COMPUTERIZED ACCESS TO INFORMATION RESOURCES ON RADIOACTIVE WASTE MANAGEMENT

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ABSTRACT

The proliferation of information in science and technology has made it difficult to stay aware of new research and development available in the published literature. Computerized access to bibliographic data files are helping scientists and engineers search and find -- with confidence -- relevant information. This paper describes the benefits of online searching, offers major sources of bibliographic databases throughout the world, and compares a sample subject search in 10 key databases in the field of Radioactive Waste Management.

BACKGROUND AND HISTORICAL OVERVIEW

We live in the technological age. It is estimated that published scientific articles are added to our worldwide "wealth of knowledge" at the rate of 6,000 items per day. [1] Seeking reliable access to this information is essential to avoid duplicated or unnecessary research and development, to promote the transfer of new ideas, and to identify and provide background for new research.

Automated access to information was the natural out-growth of the development of the computer. By the 1960s, a United States Government contract to the Lockheed Corporation had resulted in the production of an online computerized record of the information contained in the bibliographic indexes of the National Aeronautics and Space Administration. This computerization has become possible because of the simultaneous availability of several related technologies: (1) The ability to put numeric and textual information in machine-readable form; (2) Time-sharing mainframe computers to allow for large amounts of storage and for remote access to the data; (3) Interactive, user-oriented computer programs to access the data; (4) Microcomputers locally programmed that can communicate in both directions: uploading, or sending, commands to the mainfram, and downloading, or receiving, information from the remote computer at various speeds ranging from "slow" 300 baud transmission (300 characters per second) to 9600 baud (960 cps) today; and (5) Telecommunications networks with packet-switching capabilities for reducing long-distance phone charges and providing reliability through data transmission error checking.

Today, it is estimated that 2,961 databases are publicly available, worldwide, offered by over 400 separate online services, or vendors. [2] Some databases are bibliographic, offering citations, or references, to the published literature; others are numeric, providing original data (census records, for example); informational, offering handbooks and tables online; full-text, providing a complete facsimile of articles or reports; and software databases, offering programs which can be downloaded and used.

This paper discusses bibliographic databases. For more information about all databases, consult the following two sources:

1. Directory of Online Databases. Santa Monica, California, Cuadra Associates, Inc. Quarterly.

2. Directory of Online Services. Delran, New Jersey, Datapro Research Corporation, a McGraw Hill Co. Looseleaf.

ADVANTAGES TO ONLINE SEARCHING

Online Searching is Quicker

In seconds the cycle is complete, from user workstation to host computer and back. The components of an online system are shown in Fig. 1. The host computer, containing the millions of citations supplied by the vendor, is shown at the top, the user terminal at the bottom. Interconnection is provided through telecommunications at each end, with intermediate value-added packet-switching networks. Requests are sent to the host computer, and the "answers" are received at the local printers and video display units of the user workstation.

Online Searching is More Up-to-Date

Figure 2 shows the steps in the creation of an online database. The database producer acquires the source materials, such as journals, books, or reports; indexes the documents, assigning subject key words; develops abstracts; and creates the computer record for each citation. This information is stored on magnetic tape. From this tape come two products: the computer record available from online services, and the published, printed indexes, mailed to subscribers. As soon as the vendor loads the database, it is searchable. Printed copies of indexes and abstracts take longer to print, bind, and mail to local sources, such as laboratories and libraries.

When online coverage for new government reports available from the National Technical Information Service (NTIS) was February, 1985, the latest printed issue physically available in the library was the last issue of 1984.

Online Searching is Cumulative

Bibliographic databases are cumulative. For example, NTIS publishes a new index every two weeks, but compiles a cumulation of those separate indexes annually. To search a topic from 1964 to the present, therefore, in the printed NTIS index would require looking in 21 separate annual indexes from 1964 to 1984, and in 26 separate biweekly indexes to date, the latest of which is the last issue of 1985. A search in the online equivalent simultaneously searches everything from 1964 to the present. This is typical of online bibliographic databases.

Online Searching Provides More Access Points

In printed indexes, one can usually search by an author's name, and by subject, and sometimes by key words or titles. Online databases can search authors, subjects, key words, and titles, as well, but also can search any other identified fields such as journal titles, corporate sources, any word in the title of the report, any word in the abstract, report numbers, contract numbers, document types, sponsoring agencies, source language of the document, publications year, or any word in the full text of the actual article in those databases that offer full text capability. Figure 3 shows the searchable fields of a sample database.

Online Searches can Coordinate Multiple Terms

Online searching utilizes proximity operators to relate desired terms or concepts within the desired references. Boolean logic, the ability to express logical relationships between search terms, is utilized. The Boolean operators are "and", "or", and "not". Figure 4 shows an example of each depicted in Venn diagrams. The "and" concept is restrictive. To satisy "and" requires that a citation contain all terms in consideration: nuclear and energy, from the shown figure, for example, must both appear somewhere in the citation. The "or" operator is inclusive, creating synonomous terms in one set: either the term solar or the term sun must appear to satisfy the condition in the given example. The "not" operator removes concepts from consideration: citations which contain the term energy, but "not" the term nuclear will be selected in the third example. It is precisely because of this Boolean logic that online searching is so powerful. Combining two or more terms as key descriptors of a reference cannot be accomplished conclusively in the manual search of the printed indexes.

Online Searches can be Saved

User workstations contain equipment to automatically save the successful results of an online search. There are several options for saving:

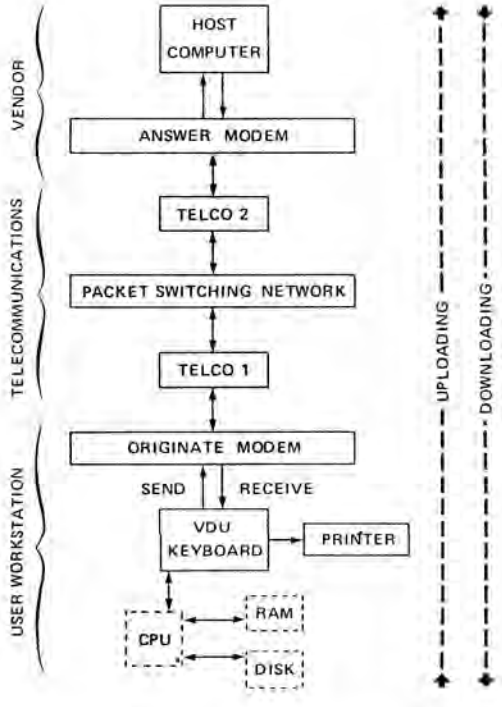

Fig. 1. Components of an Online System.

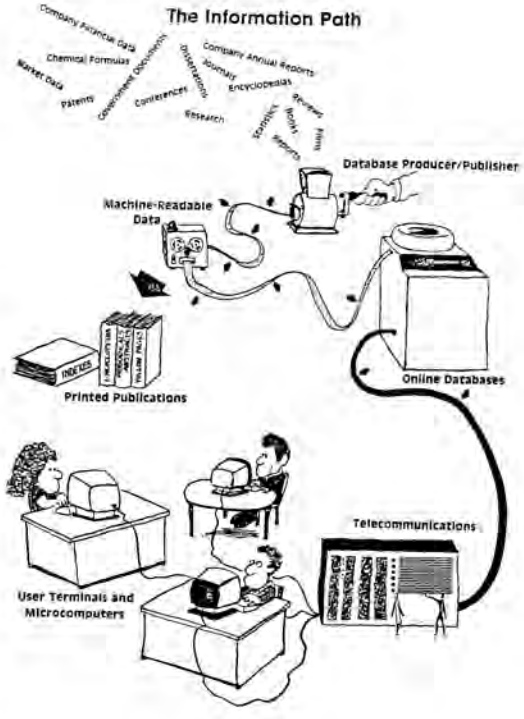

Fig. 2. Steps in the Creation of an Online Database.

AB	ABSTRACT	GP	GPO NUMBER
AN	ACCESSION NUMBER	GS	GOVERNMENT SOURCE
AU	AUTHOR	HL	HOLDING LIBRARY
BN	ISBN (BOOK NUMBER)	JN	JOURNAL NAME
CA	CALL NUMBER	LA	LANGUAGE
CL	CONFERENCE LOCATION	LC	LIBRARY OF CONGRESS
CN	CONTRACT NUMBER		NUMBER
CO	CODEN	NT	NOTE
CP	COUNTRY OF PUBL.	PU	PUBLISHER
CS	CORPORATE SOURCE	PY	PUBLICATION YEAR
CT	CONFERENCE TITLE	SE	SERIES
CY	CONFERENCE YEAR	SF	SUBFILE OF DATABASE
DE	DESCRIPTOR	SH	SECTION HEADING CODE
DT	DOCUMENT TYPE	SN	ISSN (SERIAL NUMBER)
ED	EDITION	SP	SPONSORING AGENCY
GL	GEOGRAPHIC LOCATION	TI	TITLE

Fig. 3. Searchable Fields of a Sample Database

Online searches can be typed online as a full record with abstract, or as any portion of the record, such as just the bibliographic citation.

Online searches can be printed offline and mailed from the host computer, avoiding larger online connect charges, and usually providing cleaner output.

Online searches utilizing the microcomputer can be captured in machine-readable format to the local floppy disk for offline editing or database management.

Online searches can be sorted by various fields: alphabetically by author, grouped by journal name, or in order by year of publication, to suggest a few.

Figure 5 is a sample full printed record of a search with key fields identified.

AN	CA104(4):25711m
TI	Current status and prospect of radioactive waste control
AU	Han, Pil Soon
CS	Korea Energy Res. Inst.
LO	S. Korea
SO	J. Korean Nucl. Soc., 16(4), 230-42
SC	71-0 (Nuclear Technology)
DT	J
CO	WJHKAW
IS	0372-7237
PY	1984
LA	Korean
AB	A review, with 22 refs., on radioactive waste management and disposal technology.

Fig. 5. Sample Record from CAS Online.

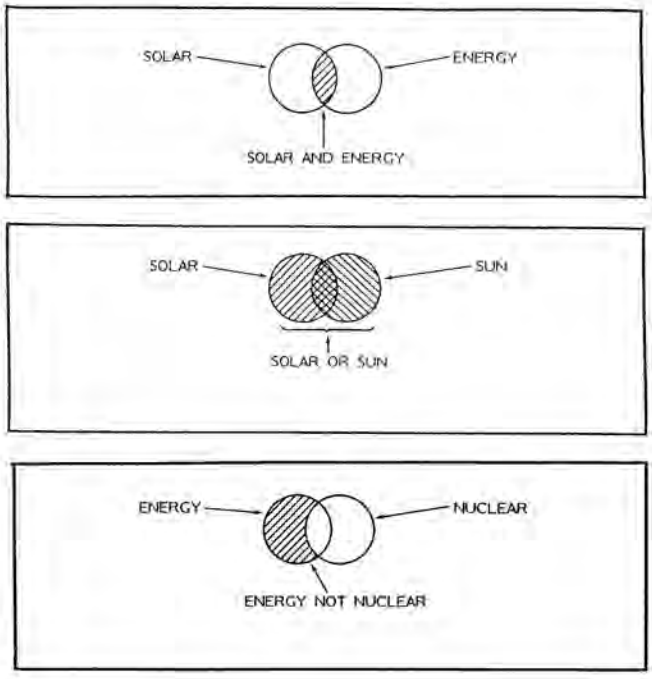

Fig. 4. Boolean Logic

CHOOSING A DATABASE FOR INFORMATION ON RADIOACTIVE WASTE MANAGEMENT

Of the nearly 3000 databases available today, only a fraction will be appropriate for any given search. Deciding what database to use is part of the "art" of effective online searching, different only in magnitude from similar decisions made in the choice of what printed index to choose.

The University of Arizona Libraries provide an active online search service, called Computer Assisted Reference Service, CARS. The CARS program accesses certain individual databases through database vendors, centralized collections of a large number of databases offered through time-sharing telecommunications systems, or direct dial access.

DIALOG Information Services, Inc., with over 200 databases containing in excess of 100 million records, is one of the vendors most commonly used at the University of Arizona, and throughout the world. Other common database vendors include BRS Information Technologies, Pergamon InfoLine, SDC Information Services, INKA Karlsruhe, and Mead Data Central. Addresses of these and other common worldwide vendors are listed in Table I.

The very general subject of Radioactive Waste Management was selected to perform a comparative search in 115 of DIALOG's databases through its helpful cross-indexing file, Dialindex. Of those searched, ten databases showed results exceeding 100 citations on the chosen subject. Table II lists these "Top Ten" databases and their worldwide availability on DIALOG as well as on other systems.

TABLE 1

Key Sources of Online Services Worldwide

BRS INFORMATION SERVICES (B)
1200 Route 7
Latham, NY 12110
(518) 783-1161
(800) 833-4707
(800) 553-5566
TWX 710-444-4965

CENTRE DE DOCUMENTATION DE L'ARMEMENT (C)
26 Boulevard Victor
75996 Paris Armees, France
33 (1) 552 45 04
Telex 202778 CEDOPAR F

CISTI (CI)
Information Exchange Centre
National Research Council Canada
Ottawa, Ontario K1A 0S2, Canada
(613) 993-1210
Telex 053-3115

DIALOG Information Services, Inc. (D)
3460 Hillview Avenue
Palo Alto, CA 94304
(415) 858-3785
(800) 227-1927
Telex 334499 DIALOG
TWX 910-339-9221
DIALOG offers international service in 45 countries

ESA-IRS (E)
C.P. 64 via Galileo Galilei
00044 Frascati, Italy
39 (6) 940 11
Telex 610637 ESRIN 1

INKA Karlsruhe (I)
c/o Fachinformationszentrum Energie,
Physik, Mathematik, GmbH
7514 Eggenstein-Leopoldshafen 2
Federal Republic of Germany
49 (7247) 82 46 00
Telex 7826487 FIZE D

JAPAN INFORMATION CENTER OF SCIENCE & TECHNOLOGY (J)
5-2, Nagatacho 2 Chome
Chiyoda - ku
Tokyo 100, Japan
81 (3) 581-6411

MEAD DATA CENTRAL (M)
P.O. Box 933
Dayton, Ohio 45401
(513) 859-1611
(800) 227-4908

PERGAMON INFOLINE (P)
12 Vandy Street
London EC2A 2DE
England
44 (1) 377-4650
Telex 8814614 PERINF G

SDC INFORMATION SERVICES (D)
2500 Colorado Avenue
Santa Monica, CA 90406
(213) 453-6194
(800) 421-7229
(800) 352-6689
Telex 652358
TWX 910-343-6643

STN INTERNATIONAL (STN)
c/o Chemical Abstracts Service
2540 Olentangy River Road
P.O. Box 3012
Columbus, Ohio 43210
(614) 421-3600
(800) 848-6533
Telex 6842086 CHMAB
TWX 810-482-1608

or

STN INTERNATIONAL
c/o Fachinformationszentrum Energie, Physik,
Mathematik GmbH
7514 Eggenstein-Leopoldshafen 2
Federal Republic of Germany
49 (7247) 82 45 66
Telex 7826487 FIZE D

U.S. DEPARTMENT OF ENERGY (U)
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37830
(615) 576-1303

Source: *Directory of Online Databases*. Cuadra Associates, Inc., Santa Monica, California 6(3) (Spring 1985).

TABLE II

Sources of Information on Radioactive Waste Management (1)

Database Name	Size/ Coverage (2)	Producer	Citation Count This Example	Worldwide Availability (See Key)
DOE ENERGY	1.5 million 1974 - 1986	U.S. Dept of Energy Office of Scientific & Technical Information, Washington,DC.	5,851	D,I,M,U
NTIS	1.1 million 1964 - 1986	National Technical Information Service Springfield, VA	1,877	B,C,CI,D,E,I,J,M,S
ENVIROLINE	115,000 1971 - 1986	EIC/Intelligence New York, NY	857	D,E,S
CHEMICAL ABSTRACTS ONLINE (3)	7 million 1967 - 1986	Chemical Abstracts Service, Columbus,OH	520	B,D,CI,E,J,S,STN
ENERGYLINE	55,000 1971 - 1986	EIC/Intelligence New York, NY	458	D,E,S
INSPEC	2.5 million 1969 - 1986	Institution of Electrical Engineers London, England	421	B,C,CI,D,E,I,J,S
CIS	190,000 1970 - 1986	Congressional Information Service Washington, DC	334	D,S
GEOREF	1 million 1919 - 1986	American Geological Institute, Falls Church, VA	195	CI,D,S
EI ENGINEERING MEETINGS	300,000 1979 - 1986	Engineering Information, Inc., New York	174	C,CI,D,E,S
COMPENDEX	1.4 million 1970 - 1986	Engineering Information, Inc., New York	112	B,C,CI,D,E,I,S,P

NOTES:

(1) Search date: February, 1986
(2) Databases vary depending upon vendor. Dialog figures given.
(3) Chemical Abstracts named differently in some files.

SAMPLE SEARCHES

Sample searches in the most recent Department of Energy database demonstrate subject and author searching, and the computer's capabilities for limiting and refining a search topic.

When the topic "Radioactive Waste Management" is searched, the (w)s in the phrase serve as proximity operators, specifying that the key words must appear exactly next to each other in order to satisfy the conditions. The set established from this search yields 2,102 relevant citations in the portion of the DOE Database coving publication years 1983 to the present.

This large set can be limited, or reduced, by choosing specific publication years, such as 1985 and 1986 only. It can be further reduced by limiting to a specific document type, such as Conference Literature. The resulting set can again be reduced, for example, by limiting to a specific Conference Location, such as Tucson, and finally, if necessary, to some specific aspect of the larger concept, such as "storage." The result in the demonstrated case is a very restricted set of only three citations. Table III is the search strategy and the first answer of the set.

An author search in a bibliographic database is facilitated by the existence of the option to display related terms in the inverted file. In this way, variant entries of an author's name can be retrieved.

REFERENCES

1. J. NAISBITT, *Megatrends: ten new directions transforming out lives*, p. 11, Warner Books, New York (1983).

2. *Directory of Online Databases*. Cuadra Associates, Inc., Santa Monica, California 6(3) (Spring 1985) and 6(4) (Summer 1985).

TABLE III

SAMPLE SEARCH STRATEGY AND FIRST ANSWER OF THE SET

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File 103: DOE ENERGY - 83-86/MAR (ISS03)

     Set   Items   Description
     ---   -----   -----------
?S  RADIOACTIVE (W) WASTE (W) MANAGEMENT
          20673   RADIOACTIVE
          32079   WASTE
          34868   MANAGEMENT
     S1    2150   RADIOACTIVE (W) WASTE (W) MANAGE-
                  MENT

?S S1 AND PY=1985:PY=1986
           2150   S1
          54717   PY=1985:PY=1986
     S2     276   S1 AND PY=1985:PY=1986

?S S2 AND DT=CONFERENCE LITERATURE
            276   S2
         160200   DT=CONFERENCE LITERATURE
     S3     142   S2 AND DT=CONFERENCE LITERATURE

?S S3 AND CL=TUCSON
            142   S3
            254   CL=TUCSON
     S4      10   S3 AND CL=TUCSON

?S S4 AND STORAGE
             10   S4
          24206   STORAGE
     S5       3   S4 AND STORAGE
```

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?T S5/2/1

983844   ERA-10:038841, EDB-85:121538
  Options for treatment, storage, and/or disposal
of radioactive mixed waste at the Idaho National
Engineering Laboratory
  Nishimoto, D.D.; Falconer, K.L.; Wiggins, D.J.
  EG and G Idaho, Inc., Idaho Falls (USA)
  1985    6p.
  TIC Accession No.: DE85014619
  Waste management '85   Tucson, AZ, USA 24 Mar 1985
  Country of Publication: United States
  Journal Announcement: NTS8508
  Availability: NTIS, PC A02/MFA01.
  Report No.: EGG-M-21484; CONF-850314-71
  Document Type: Report; Conference literature
  Language: English
  Subfile: NTS (NTIS); INS (US Atomindex input):
ERA (Energy Research Abstracts)
  Work Location: United States
  Contract No.: AC07-76ID01570
  Descriptors: IDAHO NATIONAL ENGINEERING LABORATORY
-- RADIOACTIVE WASTE MANAGEMENT; ... LOW-LEVEL
RADIOACTIVE WASTES: RADIOACTIVE WASTE DISPOSAL:
RADIOACTIVE WASTE STORAGE: SOLIDIFICATION
  Class Codes: 052000* ; ES0*00
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