	( )
The report was listed in STAR but was not automatically distributed by NASA	____	( )
The report was in a STAR category you automatically receive but you never received it	____	( )
The report was referenced as a NASA publication but was not in the NASA system	____	( )
The report was a classified, restricted, or limited distribution document	____	( )
The report was available only from the NASA center of origin	____	( )
The report was available only from the author or technical monitor	____	( )
Insufficient bibliographic information, did not know where or how to obtain the report	____	( )

Other (specify)_____ ______________________

14. Which of the following characterizes why **your library would consider *discontinuing*** automatically receiving NASA technical reports? (Circle numbers)

	Yes	No
Automatic distribution (subscription) is too costly	1	2
NASA technical reports duplicate other sources of needed information	1	2

NASA Technical Reports

	Yes	No
The information contained in NASA technical reports is not timely	1	2
Not all the reports received were useful	1	2
Problems with the distribution and receipt of NASA reports	1	2
NASA contract/grant completed; no longer needed NASA reports	1	2
Other (specify)________________		

15. To what extent do you think the following factors influence the use of the NASA technical reports in your library by **engineering students** in your institution? (Circle numbers)

	Greatly Influenced				Not Influenced	Don't Know
ACCESSIBILITY: the ease of getting to the information source	1	2	3	4	5	9
EASE OF USE: the ease of comprehending or utilizing the information	1	2	3	4	5	9
EXPENSE: low cost in comparison to other information sources	1	2	3	4	5	9
FAMILIARITY OR EXPERIENCE: prior knowledge or previous use of the information source	1	2	3	4	5	9
TECHNICAL QUALITY OR RELIABILITY: the information was expected to be the best in terms of quality, accuracy and reliability	1	2	3	4	5	9
COMPREHENSIVENESS: the expectation the information source would provide broad coverage of the available knowledge	1	2	3	4	5	9
RELEVANCE: the expectation that a high percentage of the information retrieved from the source would be used	1	2	3	4	5	9
PHYSICAL PROXIMITY: the distance to the information source	1	2	3	4	5	9
SKILL IN USE: the level of skill or skill mastery required to use the information source	1	2	3	4	5	9
TIMELINESS: the time allocated or available to produce a solution	1	2	3	4	5	9

16. To what extent do you think the following factors influence the use of the NASA technical reports in **your library** by **engineering faculty** in your institution? (Circle numbers)

	Greatly Influenced				Not Influenced	Don't Know
ACCESSIBILITY: the ease of getting to the information source	1	2	3	4	5	9
EASE OF USE: the ease of comprehending or utilizing the information	1	2	3	4	5	9
EXPENSE: low cost in comparison to other information sources	1	2	3	4	5	9
FAMILIARITY OR EXPERIENCE: prior knowledge or previous use of the information source	1	2	3	4	5	9
TECHNICAL QUALITY OR RELIABILITY: the information was expected to be the best in terms of quality, accuracy and reliability	1	2	3	4	5	9
COMPREHENSIVENESS: the expectation the information source would provide broad coverage of the available knowledge	1	2	3	4	5	9
RELEVANCE: the expectation that a high percentage of the information retrieved from the source would be used	1	2	3	4	5	9
PHYSICAL PROXIMITY: the distance to the information source	1	2	3	4	5	9
SKILL IN USE: the level of skill or skill mastery required to use the information source	1	2	3	4	5	9
TIMELINESS: the time allocated or available to produce a solution	1	2	3	4	5	9

These data will help us determine the use and importance of selected information sources and products.

17. As an academic intermediary, approximately how many times in the **past six months** have you used the following print sources in helping engineering students meet their engineering information needs?

PRINT SOURCES	Times in Past Six Months	Do Not Have (✓)
Applied Science and Technology Index	______	( )
Engineering Index	______	( )
Government Reports Announcement and Index	______	( )
International Aerospace abstracts	______	( )

PRINT SOURCES	Times in Past Six Months	Do Not Have (✓)
NASA SP-7037 (Aeronautical Engineering: A Continuing Bibliography With Indexes)	______	( )
NASA SCAN	______	( )
NASA STAR	______	( )
Science Citation index	______	( )

18. As an academic intermediary, approximately how many times in the **past six months** have you used the following **electronic sources** in helping **engineering students** meet their engineering information needs?

ONLINE (ELECTRONIC) DATABASES	Times in Past Six Months	Do Not Have (✓)
Aerospace Database	______	( )
COMPENDEX	______	( )
DTIC DROLS	______	( )
INSPEC	______	( )
NASA RECON	______	( )
NTIS Online	______	( )
SCISEARCH	______	( )
Wilson Line Index	______	( )
BRS including "After Dark"	______	( )
DIALOG including "Knowledge Index"	______	( )

19. As an academic intermediary, **how important to you** are the following print sources in helping engineering **students** meet their engineering information needs? (Circle numbers)

PRINT SOURCES	Very Important				Not at all Important	Do Not Have
Applied Science and Technology Index	1	2	3	4	5	9
Engineering Index	1	2	3	4	5	9
Government Report Announcement Index	1	2	3	4	5	9
International Aerospace Abstracts	1	2	3	4	5	9
NASA SP-7307 (Aeronautical Engineering: A Continuing Bibliography With Indexes)	1	2	3	4	5	9
NASA SCAN	1	2	3	4	5	9
NASA STAR	1	2	3	4	5	9
Science Citation Index	1	2	3	4	5	9

20. As an academic intermediary, **how important to you** are the following electronic sources in helping engineering **students** meet their engineering information needs? (Circle numbers)

ONLINE (ELECTRONIC) DATABASES	Very Important				Not at all Important	Do Not Have
Aerospace Database	1	2	3	4	5	9
COMPENDEX	1	2	3	4	5	9
DTIC DROLS	1	2	3	4	5	9
INSPEC	1	2	3	4	5	9
NASA RECON	1	2	3	4	5	9
NTIS Online	1	2	3	4	5	9
SCISEARCH	1	2	3	4	5	9
Wilson Line Index	1	2	3	4	5	9
BRS including "After Dark"	1	2	3	4	5	9
DIALOG including "Knowledge Index"	1	2	3	4	5	9

These data will help us determine the use of information technology.

21. Which of the following **best** represents **your** library's approach to paying for online search services to engineering students? (Circle **only** one number)

1 Not offered

2 User pays **nothing** for service, library or engineering department absorbs **all** costs

3 User pays **reduced** cost, library or engineering department absorbs **some** of the costs

4 User pays **all** costs

5 Other (specify) ______________________________

22. Which of the following **best** characterizes **your** library's approach to providing online (electronic) search services to engineering students? (Circle **only** one number)

1 Not offered

2 Users do **all** searches

3 Users do **most** searches

4 Users do **half** of the searches by themselves and **half** through an intermediary

5 Users do **most** searches through an intermediary

6 Users do **all** searches through an intermediary

7 Other (specify) ______________________________

23. To **what** extent do **you** think the following factors influence the use of the NASA technical reports in **your library?** (Circle numbers)

	Greatly Influenced				Not Influenced	Don't Know
ACCESSIBILITY: the ease of getting to the information source	1	2	3	4	5	9
EASE OF USE: the ease of comprehending or utilizing the information	1	2	3	4	5	9
EXPENSE: low cost in comparison to other information sources	1	2	3	4	5	9
FAMILIARITY OR EXPERIENCE: prior knowledge or previous use of the information source	1	2	3	4	5	9
TECHNICAL QUALITY OR RELIABILITY: the information was expected to be the best in terms of quality, accuracy and reliability	1	2	3	4	5	9
COMPREHENSIVENESS: the expectation the information source would provide broad coverage of the available knowledge	1	2	3	4	5	9
RELEVANCE: the expectation that a high percentage of the information retrieved from the source would be used	1	2	3	4	5	9
PHYSICAL PROXIMITY: the distance to the information source	1	2	3	4	5	9
SKILL IN USE: the level of skill or skill mastery required to use the information source	1	2	3	4	5	9
TIMELINESS: the time allocated or available to produce a solution	1	2	3	4	5	9

24. As an academic intermediary how frequently this past year did you use the following? (Circle numbers)

	Frequently				Never	Do Not Have
Electronic databases	1	2	3	4	5	9
Laser/Video Disc/CD-ROM	1	2	3	4	5	9
Desktop/electronic publishing	1	2	3	4	5	9
Electronic bulletin boards	1	2	3	4	5	9
Electronic Mail	1	2	3	4	5	9
Electronic networks	1	2	3	4	5	9
FAX/TELEX	1	2	3	4	5	9

25. As an academic intermediary, please indicate how strongly you **agree** or **disagree** with each of the following statements concerning the following bibliographic products. (Circle numbers)

About STAR	Strongly Agree				Strongly Disagree	Don't Know
The coverage is adequate	1	2	3	4	5	9
The category scheme is adequate	1	2	3	4	5	9
The announcements are current	1	2	3	4	5	9
The abstracts are adequate	1	2	3	4	5	9

About IAA	Strongly Agree				Strongly Disagree	Don't Know
The coverage is adequate	1	2	3	4	5	9
The category scheme is adequate	1	2	3	4	5	9
The announcements are current	1	2	3	4	5	9
The abstracts are adequate	1	2	3	4	5	9

About SCAN	Strongly Agree				Strongly Disagree	Don't Know
The announcements are current	1	2	3	4	5	9
SCAN is easy to use	1	2	3	4	5	9
SCAN is timely	1	2	3	4	5	9
The print quality is adequate	1	2	3	4	5	9

About RECON	Strongly Agree				Strongly Disagree	Don't Know
The coverage is adequate	1	2	3	4	5	9
RECON is easy to use	1	2	3	4	5	9
The RECON database is current	1	2	3	4	5	9
Searches on RECON meet users research requirements	1	2	3	4	5	9

26. As an academic intermediary, how likely would you be to use the following if they were provided in electronic format? (Circle numbers)

	Very Likely				Not at All Likely	Don't Know
STAR or CD-ROM	1	2	3	4	5	9
Full text of NASA report on CD-ROM	1	2	3	4	5	9
Computer program listings on CD-ROM	1	2	3	4	5	9
Numerical/Factual data on CD-ROM	1	2	3	4	5	9
Images (photographs) CD-ROM	1	2	3	4	5	9
RECON front-end	1	2	3	4	5	9
Online system (full text and graphics) for NASA technical reports	1	2	3	4	5	9

27. What barriers, if any, would hinder your library's adoption of the electronic information products listed in Question 26? (Please list)

1 ______________________________
2 ______________________________
3 ______________________________

28. What information products or services, if any, should NASA discontinue? (Please list)

1 ______________________________
2 ______________________________
3 ______________________________

29. What new information products or services, if any, should NASA consider offering? (Please list)

1 ______________________________
2 ______________________________
3 ______________________________

These data will help us determine the role that academic intermediaries play in providing information and information services to engineering students and faculty.

30. Approximately how many times in the **past six months** has your library provided the following services for engineering students and faculty?

	STUDENTS	FACULTY	Don't Provide (✓)
General library tour	______	______	( )
Library presentation as part of engineering course	______	______	( )

Library Services

	STUDENTS	FACULTY	Don't Provide (✓)
Library skills course	________	______	( )
Tour of engineering library	________	______	( )
Introduction to engineering information resources and materials	________	______	( )

31. How does your library generally learn about user needs? (Circle numbers)

		Yes	No
1	Requests received	1	2
2	Curriculum guides	1	2
3	In-house publications	1	2
4	Survey questionnaires	1	2
5	One-on-one interviews	1	2
6	Library staff meetings	1	2
7	Other meetings	1	2
8	Other (specify) ________________	1	2

32. In the **past six months** how often did **your** library staff attend meetings of research teams and/or was otherwise involved in research projects? (Circle number)

Frequently — Never

1 2 3 4 5

33. Which of the following services does **your** library provide to engineering students and faculty? (Circle numbers)

	STUDENTS		FACULTY	
	Yes	No	Yes	No
Alerting services	1	2	1	2
Bibliographic instruction	1	2	1	2
Document order and delivery	1	2	1	2
Electronic reference	1	2	1	2
Handouts & library guides	1	2	1	2
In-house SDI and routing services	1	2	1	2
Mediated online searching	1	2	1	2
NASA SCAN	1	2	1	2
Other (specify) ________________	1	2	1	2

34. Which of the following services does your library provide to engineering students and faculty? (Circle numbers)

	STUDENTS		FACULTY	
	Yes	No	Yes	No
Professional time-saving assistance in				
Locating sources	1	2	1	2
Identifying documents	1	2	1	2
Acquiring information	1	2	1	2
Expert help in learning/using information	1	2	1	2
Database development	1	2	1	2
Downloading to diskettes	1	2	1	2
Remote online access to library catalog	1	2	1	2
CD/ROM workstation(s) in library	1	2	1	2
Cooperative cost sharing services				
Group contract for online services	1	2	1	2
Coordinated access to networks	1	2	1	2
Other (specify) ____________	1	2	1	2
Acquisition of most-used databases, for searching online through campus computer facilities				
Aerospace database	1	2	1	2
NTIS online	1	2	1	2
Federal Research in Progress (FEDRIP)	1	2	1	2
Energy database	1	2	1	2
Other (specify) ____________	1	2	1	2
Acquisition or development of user-friendly front-end systems for searching most-used databases online				
Library online catalog searching	1	2	1	2
Gateway searching of multiple databases	1	2	1	2
Other (specify) ____________	1	2	1	2

Other innovative services (specify) ____________

35. Does your library provide instruction to students in how to use library resources and services? (Circle numbers)

1 Yes

2 No → Go to Q36

Is the instruction? (Circle numbers)

	Yes	No
1 Required	1	2
2 Elective	1	2
3 Non-credit	1	2
4 Credit	1	2
5 Part of an engineering course	1	2
6 Part of another course	1	2
7 Separate course	1	2
8 Other (specify)____________		

36. What do you see as "competition" for the engineering library in providing information services to students and faculty? (Circle numbers)

	STUDENTS		FACULTY	
	Yes	No	Yes	No
The "old boy" network	1	2	1	2
Personal collections	1	2	1	2
Other units within the organization				
Research assistants attached to projects	1	2	1	2
Department or Project "libraries" not a part of your library	1	2	1	2
Other (specify)__________	1	2	1	2
Direct user access to outside information sources				
Information brokers	1	2	1	2
Publishers	1	2	1	2
Online vendors	1	2	1	2
NASA/STIF	1	2	1	2
NTIS	1	2	1	2
Other (specify) __________	1	2	1	2
Direct use of national computer communications networks				
APRANET	1	2	1	2
Internet/NSFNET	1	2	1	2
Other (specify) __________	1	2	1	2
Direct use of regional computer communications networks	1	2	1	2
Direct use of campus network (local area network)				
Online access to your library catalog	1	2	1	2
Online access to other campus libraries	1	2	1	2
Other (specify) __________	1	2	1	2
Wordprocessing for transmission of text				
Office facsimile transmission	1	2	1	2
Electronic Mail	1	2	1	2
Manuscript preparation and delivery	1	2	1	2
Database creation by users				
Information collection, storage and use	1	2	1	2
Downloading to personal files	1	2	1	2
Electronic transmission of data	1	2	1	2

37. Overall, how would you rate the following characteristics of your library's information services? (Circle numbers)

	Excellent				Poor	No Opinion
Funding						
Staff salaries	1	2	3	4	5	9
Materials/equipment	1	2	3	4	5	9
Searching online	1	2	3	4	5	9
CD/ROM	1	2	3	4	5	9
Innovation	1	2	3	4	5	9
Other (specify) ______	1	2	3	4	5	9
Staffing						
Staff size	1	2	3	4	5	9
Aerospace experience	1	2	3	4	5	9
Science background	1	2	3	4	5	9
Services to users						
Information supplied on request	1	2	3	4	5	9
Alerting	1	2	3	4	5	9
Turnaround time	1	2	3	4	5	9
State-of-the-art	1	2	3	4	5	9
Other (specify) ______	1	2	3	4	5	9
Interaction with users						
User needs surveyed	1	2	3	4	5	9
User meetings attended	1	2	3	4	5	9
Orientation/instruction	1	2	3	4	5	9

38. Does your library provide instruction in engineering information resources and materials resources? (Circle number)

1 Yes

2 No → Go to Q39

Is the instruction? (Circle numbers)

	Yes	No
1 Required	1	2
2 Elective	1	2
3 Non-credit	1	2
4 Credit	1	2
5 Part of an engineering course	1	2
6 Part of another course	1	2
7 Separate course	1	2
8 Other (specify) ______		

These data will help us understand the interface between academic librarians as information intermediaries and NASA as a knowledge producer.

39. As an academic intermediary, how would **you** rate NASA's understanding of the role you perform in meeting the technical information needs of engineering **students** and **faculty** at your institution? (Circle number)

STUDENTS

Extensive				None	Don't Know
1	2	3	4	5	9

FACULTY

Extensive				None	Don't Know
1	2	3	4	5	9

40. As an academic intermediary, how much effort does it appear that NASA devotes to **understanding** the technical information needs of engineering **students** and **faculty** at **your** institution? (Circle number)

STUDENTS

Extensive				None	Don't Know
1	2	3	4	5	9

FACULTY

Extensive				None	Don't Know
1	2	3	4	5	9

41. As an academic intermediary, how much effort do you think NASA devotes to **involving you** in transferring the results of NASA research to the engineering **students** and **faculty** at your institution? (Circle number)

STUDENTS

Extensive				None	Don't Know
1	2	3	4	5	9

FACULTY

Extensive				None	Don't Know
1	2	3	4	5	9

42. As an academic intermediary, what steps or actions, if any, should NASA take to increase the participation or involvement of academic librarians in transferring the results of NASA research to engineering **students** and **faculty**? (Please list)

1 ______________________________

2 ______________________________

3 ______________________________

4 ______________________________

43. In performing your professional duties as an academic intermediary about how many times in this past year, have you contacted or been contacted by NASA personnel concerning transferring the results of NASA research?

	Times This PAST YEAR
YOU contacted NASA	________
NASA contacted YOU	________

These data will help us understand the interface between academic librarians as information intermediaries and engineering students and faculty as users of NASA produced knowledge.

44. As an academic intermediary, how would you rate **your** knowledge of the technical information needs of the engineering **students** and **faculty** at your institution? (Circle number)

STUDENTS

Extensive				None	Don't Know
1	2	3	4	5	9

FACULTY

Extensive				None	Don't Know
1	2	3	4	5	9

45. As an academic intermediary, how active are you in transferring NASA produced knowledge to the engineering **students** and **faculty** at your institution? (Circle number)

STUDENTS

Very Active				Very Passive	Don't Know
1	2	3	4	5	9

FACULTY

Very Active				Very Passive	Don't Know
1	2	3	4	5	9

46. As an academic intermediary, what steps or actions, if any, do you take to "actively" transfer NASA produced knowledge to the engineering **students** and **faculty** at your institution? (Circle all that apply)

	STUDENTS		FACULTY	
	Yes	No	Yes	No
Screening information	1	2	1	2
Interpreting data	1	2	1	2
Other (specify) ________				

47. Please cite at least one specific case or incident that demonstrates how NASA information provided (or denied) by your library made a difference to an R&D, faculty, or student project within the past year.

____

____

____

Would you be willing to identify the user, for a follow-up interview? (Circle number)

1 Yes

2 No

48. As an academic intermediary, what barriers, if any, hinder or keep you from "actively" transferring NASA produced knowledge to the engineering students and faculty at your institution? (Please list)

STUDENTS	FACULTY
1 ______________________	1 ______________________
2 ______________________	2 ______________________
3 ______________________	3 ______________________

Finally, we would like to collect some background information that will be helpful with the analysis of the data.

49. Gender:

1 Female

2 Male

50. U.S. Citizen:

1 Yes

2 No

51. Years of professional library experience?

_____ years of professional experience

52. Years in your present position?

_____ years in present position

53. Percent of your time devoted to aerospace information activities?

_____ % of time

54. Education :

1 B. A. in ______________________

2 B. S. in ______________________

3 MLS

4 Master's in ______________________

5 MBA

6 J. D.

7 Ph. D. in ______________________

8 Other (specify) ______________________

55. Professional (national) membership (Circle all that apply)

1 ALA

2 ASEE

3 ASIS

4 SLA

5 Other national library or information society (specify)______________________

6 Not a member of any national library or information society

OVER ⟶

OPTIONAL QUESTIONS

1. What suggestions can you offer for improving access by the academic community to the results of NASA produced knowledge?

2. What suggestions can you offer regarding the structure, location, purpose, content, length and necessity of a NASA STI users meeting that would be attended by information intermediaries from academia, industry, and government?

3. Is there anything else you would care to say regarding this research?

Mail to:
Center for Survey Research
1022 East Third Street
Indiana University
Bloomington, IN 47405