

CHAPTER 77

ELECTRONIC INFORMATION RESOURCES: YOUR ON-LINE BOOKSHELF

Robert N. Schwarzwald, Jr.
Michelle Kazmer
Ford Motor Company
Dearborn, Michigan

77.1 BACKGROUND AND DEFINITIONS	2269	77.3 ACCESS OPTIONS FOR ELECTRONIC INFORMATION RESOURCES	2278
77.2 INTERNET RESOURCES	2271	77.3.1 Internet Access Options	2278
77.2.1 Approaches to Using the Internet	2271	77.3.2 Database and Commercial Services	2279
77.2.2 The World Wide Web	2272	77.3.3 Databases of Importance for Mechanical Engineers	2282
77.2.3 Telnetting, Listservs, Usenet, FTP	2276	77.3.4 CD-ROM and Desktop Databases	2283
77.2.4 The Intranet: Information Resources within the Corporation	2277	77.3.5 Options for Using Electronic Information	2284
77.2.5 Future of the Internet	2278		

77.1 BACKGROUND AND DEFINITIONS

Why read this chapter? Perhaps out of curiosity about the World Wide Web. What if we could offer you a way to get better results in your job, tackle new projects without extensive gear-up time, and avoid costly dead ends? The point is, there is a great deal of technical information available on most of the technical problems you will be involved with this year. By tapping into that information, you can avoid mistakes and get a fast start on new projects. It is this competitive edge that has corporations excited about Intranets.

In the last several years, there has been an explosion of interest in the Internet and on-line information resources. These resources have emerged from obscurity and come to occupy a place of prominence in the corporate world as companies have realized that intellectual capital is as valuable as financial capital. Due to the vast quantity of information available to the mechanical engineer, the old standby of having a bookshelf of the essential handbooks is no longer sufficient. The globalization of research and development and the decreasing cycle time of product development demand rapid access to the world-wide literature of engineering. All of this at a time when professional engineers are being asked to be more productive and more time-efficient! Therefore, effective access to data and ideas requires computer interfaces that can speed access to and delivery of the information necessary for the job.

Fortunately, today's mechanical engineer has a wide variety of tools to create an electronic bookshelf, offering rapid access to a global library of technical information. In this chapter, we will discuss a variety of tools available to you and offer suggestions as to how those systems can be used to provide quick, easy access to a wide variety of information. These tools consist of Internet resources

Communications should be addressed to Robert Schwarzwald, Ford Motor Company, MD 1153 SRL, Dearborn, MI 48121, or by email at rschwar3@ford.com.

Mechanical Engineers' Handbook, 2nd ed., Edited by Myer Kutz.
ISBN 0-471-13007-9 © 1998 John Wiley & Sons, Inc.

and on-line databases. They share a common mode of access in that they are accessed by connecting to a remote computer, the host, by using a telephone or network connection from your microcomputer. In the corporate or academic workplace, this network access is typically provided by the organization. We have supplied a list of services that provide network access to information for individuals who are employed as consultants or are part of a small firm. We have also included a section about "desktop" databases available on CD-ROM, which are accessed locally on your own computer or on a local computer network.

The Internet is an interconnected series of computer networks. Begun as a Department of Defense-sponsored project, the Internet has grown into an increasingly commercial service. Because of the wide variety of services and systems available through this network of networks, it is difficult to describe. The following terms are related to the discussion of the Internet, database, and on-line information resources.

Agent. A software device that filters information before it reaches the end-user, or locates and sends information to the end-user.

ASCII. Common keyboard characters; refers to an interface that only allows the user to view and use common text and numerical characters.

Bulletin board system (BBS). Electronic discussion forums available to subscribers through networks. Messages posted to the bulletin board and the responses travel as e-mail.

CD-ROM. Compact Disk, Read Only Memory, a digital storage medium used for desktop databases.

Client. A software application mounted on your computer which extracts some service from a server somewhere else on the network. This relationship is often referred to as a *client-server* application.

Database. A computer-based search and retrieval system that allows a user to retrieve and display information based upon a series of command protocols.

Downloading. The transfer of electronic data from a larger system to a small system, such as from a mainframe computer to a desktop machine.

E-mail. Electronic mail permits an individual to post a message to the mailbox of another user. Each individual/mailbox has a unique address that can receive mail from anywhere on the Internet.

End-user. The person who ultimately uses the information. This term is typically used to distinguish situations where the person who searches an information system is the same as the person who will use the results of the search, as opposed to having an information professional search for results.

Firewall. A security system designed to keep unauthorized users out of a computer network.

FTP. File Transfer Protocol is a system for retrieving data or text files from a remote computer.

False drops. Unwanted information which is inadvertently retrieved in an Internet or on-line search.

FAQ (frequently asked questions). Often a list of frequently asked questions and their answers. Many USENET news groups, and increasingly World Wide Web sites, maintain FAQ lists in order to cut down the number of repetitive questions.

File server. A host machine that stores and provides access to files; remote users often use ftp to access a file server.

Gopher. A menu-based system for exploring Internet resources developed at the University of Minnesota in 1991. By choosing menu items, the gopher will link you to those sources.

GUI (graphical user interface). A system, such as the World Wide Web, that allows the user to view and use graphics, as opposed to an ASCII interface.

Host. A network computer that has resources that are shared with others.

Hostname. Identifies a computer, the host, by a name of the machine and the domain name. The domain name may describe a single computer or a group of computers. For example, *this.machine.com* and *that.machine.com* are two computers named *this* and *that* in the domain *machine.com*.

HTML. HyperText Markup Language, the language used to create World Wide Web documents.

Internet. A collection of interconnected networks that speak the Internet Protocol (IP) and related protocols. The Internet provides file transfer, remote login, electronic mail, news, and other services. As of April 1993, there were 10,000 networks connected to the Internet.

Knowbot. A term introduced by Vince Cerf meaning a "robotic librarian." These experimental information-retrieval agents are under development.

Listserv. A mailing list devoted to a specific topic. Any message posted to the topically oriented listserv is forwarded to all subscribers.

Node. Any computer on a network.

PDF. Portable Document Format, a computer-platform-independent electronic file format developed by Adobe Systems, Inc.

Remote login. The process of accessing a host mounted on another network, which is usually accomplished using telnet protocol.

Server. Used to mean either (1) software that allows a computer to offer a service to another computer (i.e., client), or (2) the computer on which the server software runs.

SLIP/PPP. Connection types that allow the user to access graphical interfaces, such as the Web. SLIP or PPP connections typically require client software such as WINSOCK for the PC or MacTCP or MacPPP for the Macintosh.

Telnet (TELEtype NETwork). A software application utility for TCP-IP that provides terminal emulation, and thus remote login capability from a microcomputer to some remote host.

TCP-IP (Transmission Control Protocol/Internet Protocol). The most common communication protocol for regional and national networks.

URL (Universal Resource Locator). An electronic address on the World Wide Web.

USENET. A distributed bulletin board and discussion system that generally requires access to a UNIX host. Also known as *NEWS* or *NETNEWS*.

Veronica. A search system under development at the University of Nevada that creates a mini-gopher based on a one-word search across gophers.

VT100. A standard, commonly used protocol for terminal emulation, often used when logging into a remote host or network.

WAIS (Wide Area Information Servers). A method of searching the Internet, WAIS searches specially created indexes of databases, not the databases themselves.

WWW (the Web, or the World Wide Web). A system of interconnecting resources offering flexible multimedia coverage of a variety of topics. Netscape is the primary software package for accessing the WWW.

In addition to the systems resident on the Internet are a variety of services that can be accessed through the Internet or by direct modem connection. These services consist of databases that allow the engineer to search and retrieve materials including citations to articles, technical data, financial information, and the full text of articles. This information is available from thousands of different databases. Individual databases tend to be subject-specific, although the scope of coverage can vary greatly. Databases are created by commercial publishers, research institutions, or government agencies. Hundreds of different on-line vendors, or databanks, provide the search and retrieval software to allow remote users to manipulate these databases. Unlike the Internet, where only recently have the resources to maintain a high-quality product been available, these databases are typically well supported and can be depended upon to be consistent and reliable.

77.2 INTERNET RESOURCES

77.2.1 Approaches to Using the Internet

If you have no idea of what the Internet is about, there are some good ways to get your feet wet. One is simply to find someone well versed in various Internet systems to sit down with you as you experiment. You take the keyboard; that way you can maintain the pace of the demonstration. You can also take advantage of the flurry of Internet workshops being offered at conferences or through local organizations. *The Whole Internet: User's Guide and Catalog*, 2nd edition, by Ed Krol, is an excellent Internet user's manual; we recommend it highly. But the big thing is to get started.

Why use the Internet? Simply because it offers information unobtainable via the commercial vendors and free access to some information for which you would otherwise need to pay. Internet databases such as the EPA's provide information available through the commercial database NTIS, and some information that NTIS doesn't have. Fedworld, a bulletin board of federal information resources, hooks you in to scores of federal agencies and allows you to download some documents directly. The list could go on and on. Suffice it to say that, among all of the trash, there is a great deal of real substance to the Internet.

Once you are surfing along that electronic superhighway, you'll wonder where all of that useful information is hidden. The first adjective one would use to describe the Internet is *unorganized*. Be very careful which listservs you join and which usenet groups you subscribe to; you may find yourself waist-deep in information. We have included a list of some useful Internet resources later in this chapter. These systems offer a number of advantages. Not only do they provide a unique way of interacting with professionals in your specialization, but they also allow you to keep close tabs on the newest technical issues in your field.

If you are having difficulty finding information on a topic, you can post a question to one or more of these groups. While there is no guarantee that you will get an answer, you will be surprised

by the number of information professionals and engineers who will take the time to help you. But beware; there are plenty of “lurkers” who observe but remain silent. Lurkers are interested in knowing who is doing what. It is remarkably easy to figure what people are doing by what they ask. If you represent a corporation or are working on cutting-edge research, you should either not post questions or else subdivide your query into questions that cannot be easily reconstructed by competitors.

Where can you find useful information on the Internet? Start with the list of resources provided in this chapter. Once you are actively involved, you will find it fairly easy to pick up new sources. Most Internet systems build new sources into their structure. For example, in the World Wide Web, links are rapidly being established to new sources. The nature of the network is such that many of these additions are done in a seamless manner; however, you need to be prepared for rapid and dramatic changes in the Internet. Sometimes links to valuable resources change without notice and seem to vanish. Sometimes new tools emerge that make older systems obsolete overnight. Think of it as the price we pay for innovation. You can also find out what's new on the Internet by subscribing to a listserv emphasizing your area of interest and by reading this chapter and other literature devoted to information resources in engineering and technology.

While the list below is certainly not comprehensive, it will give you a feel for the sorts of engineering resources available through the Internet. We have included brief comments on the nature and use of each type of resource. Any book on the Internet will provide in-depth discussions of these services.

77.2.2 The World Wide Web

There has been a firestorm of interest in the World Wide Web in the last few years. This system provides the user with connections to graphics, sound, and animation in a manner that allows easy browsing. The Web allows hypertextual connections. That is, by clicking your mouse button on a highlighted word or image, you can immediately connect to that remote host. So, as you browse through a homepage, you can select from a variety of options and be connected to them without needing to know where they are or what their addresses are. Ease of use is one of the Web's biggest selling factors; however, the ability to view graphics and use multimedia to present ideas is where it really excels.

Unlike a number of other resources on the Internet, the Web requires that you have client software on your computer. The most common client software is Netscape. Netscape is a Windows-type tool for navigating the Web. As the Web grows, more Web sites are requiring special software to view documents and run programs. Software packages such as Adobe Acrobat are readily available as downloadable files through the Web. Typically, Web sites requiring special software will provide instructions for obtaining the programs. While obtaining software from well established companies is fairly safe, use caution when downloading programs from unfamiliar sources. This is an excellent way to import a computer virus into your computer or network! Web addresses are referred to as *Universal Resource Locators* or *URLs*.

Alta Vista Web Search

URL: <http://www.altavista.digital.com/>

Alta Vista is one of many Web search engines. By entering terms of interest, you can retrieve lists of Web sites that may be relevant to your needs. The large number of Web sites, rather than flaws in the search engines, account for the false drops. Alta Vista is widely respected for its speed, ease of use, and strong coverage of the Internet.

ANSI Online (American National Standards Institute)

URL: <http://www.ansi.org/docs/home.html>

While it functions mostly as an on-line sales brochure, this site does help you identify ANSI and ISO standards and provides information for ordering the desired documents. The homepage provides some information on forthcoming standards and symposia, but its clear focus is on selling standards.

ASME Net (American Society of Mechanical Engineers)

URL: <http://www.asme.org/>

ASME Net is a one-stop-shop for any information emanating from the Society. It includes information about ASME conferences and publications, education, employment, professional development, and other information of interest to mechanical engineers.

American Society for Testing and Materials (ASTM)

URL: <http://www.astm.org/>

Besides producing standards, ASTM devises a large number of the test methods used to establish standards compliance. This homepage offers searching of the ASTM standards and test methods, a list of publications and services, directory information, and a full listing of the various ASTM committees.

Engineering Information Inc. Engineering Information Village (Fig. 77.1)

URL: <http://www.ei.org/> (800/221-1044 or ei@ei.org)

This Web site deserves special attention due to its unique nature and relevance to mechanical engineering. Engineering Information, Inc. (Ei) has crafted a very strong service on the Web that provides access to Ei's Compendex database and about 180 other commercial databases, as well as thousands of Web sites, listservs, and news groups. The availability of document delivery and assistance from senior engineers nicely rounds out the service. What you end up with isn't really a Web homepage, but a unique service that takes advantage of Web, e-mail, and other Internet technologies. The main graphic of the Village is mapped so that a click on a subject icon launches you to that section of the homepage. By adding connections to business, government, travel services, commercial Web services, and news resources, Ei has created a tool that provides an electronic bookshelf for the engineer. Unlike most Web resources, this Web service has a charge for using it, due to the inclusion of commercial database access, document delivery, and certain consultation services.

Fedworld

URL: <http://www.fedworld.gov>

Fedworld is the Web clearinghouse for U.S. federal information through the Internet. Since the early 1990s, the federal government has shifted to electronic publication of information in order to save money. Through Fedworld, you can access report databases from the EPA, DOE and NASA, census and economic data, and a wide variety of federal information. This is one of the most valuable Web sites available today.

General Electric

URL: <http://www.ge.com/>

General Electric provides an example of the types of corporate information available through the Web. GE uses its Web site to help advertise its products and services as well as to provide business information to existing and potential stockholders. By browsing Web pages such as GE's, you can obtain a great deal of information about a company.

ICE (Internet Connections for Engineers)

URL: <http://www.englib.cornell.edu/ice/ice-index.html>

ICE provides one of the best compilations of Web resources for engineering and the hard sciences. Produced at Cornell University, ICE is also a center for the collection of Web-based educational tools for engineering. Cornell has been a leading university in developing the Internet and this site demonstrates some of that vision and hard work.



Fig. 77.1 The Engineering Information Village provides a wide range of engineering information and services through the Web.

Information Analysis Centers (IACs)

URL: <http://www.dtic.dla.mil/iac/>

Information Analysis Centers are agencies of the U.S. Department of Defense charged with the critical analysis of data. These centers analyze materials data for metals, ceramics, polymers, and so on for DOD efforts and have a secondary objective of providing information to U.S. industry. The IAC Web pages are one of the more innovative programs of the DOD in providing technical information to the public.

International Business Information on the WWW

URL: <http://www.ciber.msu.edu/busres.htm>

This Web site, developed by Michigan State University, provides links to on-line periodicals, U.S. Commerce Department information, and country-specific pages related to international business. Some of the information available from non-U.S. corporations through the Web is unobtainable from any other source.

International Organization for Standardization (ISO)

URL: <http://www.iso.ch/welcome.html>

The ISO Web site provides a catalog of ISO standards and information on ISO and its activities. Also included are news and background information on the ISO 9000 standard on quality manufacturing.

Journal of Mechanical Design

URL: <http://www.jmd.engr.ucdavis.edu:80/jmd/index.html>

As this handbook goes to press, there are scores of Web-based journals. This seems to be a trend that will accelerate in the coming years. The *Journal of Mechanical Design* offers an index of articles back to 1993, information for authors, and general information on the journal.

NTRS (NASA Technical Reports Server)

URL: <http://techreports.larc.nasa.gov/cgi-bin/NTRS>

NTRS is a clearinghouse search that allows you to search full-text or abstracts of technical reports from several NASA Research Centers, Flight Centers, and Laboratories.

National Center for Manufacturing Sciences

URL: <http://www.ncms.org/>

NCMS is an organization of companies and individuals dedicated to the study and advancement of manufacturing. Their Web site is an excellent source of information related to manufacturing. Members of NCMS have access to citation databases and others services, but there are a variety of resources open to the general public.

National Technology Transfer Center (NTTC)

URL: <http://www.nttc.edu/>

The NTTC Web page provides a strong overview of technology transfer opportunities from the U.S. government. Included in the coverage is information on specific technology-transfer opportunities, technologies licensable from the federal government, and a list of federal research facilities.

PM Zone (Popular Mechanics)

URL: <http://popularmechanics.com/homepage2d.html>

Popular Mechanics has taken the Internet by storm with a content-rich Web site that provides broad coverage of science and engineering as well as a focused view on automobiles. This homepage creatively uses Internet technologies to offer you animation, sound, and images.

SAE International (Fig. 77.2)

URL: <http://www.sae.org/>

The SAE Web site provides information on SAE's many conferences and publications, collections of automotive press releases, and connections to sites of interest to automotive engineers. Fee-based access to an automotive news file is also available to subscribers.

SEC Edgar

URL: <http://www.sec.gov/edgarhp.htm>

This site provides access to the corporate filings of U.S. companies and foreign firms represented on the U.S. stock exchanges. 10K and 10Q reports provide a wealth of financial data on companies as well as excerpts from annual and quarterly reports. This is an excellent free source of corporate financial information.



Fig. 77.2 SAE's Web site promotes the society's activities with lists of publications and conferences, along with automotive news. (Reprinted with permission, copyright Society of Automotive Engineers, Inc.)

Society of Manufacturing Engineers

URL: <http://www.sme.org/>

With over 70,000 members, SME is one of the largest societies serving the mechanical engineering profession. The SME homepage offers information on the society's conferences and publications, educational and accreditation opportunities, and a collection of information of interest to members.

Thomas Register (Fig. 77.3)

URL: <http://www.thomasregister.com:8000/index-to.html>

The *Thomas Register* is one of the most respected names in equipment catalogs. The Web version offers free on-line use of the catalog and an easy way to search for companies. Like many Web services, free access to this catalog may not last forever.



Fig. 77.3 The Thomas Register homepage provides searching of technical equipment retailers on the Web.

77.2.3 Telnetting, Listservs, Usenet, Gophers, FTP

Telnetting

Telnet is an Internet application that allows you to enter remote hosts to search databases, use software, access bulletin boards, or perform e-mail functions. One application of telnetting is to tie directly into remote library catalogues to determine if the system has a particular book or journal. Another application is to get into your own host system if you are away from your system, but have access to a foreign host. In addition, more and more governmental agency and specialized societal databases are becoming available on the Internet. The telnet protocol is very easy. Simply enter the command

telnet HOSTNAME

where HOSTNAME is the name of the host you wish to access. Once in the host, you must follow its commands and protocols. Your system may have security measures, such as a firewall, that require special passwords to enter. Ask your local systems office for details. As always, enter *HELP* for assistance or a list of commands. Most systems use a word such as *quit*, *logoff*, *stop*, *end*, or *bye* to end the connection. If that doesn't work, simply turn off your machine.

Listservs

To subscribe to a listserv, send an e-mail message to one of the addresses below with a single line as message:

SUBSCRIBE LISTSERV.NAME FIRST NAME LAST NAME

For example, to subscribe to MECH-L, John Doe would send a message to *LISTSERV@UTARLVM1.UTA.EDU*:

SUBSCRIBE MECH-L John Doe

The first message you receive from the listserv will be a set of instructions for using that system. We advise that you save this message for further reference. For a list of listservs, send the following command to any *LISTSERV* address:

LIST GLOBAL

CAEDS-L (Computer-Aided Engineering Design)

Address: *listserv@listserv.syr.edu*

MATERIALS-L (Materials Science)

Address: *listserv@listserv.liv.qc.uk*

MECH-L (Mechanical Engineering)

Address: *listserv@listserv.utq.edu*

Usenet Groups

Usenet may be accessed from some gophers or directly using a variety of software packages. Consult your local computer systems office for information on your best option. The contents under each group will consist of series of comments on a variety of subtopics.

<i>sci.comp-aided</i>	(sci/tech computing applications)
<i>sci.engr</i>	(engineering, general)
<i>sci.engr.manufacturing</i>	(manufacturing technology)
<i>sci.engr.mech</i>	(mechanical engineering)
<i>sci.materials</i>	(materials science)

FTP

The ftp application uses the file transfer protocol to move files between your computer and a remote computer. For example, you can use ftp to retrieve a text file, spreadsheet, or image from another site. If you have an account on the remote computer, you will log in using your user name and password. There are also anonymous ftp sites, which allow users to take files without having an account. In general, the log-in name for these sites is *anonymous* or sometimes *guest*. The password is either identical to the login; your e-mail address; or there will be no password prompt.

There are two types of ftp applications that you might see. One is the command-based ftp, done from a command prompt. Type

ftp HOSTNAME

The command to get a file is *get <filename>*; to list the files available in the directory on the remote machine in which you're working, the command is *ls*. To get out of *ftp*, type *quit* or *bye*.

There are also graphical (or Windows-based) *ftp* applications that work with the point-and-click technique rather than requiring you to enter commands at a prompt.

77.2.4 The Intranet: Information Resources within the Corporation

1995 saw the advent of the Intranet, the private Internet within an organization or corporation. Intranets experienced explosive growth in 1996 because they offered a flexible option to more expensive software solutions for communication, document management, and knowledge management. These internal webs provided security, speed, graphical communications, and low cost, a combination that proved irresistible to large and small organizations. For the information customer, finding information has become as simple as obtaining a Web browser and using the corporate homepage or search engine. While most Intranets are not well organized, the information universe is small enough to be searched in a reasonable amount of time.

The opportunity and challenge of the Intranet is that anyone and everyone can become a publisher and an information manager. Bringing internal information to the Intranet is the subject of a great deal of corporate scrutiny. Issues of converting text documents to Web documents (in formats such as HTML or PDF), Web security (through authentication or encryption systems), and data storage have been addressed at great length. However, questions of providing external information feeds to augment these internal resources have been all but ignored. External information feeds can take the form of a CD-ROM system at an individual's desktop or internationally accessible, locally mounted database tapes in a major corporation. Deciding which options to take can play a major part in determining competitive position and expenses. Figure 77.4 illustrates some of the options available for information access, depending upon the size of the user population and the need for information currency. The use of CD-ROMs in a networked environment should be limited to those applications where the number of concurrent users will be very small. Even in a wide area network (WAN) configuration, significant input-output problems occur when multiple users attempt to use the same CD-ROM. In a similar fashion, while individual on-line database accounts can work well on a small scale, the companies who offer these services are not generally efficient at offering corporate-wide services. The traditional answer to developing enterprise-wide information access has been to load large databases locally. This solution is capable of supporting large numbers of concurrent users, but is very expensive. In the last few years, a number of Web-based databases have offered companies universal access to information through the Web. The fact that these systems require less network support and training make them a very attractive option for Intranet architects.

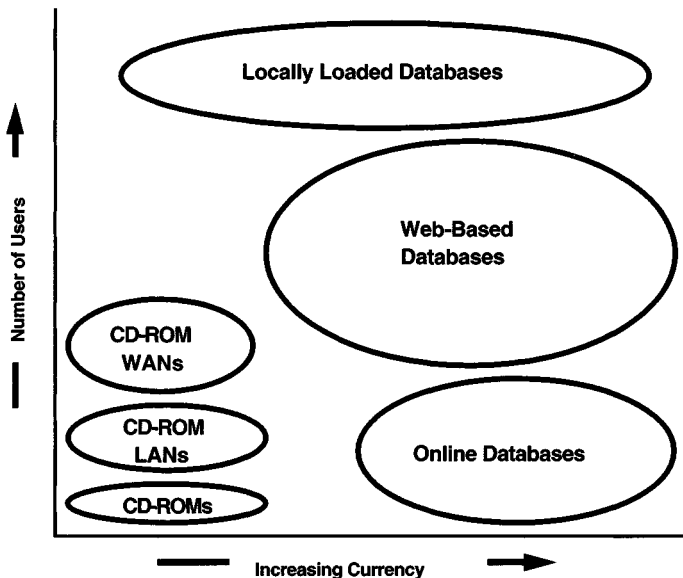


Fig. 77.4 Decision matrix represents corporate information options as a function of currency versus number of users.

77.2.5 Future of the Internet

In 1990, the Internet was primarily of interest to the federal government and academic institutions. The overwhelming concentration of use was electronic mail, much of that informal. The World Wide Web, a graphical, hypertextual medium, opened up almost limitless options for information-sharing. In the early 1990s, universities began to use the Web. They were quickly joined by businesses and individuals. By the middle of the decade, corporations had begun to exploit the flexibility of the Web to provide internal information systems. By 1997, as we write this, the growth in these Intranets has exceeded that of the publicly available Internet.

While the beginning of the Internet boom was publicly financed and free to most users, the trend in the last few years has been towards the provision of high-value, fee-based services through the Web. With the financing of commercial Web services and of corporations erecting private Web-based information networks, information value has replaced novelty as the benchmark of a Web site. It is clear from existing trends that the Web has matured from the plaything of 1990 to a fundamental tool of business and industry.

For the engineer in the corporate setting, Intranets will provide a means of easily acquiring internal corporate information and of sharing your information with others. The future of corporate information in this environment involves being able to convert graphics and documents on the fly to Web-enabled documents, thus eliminating the need for time-consuming records-retention practices. Information available through these internal Webs will be available in full format, text and graphics at the click of a mouse. The hypertextual nature of the Web will allow the combination of video and tutorials into documents, expanding the potential of electronic information from a static to a dynamic medium.

For the consulting engineer, the growth in Internet services will provide all of the advantages of a large corporate library without the space and overhead. By tapping into remote databases and document delivery options, you can scan through a global collection of literature in seconds. As these services expand, expect to see a greater abundance of materials in full text. As network services improve, we will begin to see electronic documents with accompanying graphics.

77.3 ACCESS OPTIONS FOR ELECTRONIC INFORMATION RESOURCES

77.3.1 Internet Access Options

One of the first things you will need to do to access Internet and commercial database services is to obtain a network connection. A variety of services provide Internet access to anyone with a micro-computer and a modem. Each of these services has its own unique billing structure with access fees that typically run from \$11 to \$25 per month. Which service is best for you depends upon which features you want to take advantage of and how frequently you want to use them. For example, some services allow unlimited use of electronic mail, while others include added charges for e-mail use beyond a specified limit. When negotiating with these services, you will want to determine

1. What is the exact rate structure for the service?
2. How much on-line connect time is included and what is the charge rate for additional hours of connect time?
3. Does the service provide access to the World Wide Web? (Many providers will offer you the option to create your own Web site. Beware of services which offer access through a non-graphical interface!)
4. What type of connection/modem options does the supplier provide? (Be certain that the service you select has a local number for Internet access.)
5. What types of access delays have users experienced in using the system? (America Online, which offers some of the most competitive rates, has subjected users to significant access delays in the past!)
6. What basic services does the system provide? (You should expect electronic mail, World Wide Web access, and the ability to telnet. Some people look for chat rooms and features such as on-line encyclopedias as useful extras.)

AlterNet	800/258-9695	
America Online	800/827-6364	A lower-cost access option
CompuServe	800/848-8990	A popular provider of access and information resources
InternetMCI	800/955-5210	
MicroSoft Network	800/386-5550	A useful fit with Windows 95 or subsequent systems from MicroSoft
Netcom On-Line Communication Services	800/353-6600	

Prodigy	800/776-3449	A popular on-line service, Prodigy does include advertisements
PSINet Pipeline	800/827-7482	
UUNet Technologies	800/265-2213	
The Well	415/332-9200	One of the first Internet service providers, the Well is well known for its extensive conferencing system

In addition, there are probably a number of local Internet service providers in your area. Local companies may provide better price options for local customers than the national services.

77.3.2 Database and Commercial Services

Commercial Database Services for Mechanical Engineers

There are several large companies who coordinate access to databases that you will find useful for your work. Through these services, you can gain access to retrieve technical, news, and business information. By using their services, you can purchase use of scores or hundreds of databases through a single supplier. With these systems, you can search millions of references in seconds and find references that would either have taken you days to locate or would have been impossible to find! By working on the same system, you need only learn one set of search and retrieval commands that may be used for hundreds of different databases.

Typically, when you search a database, you are retrieving citations to publications rather than the publications themselves. Increasingly, the full text of articles is available through these databases, especially for the business literature and news reports, but these still lack the graphs and figures often necessary to interpret the text. However, most items are available only as a reference. If you do not have access to a corporate, university, or public library to provide copies of the actual publications, you can use one of the document suppliers mentioned at the end of this section.

DIALOG

This system began in the 1970s and is, perhaps, the largest of the database vendors. DIALOG offers a variety of options for you to access their system through a telnet session or through the World Wide Web. If you are not interested in learning the system's command language, a menu-driven system is available. For DIALOG, and for all of the database providers, you sacrifice search power for ease of use by opting for a menu system. Such systems work well for simple requests or to retrieve a few references on a popular subject, but may fail you if you have a difficult search question. DIALOG's strength is its wide variety of databases, including many options for searching patents, trademarks, and business information, as well as references in the social sciences and humanities. While DIALOG is not very strong in its coverage of international literature, it offers a gateway to DATA-STAR, a European system that contains a number of unique databases, a few of which are not searchable in English. A useful feature of DIALOG and other database vendors is the ability to search several databases simultaneously and remove any records that appear in more than one database. In large systems such as DIALOG and STN, this feature allows you to search large collections of multidisciplinary literature quickly and economically.

DIALOG

2440 W. El Camino Real
Mountain View, CA 94040
800/334-2564

Sample DIALOG Record from Engineering Information Inc.'s Compendex Plus Database:

```
FN- DIALOG(R)File 8:Ei Compendex(R)|
CZ- (c) 1996 Engineering Info. Inc. All rts. reserv.|
AN- <DIALOG> 04510805|
AN- <EI NUMBER> EIP96103350983|
TI- Engineering in the global marketplace|
AU- Valenti, Michael|
SO- Mechanical Engineering v 118 n 9 Sept 1996. p 74-78|
SO- <PY> 1996|
CO- MEENAH|
SN- 0025-6501|
LA- English|
```

DT- JA^(Journal Article)|
TC- G^(General Review)|
JA- 9611W4|

AB- Today, mechanical engineering firms are reaping new profits by expanding into new international markets. Key to the development of a successful global strategy for many companies is the assistance provided by private consultants and government agencies. This aid ranges from using interpretive skills and explaining international tax codes to identifying reliable partners and smoothing out difficult negotiations.||

DIALOG's search language is straightforward. The basic DIALOG commands are summarized in Table 77.1.

STN International

While STN is smaller than DIALOG, it is a specialized resource for engineering and scientific information. STN contains most of the same engineering resources as DIALOG and adds a variety of specialized chemical, energy, and environment databases. This system exists as a union of three database centers, one in the United States, one in Germany, and one in Japan. While it has strong coverage of the patent literature, STN is weaker on sources of news and lacks the coverage of nontechnical disciplines. It makes up for this weakness by its unique strength in materials and chemical information. Not only is STN the best source of international materials information, especially for metals, but it provides some very sophisticated ways to search for this information. Materials data, almost completely absent from DIALOG, is abundantly available in STN.

STN International
2540 Olentangy River Road
P.O. Box 3012
Columbus, OH 43210-0012
800/848-6538

Examination of the basic STN commands (Table 77.2) will demonstrate only a few differences between it and DIALOG. Indeed most of the major systems differ only slightly in the structure and syntax of their commands.

Knowledge Express

This service is much more limited than KR DIALOG or STN International, but it is designed for the end-user and has a collection of resources that is geared to the technical business user. Knowledge Express stresses business news, federal and university research, licensable technologies, patents, and

Table 77.1

Command	Short Form	Function	Example
Begin	B	To open access to a database (e.g., B 8 . . . to open Compendex*Plus)	B 8
Search	S	Retrieves references to the specified term or phrase Allows word adjacency Allows word proximity (e.g., terms within three words of each other) Wild card (e.g., all terms beginning with manufacture, including manufacture, manufacturing, etc.)	S aluminum S metal()forming S spark(3w)timing S manufactur?
Expand	E	Displays an index of terms alphabetically related to selected term (e.g., engineer, engineering, engineers)	E engineer
Help	?	To get information or help	? Limit
Limit	L	Restricts output (e.g., set 3 to English language only)	L s3/eng
Type	T	Displays record(s) in a variety of formats (e.g., set 3, full text of records 1-6)	T 3/9/1-6
Quit	Q	To end session	Q

Table 77.2 Basic STN Commands

Command	Short Form	Function	Example
File	FIL	To open access to a database (e.g., FIL CA, to open Chemical Abstracts)	FIL CA
Search	S	Retrieves references to the specified term or phrase Allows word adjacency Allows word proximity (e.g., terms within 3 words of each other) Wild card (e.g., all terms beginning with manufacture, including manufacture, manufacturing, etc.) Wild card for internal characters (e.g., for U.S. and British spellings)	S aluminum S metal(w)forming S spark(3w)timing S manufactur? S alumin!um
Expand	E	Displays an index of terms alphabetically related to selected term (e.g., engineer, engineering, engineers)	E engineer
Help	Help	To get information or help	Help Commands
Display	D	Displays record(s) in a variety of formats (e.g., set 3, citation and abstracts for records 1-6)	D L3 bib,ab 1-6
Logoff	Log	To quit system	Log

technology transfer. Because of its strength in these areas and its lack of coverage of the mainstream technical literature, Knowledge Express is best seen as a complement to one of the larger services, rather than a substitute for either of them.

Knowledge Express
One Westlakes
1235 Westlakes Drive, Suite 210
Berwyn, PA 19312-9877
800/529-5337

Document Suppliers

In most cases, you will be obtaining citations from these databases rather than full text. There are a number of companies who will mail or fax documents to you upon request. In some cases, these services are directly accessible through the on-line database vendors. If you live near a major university, inquire with the library to see if fee-based document delivery is available. Often such university-based options cost less than the commercial services. The cost of a photocopy will include \$12 to \$20 for handling; the royalty fees (which are highly variable); plus added charges for rush delivery. Listed below are some of the major document delivery vendors who cover the technical literature.

Article Express	800/238-3458	For copies of journal articles and conference papers
Global Engineering Documents	800/854-7179 303/792-2181	Supplies articles, papers and industrial standards. Provides worldwide coverage through a number of "Global Information Centres"
ANSI	212/642-4900	ANSI can provide U.S. and international standards
IEEE	800/678-4333 908/981-0060	Source for worldwide IEEE standards
NTIS	800/553-6847	Call NTIS with requests for federal technical reports
Powells Technical Books	800/225-6911	One of the best sources of engineering books, even out of print or rare books (http://www.technical.powells.portland.or.us/)

77.3.3 Databases of Importance for Mechanical Engineers

Engineering Databases

These databases contain references to journal articles, conference papers, patents, books, and technical reports. A few databases, like those in the MDP Network, contain actual data as opposed to references to literature.

Compendex (Availability: DIALOG, STN, CD-ROM)

Compendex is produced by Engineering Information, Inc. This company has been providing access to the literature of engineering since the late 1800s, electronic access since 1970. The scope of the database is very broad, covering all subjects within engineering; however, it is best for more traditional areas like mechanical and civil engineering. While the service is not limited to U.S. literature, it is strongest for journals and conferences produced in this country. While you may not want to restrict your use to this database, it is a MUST for the mechanical engineer. (Compendex is also available through the World Wide Web. See Section 77.2.2 for details.)

ISMEC (Availability: DIALOG, STN, CD-ROM)

The database of the *Mechanical Engineering Abstracts* provides indexing of journal articles, conference papers, books, technical reports, and patents dealing with mechanical engineering, production engineering, and engineering management. ISMEC's coverage extends back to 1973. While it is significantly smaller and less frequently updated than Compendex, its strong focus on mechanical engineering makes it a valuable resource for anyone involved in this discipline.

METADEX (Availability: DIALOG, STN, CD-ROM)

This is the definitive metals database and indexes the commercial literatures on metals and alloys and metallurgy. This database references citations to articles, books, and conferences papers, as opposed to the MPD files (below), which contain data.

MPD (Materials Property Data) Network (Availability: STN)

The MPD Network is a collection of databases containing physical property data for a wide variety of materials. The network's coverage is strongest for metals and polymer data, but also includes ceramics. Of the metals, the coverage of steels and aluminum alloys is especially strong. Beside retrieving data points on particular materials, this system may be used to select a range of materials meeting specific property ranges. In this manner, you can use the MPD Network as a tool to assist you in determining materials options for a specific application.

1MOBILITY (SAE Literature) (Availability: STN, DIALOG, CD-ROM)

The Society of Automotive Engineers has produced an index of transportation engineering since the early 1900s. They produce this database, which contains citations to technical literature and news related to automotive (approximately 75%) and aviation (approximately 25%) engineering. One advantage of this database is its coverage of the reports literature of non-U.S. automotive societies.

INSPEC (Availability: DIALOG, STN, CD-ROM)

While Compendex is the best source for most engineering literature, it is no equal for INSPEC for computer science, electrical engineering, or advanced materials research. In addition, since INSPEC is produced in Britain, it has better coverage of the European literature. If your question involves mainstream mechanical engineering, this file is probably not of interest. However, it is an excellent source of computer controls and automation information.

NTIS (Availability: DIALOG, STN, CD-ROM)

The federal government spends billion of dollars each year on research and development. Unfortunately, almost none of this work is available through traditional indexes or databases. NTIS, the National Technical Information Service, provides the database of the same name to make this material accessible to the public. You can expect to find a variety of reports from agencies such as the DOE, DOD, NASA, and EPA here. Of special interest are results of Small Business Innovation Grants in cutting-edge technologies such as robotics and automation control that are given to start-up companies.

Chemical Abstracts (Availability: STN best, DIALOG, CD-ROM)

This database is the world's largest and covers anything even remotely involving chemistry or chemical engineering. If you need information on specific metal alloys or tribology, you may want to give this system a try. A companion database, the "Registry" file, contains chemical registration numbers that uniquely identify specific substances. On STN, these numbers may be used to find materials information in other databases on the network. The CD-ROM option lacks some of the search features of the on-line databases.

Aerospace Database (Availability: DIALOG, CD-ROM)

For mechanical engineers involved in aeronautics or astronautics, this database is a must. Providing a broad coverage of the aerospace literature since 1962, this database is one of the few that includes federal research in its scope.

University Technologies (Availability: Knowledge Express)

Knowledge Express's University Technologies file provides information on collaborative research and license opportunities from over 150 universities. The database covers all areas of research.

News and Business Databases

The news and business files can be of value for two reasons. First, they provide a way of locating information on companies that you may be benchmarking or are considering as suppliers. This kind of heads-up can save you time and expense. Second, there are times when the only information available on a new technology is the public statements of the company who has developed it. While this type of release is seldom a good source of technical information, it may be all there is.

ABI-Inform (Availability: DIALOG, STN, CD-ROM)

This is an excellent database of the mainstream business literature, indexing popular business periodicals along with major trade publications. It is a very good place to look for what the press is saying about a company or corporate trend.

AP NEWS (Availability: DIALOG)

A full-text database, AP News allows you to tap into the newswire service that serves the news industry. This database is updated constantly and provides up-to-the-minute news and financial information.

CORPTECH (Availability: Knowledge Express)

This directory provides detailed information on over 40,000 technology-related companies, including contact information, company descriptions, and financial information. The database is updated quarterly.

PAPERS (Availability: DIALOG)

PAPERS indexes scores of U.S. newspapers and provides a good source of background information. Often a local newspaper will get information that a major publication would not due to its everyday exposure to the company.

Patent Databases

Your first exposure to patents will leave no doubt that this is a literature written by and for lawyers. It is difficult to comprehend even if you have a firm understanding of the underlying technology. Nevertheless, this is an essential literature for engineers, since it is often the only source of technical information for certain technologies. Most of the R&D in applied areas is done by companies who have no desire to publish their results. Doing so would share millions of dollars of technology with their competitors. However, in order to protect their innovations, they need to reveal details of these technologies in the patents they file with the U.S. and foreign patent offices. By examining these patents, you can gain access to cutting-edge information long before it appears in the journal literature.

Derwent World Patents Index (Availability: DIALOG, CD-ROM)

This is an excellent database for the world's patent literature. By providing extra indexing and adding natural language keywords to each title, Derwent makes the patents easier to find. The fact that it takes 12 to 18 months for a patent application to show up in the U.S. literature, coupled with the fact that most large companies file simultaneous patent applications in other countries, suggests that searching the global literature is preferable even if you only want U.S. patents.

CLAIMS/U.S. Patents Abstracts (Availability: DIALOG)

If you are determined to limit your search to U.S. patents, this database provides strong U.S. coverage at a discount to the price of the Derwent database.

77.3.4 CD-ROM and Desktop Databases

CD-ROMs provide information that resides locally on the user's computer, rather than the information residing on a remote computer and the customer paying to access those data. CD-ROMs are sold individually or on a subscription basis. An individual CD-ROM will be a "snapshot" of information, whether it offers information traditionally found in book form, such as conference proceedings, or a database of indexing and perhaps full-text documents such as articles, papers, and standards. With

the subscription system, you will receive a new CD-ROM at a specified interval (monthly, quarterly, yearly) that supersedes the old CD.

Another important difference between CD-ROMs and some of the on-line services is that the CD-ROM may include graphical images of figures, tables, and so on that aren't available through a text-based on-line service. Also, the CD-ROM can comprise a selection of data that are part of a larger database but have been extracted to provide coverage of a more specialized subject area.

Information contained on a CD-ROM requires special software in order to read it, and you must have access to a computer with a CD-ROM drive. The software should be included with the price of the CD, and will either be included on the disk itself or packaged separately. Once the software is installed, the CD may be inserted into the CD-ROM drive at any time; the installed software can be started like any other computer program; and the data will be retrieved from the CD.

There are several factors to consider in selecting the CD-ROM option. CD-ROM provides a "pay-once" alternative to the "pay-as-you-go" system you'll get from the on-line database providers. This can be a good option, especially if you're likely to spend a lot of time searching one database. You don't watch the clock ticking, metering up on-line time, when using a CD-ROM. If, however, you need access to a large variety of databases (perhaps simultaneously), the on-line route may be the way to go. Another factor is frequency of update; if a monthly or quarterly snapshot is current enough for your application, CD-ROM is a good option. Also, find out how retrospective the information contained on the CD-ROM is; if your need is for information from the recent few years, it may be contained on one CD.

The databases available on CD-ROM are generally the same databases available through the on-line services (see Section 77.3.3). One exception to this is the Society of Automotive Engineers (SAE), who have packaged information available on CD-ROM a bit differently than what is available in the IMOBILITY (Global Mobility) database described above. (See below for further discussion.)

Three primary providers of CD-ROMs for engineering information are DIALOG, Silver Platter, and SAE. Also, several databases, such as *Chemical Abstracts* and Derwent patent products, are available on CD-ROM directly from the database producers.

DIALOG

The CD-ROM products from DIALOG, like their on-line system, offer both a command line search option (identical to the DIALOG search language described above) and a menu-driven system. Most of the databases indicated in the above section as being available through DIALOG are also available on CD-ROM. An example of a CD-ROM that includes part of a larger database geared towards a more specialized field is the Derwent Petroleum and Power Engineering database, extracted from the Derwent World Patents Index. Call 1-800-334-2564 for information.

Silver Platter

Silver Platter tends to have a lot of "general reference" databases, but they do have some of the basics for engineering literature, in particular, Ei Compendex, INSPEC, NTIS, and ABI/INFORM. Silver Platter has been in the CD-ROM business for many years (since 1983) and also has World Wide Web-based databases available. Call 617-769-2599 for information.

SAE

The databases available on CD-ROM through SAE are different from those available from the previous two vendors. SAE offers their technical papers, standards, and handbook on CD-ROM; and various repackaged segments of the Global Mobility Database covering specialized areas such as highway vehicles safety and automotive fuels and lubricants. Call 412-776-4841 for information.

77.3.5 Options for Using Electronic Information

In this chapter, we have surveyed a variety of options for you to obtain information directly through the Internet and various commercial services. At this point you have the tools necessary to develop your own unique suite of information services. Your corporate library or nearest university engineering library is an excellent place to visit for more information on these tools. Many technical libraries have become designers of Internet and Intranet systems. Their familiarity with the information systems and their experience with engineering information make them a valuable resource.

What brings many people to this point is the excitement over the Web and the Internet; what keeps them is the advantages they gain from having ready access to information. If you work for a large corporation, you are probably finding that your company is increasingly using the Intranet, LotusNotes, or e-mail as a means of corporate communication. As companies rely more heavily upon electronic communications, your ability to function effectively in this medium will affect your ability to function effectively within the organization. Those of you who work for a small firm or as consultants will find that information is your greatest tool. Technologies and business directions are changing so rapidly these days that without a means of staying current, you are at a severe competitive disadvantage.

What will information do for you? It can mean knowing which firms to benchmark and what questions to ask. It can mean getting a quick start on a new project. It can mean not missing technical options that save money or time. It can mean having better options in less time than your competition. Electronic information expands your collection of handbooks to include a global library of resources. When coupled with document delivery, the resources discussed in this chapter allow you to have greater access to information than any library in the world! For the mechanical engineer of the next century, these tools will be as common as the desktop computer is today.

BIBLIOGRAPHY

Krol, E., *The Whole Internet: User's Guide and Catalog*, 2nd ed., O'Reilly and Associates, Sebastopol, CA, 1994.

Krol's book is easily accessible to the novice and packed with practical, easy to follow information. Krol provides extensive treatment on how to use the Internet, what's allowed there, and how to deal with network problems. Although Krol did the whole book based on UNIX, he includes DOS and Mac directions also.

O'Leary, M., *The Online 100: ONLINE Magazine's Field Guide to the 100 Most Important Online Databases*. Pemberton Press Books, Wilton, CT, 1995.

This is a good overview of the major database options for all subject disciplines. While it is weak on engineering, it will be useful if your interests are more eclectic.

"Internet Watch" column in *Automotive Engineering* (for automotive engineers)

This monthly column provides tips on using the Internet along with updates on new Web sites.