UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A024 701	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) DDC 10 Year Requirements and Planning Study Final Report Volume II: Technical Discussion, Bibliography, and Glossary		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER AUER-2325/2326-TR-5
7. AUTHOR(s) Jerome T. Maddock Thomas J. McGeehan Martha Cornog		8. CONTRACT OR GRANT NUMBER(s) DSA-900-75-C-5161
9. PERFORMING ORGANIZATION NAME AND ADDRESS AAI (AUERBACH Associates, Inc.) 121 North Broad Street Philadelphia, Pennsylvania 19107		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS DSA-658-01S
11. CONTROLLING OFFICE NAME AND ADDRESS Defense Documentation Center Cameron Station, Building 5 5010 Duke Street, Alexandria, Virginia 22314		12. REPORT DATE 12 June 1976
		13. NUMBER OF PAGES 92
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) SAME		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release; Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

N/A

18. SUPPLEMENTARY NOTES

User survey planning, training, and data reduction performed by subcontract to: CRITERION DEVELOPMENT ASSOCIATES, INC., Suite 1218, White Station Tower, 5050 Poplar Avenue, Memphis, Tennessee, 38157. Dr. Charles T. Kenny, Consulting Psychologist.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

INFORMATION SYSTEMS	SURVEYS	DOCUMENTS
REQUIREMENTS	INFORMATION RETRIEVAL SYSTEMS	PLANNING
TECHNICAL INFORMATION	MANAGEMENT REQUIREMENTS	RESEARCH MANAGEMENT
INFORMATION TRANSFER	PROJECTION	
FORECASTING	TECHNOLOGY	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Three major tasks are presented of a long-range planning and management study to assess current and future Defense Research, Development, Test, and Evaluation (RDT&E) community needs in the years 1978-1988 for DDC's scientific and technical information (S&TI) services. These tasks are: a survey of DDC users and potential users (User/Potential User Survey), a survey of 14 federal agencies which interface with DDC (Interagency Survey), and a review by a panel of experts of a series of events forecasted to have the potential for occurring in the time

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

frame 1978-1988 (Expert Panel Review).
Included are a list of persons and agencies associated with the study, a Bibliography of 125 documents in the areas of technical information services and forecasting, and a Glossary of 135 acronyms and technical terms used in both volumes of this Report.

Volume I of this Report presents three recommended DDC goals, and a series of related objectives and time-phased tasks, together with overall study conclusions.

DDC 10 YEAR REQUIREMENTS AND PLANNING STUDY

VOLUME II: TECHNICAL DISCUSSION, BIBLIOGRAPHY AND GLOSSARY

AUER 2325/2326-TR-5

June 13, 1976

Contract Number DSA900-75-C-5161
Sequence Number A004
Authority (Data Item Number)
UDI-S-006

Prepared by:

Jerome T. Maddock, Thomas J. McGeehan and Martha Cornog

Final Technical Report
Submitted to:
John W. Saunders, COTR
Defense Documentation Center (DDC)
Cameron Station
Alexandria, VA 22304

AAI
AUERBACH Associates, Inc.
121 North Broad Street
Philadelphia, Pennsylvania
19107

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

SECTION I. USER REQUIREMENTS

This section summarizes the methodology, findings, and conclusions of the User/Potential User Survey, highlighting those findings and conclusions which lead into the recommended DDC S&TI objectives discussed in Section II of Volume I. The purpose of the survey was directed toward:

1. Identifying and documenting the scientific and technical information (ST&I) and research, development, test and evaluation (RDT&E) management information requirements of the Department of Defense (DoD) RDT&E community for the 1978-1988 period.

2. Identifying user problems associated with acquisition and application of S&TI/RDT&E management information provided by DDC or other Government or non-Government sources.

Both current requirements and problems and future requirements and problems for the time frame 1978-1988 were addressed in this survey.

1.1 DETAILED METHODOLOGY OF USER/POTENTIAL USER SURVEY

In order to gather the information necessary for this forecasting study, AAI (AUERBACH Associates, Inc.) and its subcontractor, CRITERION DEVELOPMENT ASSOCIATES (CDA), used a combination of the techniques of telephone interviewing and mailed questionnaires. The methodology consisted of three steps:

- Drawing the sample
- Development of the interview schedule and conduct of the interviews
- Data analysis and interpretation of results

1.1.1 Drawing of Sample

The exact size of the population surveyed in this study is not known, because the Defense Documentation Center's records describe only user organizations, rather than individual users. The best estimate, however, of the total number of individual users/potential users is 150,000. They are affiliated with 2,886 user organizations.

A stratified sampling plan with random sampling within strata was followed in order to ensure a representative sampling plan and minimize bias in the resulting sample. The population of user organizations was strati-

fied as follows:

- Step One
  - (1) DoD organizations - Key User organizations*
  - (2) DoD organizations - Non-Key user organizations
  - (3) Contractor organizations - Key users
  - (4) Contractor organizations - Non-Key users
- Step Two
  - (1) Bench Level Personnel
  - (2) Management Personnel
  - (3) Support Personnel **
- Step Three
  - (1) Individual users of DDC
  - (2) Individuals who do not use DDC

At Step One, the 2,886 user organizations were divided into the four groups listed above. Then a random sample of twenty-five organizations was drawn from each group. Backups were included in this number to ensure adequate sampling in the case of non-cooperation.

At Step Two, initial contacts were made by the interviewers. For each organization in the sample, they contacted the individual who was listed in DDC records as the "focal point". A specially designed procedure was utilized to obtain a random sample of twenty of the staff members involved in R&D in each organization.

Step Three divided survey participants into users of DDC and non-users. This information was obtained during the interview, and was not available prior to that time.

The procedure outlined above was designed to produce 650-800 interviews with a maximum of 200 in each group listed at Step One. This sample size was chosen in order to assure a confidence level of 95% for the percentages obtained in the survey. The chances are 95 in 100 that the sampling error associated with survey results will be $\pm$ 4 percentage points or less.

---

* Key user organizations are those which rank in the top 200 in terms of ordering technical reports from DDC. Non-key organizations are the remaining 2,686.

** "Support personnel" are defined as librarians, information specialists, terminal operators, etc.

1.1.2 Development of the Interview Schedule and Conduct of the Interviews

AAI and CDA developed a unique methodology specifically for this contract. Survey respondents were initially contacted by phone, asked to participate, scheduled for an interview and then sent a packet. The packet included a set of cards that provided the response alternatives for a majority of the questions in the interview. These cards vastly reduced the problems of recency effect and response set so often encountered when structured responses are obtained over the telephone.

This interview methodology combined the advantages of both telephone interviewing and the mailed questionnaire, while simultaneously eliminating the disadvantages of both.

The interview schedule was highly structured in order to ensure maximum consistency and reliability among interviews. The interview schedule used for the bench level and management personnel contained 194 questions. Support personnel have different information needs and use patterns than do managers and bench personnel, hence, a separate interview schedule was constructed for them, which consisted of 159 questions.*

Interviewer training sessions were conducted at the outset of the project, and follow-up sessions were held to discuss problems and questions. During the interviewing, thirty-one interviews (just over 4%) were monitored unobtrusively in order to ensure quality control and establish interjudge reliability. Interjudge reliability coefficients were computed between the monitor and the interviewer for each of the 31 interviews that were monitored. Percentage of agreement ranged from 84% - 97%, with an average percent of agreement for all 31 pairs of 93.2%.

1.1.3 Data Analysis

The analysis of the data for this project proceeded in three phases:

(a) Identification of major independent variables of interest (e.g., DDC user vs. non-user)

(b) Determination of significant effects of independent variables on dependent variables (e.g., preferred media).

*The following interim contract status report contains complete details on the methodology, the sampling plan and the interview schedules: DDC 10 Year Requirements and Planning Study: Survey Results Report. March 14, 1976 (AUER-2325/2326-TR-3; AD-A022 304)

(c) Identification and prediction of future trends in the DoD S&TI/RDT&E management information environment.

1.1.3.1 Identification of Major Independent Variables of Interest

In this study, there are dozens of potentially significant independent variables that define the preferences, attitudes and behaviors exhibited by the respondents in their information search strategies. In order to identify those variables that are the best predictors of variability in the responses to questions in the interview, a series of multiple regression analyses* was performed to identify the major variables to be utilized at the second phase of the analysis.

1.1.3.2 Determination of Significant Effects of Independent Variables on Dependent Variables

Analysis of variance and contingency analysis were performed on each of the quantifiable interview questions to identify the interview questions that can be accounted for (at a significance level of $p < 0.05$) in terms of one or more of the independent variables in this study.

1.1.3.3 Identification and Prediction of Future Trends in the S&TI/RDT&E Environment

This third step in the analysis consisted of two parts, both of which were designed to provide an empirical basis for forecasting.

(a) Trend analysis was performed on the respondents' answers to questions about various aspects of service in 1970, 1975, and 1980.

(b) Curve fitting was conducted using the method of least squares to predict future problems and to estimate future demand for various DDC services.

1.2 DESCRIPTION OF THE SURVEY SAMPLE

The sample will be described first in terms of the four independent variables used to stratify the sample. Then its characteristics will be described in terms of the four additional independent variables in the multiple regression analyses. This description is illustrated in tabular form in Tables 1 through 3.

---

* For definitions of statistical terms, see the Glossary at the end of Volume II of this Report.

TABLE 1

Description of Sample:
Number of Respondents in
Each User Category

User Categories	Respondents	Percentages
Respondents in Contractor Organizations	326	46.7%
Respondents in DoD Organizations	372	53.3%
	698	100.0%
DDC Users	544	77.9%
Non-Users	154	22.1%
	698	100.0%
Respondents in Key Organizations	441	63.2%
Respondents in Non-Key Organizations	257	36.8%
	698	100.0%
Bench Level Respondents	235	33.7%
Support Level Respondents	94	13.5%
Management Level Respondents	369	52.8%
	698	100.0%
High School Degree	30	4.3%
2 Year Degree	17	2.4%
Bachelors Degree	274	39.3%
Masters Degree	210	30.1%
Ph.D.	119	17.1%
[Missing Data	48	6.8%]
	698	100.0%
Top Secret	161	23.1%
Secret	486	69.6%
Confidential	16	2.3%
No Classification	35	5.0%
	698	100.0%

Average Years Experience in R&D (N = 698)	14.10
Standard Deviation	8.86
Hours Per Week in Research (N = 604)*	23.69
Standard Deviation	16.17
Modal Score	40 (N = 127)

*Does not include Support Personnel

TABLE 2

Description of Sample:
Breakdown and Interaction
Of Major User Categories --
Job Type of DDC User/
Non-User by Contractor vs.
DoD by Key/Non-Key
User Organization

	BENCH USER	BENCH NON USER	SUPPORT USER	SUPPORT NON USER	MGMT USER	MGMT NON USER	TOTAL
CON NON-KEY	26	15	12	1	55	30	139
CON KEY	53	20	30	0	67	17	187
DoD KEY	82	10	30	0	118	14	254
DoD NON-KEY	16	13	16	5	39	29	118
TOTAL	177	58	88	6	279	90	698

TABLE 3

Number of Respondents Selecting Various COSATI Fields as Their Major Areas of Specialization

COSATI Fields	Respondents	Percentage
Electronics/Electrical Engineering	107	15.3%
Mechanical/Industrial/Civil/ Marine Engineering	61	8.7%
Physics	58	8.3%
Navigation/Communications/Detection/ Countermeasures	51	7.3%
Aeronautics	44	6.3%
Ordnance	40	5.7%
Military Sciences	38	5.4%
Materials	29	4.2%
Mathematical Sciences	26	3.7%
Behavioral/Social Sciences	23	3.3%
Propulsion and Fuels	21	3.0%
Biological/Medical Sciences	20	2.9%
Missile Technology	17	2.4%
Chemistry	14	2.0%
Atmospheric Sciences	11	1.6%
Nuclear Science/Technology	10	1.4%
Earth Sciences/Oceanography	7	1.0%
Energy Conversion	7	1.0%
Methods and Equipment	7	1.0%
Space Technology	5	.7%
Agriculture	2	.3%
Astronomy/Astrophysics	1	.1%
[Support personnel and missing data	99	14.1%]
	698	99.8%

*Rounding errors

1.2.1 Variables Used to Stratify the Sample

- Contractor versus DoD organizations: There are 326 respondents in the survey working for contractors and 372 working for DoD agencies. The split was 46.7% versus 53.3%.
- DDC users versus non-users: Slightly over 3 out of every 4 survey respondents are DDC users (77.9% versus 22.1%).
- Key user organizations versus non-key organizations: There are 441 respondents working in key organizations and 257 respondents in non-key organizations (63.2% and 36.8% respectively).
- Bench level vs. Support vs. Management: 94 support personnel are included in the sample as respondents, accounting for 13.5% of its overall size. Bench level researchers number 235, accounting for 33.7% of the sample, while management personnel account for 369 or 52.8% of the sample.

1.2.2 Additional Variables Describing the Sample

- Highest degree obtained: The most common degree level obtained by survey respondents is the bachelor's degree, earned by 274 or 39.3%. The master's degree is the highest degree obtained by 210 or 30.1%, while 119 hold the Ph.D. (17.1%). Numerous respondents report additional credits beyond the degree levels they indicated. The small number of Ph.D.'s should be noted.
- Security classification: Nearly seven out of 10 respondents (69.6%) report Secret classification, while 23.1% report Top-secret, 2.3% report Confidential and 5% report no classification.
- Years of xperience: The average number of years of experience in R&D for survey respondents is 14.10. The shape of the distribution was roughly normal, with approximately two-thirds falling between five years and twenty-three years.
- Hours per week engaged in research: The average number of hours per week that survey respondents report they were engaged in research is 23.69. The distribution is bimodal, however, with 127 respondents reporting 40 hours.
- COSATI ields: The majority of the bench level and management survey respondents work in the hard sciences with emphasis on applied aspects. The four major fields respondents report most often were in order: Electronics/Electrical Engineering, Mechanical/Industrial/Civil/Marine Engineering, Physics, Navigation/Communications/Detection and Countermeasures. Data from 99 respondents are missing because the Support personnel were not asked to choose a COSATI field and six others did not answer this question.

1.3 FINDINGS OF USER/POTENTIAL USER SURVEY

1.3.1 Current Requirements

Findings of the survey are summarized below. Accompanying tables display the findings in graphic and tabular form.

1.3.1.1 Primary Sources of Information (Table 4)

- 50.7% of the respondents chose their in-house library as their primary formal source of information. A distant second and third in the order of preference are, respectively, departmental collections (13.2%) and users' personal collections (13.1%).
- Only 2.3% of respondents indicated a preference for a "distant" library as a first choice information source.

1.3.1.2 Formats (Table 5)

- Technical reports and journals are the formats preferred as "most useful" by 34.8% and 16.3% of the respondents, respectively.
- Other formats receiving mention include handbooks and manuals, abstract journals, and computer generated bibliographies, each preferred by approximately 8% of the respondents.
- 77% of the respondents reported some disadvantages in utilizing their preferred formats and almost as many (71.2%) reported some disadvantages in utilizing their second most preferred format.

1.3.1.3 Media (Table 6)

- The vast majority of respondents (84.2%) indicated that they rely most heavily on printed (hard copy) documents. This overwhelming and continued reliance on printed documents is significant, considering the technological innovations in the information science field during the past several years.
- Verbal communication is second most preferred, with 7.3% of respondents indicating that it serves as their primary medium.
- Microfiche and computer printouts are preferred by 2.9% and 2.7% of respondents, respectively.

1.3.1.4 User Charges

A number of questions were asked regarding charging for information and users' attitudes toward the costs of the services that they utilize.

TABLE 4

Number and Percentage of
Respondents Choosing Various
Sources as Most Preferred

SOURCES	NUMBER OF RESPONDENTS	PERCENTAGE
In-house Library	306	50.7%
Department Collection	80	13.2%
Personal Collection	79	13.1%
Friend, Peer, Associate	43	7.1%
Mechat. ed Information Service	21	3.4%
Distant Library	14	2.3%
Consultant	6	1.0%
Supervisor	2	.3%
Publisher, Bookstore	1	.2%
Seminars/Meetings/Conferences	0	0.0%
Other	53	8.7%
	604*	100.0%

*Does not include Support personnel

TABLE 5

Summary of Preferences for Various Formats

FORMATS	RESPONDENTS	PERCENTAGE
Technical Reports	243	34.8%
Journals	114	16.3%
Handbooks and Manuals	62	8.9%
Abstract Journals	61	8.7%
Computer-Generated Bibliographies	58	8.3%
Personal Conversations	47	6.7%
Books	33	4.7%
Published Bibliographies	15	2.1%
Management Reports	13	1.9%
Reviews/State of the Art Papers	9	1.3%
Commercial Brochures	8	1.2%
Numeric Data	5	.7%
Current Awareness	3	.4%
Other	27	3.9%
	698	99.9%*

*Rounding errors

TABLE 6

Number and Percentage of Respondents
Choosing Various Media As Most Preferred

MEDIA	RESPONDENTS	PERCENTAGE
Printed Documents	588	84.2%
Verbal Communication	51	7.3%
Microfiche	20	2.9%
Computer Printouts	19	2.7%
Microfilm	11	1.6%
Charts	2	.3%
Punched Cards	1	.1%
Magnetic Tape	1	.1%
CRT	1	.1%
Other	4	.6%
	698	99.9%*

*Rounding errors

- The overwhelming majority of users are unaware of the costs of information services.
- The vast majority of those responding (80.3%) said they would prefer an SDI type of service they pay for that covers precise needs in specialty areas over a free service covering broad areas.
- 46.8% of those responding indicated that they currently subscribe to a service which "automatically provides information according to previously registered categories." Of these, 56.6% say that they pay for the service.
- A series of questions was asked in order to determine users' willingness to "trade off" between improvements in the aspect of service that they rate the lowest, and increases in cost. 73.1% of respondents reported that they would be willing to pay more for improved information services, while 26.9% say that they would not be willing to pay more. Of those who responded to questioning about how much more they would be willing to pay, 43.3% say that they would be willing to pay "just a little bit more," 24.9% indicate that they would be willing to pay "somewhat more," and 31.8% say that they would be willing to pay "a lot more."
- Respondents were then asked if they would be willing to wait longer if, as a consequence, they could receive improved services. 58.3% said no and 41.7% said yes. The predominant attitude among those who do say that they would be willing to wait longer is that they would only be willing to wait "a little bit" longer to improve the services they receive.

1.3.1.5 Evaluation of DDC Products and Services

Respondents who indicated that they were users of DDC were asked to compare DDC services in terms of six dimensions with a comparable service provided by another agency that the interviewee said that he used. The six dimensions were:*

Quantity of information provided
Quality of information provided
Response time
Currency of information provided ("up-to-dateness")
Medium in which the information is provided
Format in which the information is provided

Results indicated the following:

- There are no significant differences between DDC and other agencies on any of the six dimensions. Users perceive the services provided by the DDC and comparable agencies as approximately equivalent in meeting their needs in these respects.

*These six concepts are all defined in the Glossary at the end of Volume II of this Report.

- There were significant differences between those with Top-Secret classifications and those with Secret classifications on the quality and the currency dimensions. In both cases, those with Top-Secret clearances see the DDC services as .3 points closer to meeting their needs than do those with Secret clearances, even though DDC does not handle Top-Secret documents or information.

1.3.1.6 Awareness of DDC Services (Tables 7 through 10)

A series of questions was asked to determine the awareness of DDC users regarding specific DDC services.

- The best known DDC demand service is the Technical Report Program (known to 86.3% of respondents), which is followed closely in awareness by Report Bibliographies (75.6%). The other demand services are not nearly so well known as these two.
- 19.3% of DDC user respondents reported awareness of RBMT's. This figure appears high, since only five of these bibliographies were requested by users and delivered by DDC in 1975. However, the service is well publicized, especially to support personnel, who reported the highest awareness of this service. In any event, awareness of the service is not correlated with either current or predicted use.
- Among the subscription services, TAB is by far the best known, with 84.2% of respondents reporting awareness. TAB is followed by the DDC Digest, with 51.8% of users indicating awareness, and then by ADD (39.6%).
- 36.3% of DDC user respondents reported awareness of Current Awareness Bibliographies. This figure appears high in light of the fact that this service receives very limited publicity (and currently serves less than 4% of DDC user organizations). However, the name of the service, Current Awareness Bibliographies, calls to mind the generic term "current awareness." Therefore, it is probable that some respondents who subscribe to other services they know as "current awareness services" confused them with the DDC service and reported awareness of the DDC service. This fact has no significance regarding predicted use of Current Awareness Bibliographies.
- Questions about specific DDC services produced hesitancy and an apparent lack of knowledge of these services on the part of many DDC users. Only 61.8% of the DDC users were able to give meaningful responses to the question on awareness of specific DDC services. Many of the 38.2% who were not able to answer these questions know that they use DDC, but are not sure which of the information products and services that come to their attention are from DDC and which are from another agency.

TABLE 7

Number and % of DDC Users Who Reported Awareness And Preferences for Various DDC Demand Services

DEMAND SERVICE	RESPONDENTS AWARE* (%)	RESPONDENTS RANKING 1st (%)	RESPONDENTS RANKING 2nd (%)	RESPONDENTS RANKING LEAST USEFUL (%)	RESPONDENTS RANKING NEXT TO LEAST USEFUL (%)
Technical Report Program	290 (86.3%)	207 (63.1%)	39 (14.9%)	3 (2.0%)	0 (0.0%)
Report Bibliographies	254 (75.6%)	59 (18.0%)	107 (40.8%)	12 (7.9%)	6 (5.8%)
Scheduled Bibliographies	158 (47.0%)	8 (2.4%)	17 (6.5%)	22 (14.6%)	11 (10.6%)
R&T Work Unit Information System	157 (46.7%)	14 (4.3%)	43 (16.4%)	13 (8.6%)	12 (11.5%)
DDC Referral Service	148 (44.0%)	8 (2.4%)	10 (3.8%)	20 (13.2%)	14 (13.5%)
RDT&E On Line System	126 (37.5%)	24 (7.3%)	17 (6.5%)	16 (10.6%)	4 (3.8%)
R&D Program Planning	118 (35.1%)	4 (1.2%)	11 (4.2%)	16 (10.6%)	15 (14.4%)
IR&D	117 (34.8%)	3 (9%)	13 (4.9%)	16 (10.6%)	11 (10.6%)
DRIT	101 (30.1%)	1 (.3%)	2 (.8%)	11 (7.3%)	13 (12.5%)
DRIT-H	82 (24.4%)	0 (0.0%)	1 (.4%)	3 (2.0%)	12 (11.5%)
Defense R&D of the '60's and 1970	81 (24.1%)	0 (0.0%)	1 (.4%)	19 (12.6%)	5 (4.8%)
RBMT's	65 (19.3%)	0 (0.0%)	1 (.4%)	0 (0.0%)	1 (1.0%)
		328 (99.9%)**	262 (100%)	151 (100%)	104 (100%)

*N = 336
**Rounding errors

TABLE 8

Number and % of DDC Users Who Reported Awareness
And Preferences for Various DDC Subscription Services

SUBSCRIPTION SERVICE	RESPONDENTS AWARE* (%)	RESPONDENTS RANKING 1st (%)	RESPONDENTS RANKING 2nd (%)	RESPONDENTS RANKING LEAST USEFUL (%)	RESPONDENTS RANKING NEXT TO LEAST USEFUL (%)
TAB	283 (84.2%)	190 (71.4%)	28 (16.4%)	11 (11.1%)	3 (5.2%)
DDC Digest	174 (51.8%)	11 (4.1%)	56 (32.7%)	19 (19.2%)	6 (10.3%)
ADD	133 (39.6%)	26 (9.8%)	23 (13.4%)	14 (14.1%)	4 (7.0%)
Current Awareness Bibliographies	122 (36.3%)	21 (7.9%)	26 (15.2%)	6 (6.1%)	8 (14.0%)
TAB on Tape	79 (23.5%)	5 (1.9%)	4 (2.3%	23 (23.2%)	14 (24.6%)
Recurring Reports (IR&D)	76 (22.6%)	4 (1.5%)	7 (4.1%)	12 (12.1%)	3 (5.3%)
Recurring Reports (WUIS)	75 (22.3%)	4 (1.5%)	16 (9.4%)	1 (1.0%)	1 (1.8%)
Selective Dissemination of Information Software Packages	67 (19.9%)	4 (1.5%)	9 (5.3%)	11 (11.1%)	11 (19.3%)
Recurring Reports (Program Planning)	57 (16.9%)	1 (.4%)	2 (1.2%)	2 (1.2%)	7 (12.3%)
		266 (100%)	171 (99.9%)**	99 (99.9%)**	57 (99.9%)**

*N = 336
**Rounding errors

TABLE 9

Percentages of DDC Users Who
Reported Awareness of DDC Demand Services*

DDC SERVICES	SUPPORT	BENCH	MANAGEMENT
Technical Report Program	85.2%	44.6%	47.3%
Report Bibliographies	79.5%	36.7%	41.2%
Scheduled Bibliographies	78.4%	17.5%	20.1%
R&T Work Unit Information System	75.0%	16.9%	21.9%
DRIT	73.9%	3.9%	10.4%
RDT&E On Line System	63.6%	11.9%	17.6%
DRIT-H	63.6%	2.3%	7.9%
DDC Referral Service	63.6%	10.7%	25.8%
Defense R&D of the '60's and 1970	59.1%	1.7%	9.3%
IR&D	56.8%	7.3%	19.9%
R&D Program Planning	51.1%	13.6%	17.6%
RMBT's	46.6%	1.7%	7.5%

*N = 544

TABLE 10

Percentages of DDC Users Who Reported Awareness of DDC Subscription Services*

DDC SERVICES	SUPPORT	BENCH	MANAGEMENT
TAB	88.6%	43.3%	44.3%
DDC Digest	85.3%	14.3%	25.5%
ADD	77.5%	6.8%	18.4%
Current Awareness Bibliographies	70.6%	11.4%	13.8%
TAB on Tape	54.4%	5.7%	6.0%
Recurring Reports (WUIS)	53.9%	2.8%	7.7%
Selective Dissemination of Information Software Packages	50.5%	4.5%	4.9%
Recurring Reports (IR&D)	49.4%	4.6%	8.5%
Recurring Reports (Program Planning)	43.7%	1.7%	5.3%

*N = 544

- Users in DoD agencies are significantly more aware of DDC services than are users in DoD contractor organizations.
- Support personnel are often not aware of many of the DDC services. The percentage of support personnel who are aware of DDC services ranges from a low of 43.7% (for Program Planning Recurring Reports) to a high of 98.6% (for TAB).

1.3.1.7 Preference Among DDC Services (Tables 7 and 8)

Respondents were asked to rank the DDC subscription and demand services separately in terms of those that they found to be most useful.

- The Technical Report Program is by far the most popular of demand services, with 63.1% of respondents rating it most useful.
- Report Bibliography Service is a distant second in popularity, with only 18% of respondents choosing it as the most useful service.
- In a choice of second most useful, Report Bibliographies was ranked first (40.7% of respondents) and the R&T Work Unit Information System was ranked second (16.3%).
- Among the DDC subscription services, TAB received by far the most votes for first choice, with 71.4% of participants choosing it. ADD was next (9.8% of respondents selecting it as first choice).
- The DDC Digest was the second choice as most useful subscription service, with 32.7% of respondents.
- Lack of awareness was again revealed when respondents were asked to rank specific DDC services in terms of those that are most and least useful to them. Only 78.3% chose a second most useful demand service, 45.2% chose a least useful service and 31.3% chose a next to the least useful demand service. The pattern was similar for subscription services.

1.3.1.8 RDT&E Management Information System (Table 11)

A series of questions was designed to measure various aspects of users' perceptions of the RDT&E Management Information System (MIS)--WUIS, IR&D and Program Planning Reports.

- 22.8% of the DDC users interviewed reported using the R&T Work Unit Information System.
- 9.4% of all DDC users (16.9% of the DoD/DDC users) reported having used Program Planning Reports. (Only DoD personnel are permitted access to this service.)
- 7.7% of all DDC users (13.9% of the DoD/DDC users) reported that they used the IR&D data base. (Only DoD personnel are permitted access to the IR&D.)

TABLE 11

Number and % of DDC Users
Who Have Used WUID, IR&D
And Program Planning Reports

DDC SERVICE	OVERALL	BENCH	SUPPORT	MANAGEMENT
WUIS	124 (22.8%)	20 (11.3%)	52 (59.1%)	52 (18.6%)
IR&D	42 (7.7%)	4 (2.3%)	17 (19.3%)	21 (7.5%)
Program Planning Reports	51 (9.4%)	7 (3.9%)	20 (22.7%)	24 (8.6%)

N (Bench) = 177
N (Support) = 88
N (Management) = 279
N (Overall) = 544

- WUIS is used by a larger percentage of DoD researchers (30.9%) than contractors (12.8%). A majority of support personnel (59.1%) user WUIS. The same patterns of use by job type may be observed for Program Planning Reports and the IR&D data bases, with support personnel utilizing them more heavily than management and bench level respondents.

1.3.1.9 Information Analysis Centers (Table 12)

Percentages of support personnel using IAC's are relatively low overall, ranging from a low of 0.0% (Bathythermograph Data Processing and Analysis Facility) to a high of 42.0% (Infrared Information and Analysis Center). The average percentage for support personnel is 14.4%. These support percentages, however, are much larger than the percentages for bench IAC users (0.0% to 7.9% with an average of 1.3%) and management IAC users (0.0% to 7.9%, with an average of 2.7%).

1.3.1.10 User Training and Marketing

Respondents were asked if they felt that training programs on DDC services would be of help to them.

- 75.4% said that they thought such programs would help; 24.6% said no.
- Of those who expressed interest in such training, 91.8% said that they would make use of it, if it were available. Many spontaneously added the provision that training programs "...should not take too much time."

1.3.2 Current Problems in Information Use

In order to identify current problems regarding various aspects of information services, users were asked to describe their information search experiences along the six dimensions previously described for evaluation of DDC services.

- On the whole, respondents felt at least "mildly satisfied" with all aspects of information services which they currently receive, since the average scores on all six dimensions were on the positive side of the neutral point.
- A higher degree of problems were reported as experienced in terms of the dimensions of information quantity (amount), quality, response time and currency than in terms of the media and formats in which information appears.
- DoD agency personnel reported that the amount of information they receive comes closer to meeting their needs than did the DoD contractors.

TABLE 12

Percentages of DDC Users Who Have
Used Various Information Analysis Centers*

INFORMATION ANALYSIS CENTER	SUPPORT	BENCH	MANAGEMENT
Infrared Information and Analysis Center	42.0%	7.9%	7.9%
Metals and Ceramics Information Center	39.7%	3.4%	6.8%
Shock and Vibration Information Center	37.5%	2.3%	3.2%
Chemical Propulsion Information Agency	36.4%	1.7%	6.8%
Reliability Analysis Center	31.8%	.6%	5.0%
Nondestructive Testing Data Support Center	27.3%	.6%	4.3%
Thermophysical and Electronic Properties Information Analysis Center	26.1%	3.4%	3.6%
Plastics Technical Evaluation Center	25.0%	.6%	3.2%
DoD Nuclear Information and Analysis Center	19.3%	5.1%	4.6%
Mechanical Properties Data Center	18.2%	3.4%	4.3%
Electronic Properties Information Center	17.0%	0.0%	3.9%
Tactical Technology Center	13.6%	0.0%	2.9%
Machinability Data Center	10.2%	.6%	2.5%
Radiation Shielding Information Center	9.1%	0.0%	.7%
Physical Data Group, Lawrence Livermore Laboratory	7.9%	2.3%	1.8%
USAF Environmental Technical Applications Center	6.8%	0.0%	.4%
Environmental Information Division (Air Force)	6.8%	1.1%	2.9%
Strategic Technology Office Data Base	5.7%	0.0%	1.1%
Soil Mechanics Information Analysis Center	5.7%	.6%	1.4%
Coastal Engineering Information Analysis Center	3.4%	0.0%	0.0%
Concrete Technology Information Center	3.4%	0.0%	1.4%
Hydraulic Engineering Information Analysis Center	2.3%	.6%	.3%
Pavements & Soil Trafficability Information Analysis Center	2.3%	0.0%	1.1%
Chemical Kinetics Information Center	2.3%	1.1%	1.4%
Data Collection and Processing Group, Scripps Institution of Oceanography	2.3%	.6%	2.5%
X-Ray Attenuation Coefficient Information Center	1.1%	.6%	0.0%
Institute of Polar Studies	1.1%	.6%	2.5%
Bathythermograph Data Processing and Analysis Facility	0.0%	0.0%	.4%

*N = 544

- Management personnel reported that the quality of information is further from meeting their needs than did bench level users.
- Management personnel reported less satisfaction than the support personnel thought they were experiencing. This discrepancy between management and support personnel indicates that support personnel see management as experiencing significantly more satisfaction than they actually do on this dimension. In addition, DDC users among management personnel reported less satisfaction than managers who do not use DDC services.
- Those with Top-Secret classifications reported less satisfaction with the currency of information than their counterparts with Secret classifications. It appears that there is a strong relationship between Top-Secret classifications and the individual researcher's need for up-to-date information.
- Support personnel perceive the managers and bench level users as more satisfied with the currency of information than they actually are. However, this discrepancy appears only among those with Top-Secret classifications.
- Bench level users reported somewhat more satisfaction with the format in which they receive their information than do management level users.

1.3.3 Predicted Requirements

The series of questions regarding the six dimensions of information services that were asked for 1975 were also asked retrospectively for 1970 and for the respondents' expectations for 1980. Trends across these three time periods were computed for each of the six dimensions.

1.3.3.1 General

- Approximately 25% of the users feel that improvements in quality and response time would be most useful to them. 17.9% feel that improvements in currency would be most useful, while 11.2% are most interested in increasing the quantity of information. Finally, about 9% see change in media and format as most useful. (Table 13)
- Management personnel are more often interested than are support personnel in improving quality, whereas support personnel are more interested in changing the media than are bench researchers or managers. Bench level researchers more often feel that improvement in currency would be most useful to them. (Table 13)
- In order to effect the improvement they would like to see by 1980, 87.7% of respondents said that they would be willing to pay more, while 12.3% said they would not be willing to do so. 37% would be willing to wait longer to receive information, but 63% would not be willing.

TABLE 13

Percentage of Respondents Reporting
The Dimension of Information Service
For Which Future Change Would Be Most Useful

DIMENSION	OVERALL*	BENCH	SUPPORT	MANAGEMENT
Response Time	24.9%	25.3%	25.3%	24.6%
Quality	24.7%	24.1%	14.7%	28.2%
Currency	17.9%	25.3%	13.3%	14.7%
Quantity	11.2%	9.8%	10.7%	12.3%
Medium	9.8%	4.3%	28.0%	7.9%
Format	9.6%	8.6%	8.0%	10.7%
Combination of above	1.6%	2.5%	0.0%	1.6%
	99.7%**	99.9%**	100.0%	100.0%

*N = 665
**Rounding errors

- 50% of the respondents said that they would be willing to pay for a service that is matched precisely to their needs. Of this group, the percentage of DoD contractors was higher than that of DoD researchers (40.3% vs. 18.3%).

1.3.3.2 Remote On-Line Retrieval Services

- 59.2% of DDC users are currently unfamiliar with remote on-line services even though remote on-line retrieval systems appear to be the "wave of the future." 40.8% reported that they had heard about the possibility of on-line information services, but only 20.9% said they have used such a system.
- There is a striking lack of familiarity with the DDC RDT&E on-line system (DROLS) except among the support personnel (75% vs. 18.4%).
- DoD researchers (32.6%) are more familiar than contractors (20.6%) with DROLS.

1.3.3.3 Future Demand for DDC Services

Past records of DDC activity were analyzed in order to estimate potential future demand upon DDC for various categories of service. System records were analyzed separately at yearly intervals for each category of service. Records were utilized as far back as the criteria for recording of input and output volume of a particular DDC service remained unchanged.

- Technical Reports

  System records for Technical Report output were analyzed from FY 1972 to FY 1975. Data prior to 1972 were excluded, because DDC introduced charges for services in FY 1972, thereby affecting user behavior and making comparisons between pre- and post-1972 system records misleading. Inspection of these system records reveals that output for Demand Technical Reports is lower in recent years relative to Automatic Document Distribution (ADD). Changes in both hard copy and microfiche Demand Technical Reports have been erratic, suggesting a slight absolute decrease relative to ADD; that is, the proportion of Technical Reports delivered on demand has been decreasing. Because of the erratic pattern here, no predictions were made for Demand Technical Reports.

  In 1972, DDC delivered 168,855 technical reports as part of the ADD Program. In 1973 the total was 207,274; in 1974 343,882 and in 1975 382,358. The method of least squares was applied to the data points to determine the "best fitting" curve or straight line. Then output for future years was forecast on the basis of extrapolation from this best fitting line. It should be noted here that the accuracy of forecasting based on this approach is limited by the assumptions that are made.

For example, it is assumed that no additional variables will be introduced in the future. If one assumes no other extraneous variables (such as in DoD RDT&E programming or budgeting), then a reasonably accurate prediction can be made. Using this approach, the best prediction for the 1988 level of demand for ADD Technical Reports is 882,546. This prediction is based on FY 1974 and FY 1975, because including 1972 and 1973 would have produced unreasonably high predictions. In other words, it is believed that the sudden increases for 1972 to 1973 and from 1973 to 1974 are not representative of future annual changes. The sharp increases during these years may be partly a result of user readjustment after the policy and price changes in 1972.

- Current Awareness Bibliographies

  Starting with 2,399 Current Awareness Bibliographies in 1970, the demand rose to 14,683 in 1974. Of all the system records, this service came closest to departing from a straight line. Several curved line functions, such as parabolic and exponential, were fit to the data, but all yielded unrealistically high predictions. It is recognized that this service is currently not generally available to all DDC users. However, if limitations are removed, demand could well exceed predictions based on extrapolations from a straight line that excludes the first two years of system record keeping. Therefore, a "best fitting" line was determined for 1972 through 1974, and forecasting was based on these three points. Predictions for 1976 are 23,933 and for 1988, 82,933.

- Defense RDT&E On-Line System (DROLS)

  It is predicted that on-line remote services will reach 360,600 searches by 1988. However, the sudden recent increase in usage of DROLS from 1973 to 1974 makes predictions less accurate and stable than would be the case were data available over a longer period of time. Therefore, predictions for DROLS may be less accurate than the other predictions advanced in this report. Specifically, predictions for DROLS may underestimate future levels of user demand. Because of this, DROLS is predicted to be among the DDC services with heaviest demand.

- Management Information Services

  System records for usage of the management information data bases are extensive and provide five separate but related forecasts of future demand. IR&D output (demand reports produced in batch mode) is expected to increase about 70% by 1988 if the present rate of growth continues. Similarly, Program Planning Reports batch output may increase 25%, Work Units batch output by 50%, and Work Units changes (transactions) by 50%.

  These predictions show that future levels of demand for management information services will rise steadily. Even though input to the Work Unit data base will most likely remain stable, services that are derived from these data bases will increase.

In summary, significantly increased demand is predicted for three categories of currently-provided DDC services:

- Current Awareness Bibliographies (assuming unlimited availability)
- DROLS
- RDT&E management information services

These predictions are particularly interesting, since (a) Current Awareness Bibliography service is not well-advertised by DDC, and (b) the other two services were introduced relatively recently.

1.3.4 Predicted Problems

Respondents were asked about their experience in gathering information in 1970 and 1975, and about their expectations for 1980 in terms of the six dimensions (quantity, quality, response time, currency, formats, media).

- A clearcut pattern emerged showing a significant decrease in problems experienced in gathering information between 1970 and 1975.
- When users were asked to predict how close each aspect of service would come to meeting their needs in the future, there was a large and highly significant increase in problems anticipated in 1980.
- Using the method of least squares, extrapolations were made beyond 1980 to 1988. For each of the six dimensions, the result is a continued increase in anticipated problems through 1988.
- Quantity, quality, response time and currency were seen as most likely to be problems in 1980, while formats and media were seen as the dimensions least likely to be problems in 1980 (similar to results presented in Section 1.3.2 above).

1.4 SUMMARY OF CONCLUSIONS DRAWN FROM USER/POTENTIAL USER SURVEY

1.4.1 Conclusions Directed Toward Provision of Improved DDC Products and Services:

- The current and predicted needs for improved quality of information services point up the requirements for:
  (a) critically analyzed outputs (information analysis)
  (b) access to verified, factual data, both numeric and non-numeric

  In summary, DDC should move from a position of providing only bibliographic, document-oriented service to the provision of fact services and information services as well.
- There is continued reliance upon personal files, projected

increased demand for Current Awareness service, and preference for technical reports and journals in hard copy. These trends will require greater emphasis upon the human (i.e., behavioral, attitudinal) rather than the technological aspects of improved information service.

- The fact that those with Top Secret clearances saw DDC as coming closer to meeting their needs than those with Secret clearances highlights the importance of DDC as a source of classified information and justifies the continuation of its providing this information.

- The need for a thorough review and modification of the DDC RDT&E management information system is indicated by the findings that:

  (a) non-DDC management users reported more satisfaction in the information service they received elsewhere than DDC management users

  (b) management respondents reported more problems in accessing and using information than bench level respondents

  (c) support personnel ranked management user satisfaction higher than did these users themselves

- Almost half of the survey respondents utilize subscription service, but there is no indication that this will ever replace retrospective, demand search service, so DDC must continue to provide both modes of service. However, the volume of demand service for documents may decrease if DDC provides fact service and more ADD service.

- Demand for DROLS service may increase even beyond the high levels predicted in this report if DDC converts from leased line to dial-up mode. This will result in a significant burden upon DDC hardware.

- Two findings indicate that the abstract bulletin, TAB, could be phased out during the target period because, in the future, demand for Current Awareness and DROLS services will increase. If these demands are met, the usefulness of TAB will diminish.

- Improved access to Information Analysis Centers (IAC's) by bench level personnel is required, as indicated by the fact that support personnel are the chief IAC users, presumably to provide information to bench-level users in their organizations.

1.4.2 Conclusions Directed Toward Improved Management of the RDT&E Information Transfer Process:

- The problems and requirements reported in information currency and response time indicate that improved management of all aspects of both the S&TI and the RDT&E management information system is required, from information generation to end use.

- The fact that the local library is the overwhelming first choice of a source for information and that a "distant" library such as DDC is one of the last choices indicates that:

  (a) DDC should concentrate its efforts on serving end users through local librarians

  (b) increased decentralization and regionalization of DDC reference services is required

  (c) remote, on-site access devices, such as DROLS, will be welcomed

- The need for development and application of a value system for information services is highlighted by the fact that most users are unaware of the cost of information.

- The fact that users appear willing to pay for improved quality and reduced response time opens the way to developing an increased measure of accountability in the DoD RDT&E information transfer process.

- More behavioral research is required in developing improved information system outputs, since 77% of respondents reported some disadvantages in using even their preferred information formats.

- DDC must be even more concerned than other information transfer organizations (such as NTIS) with the rapid delivery of current information, especially if it is classified. This conclusion is based upon the finding that users with Top Secret classifications found the currency of the information they received less satisfactory than did those with Secret or lower level classifications. DDC is one of the few S&TI and RDT&E management information services that provide classified information.

1.4.3 Conclusions Directed Toward Improved Marketing of DDC Products and Services:

- The extremely low level of awareness of most DDC services (i.e., only 4 out of 22 DDC services are known to more than 50% of the respondents who are DDC users) among all classes of users indicates a need for improved user education programs targeted specifically toward demonstrating how DDC services can satisfy requirements of each class. Users indicated by a margin of 75% that they would welcome such educational programs.

- The importance of marketing of DDC services is emphasized by the fact that DDC Digest, a user education tool, was ranked as second most useful DDC subscription service.

- The DDC user population consists of a variety of strata, and each must be considered independently in the development of new products, services, processing modifications and marketing programs, etc. This fact is attested to by the low correlations between user types and responses to questions. Particular attention should be directed toward the delineation of information requirements of users by job type.

- DDC should continue to direct a significant portion of the marketing of its services toward DoD Contractors (i.e., continuation of the "contractor access program"), since more contractors than DoD respondents reported problems with the amount of information they had been receiving; also because fewer contractors than DoD personnel were aware of DDC services.

- The discrepancies between user satisfaction and support personnel perception of the degree of user satisfaction militates for the establishment of a user feedback system which will provide direct feedback from users without the intervention of support personnel, who would tend to act as filters.

SECTION II. INTERAGENCY ENVIRONMENT

This section defines DDC's scientific and technical information (S&TI) and the research, development, test and evaluation (RDT&E) management information system environment, and addresses related problems and issues. It protrays a role for DDC within an interagency environment external to DDC, including the interagency structure external to the Department of Defense (DoD) of which DDC is a part.

This interagency environment consists of independent and often insular agencies. Most have a limited, mission-oriented operating scope which focuses that agency's interests on specific groups of users, to the exclusion of others. However, taken together, the technical information agencies of the U.S. represent a vital national resource which ought to be fully utilized in national defense efforts.

The observations and conclusions discussed below are drawn from a survey of 14 Federal information processing agencies, selected for their current and potential relationships to DDC.* As a result of this survey, three general observations stand out:

1. The relationships between U.S. technical information agencies are complex and, for the most part, uncoordinated
2. Interagency cooperation and joint ventures are hindered by diversity of operating modes and conflicting objectives
3. The potential payoff to be achieved through harnessing the national information resources via networking and interagency interfacing is great

The current and projected interagency environment is discussed in detail below in terms of four parameters:

- Technology (automation and information handling techniques)
- Organizational Structures and Affiliations (interagency relationships)
- Economics and Marketing (costs, values and awareness programs)
- Scope and Nature of Services (trends in information services and products)

*A more detailed presentation of the data, methodology, and findings of the Interagency Survey is contained in DDC 10 Year Requirements and Planning Study: Interagency Survey Report. December 12, 1975. (AUER-2325/2326-TR-2; AD-A022 302)

2.1 TECHNOLOGY

Within the context of this discussion, "technology" includes all information handling techniques, particularly those involving automation.

2.1.1 Summary of the Technological Environment

The following are the most important characteristics of the projected technological environment for information processing:

- Information processing technologies which are currently available are not being fully exploited by the S&TI and RDT&E management information community.
- Inconsistency and lack of standardization in information processing, design and operations confound the potential for interagency interfacing. This creates a problem for users who are forced to be familiar with the complexities of a variety of information systems.
- Information technology has traditionally relied upon general purpose numeric data processing equipment. However, the information community is collectively large enough to influence technological development specifically for textual information processing.
- For some time to come, batch processing of large scale, centralized files will be an important mode of operation for the information community. But on-line interactive computer systems are becoming increasingly attractive from both the cost and service viewpoints. On-line and distributed processing operations are key elements of the trend toward decentralized systems. The divergent demands of centralized versus decentralized systems requirements are straining the capabilities of present systems.
- Software and design structures for logical segmentation and maintenance of large scale (10^{10} to 10^{15} bytes) files are in an elementary stage of development. Information scientists in all surveyed systems are looking for techniques to help structure the intellectual content of systems in ways corresponding to the probable use of the files and which are rather transparent* to the user.
- Controversy exists on the appropriate content of such structured files. The use of free text versus controlled vocabulary, the level of indexes, the storage and dissemination media for abstracts and full text, the value of data tagging and the use of special data banks rather than bibliographic citation files are unresolved issues.

---

*This term, as well as many other technical terms and terms used in specific ways, is defined in the Glossary at the end of Volume II of this Report.

2.2 ORGANIZATIONAL STRUCTURES AND AFFILIATIONS

2.2.1 Summary of the Interagency Organizational Environment

External to DDC, there is no unified, cohesive structure to the S&TI community, and this condition will persist for the target period, 1978 to 1988. The major information processing agencies are insular, and there is no interdependency of these agencies at the operating level. Limited, ad hoc interagency agreements have resulted in linkages which must be regarded as an economic necessity more than as an attempt to unify the community into a national network.

The DoD RDT&E management information structure is a tiered, hierarchical reporting mechanism, and this is quite different in nature from the S&TI environment. In this survey, the Army and Air Force indicated a preference for an RDT&E management information transfer process independent of DDC. The Navy prefers to operate through DDC in developing a system adapted to its RDT&E management information requirements.

Key issues affecting the organization of the future S&TI interagency environment and DoD RDT&E management information structure include:

- Prospects for a National Information System

  It is technologically feasible to develop a multidisciplinary national information system. However, a more logical alternative would be development of a national information "network" which would entail:

  - Adoption of standards for design and processing to allow logical integration and intersystem compatibility.
  - Formal interaction with resource sharing and system failure back-up provided by network members.

- Development and Adoption of Standards for Information Processing

  The major information agencies acknowledge the value to be derived from development and adoption of universal information processing standards. But no real support is found for compromising existing conventions without significant local advantage.

- Public vs. Private Rights to Information

  The emergence of a viable information industry and the issue of information as a public good raises serious concerns over property rights to systems software and information files. While this issue is unresolved, it will reinforce a natural tendency to insular operations - especially in the large, mission-oriented information centers with which DDC is most likely to interact in a cooperative interagency structure.

- Lack of progress in file design is evident in the development of management information systems. Data files of high reliability are critical for rational management decision-making. Principles of information system design for bibliographic systems have generally proved to be inadequate for management systems.
- Electronic communication for information retrieval requires flexibility and low cost. Both can be found in the "dial-up" type shared communications systems, e.g., ARPANET or Tymeshare, Inc. At the transmission/receipt ports, the trend is toward greater utilization of existing lines and the use of packet switching technology.
- Evolving computer technology offers the potential for complete data control for retrieval processes. Eventually (beyond 1988) the primary records as well as processing records and search files will be electronically stored. Then all types of in-information operations, including physical transport of materials in the distribution functions, will be supported through the use of machine-readable files combined with electronic communications.

2.2.2 DDC's Role with Respect to the Technology of Information Processing (1978-1988)

The information community has not yet fully exploited the potential for computer control and electronic telecommunication to support information processing and delivery functions. Consequently, it is recommended that DDC should be a leader in exploiting the state-of-the-art technologies, not only as utilized currently in the information community, but also as utilized by other industries with wide "retail-like" services. The objectives would be to bring fresh applications to system designs and to bring both S&TI and RDT&E management information services and products into more direct contact with DoD decision-making processes. This will involve the following successive steps:

- Development of a better understanding of RDT&E and S&TI decision processes
- Development of innovative services to contribute to enhancing those decision processes, using state-of-the-art technology
- Clarification of inadequacies in the state-of-the-art so that vendors and systems designers can jointly contribute to development of improvements
- Announcement of DDC plans and programs to upgrade information technology so that other agencies can benefit from DDC leadership and cooperate in solving problems of mutual interest

- The Relative Functional Roles of Centralized and Localized Facilities and Resources

  Localized facilities are expected to be a vital component of information-providing organizations for the foreseeable future. The majority opinion of those surveyed is that local facilities staffed by personnel trained in information retrieval techniques can provide end users with a higher quality of service than can a large, centralized facility.

- Development of a DDC/IAC Network

  Factual information of the type provided by Information Analysis Centers (IAC) must be made an integral part of the formal S&TI information transfer process. The military research directorates, NBS, and the agencies with national priority missions (NOAA, ERDA, etc.) report a need for linking IAC resources to bibliographic retrieval systems. DDC could add a new dimension to its S&TI information program by serving as the central point of contact in DoD for IAC/fact data.

- Coordination of the RDT&E Management Information Transfer Process

  DoD has a parochial RDT&E management information structure. The Army, Navy and Air Force each maintain a unique profile, with all three military RDT&E management information systems interfacing with DDC and the Office of the Director of Defense Research and Engineering (ODDR&E), while serving the needs of their own program managers and work unit supervisors. It appears that there is sufficient similarity in the objectives of the three independent military systems to consider central coordination at DDC.

2.2.3 Organizational Interface Between DDC and Other Information Agencies

DDC has two rather different roles to play in support of its RDT&E management information program, on one hand, and its S&TI program on the other hand. DDC is an integral part of the DoD RDT&E management structure, but there is virtually no formal relationship involving DDC with external S&TI agencies. Within DoD, DDC can function to improve the RDT&E management information system through coordination, system design, and operation. For the S&TI program, DDC's role is that of an intermediary agent to make external S&TI information resources more fully accessible to DDC users.

2.3 ECONOMICS AND MARKETING

In the current information environment, the value of information is subjective. Consequently, the economic system for measuring the information transfer process is artificial. In this environment, a marketing effort aimed at demonstrating the empirical usefulness of information products and services

becomes an essential function of an information agency.

2.3.1 Summary of Economic and Marketing Environment

The key characteristics of the economic and marketing environment in the information processing community are summarized as follows:

- Little is known about the true costs of information processing and the potential savings to be gained through effective information utilization
- Direct costs for automated technology, computer costs, in particular, are on a downward trend. Improvements in cost performance have resulted from cutbacks in human input requirements, use of special purpose mini-computers to do tasks formerly done on general purpose machines, better overall utilization in distributed networks, lower data storage costs, and lower per unit communications costs. Operating budgets, however, have tended to rise even beyond inflationary increases due to the introduction of new services.
- The surveyed agencies generally do not intend to recover costs of information storage and retrieval from users. In some cases, however, budget constraints have resulted in efforts to recover nominal costs or incremental costs from customers more as a demonstration of accountability than pure economic concern.
- Marketing efforts, including brochures, training manuals and other user awareness efforts, have had minimal success in those information agencies where they have been employed.

2.3.2 DDC's Role with Respect to Economic and Marketing Issues

DDC's economic role is to present DoD parent management with clear cost and technical alternatives in information programs. At this time, the cost of providing information is the only direct economic measure available, so DDC must be able to provide an estimate of benefit value for various levels of service in some subjective measure that can indicate the intrinsic worth of information to DDC users.

One part of DDC's marketing role is educational. Users need to be educated regarding DDC products and services. A program is needed to show how DDC services help DoD's technical staff, its contractors, and RDT&E managers do their jobs better and more efficiently. This must be done by providing examples, rather than general information.

Obtaining user feedback is also part of DDC's marketing role. As a marketing function, product development should be receptive to new ideas

presented by users. Users (including organizational users) who are heeded become strong information service supporters.

2.4 SCOPE AND NATURE OF SERVICES

The information services explored in the course of the Interagency Survey were those designed to serve scientists, engineers and also planners and managers in the RDT&E user community.

2.4.1 Summary of Trends in the Scope and Nature of Information Services and Products

DDC needs to broaden its scope of services and satisfy a wider range of DoD information needs. Related issues that surfaced in the Interagency Survey include:

- RDT&E Management Information Services
  - RDT&E management information services must be fundamentally different from those currently provided by DDC

    Traditional bibliographic information storage and retrieval techniques are insufficient for satisfaction of future RDT&E management information requirements: new concepts in information transfer are required. Fact retrieval and exception reporting to support management control functions are key elements of management information systems. The military RDT&E management information systems perform these functions, although each branch of the military has a unique system.
  - Information needs differ at various management levels

    A successful RDT&E MIS will:

    Support management control functions (requires accurate and reliable data collection)

    Support RDT&E program planners (requires data assimilation and inferential decision analysis models)

    Support top level administrators, including non-R&D administrators on an ad hoc basis (requires rapid access to volume data in a variety of files not necessarily in a single operating system)

- S&TI Services
  - Specialized data bases are needed for comprehensive S&TI

    There is a trend toward the development of specialized data bases of scientific information, consisting of factual data in computer storage, rather than citations to documents containing facts. Files such as the NBS National Standard Reference Data Files and unique files compiled by the IAC's

are characteristic of the special data bases that are emerging. It is expected that technical data files will develop as independent scattered files that become known within a relevant field. Mergers will be a first step toward central management, properly coordinated in more than one network. Finally, standards will be established for standardized data reporting.

- National information agencies included in the survey provide comprehensive S&TI

  DDC's sole reliance on DoD technical reports for its S&TI data base is at variance with the policies of most of the agencies surveyed. A trend to broaden the S&TI coverage of all key information agencies has been underway in recent years because R&D projects and priorities are not static, and R&D is becoming more multidisciplinary. Demands for comprehensive coverage of many disciplines and all forms of published information are reported by the agencies surveyed.

- Document delivery problems

  The problems of providing full text of documents to remote locations is a form acceptable to users are becoming increasingly difficult to solve. Currently, the only practical alternatives include the use of extensive remote collections (e.g., local libraries) or central microfilm and hard copy collections distributed by U.S. Mail -- both are inadequate. User dissatisfaction is expected to increase as information handling is improved and the time span between the completion of search and retrieval activity and document delivery widens.

2.4.2 DDC's Role with Regard to its Scope and Nature of Services

DDC has a twofold role with regard to its scope of services.

- DDC should broaden the context of its present services to respond to a wider spectrum of DoD technical and management information needs. To accomplish this, DDC must find means of incorporating open literature, fact services, and specialized information resources into its scope of services.

- DDC must work toward the development of fact systems, and ultimately toward decision-making services for both the S&TI and RDT&E management information programs.

SECTION III. INFORMATION TECHNOLOGY ASSESSMENT FOR 1978-1988

This section discusses projected future developments in information technology which are expected to affect DDC planning for the period 1978-1988. These "projected future developments" are derived from a review of potential events affecting information transfer, by a series of expert panels selected and convened by AAI as described below.

3.1 PURPOSE AND METHODOLOGY OF THE EXPERT PANEL REVIEW

The Expert Panel Review task of this project was used by the AAI project team to formulate a set of reasonable time-phased assumptions about future information technological, organizational, and economic factors. For this review, the results of a Literature Survey, an Interagency Survey and an internal review of DDC plans and operations were converted to a select list of future events that are expected to be especially relevant to the DoD RDT&E information processing and user communities.

The method used by AAI to conduct the Expert Panel Review was a modified composite of two Delphi-like approaches: (a) the SEER (System for Event Evaluation and Review) approach developed and employed for technology assessment by Bernstein, et al* of the Naval Supply Systems Command, and (b) the Probe II methodology of the TRW Corporation employed by North and Pyke.** AAI's composite methodology consisted basically of these four steps:

- Development of a compendium of factual data and potential events, and distillation of these data into an original Events List.
- (Round I) Evaluation of this original Events List by experts involved in information transfer at the R&D, operations and product planning levels.
- (Round II) Modification of the Events List based on the results of Round I, and re-evaluation of this new Events List by a second panel of specialists in information technology (Round IIA) and individuals in influential positions who are concerned with long range information science planning and administration (Round IIB).

---

* Bernstein, G.B. et al. A Fifteen Year Forecast of Information Processing Technology. Final Report. Naval Supply Systems Command, Jan. 20, 1969. (AD 681 752).

** North, H.Q. and Pyke, D.L. "Probes of the Technological Future." Harvard Business Review, 47(3):68-82, May-June 1969.

- Analysis of results; description of the state-of-the-art; definition of potential alternative short, mid-, and long-range goals; and identification of events necessary or desirable to support these goals.

For a listing of panel members involved in Round I and II, see the Appendix of Volume II of this Report.

3.2 INFORMATION TRANSFER 1978-1988

Data were collected for fifty events representing the four areas of information transfer considered by this study:

- Technology
- Organizational Structures and Affiliations
- Economics and Marketing
- Services

Each event was considered by the experts in terms of its importance, desirability,* feasibility,* and probable timing. The individual reactions of the experts to each event were averaged to give a composite rating that was used for the overall analysis in comparing events against each other. This section describes the future information transfer environment as pictured in the findings of the Expert Panel Review.** Three time phases will be referred to in the following text: short range (before 1985), mid range (1985 to 1995), and long range (beyond 1995). The evaluations of the specific events are shown in Tables 14 to 17. Findings and trends are summarized below.

3.2.1 Technology

3.2.1.1 Computer Hardware

Large scale, general purpose computers will continue to be utilized for bibliographic as well as other types of storage and retrieval in the next decade. It appears quite unlikely (as well as basically unnecessary) that specialized computer systems will be designed specifically for bibliographic applications.

---

*These terms are defined in the Glossary at the end of this Report. "Importance" is expressed as a percentage of experts who designated the event "important."

**A more detailed presentation of the data, methodology and findings of the Expert Panel Review is contained in DDC 10 Year Requirements and Planning Study: Expert Penal Review Report. December 31, 1975. (AUER-2325/2326-TN-5; AD-A022 303)

TABLE 14

Evaluation of Technological Events

EVENT	IMPORTANCE	TIMING
Most Desirable and Most Feasible		
1. Most technical information retrieval by dial-up communication lines	59%	1983-1986-1990 (M)
2. Facsimile transmission competitive with postal service in cost	50%	1981-1987-1995 (M)
3. Paper will be replaced as primary numeric storage medium by digital media	77%	1981-1988-1995 (M)
4. OCR able to convert any document to machine readable form	70%	1980-1989-2050 (M)
5. Word processing equipment making available machine readable full text	68%	1981-1985-1994 (M)
Most Desirable and Moderately Feasible		
6. Machine readable storage media competitive with paper	70%	1982-1990-2071 (M)
7. Files electronically transferred between different locations at low cost	68%	1982-1989-1996 (M)
8. Commercial software packages replacing most original software development	46%	1983-1987-1994 (M)
9. Most packaged software machine independent	66%	1983-1990-2080 (M)
Moderately Desirable Most Feasible		
10. Machine readable storage competitive with microfilm	66%	1982-1991-2003 (M)
11. Peripherals with m will take over many automated fun ns	40%	1979-1983-1987 (S)
12. Interactive computer terminals available for $500	60%	1980-1983-1986 (S)
13. High quality, low cost microfilm reader-printer available	55%	1979-1984-1988 (M)
14. Paper replaced as document storage medium by microforms	44%	1980-1988-1994 (M)

S = < 1985 M = 1985-1995 L = > 1995

TABLE 14

Evaluation of Technological Events (Continued)

EVENT	IMPORTANCE	TIMING
15. Automatic monitoring built into retrieval systems	34%	1976-1981-1984 (S)
16. Paper replaced as numeric dissemination medium by digital media	74%	1984-1994-2003 (M)
Least Desirable and Most Feasible		
17. Paper virtually replaced as a numeric dissemination medium by microform	46%	1982-1988-1994 (M)
Moderately Desirable and Moderately Feasible		
18. Associative memories commonly used for machine-aided fact retrieval	55%	1982-1992-2000+ (M)
19. "Personal" interactive terminals very common	67%	1983-1993-2013 (M)
20. Paper replaced as document storage medium by full text digital media	44%	1985-1997-2014 (L)
21. Acceptable machine generated index data	78%	1980-1986-1998 (M)
22. Tutorial features of on-line systems making intermediaries unnecessary	58%	1981-1988-1996 (M)
Moderately Desirable and Least Feasible		
23. Associative memories commonly used in machine-aided retrieval	44%	1984-1995-2000+ (M)
Least Desirable and Moderately Feasible		
24. Paper replaced as document dissemination medium by microform	34%	1981-1990-1998 (M)
25. Paper replaced as numeric storage medium by microform	46%	1981-1988-1992 (M)
Least Desirable and Least Feasible		
26. Computers designed specifically for bibliographic storage and retrieval	20%	1980-1984-1988 (L)
27. Paper replaced as document dissemination medium by full text digital media	65%	1989-2003-2023 (L)

TABLE 15

Evaluation of Events Relating To Organizational Affiliations

EVENT	IMPORTANCE	TIMING
Most Desirable and Most Feasible		
28. Standardized citation formats	71%	1979-1982-1986 (S)
29. Standardized abstract formats	64%	1980-1982-1986 (S)
Most Desirable and Moderately Feasible		
30. Standardized user protocols for on-line retrieval systems	68%	1983-1989-2000+ (M)
Moderately Desirable and Most Feasible		
31. Two levels of information providers - wholesalers/retailers	43%	1977-1980-1985 (S)
Moderately Desirable and Moderately Feasible		
32. Unnecessary data base duplication eliminated	64%	1979-1983-1993 (S)
Moderately Desirable and Least Feasible		
33. Standardization allowing user organizations to merge data bases into a single file	61%	1987-2000+-2000+ (L)
Least Desirable and Moderately Feasible		
34. Decentralized input processing for large IS&R systems	36%	1981-1988-2000 (M)
Least Desirable and Least Feasible		
35. One interdisciplinary subject vocabulary	57%	1983-1993-2000 (M)

TABLE 16

Evaluation of Economics and Marketing Events

EVENT	IMPORTANCE	TIMING
Most Desirable and Most Feasible		
36. Facsimile transmission competitive with postal service in cost	60%	1981-1987-1995 (M)
Moderately Desirable and Most Feasible		
37. Interactive computer terminals available for less than $500	60%	1980-1983-1986 (S)
38. High quality, low cost microfilm reader-printer available	55%	1979-1984-1988 (M)
Least Desirable and Least Feasible		
39. Federal technical information services to become self-supporting	36%	1982-1987-1992 (M)

TABLE 17

Evaluation of Events Relating To Services

EVENT	IMPORTANCE	TIMING
Most Desirable and Most Feasible		
40. Accessibility of many data bases through a single terminal	73%	1980-1986-1994 (M)
Most Desirable and Moderately Feasible		
41. Major IS&R systems allowing choice of output	38%	1982-1988-1997 (M)
42. Researchers have access to data bases of factual, verified data	81%	1990-2000-2000+ (L)
Moderately Desirable and Most Feasible		
43. Interactive access to citation data bases replacing abstracts and indexes as searching tools	71%	1980-1986-1993 (M)
Moderately Desirable and Moderately Feasible		
44. Personal interactive terminals very common	67%	1983-1993-2013 (M)
45. Tutorial features of on-line systems making intermediaries unnecessary	58%	1981-1988-1996 (M)
46. Interactive access to full text data bases replacing abstracts and indexes as searching tools	94%	1986-1997-2013 (L)
Moderately Desirable and Least Feasible		
47. Information synthesis and analysis available to all researchers	71%	1984-1991-2003 (M)
Least Desirable and Moderately Feasible		
48. Processing of numeric data at least equal to the processing of bibliographic information	44%	1980-1985-1989 (M)
Least Desirable and Least Feasible		
49. Dissemination of full text of documents precluding need for abstracts as announcement devices	36%	1986-1993-2004 (M)
50. Dissemination of full text of documents precluding need for abstracts as retrieval devices	50%	1985-1991-1998 (M)

Complete electronic control over information processing operations is desirable. The feasibility of complete control is questioned by the experts. However, at least partial control over sub-functions is increasingly going to involve automation. The probability that technological growth will be piecemeal implies that systems will soon enter a developmental phase favoring decentralization and distributed processing.

Already emerging are new applications in peripherals which may be especially adapted for bibliographic and full text processing, notably optical character recognition (OCR) input devices and word processing equipment. It is unlikely, however, that either input process will be widespread before the late 1980's due to human engineering problems, incompatible equipment produced by different manufacturers, lack of standardization, unwillingness of potential buyers to commit funds, and general unsureness as to exactly how to use such equipment most effectively, were it to be acquired. Automatic text input devices are seen as potentially desirable and only slightly ahead of the current state-of-the-art.

Another possible and quite controversial development in peripherals is the inexpensive "personal" interactive computer terminal. Many experts see this as only a potential burden on any researcher who then would presumably be expected to perform his information searches himself, rather than rely upon a trained intermediary. Other information professionals foresee favorable effects of such a device, including possibilities for teleconferencing. Whether or not the "personal" terminal becomes a reality, however, interactive terminals will proliferate and become more available to all researchers in the next decade. Interactive terminals and other types of peripherals may also be coupled with minicomputers (and eventually, microcomputers) resulting in "intelligent" terminals, with applications such as data manipulation, intermediate data processing, and local data control.

3.2.1.2 Computer Software

In software, machine independence is seen as a trend favorable to enhanced information processing. However, it is regarded as a mid-range achievement, delayed into the 1990's by inherent inefficiencies of machine independent software.

Purchasing of software packages is seen as a desirable alternative to de novo programming. Packages with monitoring and tutorial features for on-line interactive systems can be available in the short range. The development of useful commercial packages is regarded as feasible if DDC or similar influential agencies could define their requirements in this area and thus offer an incentive to potential vendors to develop such packages. The importance of on-line tutorial assistance is linked to the growth of personal interactive search services.

3.2.1.3 Communications

Total electronic point-to-point communication is seen as highly desirable. For example, the event ranked highest in importance by the experts was "interactive access to full text data bases replacing abstracts and indexes as searching tools." Supporting events leading toward that all encompassing, long range event show a set of short and mid range achievements including widespread availability of computer terminals, broader use of dial-up communication systems, electronic file transfer at reasonable cost and facsimile transmission of supporting material.

3.2.1.4 Information Storage and Dissemination Media

Microform will be the prime storage medium for large bibliographic files for at least the next decade. Beginning in the 1980's, machine readable digital storage will begin to be cost competitive with paper and microform. Gradually, digital, machine readable file storage will replace present day file techniques. The probable sequence will be numeric data files first, then bibliographic surrogate files (indexes before abstracts), and ultimately full text files. However, the opinion of the members of the Expert Panel is that no media will ever completely replace or be more acceptable than paper. Therefore, DDC should always consider ways that permit individuals to select or regenerate paper copy from bibliographic system output files.

3.2.2 Organizational Structures and Affiliations

Events relating to standardization are regarded among the most important and as most desirable and feasible, with standardization of citation data somewhat more feasible than standardization of abstracts. However, there is a counter influence, indicated in several events, that dictates a

preference for independent operations. For example, standardized vocabularies and merged data bases are regarded as relatively unimportant and only moderately desirable. Consequently, standardization should not be viewed as part of a move toward coalescence into some form of a consolidated national system, but rather as a matter of common interest to facilitate interagency communication and information exchange.

Similarly, information processing organizations acting exclusively as either "wholesalers" or "retailers" is an unlikely and undesirable event. Technological and applications gaps will prevent adequate direct service to users from being provided exclusively from remote, central information resources. Thus, for the foreseeable future, large processors, such as DDC, must function with a structure that permits and encourages smaller or more specialized information agencies to deal directly with users, even if the central agency elects to provide some "retail" services directly to users.

Frequent and intensified cooperative efforts are forecast as desirable and feasible, particularly among agencies with complementary capabilities. For example, DDC's cooperative efforts with NASA and its plans to utilize the ARPANET to broaden its service range were cited as favorable developments.

On the questions involving interactions of data bases, "independence with cooperation" was predicted to be the predominent characteristic. Feasible events point toward development of algorithms and methodologies for translating between different data formats, thus ensuring a workable measure of compatibility without rigid interagency standardization.

3.2.3 Economics

3.2.3.1 Costs

Cost factors are not inherent barriers to advancing information technology. Notably, no event directed at cost issues was rated among the top 20% in importance by the experts, regardless of the level of desirability and/or feasibility. Naturally, downward cost trends were regarded as desirable. In fact, downward costs are forecast because of increased production and more widespread use of digital technologies which will result in lower costs per unit for hardware and software (in terms of current dollars). Communications costs will also drop, although not indefinitely.

However, conjecture suggests that lower costs and more efficient hardware are insufficient and possibly inappropriate objectives as such for the information community. The essential problems of intellectual information transfer are identified as the "important" gaps in information technology. System design problems involving machine-machine interface, man-machine interface and interorganizational interaction are consistently highlighted by the experts. More sophisticated, total, and human sensitive design concepts are required than have been employed to date. Given these circumstances, priorities for information R&D funding ought to emphasize projects directed toward these areas.

3.2.3.2 Source of Funding for Information Services

That Federal technical information services become self-supporting is regarded as undesirable and unfeasible. Both R&D funding and operating costs are likely to require at least partial subsidy. The perception of a relationship between information services and accrued benefits is, at best, tenuous. Thus, efforts to achieve total cost recovery are likely to retard experimentation with new concepts and services at a time when such experimentation is seen as essential to real progress in information processing technology.

3.2.4 Services

Events directed toward identifying conceptual gaps in the nature of information services were rated highest in importance by the experts. However, it is disappointing (as well as enlightening) that the panels were very pessimistic about the prospects for bridging these gaps before 1995.

Three conclusions can be drawn:

- Access to complete information is needed (surrogates are only useful as intermediate tools)
- Information access must be interactive to allow for search information and refinement
- Researchers need improved access to factual, verified data

3.2.4.1 Accessibility to Information Resources

All expert panelists stressed the need for users to have comprehensive access to information resources. It is desirable and feasible that the

access to comprehensive information stores appear direct and "simple" to the user. While many events imply that in the long range, total electronic control and manipulation of information processes will provide the means for accomplishing widespread and comprehensive accessibility, the human intermediary is seen as essential to be able to translate man-machine communications, and to act as a logical connecting node in an accessible, but complicated technical information environment which will persist into the 1990's.

Also important is the ability to pursue an interactive search strategy. Broad accessibility is implied by comprehensive addressibility. Precise accessibility is provided by iteration. Thus, an interactive type of information system is the most preferred mode of operation. Interaction can exist at several levels. It usually is taken to refer to the ability of a terminal user to address and define succeeding subsets of a master file via man-machine dialog. More sophisticated interaction can involve machine-to-machine interaction and inter-file interaction (e.g., use of multiple files accessed in a number of independent locations) on an ad hoc basis.

3.2.4.2 Fact Services

The most conspicuous gap in information services, according to the Expert Panels, is the provision of fact information services. "Fact information" includes numeric values and also pieces of discrete data capable of satisfying inquiries without further reference. The technology is predicted to be capable of supporting such a service, and it is rated most desirable and extremely important, yet the probable timing places this as a mid- to long-range event.

This event must be regarded as a high-payoff area for DDC to pursue. There appears to be no explanation for the lack of progress in fact services other than neglect on the part of the information planners and designers.

3.2.4.3 Information Analysis

Information analysis, like fact retrieval, is an extension of information service that goes beyond the provision of citations and document retrieval. This, too, is an event that was regarded by the panels to be "important." However, it is interesting that it was considered to be only

"moderately desirable" and "least feasible" as a service for "all researchers." It appears that information analysis is a service to be offered judiciously.

Alternative interpretations inferred from these results suggest two DDC options. DDC can build on its present referral service and become a centralized referral center for information analysis. This option requires that DDC be able to provide expert consultation on the various capabilities of information analysis centers.

A second alternative is for DDC to sponsor or establish and maintain an information analysis center covering subjects of general interest or multidisciplinary fields not adequately provided for by the specialized information analysis centers currently sponsored by DoD.

3.3 SUMMARY

The basic trends in information transfer for the years 1978-1988 are highlighted as follows:

- Important General Trends
  - Scientific bibliographic information systems are following a trend that will eventually result in a comprehensive, international, cross-disciplinary and integrated data resource that will be accessible to individuals through single access points.
  - The highest payoff area for increased scientific and technical information service is in supplying factual data services.
  - Information analysis services will be an increasingly important component of total technical information systems.
  - The gaps in information services and products are not in technology, per se, but in the application of that technology to the satisfaction of user needs.
  - The application of electronic devices to the control and manipulation of information and data is a dominent trend. The particular devices themselves are basically of incidental importance. It is the applications techniques for information handling that facilitate total electronic control of technical information processes that are among the most important matters to be resolved.
- Technology
  - Large computers designed specifically for textual information processing are unlikely. Peripheral and decentralized special purpose units, however, are desirable and feasible.

- Complete electronic control over information processing operations is desirable.
- Electronic storage and dissemination media will virtually supplant microform media.

- Organizational Structures and Affiliations
  - Interorganizational cooperation and standardization is fundamental to the advancement of information processing technology.

- Economics
  - Cost alone is not a barrier to the advancement of information processing technology.

- Services
  - New concepts in service are seen as highly desirable and feasible but a perplexing pessimism exists concerning the ability of the information community to develop them.
  - Widespread accessibility to many data bases is a highly desirable objective.
  - Provision of fact services is a conspicuous gap in current information services.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Abramson, Norman and Franklin F. Kuo, eds. Computer-Communication Networks. Prentice-Hall, 1973.

2. Anderla, J. Georges. The Growth of Scientific and Technical Information: A Challenge. Lecture and Seminar Proceedings. NSF, Jan. 1974.

3. _____. Information in 1985. Organization for Economic Cooperation and Development, 1973.

4. Anderson, William S. et al. "Where Are We Going with Future Technology?" Data Management, 13:19, 20, January 1975.

5. American Society for Information Science. "An Investigation of Planning Requirements and Priorities of the Scientific and Technical Information Community; Summary of Project Activities to Date." April, 1975.

6. _____. "Questionnaire on the Planning Requirements of the Scientific and Technical Community."

7. Applied Communication Research, Inc. Innovation in the Dissemination of Scientific and Technical Information. Prepared for National Science Foundation, April 1975. dist. by NTIS. (PB-244 333)

8. AUERBACH Associates Inc. DDC Organization, Administration, Operations, and Budgeting: Current and Planned. November 17, 1975. (AUER-2325/2326-TR-4)

9. _____. DDC 10 Year Requirements and Planning Study: Expert Panel Review Report. December 31, 1975. (AUER-2325/2326-TN-5; AD-A022 303)

10. _____. DDC 10 Year Requirements and Planning Study: Interagency Survey Report. December 12, 1975. (AUER-2325/2326-TR-2; AD-A022 302)

11. _____. DDC 10 Year Requirements and Planning Study: Literature Survey Report. October 17, 1975. (AUER-2325/2326-TN-2; AD-A022 301)

12. _____. DDC 10 Year Requirements and Planning Study: Survey Plan. August 15, 1975. (AUER-2325/2326-TR-1; AD-A022 300)

13. _____. DDC 10 Year Requirements and Planning Study: Survey Results Report. March 14, 1976. (AUER-2325/2326-TR-3; AD-A022 304)

14. _____. Evaluation of On-Line Bibliographic Retrieval System Usage, With Special Reference to CIRC II: A Literature Review. Submitted to Foreign Technology Division, Wright-Patterson AFB, Dayton, Ohio, November 8, 1974. (AUER-2242-TN-2)

15. _____. Technical Note: Expert Panel Review Report. December 31, 1975. (AUER-2325/2326-TN-5)

16. _____. Technical Note: Interagency Survey Plan. July 21, 1975. (AUER-2325/2326-TN-1)

17. AUERBACH Publishers, Inc. "Five Year Technology Forecast." Data Processing Manual, 6-02-01, 1974.

18. Bernstein, George B. A Fifteen-year Forecast of Information Processing Technology. Final Report. Naval Supply Systems Command, Jan. 20, 1969. (AD 681 752)

19. Blue, Joseph L. Proceedings of the Meeting of Managers and Users of the Department of Defense Information Analysis Center, Held at Army Materials and Mechanics Research Center, Watertown, Mass. 18-20 September 1973, dist. by NTIS, Nov. 1973. (AD-A008 289)

20. Bowers, Dan. "Revolution, Not Evolution." Modern Data, 8:58, February 1975.

21. Capital Systems Group. Developing a Planning Guide for Innovation in the Dissemination of Scientific and Technical Information: Final Report of Phase 1. Submitted to the Office of Science Information Service, National Science Foundation, March 31, 1975. (PB-243 469)

22. Chiaraviglio, Lucio, and John Gehl. "Some Notes on the Planning of Research in the Information Disciplines." In: Zunde, Pranas, ed. Information Utilities: Proceedings of the 37th ASIS Annual Meeting, Vol. 11, Atlanta, Georgia, October 13-17, 1974. ASIS, 1975. pp. 202-207.

23. Committee on Information Hang-Ups. Especially DDC: Users Look at the DoD Information Transfer Process. January 1975. (AD-A005 400)

24. "Communications News Facsimile Buyer's Guide" Communications News, 9(2):30-31, February 1972.

25. Criteria for Evaluating Forecasts. Principal investigator: Thomas W. Melburn. Psychology Department, Northwestern University (Evanston, Illinois). Prepared for the Office of Naval Research, May 1969. (AD 696 091)

26. Cuadra, Carlos A., ed. Annual Review of Information Science and Technology. Vol. 9. ASIS, 1974.

27. Dammers, H. F. "Progress in Documentation; The Economics of Computer-Based Information Systems: A Review." Journal of Documentation, 31(1):38-45, March 1975.

28. Datamation, 20(3), March, 1974. (networking issue)

29. David, Jon R. "Microcomputers." In: Waldron, Helen J. and F. Raymond Long. eds. Innovative Developments in Information Systems: Their Benefits and Costs. Proceedings of the American Society for Information Science, Vol. 10. 36th Annual Meeting, Los Angeles, Calif., Oct. 21-25, 1973. Greenwood, 1974. pp. 41-42.

30. Decisions and Designs, Inc. Automatic Data Processing Strategy Study. Volume 1: A Summary of the Findings. Prepared for General Services Administration, March 1975. dist. by NTIS (PB-240 903)

31. Defense Documentation Center. DDC Long-Range Objectives FY 76 Through FY 86. April 4, 1974.

32. _____. Defense RDT&E On-Line System Terminal Operator's Manual. Defense Supply Agency, June, 1975. (DSAM 4185.13)

33. _____. Independent Research and Development Data Bank Input Manual. Defense Supply Agency, June 1973. (DSAM 4185.9)

34. _____. Magnetic Tape Dissemination Reference Manual. Defense Supply Agency, April 1973. (DSAM 4185.8)

35. _____. Organization, Missions, and Functions. Defense Supply Agency, March 1972 (as amended). (DDCM 5810.1)

36. _____. The Research Connection. (undated).

37. _____. Research, Development, Test, and Evaluation (RDT&E) Program Budget. Fiscal Years 1976/197T/1977. Defense Supply Agency, August 20, 1975.

38. _____. R&T Work Unit Information System Contractor Access Manual. Defense Supply Agency, July 1973. (DSAM 4185.6)

39. _____. R&T Work Unit Information System Report Format Catalog. Defense Supply Agency, October 1970. (DSAM 4185.2)

40. _____. R&T Work Unit Information System U.S. Government User's Manual. Defence Supply Agency, July 1972. (DSAM 4185.4)

41. _____. Selected Management Data Concerning the Defense Documentation Center. Pamphlet. (undated)

42. _____. Services Available to Federal Organizations and to their Contractors, Subcontractors and Grantees. 1974.

43. _____. Summary Management Data Report. Office of Planning and Management. Defense Supply Agency, June 1975. (RCS DDC(M)2)

44. _____. Two Year Development Plan. Fiscal Years 1976, 197T, 1977. Defense Supply Agency, June 2, 1975.

45. _____. User's Guide to Defense Documentation Center Programs, Products, Services. November 1974. (DDC-ML No. 1)

46. Defense Supply Agency. User Guide for DSA-Administered DoD Information Analysis Centers. September, 1974.

47. Dei Rossi. Cost Recovery In Pricing and Capacity Decisions for Automated Information Systems. Prepared for the National Science Foundation. NBS, dist. by NTIS. April 1975. (COM-75-10616)

48. Department of Defense. An Introduction to the Defense Supply Agency. Defense Supply Agency, 1975.

49. "Distributed Intelligence in Data Communications." EDP Analyzer, 11(2), February 1973.

50. Farmer, Vic. "A Look Toward 1985." Computer World, 8:25, Feb. 27, 1974; 8:21, March 20, 1974; 8:17, March 27, 1974.

51. Federation of Information Users. DDC-Present and Future: a Planning Conference. Third Conference, Jan. 20-21, 1975. FIU, 1975.

52. Ferreira, Joe. "Planning for the Fourth Generation." Computer Decisions, 7:D5-6, January 1975.

53. Freeman, James E. and Albert H. Rubenstein. The Users and Uses of Scientific and Technical Information: Critical Research Needs. University of Denver Research Institute, prepared for the Office of Science Information Service, National Science Foundation, November 1974. (PB 237 941)

54. Freeman, Robert R. "Environmental Information: New Developments in NOAA" In: North, Jeanne B., ed. Communication for Decision-Makers: Proceedings of the American Society for Information Science. Vol. 8. 34th Annual Meeting, Denver, Nov. 7-11, 1971. Greenwood, 1972. pp. 115-119.

55. Fried, John B. "On-line Numeric Data Bases." Bulletin of the American Society for Information Science, 1(7):17-18, February, 1975.

56. Glynn, John J. "Implementation Plan for Phase I of the Redesign/Conversion Project." Defense Supply Agency Inter-Office Memorandum. June 9, 1975.

57. Gordon, J. T. and Olaf Helmer. Report on a Long Range Forecasting Study. RAND Corporation, 1964. (Reprinted by DDC. AD 607 777)

58. Hays, David. "The Future May be Science Fiction, But It's Still Fiction." In: North, Jeanne B., ed. Communication for Decision-Makers: Proceedings of the American Society for Information Science. Vol. 8. 34th Annual Meeting, Denver, Nov. 7-11, 1971. Greenwood, 1972. pp. 5-11.

59. Henry, Nicholas L. "Copyright: Its Adequacy in Technological Societies." Science, 186:993-1004, December 13, 1974.

60. _____. "Copyright, Public Policy, and Information Technology." Science, 183:384-91, February 1, 1974.

61. Impact of Future Technology on Navy Business Management. Vol. 2: Technological Forecast. Department of the Navy, 1967. (AD 824 693)

62. Index Systems, Inc. Linking NASA RECON to Scientific and Technical Data Bases: Final Report. Prepared for NASA, February 1975.

63. _____. Study of Purging and Reorganization of the Data Base of the NASA Scientific and Technical Information Facility: Final Report. Prepared for NASA, July 1973.

64. Information Industry Association. "The Information Industry Association before the Committee on Science and Technology, U.S. House of Representatives on HR 4461," July 22, 1975.

65. Jackson, W. Carl. "Telefacsimile at Penn State University: a Report on Operations During 1968-1969." Library Resources and Technical Services, 15(2):22-38, Spring 1971.

66. Jahoda, Gerald. "Reference Question Analysis and Search Strategy Development by Man and Machine." Journal of the American Society for Informative Science, 23(3):139-144, May/June 1974.

67. Kaplan, Gadi. "Fax: Specs and Projections," IEEE Spectrum, 11(9):77-83, September, 1974.

68. Kent, Allen. Resource Sharing in Libraries. Dekker, 1974.

69. Klingbiel, Paul. "A Technique for Machine-Aided Indexing." Storage and Retrieval, 9(9):477-494, September 1973.

70. Leonov, Valery, and Dagobert Soergel. "Compressing and Abstracting of Information for Information Utilities." In: Zunde,Pranas, ed. Information Utilities: Proceedings of the 37th ASIS Annual Meeting, Vol. 11, Atlanta, Georgia, October 13-17, 1974. ASIS, 1975. pp. 46-49.

71. Leslie, Philip. Forecast For Library/Information Service Technology. Speech given at Symposium IV, American Society for Information Science 2nd, mid-year regional conference, Bloomington, Minnesota, April 27, 1973. Reprinted by ERIC. (ED 089 659; IR 000 356)

72. Library Networks '74-'75. Knowledge Industry Publications, 1974.

73. Lide, David R. "The National Standard Reference Data System." Bulletin of the American Society for Information Science, 1(7):10,34, February 1975.

74. Logistics Management Institute. DoD Transportation Information Systems Study - Reconnaissance. Prepared for: Asst. Sec. of Defense (Installations and Logistics), dist. by NTIS, Aug 1974. (AD 786 742)

75. Long Range Forecasting Methodology. A symposium held at Alamogordo, New Mexico, 11-12 October 1967. Office of Aerospace Research, dist. by DDC (AD 679 176)

76. Lundell, E. Drake. "Need for Compatability to Temper 1984 Systems, Information Session Told." Computer World, 8:12, September 18, 1974.

77. McCarn, Davis B. "Trends in Information." In: Zunde, Pranas, ed. Information Utilities: Proceedings of the 37th ASIS Annual Meeting, Vol. 11, Atlanta, Georgia, October 13-17, 1974. ASIS, 1975. pp. 145-150.

78. "Mainframers (Minus IBM) Talk About the Future of Computing." EDP Industrial Report, 9:34, July 8, 1974.

79. Malin, Morton. "The Importance of R&D Information Companies." In: Waldron, Helen J. and F. Raymond Long, eds. Innovative Developments in Information Systems: Their Benefits and Costs. Proceedings of the American Society for Information Science, Vol, 10, 36th Annual Meeting, Los Angeles, Calif. October 21-25, 1973. Greenwood, 1974. pp. 133-134.

80. Marron, Harvey. "Review of Portland Meeting of ASIS Chapter Representatives." Memorandum to Robert Cutler, May, 1975.

81. _____, and Sheryl Wormley. ASIS Research Project to Investigate the Planning Requirements of the Scientific and Technical Information Community. ASIS, 1975.

82. Martin, James. Design of Man-Computer Dialogues. Prentice-Hall, 1973.

83. Martin, R. R. and H. D. Frankel. "Electronic Disks in the 1980's." Computer, 8(2):24-30, 1975.

84. Martin, Susan K. "Tools for the Information Community." Library Journal, 101(1):163-168, January 1, 1976.

85. Myatt, DeWitt O. and Susan I. Jover. Compilation of Major Recommendations from Five Studies Relating to National Scientific and Technical Information Systems. Science Communication, Inc., prepared for the Domestic Science Information Program Office of Science Information Service, National Science Foundation, April 17, 1970, dist. by NTIS. (PB 193 345)

86. Nanus, Burt. "Profiles of the Future: Managing the Fifth Information Revolution." Business Horizons, 15(2):5-13, April, 1972.

87. National Council for Libraries and Information Science. Annual Report to the President and the Congress 1972-1973. January 31, 1974.

88. _____. Toward a National Program for Library and Information Services: Goals for Action. 1975.

89. "NCLIS Draft Proposal Calls upon Federal Government to Bear Permanent Responsibility for Preserving and Maintaining U.S. Knowledge Resources." Information, November 1974, p. 257-263.

90. Neumann, A. J. User Procedures Standardization for Network Access. NBS, 1973. (NBS TN 799)

91. New Techniques in Scientific Information Systems: USSR. Joint Publications Research Service, May 1969. (JPRS 47965)

92. North, Harper Q. and Donald L. Pyke. "'Probes' of the Technological Future." Harvard Business Review, 47(3):68-82, May-June 1969.

93. O'Connor, John. "Passage Retrieval Services for Scientists." In: Information Revolution: Proceedings of the 38th Annual Meeting of the American Society for Information Science, Boston, Mass., Oct. 26-30, 1975. vol. 12, p.80.

94. _____. "Text Searching Retrieval of Answer-Sentences and Other Answer Passages." Journal of the American Society for Information Science, 24(6):445-460, November/December 1973.

95. Parsons and Williams. Forecast 1968-2000 of Computer Developments and Applications. P&W (Denmark), 1968.

96. Peirce, James G. et al. "Anticipated Cost Savings in the Registration and Classification of Potential Contractors for Access to DDC." In: Waldron, Helen J. and F. Raymond Long, eds. Innovative Developments in Information Systems: Their Benefits and Costs. Proceedings of the American Society for Information Science, Vol. 10. 36th Annual Meeting, Los Angeles, Calif. October 21-25, 1973. Greenwood 1974. pp. 186-187.

97. Planning for National Networking: Proceedings of the EDUCOM Spring Conference. April 6, 1973, Boston, Mass. EDUCOM, 1973.

98. "Progress Toward International Data Networks." EDP Analyst 13(1), Jan. 1975.

99. The Public Research Library of the Future: A Report of a Study Conducted by the Office of Academic Planning at the Request of The Environmental Subgroup of the Advisory Committee for Academic Planning. University of Southern California, July 1975.

100. Questionnaire in the Area of Scientific and Technical Information Handling. Forecasting International, Ltd., 1975.

101. Raymond, Richard C., et al. Management Review of the Technical Information Program of the Department of Defense. Office of the Director of Defense Research and Engineering, May 1967.

102. Reese Alan, ed. Contemporary Problems in Technical Library and Information Center Management: a State of the Art. ASIS, 1974.

103. Riegger, Geri. The Effectiveness of Technical/Management Systems in the Department of Defense. (unpublished report), February 28, 1975.

104. Rosenberg, Victor. "A Technique For Monitoring User Behavior at the Computer Terminal Interface." (Brief Communication). Journal of the American Society for Information Science. 24(1):71, January/February 1973.

105. Sauter, Hubert E. "Linking US/DoD and Other Scientific/Technical On-Line Systems."

106. _____. "Planning with DDC." Address to SLA, 66th Annual Conference, Palmer House, Chicago, Ill. June 10, 1975.

107. Schlessinger, Bernard S.,ed. Proceedings of the Fifth Scientific and Technical Information Seminar. Held at: Southern Connecticut State College, New Haven, Conn., April 9, 1970. NTIS, 1970. (AD 722 463)

108. "Structures For Future Systems." EDP Analyzer, 12:1-13, August 1974.

109. Support of Air Force Automatic Data Processing Requirements Through the 1980's (SADPR-85). Volume III, Technology, Appendix VI, including Annex A. Air Force Systems Command, Electronic Systems Division, June 1974. (AD 783 768)

110. Swanson, Rowena W. Trends in Information Handling in the United States. Prepared for presentation at the 1970 Conference of the Institute of Information Scientists held at the University of Reading, Reading, England 10-12 April 1970. Air Force Office of Scientific Research.dist. by DDC. (ASOSR 70-2145TR; AD 710 322)

111. Tell, Bjorn V. "Selective Dissemination of Information (SDI) in a Technological University Library." UNESCO Bulletin for Libraries. 26(6):301-306, November/December 1972.

112. Tressel, George W. and Patricia L. Brown. A Critical Review of Research Related to the Economics of the Scientific and Technical Information Industry. Prepared for the National Science Foundation, March 25, 1975.

113. Turn, Rein. Computers in the 1980's. Columbia University Press, 1974.

114. _____. Computer Systems Technology Forecast. NTIS, January 1975 (AD-A010 944)

115. U.S. Air Force. Information Processing/Data Automation Implications of Air Force Command and Control Requirements in the 1980's (CCIP-85) Vol. V. Technology Trends: Hardware. USAF, April 1972. (AD 907 626)

116. "U.S. Army Awards Contract to A. B. Dick/Scott" Information and Records Management, 9(8):6, August 1975.

117. U.S. Congress. House. National Science Policy and Organization Act of 1975. March 6, 1975.

118. Vagianos, Louis. "Today is Tomorrow: A Look At The Future Information Arena." Library Journal, 101(1):147-156. January 1, 1976.

119. Voos, Henry. "What's in the Future that Ink May Character". Sci-Tech News, 29(1):21-3, January, 1975.

120. Wait, Carl. "Information and Public Policy" In: Wilson, John B., A World of Information: Proceedings of the American Society for Information Science. Vol 9, 35th Annual Meeting, Washington, D.C., October 23-26, 1972. Greenwood, 1973. pp. 205-211.

121. White, Herbert S. Evaluation of Progress and Results to Date of ASIS Activities in Behalf of NSF/OSIS Grant Entitled "An Investigation of Planning Requirements and Priorities of the Scientific and Technical Information Community", June 8, 1975.

122. Withington, Frederick G. "Beyond 1984: A Technology Forecast" Datamation, 21(1):31-3, January 1975.

123. Wolfe, Theodore. An Evaluation of On-Line Information Retrieval System Techniques. Department of the Navy, December 1970. (AD 723 214)

124. Woolston, John. "The Future for International Information Systems." In: Wilson, John H., ed. A World of Information: Proceedings of the American Society for Information Science. Vol 9, 35th Annual Meeting, Washington, D.C., October 23-26, 1972. Greenwood, 1973. pp. 23-24.

APPENDIX. PERSONS AND ORGANIZATIONS INVOLVED IN THIS PLANNING STUDY

AGENCIES AND THEIR REPRESENTATIVES CONTACTED FOR THE INTERAGENCY SURVEY

I. Military Agencies

1. Defense Advanced Research Projects Agency
   1400 Wilson Boulevard
   Arlington, VA

   David C. Russel, Colonel U.S.A., Chief of the Information Processing Techniques Office

2. U.S. Air Force
   Air Force Systems Command
   Foreign Technology Division
   FTS/NI
   Wright Patterson AFB, OH

   Franz Dettemer, Colonel, U.S.A.F., Director of Information
   Charles Mangio, Deputy Director for Technical Services

3. U.S. Air Force
   Air Force Systems Command
   INFOCEN
   AFSC/AD
   Wright Patterson AFB, OH

   William H. Stewart, Major, U.S.A.F.

4. U.S. Air Force
   Air Force Systems Command
   Management and Scientific Information System (MASIS)
   Headquarters AFSC, ACDMO
   Andrews Air Force Base
   Washington, DC

   Ingram T. Quick, Major, U.S.A.F., Acting Director
   Don All, Major, U.S.A.F., Office of the Director of Science and Technology

5. U.S. Army
   The Army Library
   Room 1A518
   The Pentagon
   Washington, DC

   Mrs. Mary L. Shaffer, Director
   Ms. Mary Randolph, Systems Analyst

6. U.S. Army
Office, Deputy Chief of Staff for Research, Development and Acquisition
Modernized Army Research and Development Information System (MARDIS)
AMCHQ
The Pentagon
Washington, DC

Walter Perry, Major, U.S.A.

7. U.S. Navy
Naval Material Command
Navy Technical Information (NTI)
MAT 836
Crystal Plaza 6
2221 Jefferson Davis Highway
Arlington, VA

Perry B. Newton, Jr., Director, Navy Technical Information

II. Civilian Agencies

1. Energy Research and Development Administration
Office of Information
Century XXI Complex
Germantown, MD

Edwin F. Stokeley, Deputy Director
Thomas Hughes, Technical Contact

2. National Aeronautics and Space Administration
300 7th Street, S.W.
Washington, DC

Van A. Wente, Chief, Systems Development Division

3. National Agricultural Library
U.S. Department of Agriculture
Beltsville, MD

Samuel T. Waters, Deputy Director, Resource Development

4. National Bureau of Standards
Gaithersburg, MD

Edward L. Brady, Ph.D., Associate Director for Information Programs
David R. Lide, Ph.D., Chief, Office of Standard Reference Data

5. The National Library of Medicine
U.S. Department of Health, Education and Welfare
Public Health Service
National Institutes of Health
8600 Rockville Pike
Washington, DC

Melvin S. Day, Deputy Director
Charles Goldstein, Chief of the Computer Sciences Group

6. National Oceanic and Atmospheric Administration
Environmental Data Service
3300 Whitehaven Street
Washington, DC

Joseph F. Caponio, Ph.D., Director
John Shuman, Technical Assistant

7. National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA

William T. Knox, Director
Mitchell Krasny, Technical Contact

EXPERT PANEL REVIEW: PANEL MEMBERS FOR ROUND I

1. Elizabeth Fong
   National Bureau of Standards
   Institute for Computer Science and Technology
   Department of Commerce
   Washington, DC

2. Richard H. Giering
   Mead Data Corporation
   3481 Dayton-Xenia Road
   Dayton, OH

3. Charles Coldstein
   National Library of Medicine
   8600 Rockville Pike
   Bethesda, MD

4. Madeline Henderson
   National Bureau of Standards
   Institute for Computer Science and Technology
   Department of Commerce
   Washington, DC

5. Mitchell Krasny
   NTIS
   5285 Port Royal Road
   Springfield, VA

6. Bea Marron
   National Bureau of Standards
   Institute for Computer Science and Technology
   Department of Commerce
   Washington, DC

7. Thomas H. Mott, Ph.D.
   Graduate School of Library Science
   189 College Avenue
   New Brunswick, NJ

8. Louise Schultz
   BIOSIS
   2100 Arch Street
   Philadelphia, PA

9. Siegfried Treu, Ph.D.
   University of Pittsburgh
   809 C L
   Pittsburgh, PA

10. Ronald Wiggington
    Chemical Abstracts Service
    2540 Olentangy River Road
    Columbus, OH

EXPERT PANEL REVIEW: PANEL MEMBERS FOR ROUND IIA

1. Isadore Goldhirsh
   Senior Consultant
   Research and Development Division
   AUERBACH Associates, Inc.
   121 North Broad Street
   Philadelphia, PA

2. John Hunter
   Project Editor
   Editorial Department
   AUERBACH Publishers, Inc.
   6560 North Park Drive
   Pennsauken, NJ

3. Robert Langevin
   Staff Vice President
   Federal Systems Division
   AUERBACH Associates, Inc.
   1501 Wilson Boulevard
   Arlington, VA

4. Norman Lord, Ph.D.
   Senior Consultant
   Federal Systems Division
   AUERBACH Associates, Inc.
   1501 Wilson Boulevard
   Arlington, VA

5. John McCrea
   Senior Consultant
   Research and Development Division
   AUERBACH Associates, Inc.
   121 North Broad Street
   Philadelphia, PA

6. Jerome Sable, Ph.D.
   Staff Vice President and Senior Scientist
   Research and Development Division
   AUERBACH Associates, Inc.
   121 North Broad Street
   Philadelphia, PA

7. Arnold Shafritz
   Vice President and Technical Director
   AUERBACH Associates, Inc.
   121 North Broad Street
   Philadelphia, PA

8. Martin Trachtenburg
   Senior Consultant
   Commercial/Industrial Division
   AUERBACH Associates, Inc.
   121 North Broad Street
   Philadelphia, PA

9. Robert Wallace
   Vice President
   Commercial/Industrial Division
   AUERBACH Associates, Inc.
   121 North Broad Street
   Philadelphia, PA

10. Paul Winsor
    Staff Vice President and Senior Scientist
    Commercial/Industrial Division
    121 North Broad Street
    Philadelphia, PA

EXPERT PANEL REVIEW: PANEL MEMBERS FOR ROUND IIB

1. Dale B. Baker, Director
   Chemical Abstracts Service
   2540 Olentangy River Road
   Columbus, OH

2. Raymond P. Barrett
   Vice President
   Research and Development Division
   AUERBACH Associates, Inc.
   121 North Broad Street
   Philadelphia, PA

3. Toni Carbo Bearman
   Executive Director
   National Federation of Abstracting and Indexing Services
   3401 Market Street
   Philadelphia, PA

4. Marilyn C. Bracken, Ph.D.
   Director of Scientific Coordination
   Bureau of Biomedical Science
   5401 Westbard Avenue, Room 700
   Bethesda, MD

5. Wesley T. Brandhorst
   Operations Research, Inc.
   4833 Rugby Avenue
   Bethesda, MD

6. John Creps
   Engineering Index, Inc.
   345 East 47th Street
   New York, NY

7. Carlos Cuadra, Ph.D.
   System Development Corporation
   2500 Colorado Avenue
   Santa Monica, CA

8. Melvin S. Day
   Deputy Director
   National Library of Medicine
   8600 Rockville Pike
   Bethesda, MD

9. Robert Kennedy
   Bell Telephone Laboratories
   Mountain Avenue, Room 1E-239
   Murray Hill, NJ

10. Brigitte L. Kenney
Associate Professor
Graduate School of Library Science
Drexel University
Philadelphia, PA

11. Donald King
Market Facts, Inc.
Center for Quantitative Science
6110 Executive Boulevard
Rockville, MD

12. J.C.R. Licklider, Ph.D.
MIT
Project MAC
545 Technology Square, Room 218
Cambridge, MA

13. Thomas H. Martin, Ph.D.
Annenburg School of Communications
University of Southern California
Los Angeles, CA

14. Douglas S. Price
NCLIS
1717 K Street, N.W., Suite 601
Washington, DC

15. Vladimir Slamecka, Ph.D.
Georgia Institute of Technology
School of Information and Computer Science
Atlanta, GA

16. Roger Summit, Ph.D.
Lockheed Missiles and Space Company, Inc.
Lockheed Palo Alto Research Laboratory
3251 Hanover Street
Palo Alto, CA

17. Ben H. Weil
ESSO Research and Engineering Company
P.O Box 121
Linden, NJ

GLOSSARY

GLOSSARY

This glossary is intended to facilitate use of this Report by providing definitions of DDC products and services, statistical terms, acronyms, and information storage and retrieval terminology. Cross references are made in some definitions to terms which are related to defined terms, and which are also defined in this glossary. (These terms are underlined.)

Abstract Journal

A publication appearing at regular intervals, containing citations and abstracts of selected documents in a particular subject field or fields. (e.g., TAB)

Accountability

The quality or state of being answerable (responsible) for decisions made.

ADD

Automatic Document Distribution. A service which supplies microfiche copies of DDC documents in specific subject areas to users who have supplied a subject interest "profile." (See also Profile.)

ARPANET

A data processing and communications network established by the Defense Advanced Research Projects Agency (DARPA), and currently administered by the Defense Communications Agency (DCA), which utilizes packet switching technology. (See also Packet switching.)

Average

A quantity arrived at by adding a series of quantities together in any order, and dividing by their number. (Also called "arithmetic mean." Compare: Modal score.)

Awareness (of a service)

Knowledge that a given service exists, whether or not the respondent has used it.

Bench Level Personnel

Personnel performing primarily research, development, testing and evaluation activities. Also sometimes referred to as researchers. (Contrast: Management personnel.)

Bibliographic Service

A type of information service which provides information in the form of documents, (reports, books, etc.) or abstracts of documents, or document citations. (Contrast: Fact Service.)

C.A.

Current Awareness.

Cathode Ray Tube (CRT)

A possible component of an on-line information system consisting of a vacuum tube (similar to a T.V. screen) on which text or other data can be projected by the computer for direct viewing by a person doing an on-line search or query.

Circuit Switching

An electronic communications system in which stations on different circuits within a network are joined by connecting the two circuits together.

COM

Computer output microfilm. A method of producing computer output in microform through the use of a special microform printer that will take output directly from the computer without a paper intermediary.

Comparable Source

An information service supplied by a non-DDC agency which is similar to a given DDC service (e.g., the NASA technical report program is comparable to the DDC Technical Report Program).

Computer-Generated Bibliography

A computer-printed list of documents produced as the output of a computer search by subject area(s) of a machine-readable file of document citations.

Consultant

An individual or organization who gives professional advice or services in response to a respondent's information needs.

Contingency Analysis

A statistical method for computing the probability of the joint occurrence of attributes or characteristics.

Contractor Access Program

A DDC program to test the feasibility of providing Defense contractors with access to the Defense RDT&E On-Line System (DROLS).

COSATI

Committee On Scientific And Technical Information of the Federal Council for Science and Technology. A committee which had responsibility for the coordination of Federal agency programs in information for science and technology. It was disbanded in 1973.

Critical Incident (technique)

A means of eliciting information in a survey by asking the respondent about a specific event with which he was involved.

CRT

See Cathode ray tube.

Currency (of information)

The up-to-dateness of the information. Generally refers to the length of time between when a piece of research was performed and when the results of the research are made available.

Current Awareness Bibliographies

A DDC service which provides bi-weekly bibliographies of citations for documents in specific subject areas announced in the current TAB issues, according to user subject interest "profiles." (See also Profile.)

Data Tagging

A method of electronically marking certain designated items (words, phrases, numerical quantities) in a machine readable data base so that they may be retrieved through a search or query.

DCASR

A Defense Contract Administration Services Region.

DDC

The Defense Documentation Center.

DDC Digest

A four-page DDC publication distributed automatically, at intervals of between one and two months, to all established users of DDC, to announce plans, changes in service, and other developments in the scientific and technical information field.

Defense R&D of the 1960's

A list of DDC technical reports (with indexes) accessioned during 1960-1967, available as a publication or on magnetic tape (with abstracts) or on reel microfilm (without abstracts).

Defense R&D of 1970

A list of DDC technical reports accessioned during 1970, available as a publication, on magnetic tape, or on reel microfilm.

Delphi

A forecasting technique in which successive groups of experts are polled (usually via questionnaire) concerning future developments in a specific area. Results of each group interrogation are tabulated and submitted to the next group of experts along with the questionnaire in the intent of achieving an ultimate consensus.

Demand Service

An information service which provides information (data or document) in response to a specific request. Also called Request service. (Contrast: Subscription service.)

Departmental Collection

A collection of documents or information files retained by the respondent's organizational department and kept in one location.

Desirability

A relative assessment of the need for a given event within the information community.

Dial-Up (Communications Service)

Data transmission service via telephone communication lines. Charge is made on a seconds-of-use basis, similar to long distance telephone service. (Contrast: Leased Line.)

Distant Library

A library or information center which is located more than a short distance from the respondent. (Contrast: Local Library.)

DMS

Data Management System.

Document

A piece of textual information, such as book, technical report, letter, journal article. (A document can exist in hard copy, microform, or other media.)

DoD

The Department of Defense.

Downtime

The period of time during which a computer or other equipment is unavailable for productive use because of a mechanical or electronic fault or malfunction.

DRIT

Defense Retrieval and Indexing Terminology. The official listing of the DDC Natural Language Data Base, (NLDB), a natural language technical vocabulary of unique terms extracted from technical summaries, titles and abstracts, and used to automatically and manually index DDC data bases.

DRIT-H

Defense Retrieval and Indexing Terminology, Hierarchy. An alphabetical listing of the DRIT vocabulary, each term displayed with its hierarchical relationship to other main terms within the Natural Language Data Base. (See also DRIT.)

DROLS

The Defense RDT&E On-Line System. A service whereby a DDC user may query any of several DDC data banks (technical reports, WUIS, and R&D Program Planning Data Base) by means of an on-line terminal connection consisting of a cathode ray tube (CRT) display device with a keyboard and attached printer. Also called the RDT&E On-Line System. (Contrast: Report bibliography service.)

DSA

The Defense Supply Agency.

Electronic File Transfer

The electronic transmission of stored data (in a form such as magnetic tape) from one location to another over a communication line.

ERDA

The Energy Research and Development Administration.

Extrapolation

The process of inferring a future trend from an observed series of events occurring over a period of time.

Facsimile Transmission

A process by which printed or graphic matter is scanned and the image converted into electronic signals which are electronically transmitted (as over telephone lines) and used at a receiving point to reproduce the original. Often referred to as "fax."

Fact Service

A type of information service which provides information in the form of data, (usually numeric) or an answer to a specific question. (Contrast: Bibliographic service.)

Fax

See Fascimile transmission.

Feasibility

A relative assessment of the practicality of a given event occurring.

Formal Source of Information

A source such as a library or an information analysis center which is set up a priori in a formal manner to provide information to a general or specific set of potential users. (Contrast: Informal source of information.)

Format (of information)

The physical arrangement in which information is presented, e.g. in a book, journal, technical report, abstract bulletin.

Friend, Peer, Associate

A professional or otherwise technically knowlegeable person known to the respondent. (Frequently a co-worker.)

GAO

General Accounting Office.

Goal

A statement of an aim toward which efforts are directed, but which is not necessarily quantifiable.

Hard Copy

The print medium. Paper copy.

IAC

Information Analysis Center. A data gathering and dissemination center, similar to a library, but which specializes in a narrow, highly technical subject area and provides authoritative data review, evaluation, and synthesis in that subject area.

Independent Variable

A variable or condition, which is not dependent on other variables, i.e., representing a condition which does not change as a function of other variables being considered.

Informal Source of Information

A source of information not formally set up and not generally available to a wide audience, e.g., a personal or departmental collection of documents, casual conversations with colleagues, etc. (Contrast: Formal source of information.)

Information

Knowledge or intelligence communicated or received.

In-House Library

A library or information center which is a part of the respondent's organization; or, which is administered from outside the organization but located on the organization's property and available to that organization's personnel. Also called Local library. (Contrast: Distant library.)

"Intelligent" Terminal

A terminal in a computer system which has, in addition to input/output function, some storage and processing capability.

Intermediary (in information service)

A person such as a librarian, search specialist, or terminal operator who procures information and makes it available to a requestor or user.

I/O

Input/Output

IR&D

Independent Research and Development. A data bank of research information performed by industrial organizations, not wholly funded by the DoD.

Key Users (of DDC)

The 200 user organizations (out of a total of 2,886 user organizations) which order the most technical reports in a given year. (This is taken as an index of use.) (Contrast: Non-key users.)

Leased Line (Communications service)

Data transmission service via a communication line installed specifically for a given customer. Charge is made on a monthly basis depending on the distance between end points of the communication line. Also called "private line" or "dedicated line." (Contrast: Dial-up.)

Least Squares

A statistical method of fitting a line to a set of points in such a way that the sum of the distances of the points from the line is a minimum.

Local Library

A library or information center which is a part of the respondent's organization and located at reasonable proximity to the respondent's office or laboratory or, which is administered from outside the organization, but located on the organization's property and available to that organization's personnel. Also called In-house Library. (Contrast: Distant library.)

Machine Independence (of software)

The capacity of a given piece of software to be run on (hypothetically) any computer system.

MAI

Machine-aided indexing.

Management Information System (MIS)

A system designed to supply the management of an organization with the information needed to keep informed on the current status of the organization, to understand related implications and to make the appropriate operating decisions.

Management Personnel

Personnel performing predominately supervisory or managerial activities (Contrast: Bench level personnel.)

MAR

Machine-aided retrieval.

MCIC

Metals and Ceramics Information Center. (A DSA Information Analysis Center.)

Mechanized Information Service

An information service in which a query or search is made of one or more data banks by means of a computer, and which produces as output data, document citations, or abstracts.

Medium (of information)

Any means for representing information; usually a material on which information is recorded, e.g., paper (print), microform, magnetic tape.

Message Switching

A technique for controlling data transmission within an electronic communications network that involves: the receiving of messages from various sources at a switching center, the temporary storage of each message until the proper outgoing communications linkage is available, and the retransmission of each message to its destination.

Microcomputer

A very small computer, consisting of a CPU and main memory on a single printed circuit board composed exclusively of integrated circuit (IC) chips, and which has limited programming and storage capability.

Microfiche

An information medium in the form of a series of reduced photographic images in rows on a piece of film about 4 x 6" square, which can be enlarged (by means of a microfiche reader/printer) for viewing or printing.

Microfilm (roll f...)

An information medium in the form of a strip of film, usually 16 mm. wide, having a photographic record on a reduced scale of printed or other graphic matter, that can be enlarged (by means of a microfilm reader/printer), for viewing or printing.

Microform

A generic term for the various information media in which printed graphic matter is recorded in photographically reduced form, and may be enlarged for viewing or printing. Includes Microfilm, Microfiche, microcards, and aperature cards.

Minicomputer

A computer system with the power of a medium scale computer system, but physically smaller, less expensive, possessing a smaller main memory, and with more limited availability of high level programming languages.

MIS

See Management information system.

Modal Score

The quantity that occurs most frequently in a set of varying quantities. (Contrast: Average.)

Multiple Regression Analysis

A type of statistical analysis used in analysis of the DDC User/Potential User Survey results which considers a number of independent variables characteristic of the population and determines which of these is most highly related to the way in which survey respondents differed in their answers to survey questions.

NASA

National Aeronautics and Space Administration.

Natural Language

A language (list of terms) used in indexing and accessing documents in an information system which is based on current actual usage rather than a priori prescribed usage. (Contrast: Controlled vocabulary.)

NBS

The National Bureau of Standards.

Network (information)

a) Computer (data processing) network: an interconnected group of computer systems which share resources such as data, hardware, and software. b) Information center network: a group of information centers (libraries, clearinghouses, information analysis centers, depositories, etc.) which share resources and operations such as collections, services, and processing.

NOAA

The National Oceanic and Atmospheric Administration.

Non-Key Users (of DDC)

User organizations which do not fall into the top 200 user organizations in terms of the quantity of technical reports ordered in a given year. (Contrast: Key users.)

Non-User (of DDC)

An individual member of a DDC user organization who has not knowingly used a DDC service within the past few years.

NTDSC

Nondestructive Testing Data Support Center. (A DSA Information Analysis Center.)

NTIS

National Technical Information Service. A government agency within the U.S. Department of Commerce which is responsible for the public distribution and sale of unclassified and unlimited Government-sponsored research, development, and engineering documents prepared by Federal agencies, their contractors, and grantees.

Objective

A measurable effort directed toward the achievement of a goal.

OCR

See Optical character recognition.

ODDR&E

The Office of the Director of Defense Research and Engineering.

On-Line Remote Information Service

A computerized information service in which a user may communicate directly with the computer to perform a search or query (or submit input) by means of a keyboard at a location at any distance from the computer itself, but hooked up to the computer via telecommunication. A CRT (cathode ray tube) and a printer may also be present with the keyboard.

Open Literature

Published documents freely available to the public on the open market.

Optical Character Recognition (OCR)

The electronic identification of printed characters through use of light sensitive devices.

OR

Operations research.

Packet Switching

A type of electronic data transmission in which a message is broken into several discrete parts, routed over alternate circuits simultaneously to optimize available lines, and then reassembled at its destination.

Peripheral (computers)

An auxiliary unit which may be placed under the control of a CPU in a computer system, e.g., a card reader or punch, printer, CRT. (See also Cathode ray tube.)

Personal Collection

A collection of documents or information files belonging to the respondent and kept in his office or laboratory.

rofile

The subject interest of an individual or group. Interest profiles may be ed for selective dissemination of information. (See also Selective issemination of information.)

rogram Planning Information System

A DDC service in which descriptions of R&D projects planned by DoD organizations are made available in the R&D Program Planning Data Bank. Input is made on DD form 1634.

Protocol

A formal set of conventions governing the format and relative timing of message exchange between two communicating processes.

Quality (of information)

The technical quality of information, including accuracy, relevance and organization.

Quantity (of information)

The amount of information, including amount of documents and amount of data.

RBMT

See Report Bibliographies on Magnetic Tape.

RDT&E On-Line System

See DROLS.

RDT&E (program)

Research, Development, Test, and Evaluation Program. The DoD's defense research program.

Referral Service (DDC)

A DDC service providing names of sources beyond DDC of Government sponsored scientific and technical information services not available in DDC. (E.g., information analysis centers, laboratories, audiovisual depositories, etc.)

Remote On-Line Service

See On-line remote information service.

Report Bibliography

A bibliography (in the form of a DDC document) resulting from a tailor-made literature search on a particular subject, performed in batch mode at the request of a user. (Contrast: DROLS.)

Report Bibliography on Magnetic Tape (RBMT)

A bibliography in machine readable form (on magnetic tape) resulting from a DDC tailor-made literature search on a particular subject, performed in batch mode at the request of a user. (Compare: Report bibliography.)

Request Service

An information service which provides information (data or document) in response to a specific request. Also called Demand service. (Contrast: Subscription service.)

Respondent

A person interviewed as part of the DDC User/Potential User Survey.

Response Time (of information)

The elapsed time between a person's request for information and the arrival of the requested information. (Sometimes called "turn-around time".)

Retrospective Service

A service oriented toward providing information (usually in the form of documents, citations, or abstracts) that was originally published during a specified past period of time, rather than oriented specifically toward providing the most recently published information.

RTIS

Remote Terminal Input System. A method of on-line data input to the DDC data banks utilizing the terminals of the DROLS. (See also DROLS.)

Scheduled Bibliography

A bibliography (in the form of a DDC document) resulting from a DDC literature search of a specific subject of current or anticipated interest. (These are not dependent on user requests. Contrast: Report bibliography service.)

SDC

Systems Development Corporation.

Selective Dissemination of Information

A type of information service in which information is provided on a continuing basis according to previously registered subject interest categories.

Selective Dissemination of Information Software Packages

A set of five machine-independent computer programs available from DDC for user organizations to be used on the TAB on tape data base, to produce bibliographies for individual users according to their individual subject profiles. (See also Selective dissemination of information.)

Simulation

The representative of physical systems and phenomena by computers, models, or other equipment for purposes such as testing and forecasting.

Software Package

A computer program or a set of interacting or related computer programs used in a particular application.

Source (of information)

The physical location the respondent goes to to find information, e.g., local library, personal collection, distant library.

Standard Deviation

A statistical concept designating a measure of variability around a point representing the average of a given series of quantities. All the individual deviations from the average are squared then averaged. The square root of this quantity is called the "standard deviation".

S&TI

Scientific and Technical Information. (Also referred to as STINFO.)

Subscription Service

An information service which can be obtained by requesting it once, but which provides information on a continuing basis, e.g., journal subscriptions, current awareness services.

Support Personnel

Personnel in occupations providing information support services, e.g., technical librarians, information scientists, and terminal operators.

TAB

Technical Abstract Bulletin. A bi-weekly DDC publication which provides citations and abstracts of new classified and limited DDC reports. Indexes to TAB are cumulated quarterly and annually.

Task

A specific action that contributes toward achievement of an objective. (See also Objective.)

Technical Report Program

A DDC program in which technical reports produced by Defense facilities and their contractors are accessioned, processed, and made available to DDC users.

Transparent

The quality of a function or operation of an information system of being not perceived by, i.e. invisible to, a user or operator.

Tutorial

The means by which an interactive computer terminal may instruct a novice user in using the system effectively, without need of a human intermediary. (See also Intermediary (in information service).)

User (of DDC)

An individual member of a DDC user organization who has knowingly used a DDC service within the past few years.

Variance

The square of the standard deviation, i.e., the average of the squares of the deviations from the average point of a frequency distribution. (Compare: Standard deviation.)

Word Processing

A method of creating, producing and distributing written communication at high speeds with a high degree of accuracy, minimum human effort and low cost through the combined use of special procedures, automated business equipment and trained personnel.

WUIS

The Research and Technology Work Unit Information System. A DDC service producing a collection of technically oriented summaries describing research and technology projects currently in progress. Input is made on DD form 1498.