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ABSTRACT

Project Intrex is a program of information transfer experiments directed toward new services and facilities for people who seek information in large libraries. The Project Intrex program includes: (1) the assembly and organization of an information store of sufficient size; (2) the development of the essential facilities for storing, retrieving, transmitting and displaying the information; (3) the study of the operations and reactions of users under varying conditions and (4) the design of user aids for a library providing both machine access and conventional services. (Author/MM)

PROJECT INTREX
A BRIEF DESCRIPTION
CARL F. J. OVERHAGE

MASSACHUSETTS INSTITUTE
OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTS
1971

## ACKNOWLEDGMENTS

The research reported in this document was made possible through the support extended the Massachusetts Institute of Technology, Project Intrex, under grants from the Carnegie Corporation, the Council on Library Resources, Inc., and the National Science Foundation.

The Intrex information storage and retrieval system is being developed at the Electronic Systems Laboratory, Massachusetts Institute of Technology, under the leadership of Professor J. F. Reintjes. Messrs. Richard S. Marcus, Peter Kugel and their associates designed the software system; Mr. Alan Benenfeld has taken major responsibility for literature selection, cataloging and data-base inputting; and Mr. Donald R. Knudson is the leader of the hardware group. The current program of experiments utilizing the Intrex retrieval systems is being carried out by Electronic Systems Laboratory Staff.

Mr. Charles H. Stevens has directed the library development associated with this project, including the planning of the new James Madison Barker Engineering Library at M.I.T. The management of this library, which provides an integrated environment for conventional services and Intrex operations, is in the hands of Miss Rebecca L. Taggart.

For a detailed review of the manuscript of this document, the author is indebted to the director and staff of the Electronic Systems Laboratory.

CONTENTS

Project Intrex is a program of information transfer experiments directed toward new services and facilities for people who seek information in large libraries.

Recent advances in digital data processing, when combined with photographic and video technology, suggest the basic concept shown in Figure 1 for a future library operation.

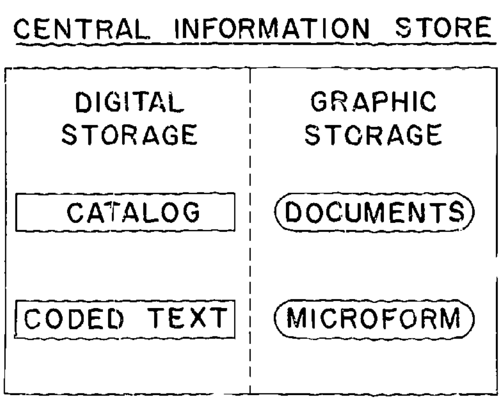


Figure 1 Information Transfer System Concept. Access to centrally stored information can be obtained at many remote terminals by computer-controlled telecommunications. Local information resources can be augmented by links to external stores.

The central information store of such a system contains both graphic and digital records, as shown in Figure 2.

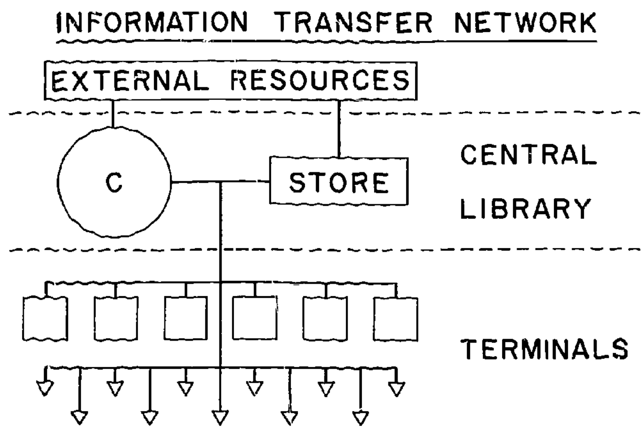


Figure 2 Central Information Store.
The bulk of the information contained in a library system is in graphic form, either as printed documents or as microform records. A small but growing fraction of the stored information is in digitally encoded form: this fraction is more easily handled by the computer and the communication links.

The actual design and construction of an information transfer system of this kind must rest on a solid foundation of experimental facts concerning the interaction of users with the system. The purpose of Project Intrex is to obtain these facts.

The program includes:

(1) the assembly and organization of an information store of sufficient size;

(2) the development of the essential facilities for storing, retrieving, transmitting, and displaying the information;

(3) the study of the operations and reactions of users under varying conditions;

(4) the design of user aids for a library providing both machine access and conventional services.

The experiments of Project Intrex are concerned with two main functions of any information transfer system, viz. (1) the bibliographic search by which the user identifies the documents relevant to his needs, and (2) the display of these documents to the user. The information required for (1) will be briefly designated as the catalog; that required for (2) as full-text.

Catalog information is relatively compact; the user w manipulate it interactively; it is therefore stored in computer memory in digitally encoded form.

Full-text information is much more extensive; computer storage by present technology would be economically prohibitive; it is therefore stored in graphic form on microphotographic records.

Subject matter

As of 1 April 1971 the Intrex file consisted of 15,000 documents from the recent technical literature (beginning in 1967) of the following fields of materials science and engineering:

A. Physics

(1) Optical and magnetic properties of solids;

B. Metallurgy

(2) High temperature metallurgy;

(3) Casting and solidification;

(4) Structural materials.

Selection

The selection of these fields was governed by the objective of engaging the substantive interest of serious users. These fields correspond to the activities of strong research groups at M.I.T.; they are narrow enough so that the relatively small number of documents in the file constitutes a significant fraction of the total literature. In choosing the specific documents that are entered into the file, the Project Intrex librarians have the continuing advice of research workers from the teams whose fields are involved.

The Catalog Entry

Each document is represented in the Intrex catalog by an entry prepared by catalogers and subject specialists. Such an entry contains considerably more information than conventional references. In addition to author, title, and citation date, the entry includes a list of noun phrases that describe the contents of the document. The vocabulary is not controlled; in deriving these "subject headings" from an examination of the document, the catalogers are not restricted by a thesaurus or authority list. They normally use terms employed by the author. An abstract of the document is also included in the catalog entry, and, if there is a table of contents, that is included too.

The result is an "augmented" catalog, in which the entry for a typical document contains the information shown in Figures 3 and 4 as received at a teletypewriter terminal.

DOCUMENT 9343; Elevated temperature compressive creep behavior of tungsten carbide-cobalt alloys; Smith, J.T. (TA); Wood, J.D. (JA); Lehigh University, >Bethlehem<, >Pa.< (BT); AMETA. v.16,no.10,100068. pp.1219 1226.

CHOSEN (FIELD 2)
High temperature metallurgy (Professor Grant); Graduate student
CATALOGER (FIELD 3)
1502
ONLINE (FIELD 4)
08/22/69
MAIN (FIELD 20)
Personal author
AFFILIATION (FIELD 22)
Lehigh University, >Bethlehem<, >Pa.< Dept. of Metallurgy and Materials Science/Battelle Memorial Institute, >Columbus<, >Ohio<. Powder Materials Application Div.;
Lehigh University, >Bethlehem<, >Pa.< Dept. of Metallurgy and Materials Science
MEDIUM (FIELD 30)
Conventional
FORMAT (FIELD 31)
Professional journal article
ILLUSTRATIONS (FIELD 33)
illus.
LANGUAGE (FIELD 36)
English
ABLANG (FIELD 37)
efg
CONTRACT (FIELD 40)
National Science Foundation (>U.S.<) #G24000
THESIS (FIELD 43)
1,. Ph.D.
RECEIPT (FIELD 46)
12/07/67
PURPOSE (FIELD 65)
Theoretical and experimental
APPROACH (FIELD 66)
Professional
TABLE (FIELD 67)



Figure 3 Catalog entry for Document 9343 (First half).

BIBLIOGRAPHY (FIELD 69)

1e(15)

ABSTRACT (FIELD 71)

The compressive creep deformation of two-phase tungsten carbide-cobalt alloys with 12 and 15 *percent* Co has been investigated at temperatures of 800, 900, and 1000 *deg*C for stresses fo 10,000 to 110,000 psi. At each temperature studied, the WC-Co alloys showed a decreasing steady-state creep rate with increasing WC particle size for low creep-stress levels. At high stress levels, the steady-state creep rate was observed to increase with increased WC particle size. These observations, with additional considerations of the creep behavior, indicated that two mechanisms were rate determining during deformation of WC-Co alloys. To ascertain the rate-determining mechanisms during deformation, existing creep models were extended to include the high volume loading of dispersed WC particles present in these alloys. At high stresses, the mechanism postulated to describe steady-state creep deformation was the looping of dislocations in the Co matrix between WC particles and the climb of pinched-off loops. The diffusion of Co in the matrix around WC particles has been suggested as the rate controlling steady-state creep mechanism at low stresses. (author)

SUBJECTS (FIELD 73)

elevated temperature compressive creep behavior of tungsten carbide cobalt alloys (1);
effect of tungsten carbide particle size on creep in tungsten carbide cobalt alloys (2);
creep models extended to include the high volume loading of dispersed WC particles present in WC-Co alloys (2);
rate-controlling steady-state creep mechanism for WC-Co alloys at low stresses (2);
rate determining and deformation mechanisms associated with the compressive creep behavior of WC-Co alloys at high stress and elevated temperature (2);
dislocation looping, dislocation climb, particle movement in the matrix in the two-phase alloy system tungsten carbide dispersed in a cobalt matrix (2);
micro-optical pyrometer (4);
strain measurements in WC-Co alloys made by a photographic technique (4);
WC-Co alloy specimens characterized by quantitative metallographic techniques and deformed in compression creep at 800, 900, and 1000 *deg*C (4);
influence of temperature, stress, WC particle size and mean free distance between WC particles on the creep behavior of the WC-Co alloys (2);
creep mechanisms developed for dispersion strengthened alloys applied to WC-Co alloys containing 75-85 volume *percent* dispersed phase (2);

FICHE (FIELD 5)

| Fiche No. | First Frame | Last Frame |
|---|---|---|
| 825 | a1 | a8 |

Figure 4 Catalog entry for Document 9343 (Second half).

Full-text Storage

The full text of the documents selected for the Intrex file is stored in the form of negative-appearing micro-images of the printed pages. At a reduction of approximately 18X, images of 60 pages are stored on a sheet of photographic film 4 x 6 inches in size. Such a sheet is called a microfiche; its appearance is shown in Figure 5. The format we use follows American National Standard Specifications PH 5.9 - 1970.

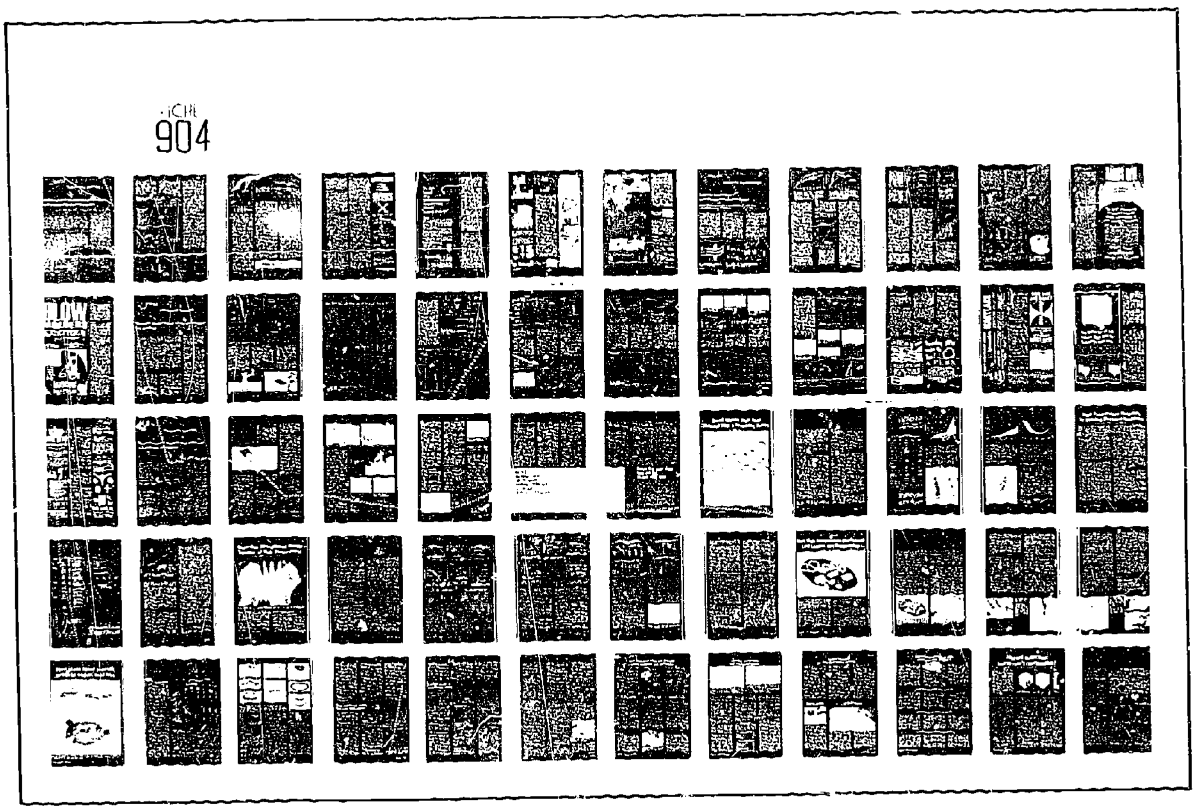


Figure 5 Intrex Full-text Microfiche.

The documents in the Intrex file are relatively short. On the average, they are less than ten pages long, so that several documents are included on each microfiche. In this way, the collection of 15,000 documents can be contained on approximately 1,500 sheets of microfiche.

The Catalog System

Computer

The computer used in the Intrex experiments is an M.I.T. augmentation of the IBM 7094 processor, with two 32K banks of core storage.

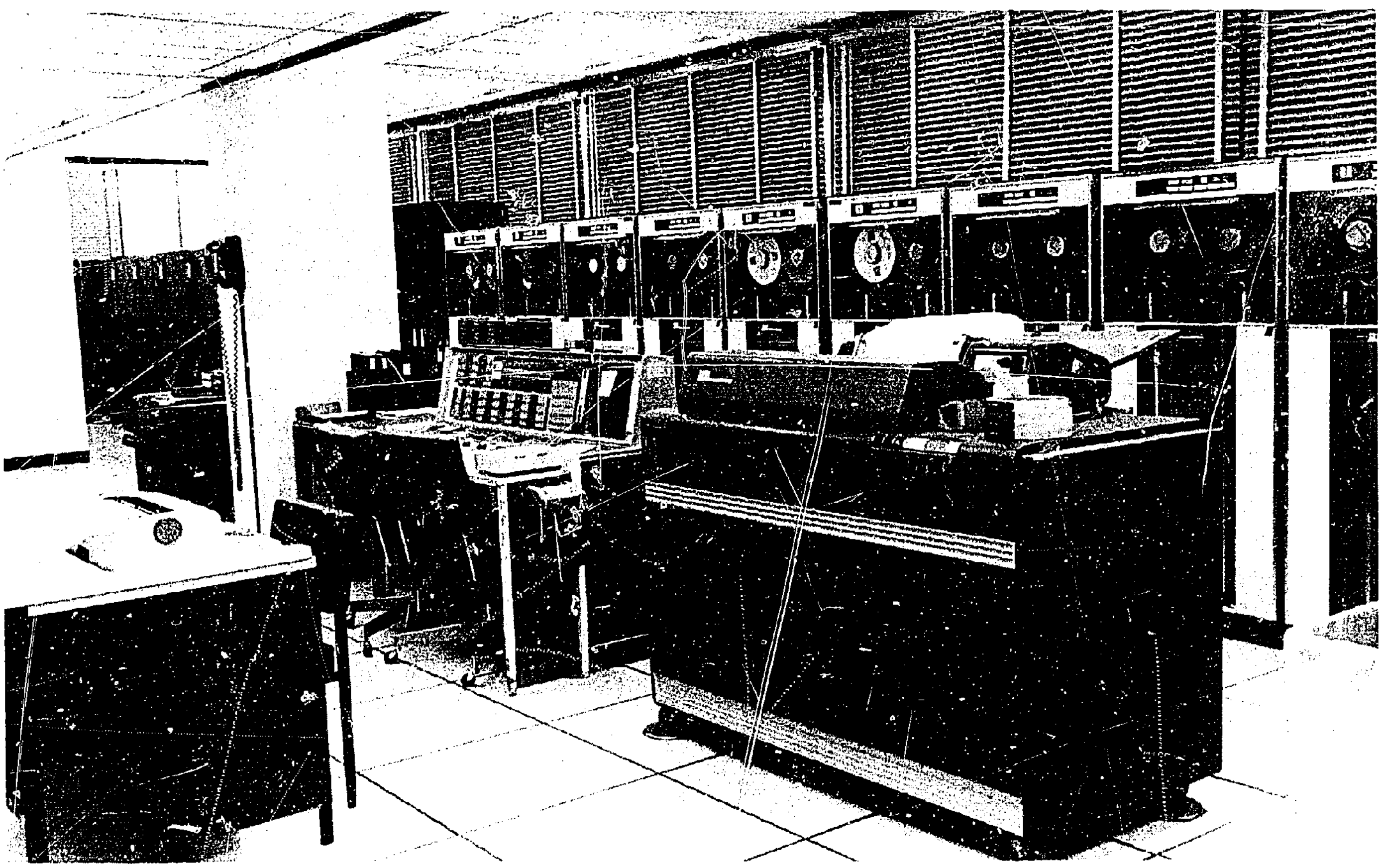

Figure 6 Computing Facility Used for Intrex. This facility is called the Compatible Time Sharing System (CTSS); it has been in successful operation at M.I.T. since 1963. It can handle thirty concurrent users with adequate speed of response.

An IBM disc file is the principal storage device for the data and programs of Project Intrex. At the end of 1970, the total storage requirement for the augmented catalog of Project Intrex was approximately 12,000 disc file records, each record consisting of 432 36-bit computer words.

### Transmission Links

The digital signals involved in the catalog interaction between computer and user terminal are transmitted over telephone voice-grade lines via the M.I.T. data switch.

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Terminals

The primary device for interactive communication with the CTSS computer has been the teletypewriter terminal. A typical installation is shown in Figure 7.

Figure 7 Teletypewriter Terminal.
For Project Intrex, we have used both the IBM 2741 and the Datel 30 teletypewriters. The former is connected to the line by a Western Electric 103A Dataset; the latter by an acoustic coupler.

In recent years, there has been a strong trend toward the use of cathode-ray-tube (CRT) display units with keyboards, in lieu of teletypewriters. The advantages are silent operation and very rapid display. The displays are transient; where permanent ("hard") copies of the interaction are required, additional equipment must be installed for that purpose, or, more simply, the user must settle for the slower teletypewriter.

Two types of CRT terminals are used by Project Intrex. The first is the ARDS console, manufactured by Adage, Inc., which uses a direct-view storage tube (Tektronix 611) to hold the image so that no other local or computer storage is required to refresh the display. A photograph of the ARDS terminal is reproduced in Figure 8.

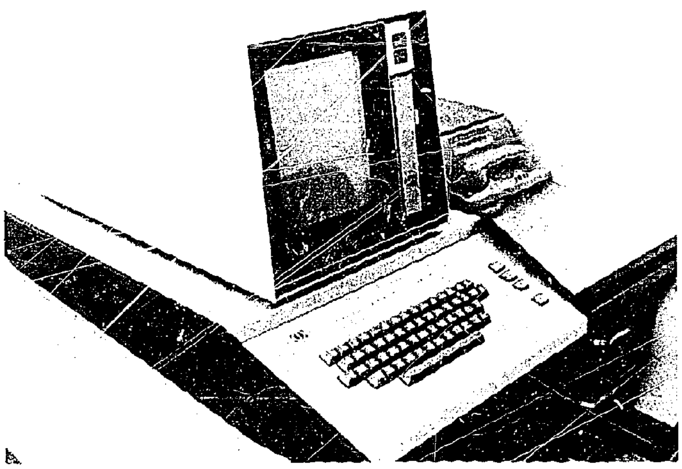

Figure 8 ARDS Cathode-ray-tube Terminal. The resolution of the tube is adequate for 4,000 characters in a single display. The image remains on the tube until erased.

The second type of CRT terminal was designed and built in the Electronic Systems Laboratory as a demonstration of an optimum console for user interaction with the Intrex catalog. It uses local drum storage in a separate buffer-controller and a special character-generator with an expanded set of characters and symbols.

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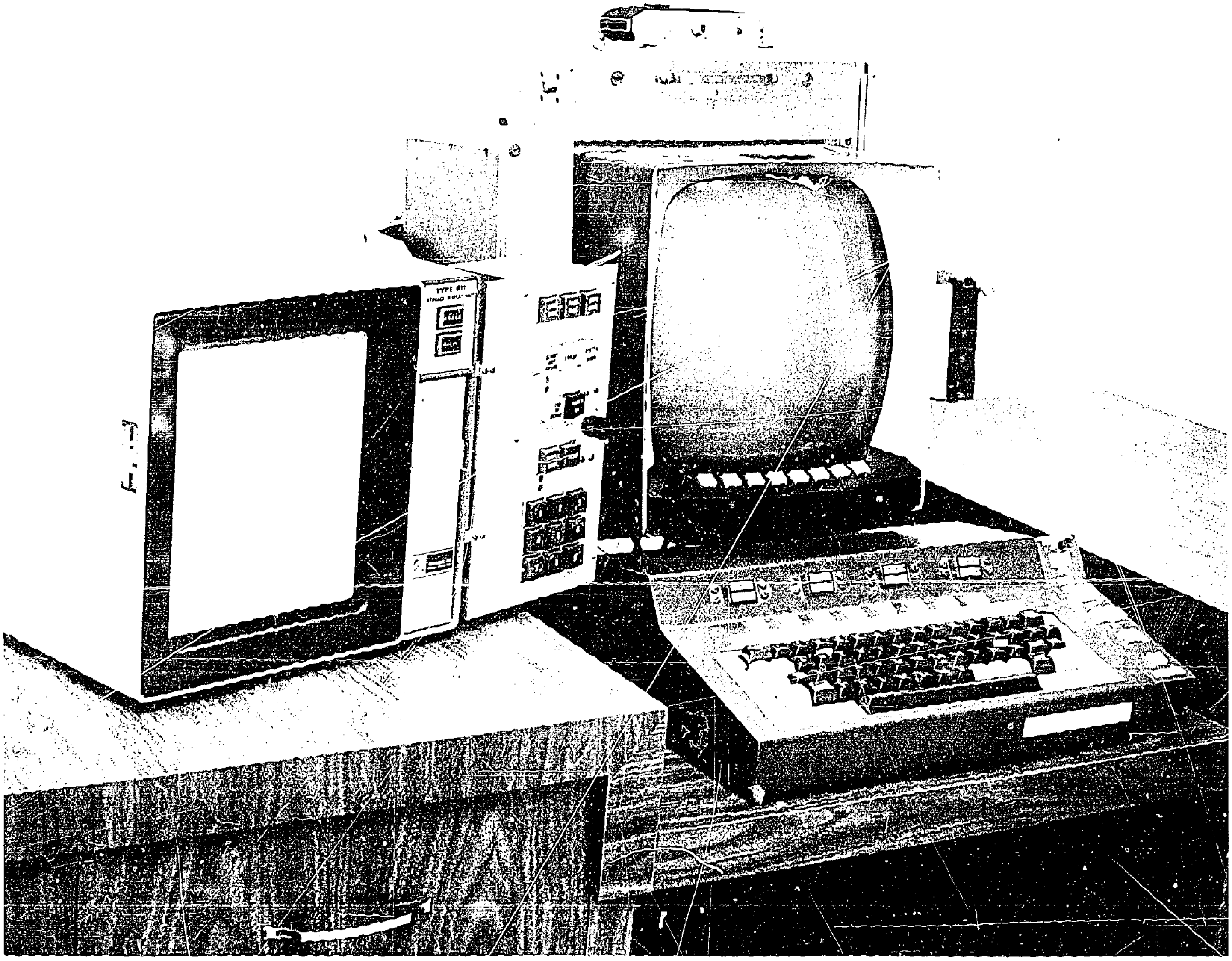

Figure 9 Intrex Cathode-ray-tube Terminal.
1800 high-quality characters, selected from a set of 192, can be presented in a single display. Each character is generated in less than ten microseconds and refreshed sixty times per second for flicker-free appearance. The user enters his search requests through a typewriter keyboard. For frequently used commands, special function switches are provided.

## The Text-Access System

### Microfiche Storage and Retrieval

The 1,500 sheets of microfiche which contain the full text of the documents in the Intrex file are stored in two Compact Automatic Retrieval Device (CARD) units manufactured by Image Systems, Inc. These units provide for the mechanical selection of any specific fiche and for the placement of a selected frame of that fiche in a viewing aperture. Modifications for the purposes of Project Intrex provide for microfiche selection and positioning in response to digital command signals from a remote source, and for the coupling of the unit to a flying-spot scanner which generates video signals from the image in the aperture. A photograph of one of the modified units is reproduced in Figure 10.

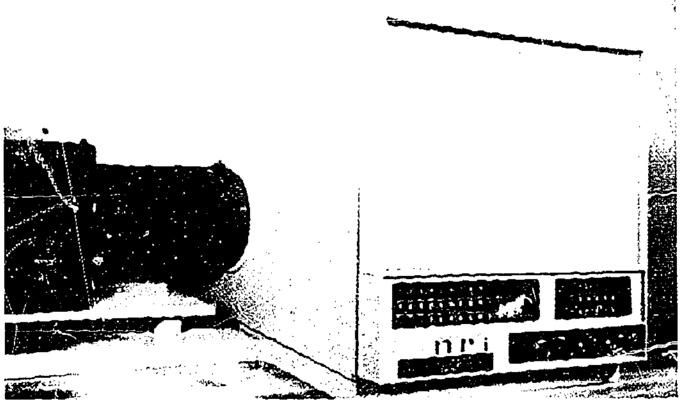

Figure 10 Microfiche Retrieval Unit.
The unit at the right contains 750 sheets of microfiche. When a command signal is received, one of these sheets is moved to the scanning station, and the appropriate frame on the fiche is positioned in the scanning aperture. The smaller unit at the left contains the flying-spot scanning tube for the video transmitter.

### Transmission Links

For the transmission of video signals of full-text images, we use a microfacsimile system operating via coaxial cable. The scanned image of a single page of text is transmitted in approximately two seconds. With 2,000 scan lines, the required bandwidth of the transmission system is about one MHz. The channel we actually use is 4.5 MHz wide.

### Terminals

High-speed transmission of single-frame images permits the text-access system to be shared by several users, but it becomes necessary to store the image at the receiving terminal, so that the user may examine it at leisure. Two types of terminals are provided for the text access experiments of Project Intrex.

ne irst of these termi (Figure 11) uses a
ect-v ew storage ca ray-tube as the de
f r holding the image u t is erased by the user.
he tube used in this tex access terminal is of the
same type (Tektronix 611) that is employed in the
ARDS terminal for catal splay.

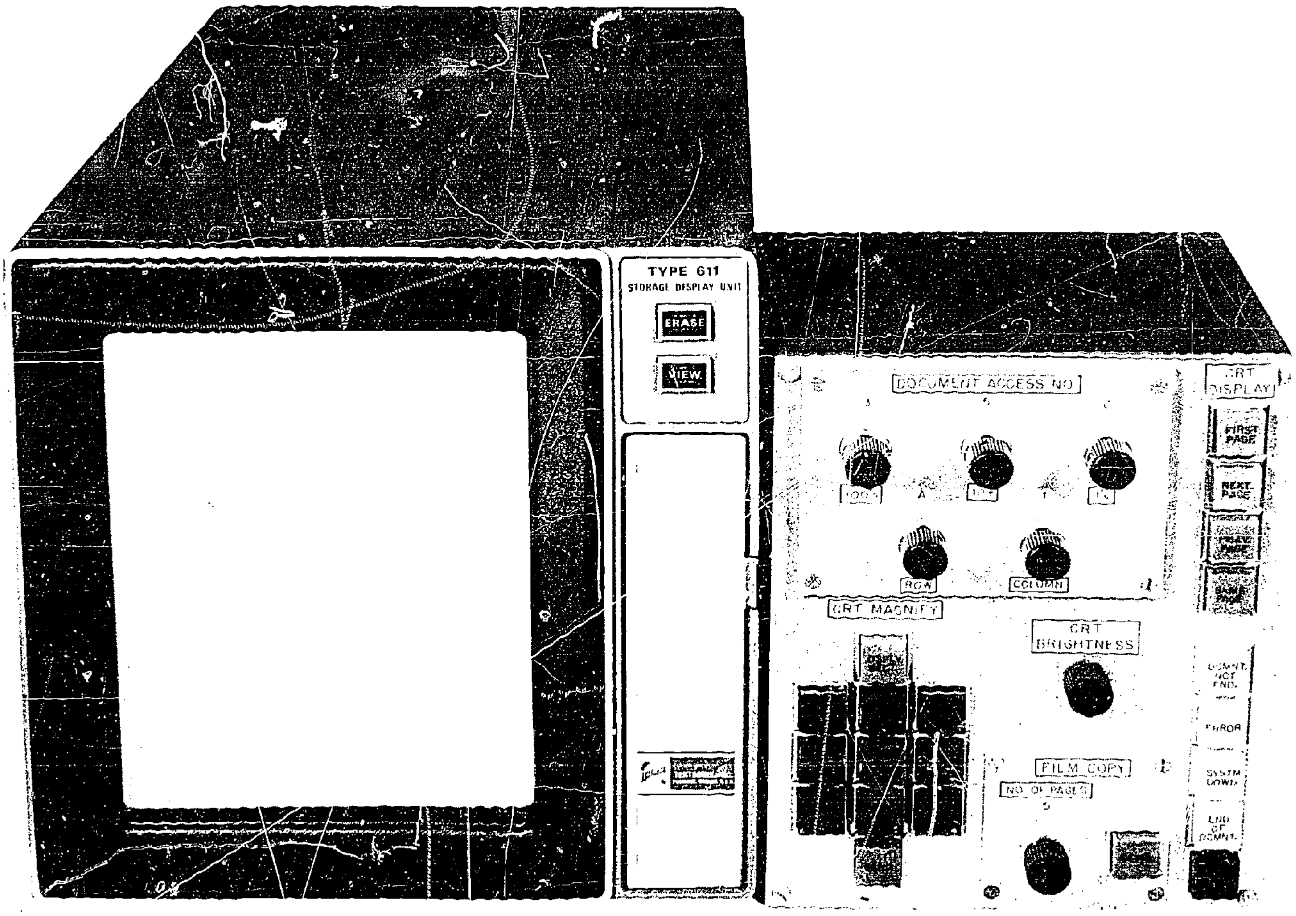


Figure 11 Storage-tube Text-access Terminal. The image of a full page of text is displayed on the face of the cathode-ray-tube with sufficient resolution for scanning, identifying, and selecting documents. Magnified images of different parts of a page can be produced by push button actions if fine detail is to be examined. For protracted study, most users prefer microfilm or full-size paper copy.

The second type of text-access terminal uses photographic film as the local storage medium. In this terminal, shown in Figure 12, the instantaneous video image received on a high-resolution cathode-ray tube is optically projected onto 35 mm film in a recording camera.

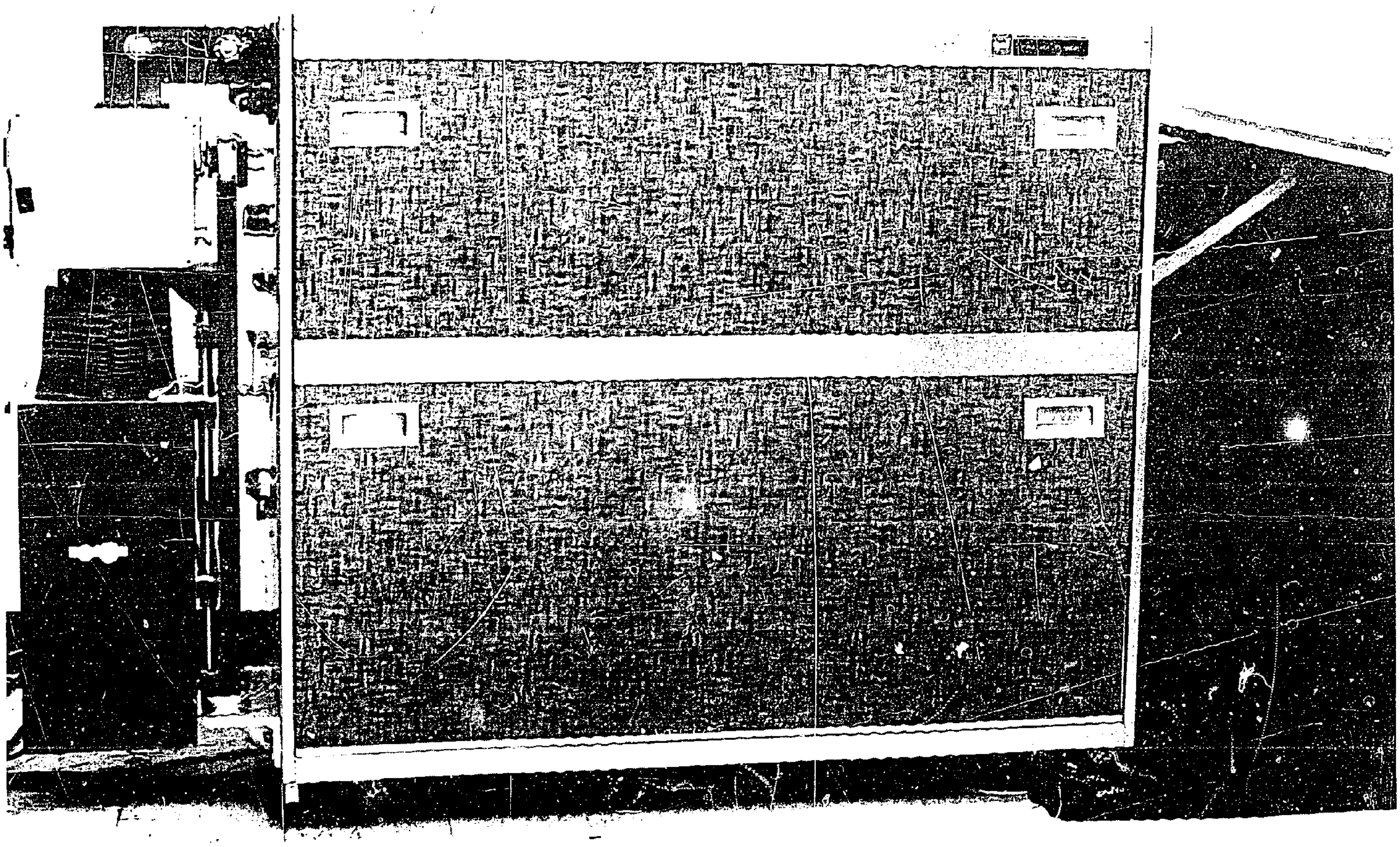

Figure 12 Photographic Text-access Terminal. Strips of exposed film containing up to seven pages at a reduction of approximately 10X pass from the camera through a rapid-processor in sixty seconds. The user examines the finished strips in a microfilm reader or obtains enlarged paper copies from a modified electrostatic office copying machine.

The Combined Terminal

Both the ARDS terminal used in the catalog system and the storage-tube terminal used in the text-access system employ the Tektronix 611 tube as the basic display device. This situation suggested a combined terminal in which alphanumeric characters from digital signals and full-text images from video signals can be consecutively displayed, at the option of the user, on the same screen. Such a combined terminal, shown in Figure 13, was put into operation in 1970 and has been well received by Intrex users.

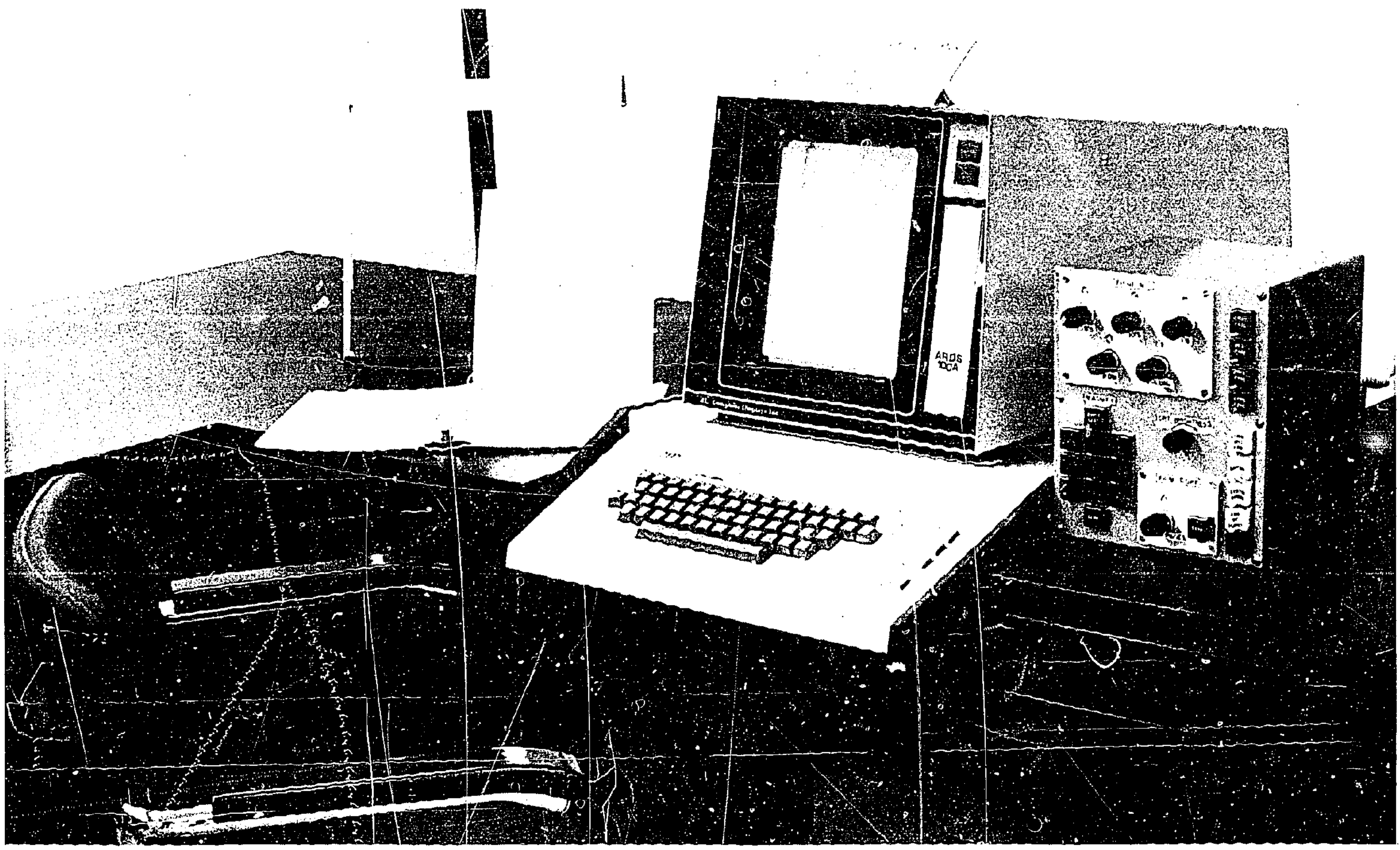


Figure 13 Combined Terminal.
This terminal allows the user to transfer easily from catalog search to full-text display and back again without changing his focus of attention. When the command "output text" is entered on the keyboard, the display unit is switched from the catalog data stream to the video link with the text-access system control. Digital signals from the computer select and position the appropriate microfiche; push-button actions on the control panel shown at the right produce displays of subsequent pages or of enlarged portions of individual pages.

Current Installations

The basic concept of an information transfer system is to make information available to users at the decentralized locations that are most convenient for them. We have established experimental access points in four different environments: First, we have a group of terminals in the Electronic Systems Laboratory where the equipment was developed and where we have optimum facilities for making modifications and for working with specific individuals who have agreed to serve as experimental subjects. Second, we have two terminals in the Barker Engineering Library, where students and other library users can work concurrently with Intrex information and conventional library resources. Third, we are installing Intrex terminals in the environment of a research laboratory, specifically the Center for Materials Science and Engineering. Fourth, we are making the Intrex catalog system available to users at Harvard, three miles away from the computer and its disc file. Figure 14 presents an overview of these arrangements.

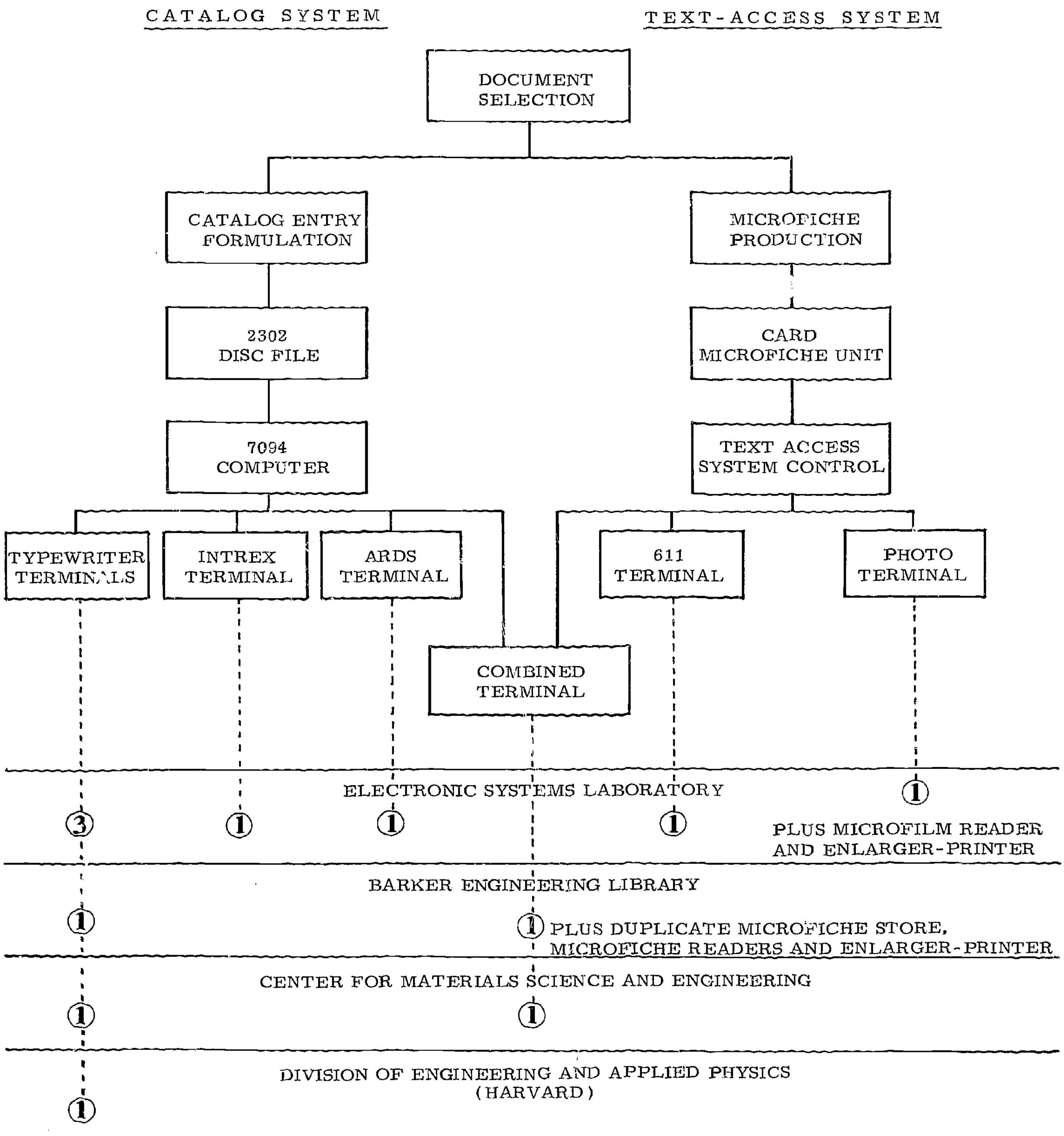


Figure 14 Schematic Diagram of Intrex System and Terminals.
The functional relationships between the principal components of the Intrex system are shown in the upper part of this diagram. The lower part shows the distribution of the different types of terminal equipment among the four locations at which access facilities are provided for users.

## Interactive Access to Catalog and Text

The experimental facilities, which have been described, offer a broad range of services to a library user in search of information. Typically, such a user starts his interaction with the system by indicating his subject of interest. After logging in and identifying himself as an Intrex user, he may type "subject nonlinear optics." The computer responds with a statement that the catalog contains 90 entries on this subject, and the user shifts to a narrower specification, such as "subject nonlinear susceptibility" or "subject second harmonic generation in KDP." Presently he calls for number, titles, authors, and citations of documents that match his subject specification. If these look interesting, he may next ask for one or more abstracts, by typing, for example, "Document 8842/output abstract." The system will then display the abstract to the user.

A print-out of a complete user session with the interactive Intrex catalog has been reproduced in a separate brochure entitled "Project Intrex: Samples of Catalog Interactions."

At some point in his search, the user may wish to examine the full text of a document he has identified. If he has been sitting at one of the combined terminals described on page 15, he simply types "output text" and the image of the first page of the document in question will appear on the screen. Subsequent pages can be summoned by simple push-button actions. If a new search request is entered on the keyboard, the system will automatically return to the catalog mode.

If the user's terminal is a teletypewriter, his access to full text may be either by an adjacent cathode-ray-tube text-access terminal, or by the delayed delivery of a photographic copy on microfilm, microfiche, or (at full size) on paper.

## User Instruction

While everything in the design of the Intrex system has been aimed toward simplicity for the user, a beginner will nevertheless need some instruction. He must learn the command words for subject, author, and title searches, and for output from different catalog fields; he must know how to correct typing errors, and he must learn to use the carriage return button to transfer control of the dialog from himself to the computer.

Three parallel techniques are in operation to convey this information to the user. If he knows how to type the word "begin" on a keyboard, the Intrex computer program will take him through a step-by-step sequence of instructions that will teach him the elements of Intrex interaction. Alternatively, he can refer to a User's Guide in which all necessary instructions are fully set forth. If he uses the Intrex facilities in the Barker Engineering Library, he will find an "Intrex advisor" in the room who will help him with any problems he may encounter.

As the user acquires experience and skill, he will begin to take advantage of the more sophisticated features of the system which will permit faster and more powerful retrieval operations. Command words are abbreviated in this advanced mode; catalog fields are identified by two-digit numbers; lists of documents can be filed in computer storage for future use; lists can be combined to create new lists that contain all documents in either or in both of the original lists.

User Experiments

The most important aspect of Project Intrex is the study of the interaction between the system and those of its users whose concern is with the extraction of substantive information rather than the technological means. We observe this interaction under two rather different sets of conditions:

In the Barker Engineering Library, we provide access to the Intrex facilities in an open environment, available to all library users with assistance, where desired, from the Intrex advisors.

In the Electronic Systems Laboratory, we conduct controlled experiments with carefully planned work sessions involving an experimental subject and a member of the Intrex research staff.

The objective of all user experiments is to find out in detail how users interact with the system, and thus to obtain factual data for the design of an operational system. For example, the description of each document in the experimental catalog includes more descriptors and thus uses more words than are economically feasible in an operating system. The problem is to achieve maximum retrieval power with a minimum number of words in computer storage. What are the best descriptors for the ultimate operational catalog, and how is their choice influenced by the rapid and assured availability of full text?

The controlled experiments are divided into three categories. In Category I, experiments compare a bibliography obtained by Intrex techniques with a conventionally compiled bibliography. In Category II, the relative utility of the several catalog fields is determined. In Category III, an assessment is made of the relative value of specific features of the retrieval process, such as the Boolean combination of lists.

Preliminary Findings

Each experiment yields a vast amount of information which must be analyzed and evaluated. Details of our results will be found in the semiannual activity reports of Project Intrex and in other publications listed in the final pages of this report.

In general, the response of Intrex users has been favorable. With some initial help, they find it easy to use the system. Their most frequent complaint is that their own field of specialization is not included within the narrow subject range of the Intrex collection.

The deep indexing which characterizes the Intrex catalog results in the retrieval of documents that would be missed by searching only on words in titles or abstracts, but the improvement is obtained at a considerable price in storage costs. More experiments must be made and evaluated to establish precise quantitative relationships.

The installation of Intrex consoles in the Barker Engineering Library at M. I. T. was preceded by a library reconstruction project. The renovated library (Figure 15) serves two functions: conventional library services are provided for the School of Engineering, and experiments with new information transfer techniques are going forward in the environment of a working library.

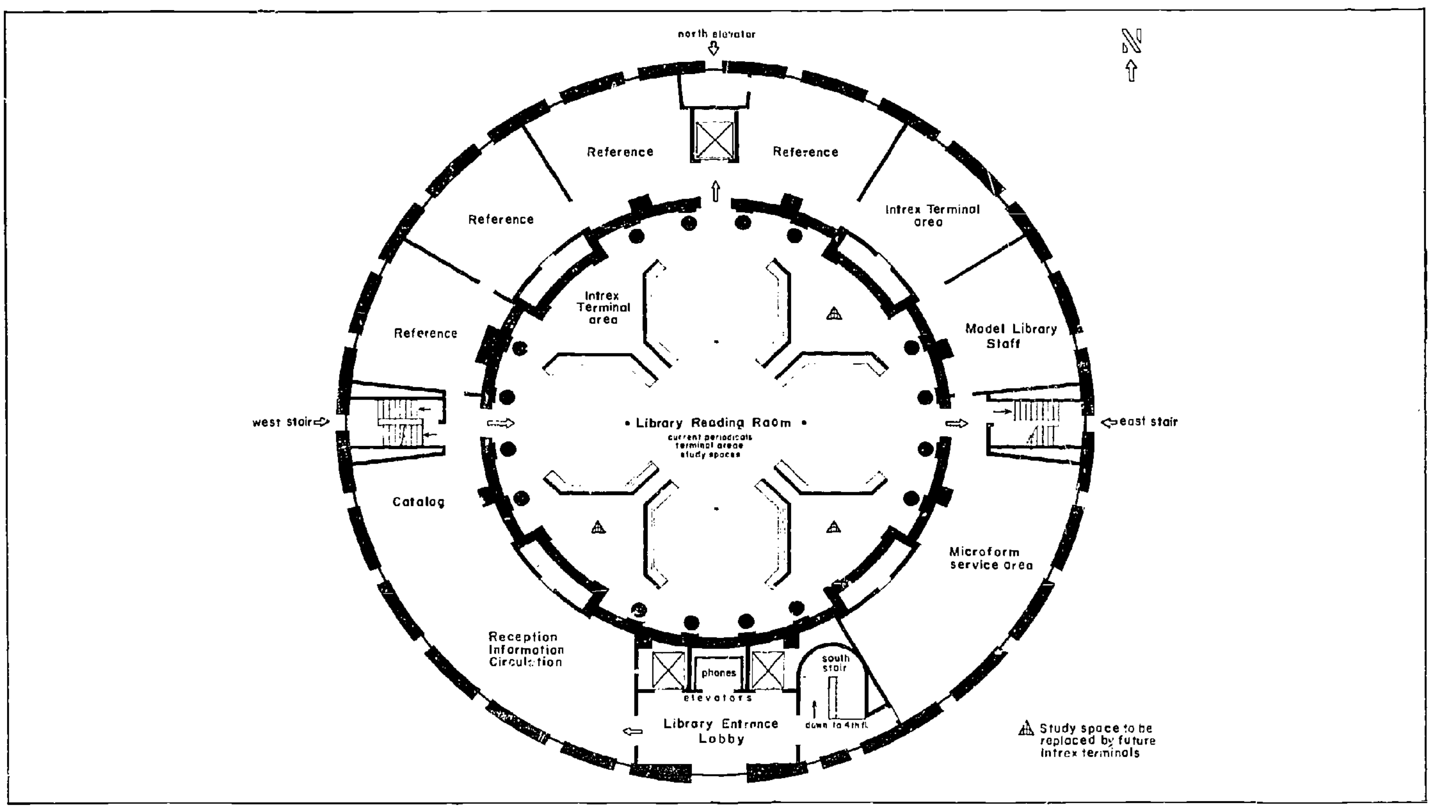


Figure 15 The Main Floor of the Barker Engineering Library. Fifth floor, Building Ten, Massachusetts Institute of Technology. The central area is a reading room for current periodicals. Intrex consoles are located in a small meeting room adjacent to the reference area. The conventional catalog and the microform service area are on the same floor. Future Intrex terminals can be installed at locations marked ⚠.

As a constantly changing mixture of traditional and innovative elements is foreseen in the future operations of all research libraries, experiments are needed with new techniques of user instruction for such a transition regieme. This part of our work is called the "Model Library Program;" one of its most successful developments has been a series of printed search-path check-lists, called Pathfinders, that serve as printed bibliographic maps to help the individual during his initial library work in an unfamiliar subject area. A representative Pathfinder is reproduced in Figure 16.

LIBRARY PATHFINDER — ELECTRONIC DIGITAL COMPUTERS

SCOPE: Computers that operate on variables, expressed in the form of discrete numeric data, by performing internally stored instructions (i. e., arithmetic and logic operations) on the data.

An introduction to this topic appears in Vol. 4 (pp. 175-188) of the McGraw-Hill Encyclopedia of Science and Technology under the entry "Digital Computers."
Q121 .M147 — 5th Floor

BOOKS dealing with electronic digital computers are listed in the subject card catalog. Look for the subjects:
"Electronic Digital Computers" (highly relevant)
"Electronic Calculating Machines" (more general)

Frequently mentioned texts include:

Arden, Bruce W. An Introduction to Digital Computing (1963)
QA76.5 .A676 — 7th Floor

Haberman, C. M. Use of Digital Computers for Engineering Applications (1966)
TA345 .H114 — 7th Floor

Richards, Richard Kohler
Electronic Digital Systems (1966)
TK7888.3 .R5175 — 7th Floor

Scott, Norman R. Analog and Digital Computer Technology. Chaps. 1-5 (1960)
QA76 .S428 — 7th Floor

Other books including material on electronic digital computers are shelved under call numbers: QA75; QA76.5; TJ213; TK7888.3.

HANDBOOKS, ENCYCLOPEDIAS, and DICTIONARIES which contain information on electronic digital computers are:

Grabbe, Eugene M., et. al. (eds.) Handbook of Automation, Computation, and Control v. 2 Computers and Data Processing. Chaps. 2-20 (1959)
TJ213 .G727 — 7th Floor

Huskey, H. D. and Korn, G. A. (eds.) Computer Handbook. sections 10-21 (1962)
QA76 .H971 — 5th Floor

Klerer, M. and Korn, G. A. (eds.) Digital Computer User's Handbook (1967)
QA76.5 .K64 — 5th Floor

Auerbach Corp., Philadelphia. Auerbach Standard EDP Reports: Auerbach Scientific and Control Computer Reports. 3 vols. (1968) (v. 1 includes Directory and Glossary; v. A, B give details on major U.S. digital computer systems.)
TK7885 .A927 v. 1, A, B — 5th Floor

Auerbach Computer Notebook International (1969-) (Current awareness service for 80+ digital computer systems) pp. 11:210.104-132; 11:510.102-108.
QA76.5 .A9175 — 5th Floor

BIBLIOGRAPHIES which contain material on electronic digital computers include:

Youden, W. W. Computer Literature Bibliography, 1946-1963 (1965) (6,100+ references)
ZQA76 .Y76 — 5th Floor

Studiecentrum voor Administratieve Automatisering. International Computer Bibliography (1968) (In English).
ZQA76 .S933 — 5th Floor

JOURNAL ARTICLES and other literature on electronic digital computers are indexed primarily in the guides listed. The quoted subject headings are those in use since 1965 unless other dates are given.

Applied Science and Technology Index (Covers popular engineering periodicals) See:
"Computers - Digital Computers"
ZT45 .A652 — 5th Floor

Science Abstracts. Series C. Computer and Control Abstracts (1969+; continues Series C. Control Abstracts) See:
"Digital Computers" (highly relevant)
"Digital Systems" (more general)
ZQA402.3 .C764 — 5th Floor

Science Abstracts. Series C Control Abstracts (1966-1968; earlier, see Section B. Electrical Engineering Abstracts) See:
"Computers, digital"
ZQA402.3 .C764 — 5th Floor

Science Abstracts. Series B. Electrical and Electronics Abstracts (1966+; earlier, see Section B. Electrical Engineering Abstracts) See:
"Computers, digital" (1966-1968; highly relevant)
"Calculating Apparatus, -digital" (prior 1966; relevant)
"Computer Applications" (1969+; more general)
"Digital Circuits" (1969+; related)
"Digital Communication Systems" (1969+; related)
ZTK145 .E38 — 5th Floor

Computer and Information Systems (Comprehensive coverage of world literature) (1967+; earlier, see Information Processing Journal, 1962-1966, or Cumulative Computer Abstracts) See:
"Digital Computer"
Z699 .I434 — 5th Floor

Cumulative Computer Abstracts (Cumulates Information Processing Journal, 1962-1966) See:
"Section 2, Digital Computers and Systems"
ZQA76 .C971 v. 1 — 5th Floor

Computer Abstracts (Coverage includes 160+ periodicals) See:
"Digital Computers"
ZQA76 .C7383 — 5th Floor

Other indexes, listed here, should be used for an exhaustive search. Only a limited return can be expected for the time spent. Directions are generally given in the front of each issue.

Computing Reviews
ZQA76 .C738 — 5th Floor

Dissertation Abstracts International: Section B. The Sciences and Engineering
Z5055 .U49 .D61 — 5th Floor

Engineering Index
ZTA145 .E57 — 5th Floor

International Aerospace Abstracts
ZTL790 .I61 — 5th Floor

Pandex Current Index to Scientific and Technical Literature
ZQ158 .P189 — 5th Floor

JOURNALS that often contain articles relevant to electronic digital computers are:

Institute of Electrical and Electronics Engineers. Transactions on Computers (1968+; earlier, see IEEE Transactions on Electronic Computers) — 6th Floor

Computers and Automation — 6th Floor

STATE-OF-THE-ART REVIEWS and CONFERENCE PROCEEDINGS containing material on electronic digital computers include:

Joint Computer Conference. Proceedings (1951+)
QA76 .J74 — 7th Floor

Association for Computing Machinery. Proceedings of the National Conference (1952+)
QA76 .A846 — 7th Floor

Institute of Electrical and Electronics Engineers. Computer Group. Digest of the Computer Group Conference (1967+)
TK7885 .A1 .I11 — 7th Floor

REPORTS and other types of literature are indexed in these guides:

U. S. Government Research and Development Reports (Index) (1968+) (Covers U.S. sponsored reports) See:
"Digital Computers" (highly relevant)
"Digital Systems" (more general)
ZQ180 .U58 .U581 — 5th Floor

U. S. NASA Scientific and Technical Aerospace Reports - STAR (worldwide report literature) See:
"Digital Computer(s)" (highly relevant)
"Digital Systems" (more general)
ZTL790 .U586 — 5th Floor

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Barker Engineering Library, M.I.T.

Center for Materials Science and Engineering, M.I.T.

Division of Engineering and Applied Physics, Harvard.

## PUBLICATIONS

Details on the work performed in Project Intrex will be found in the publications listed in this section. For additional information, please address your inquiries to:

Projec' Int ex
Room 10-4?0
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139.


Massachusetts Institute of Technology. Project Intrex. Semiannual Activity Reports, 15 March and 15 September 1966-1971.

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Knudson, D. R., and Teicher, S. N., "Remote Text Access in a Computerized Library Information Retrieval System." AFIPS Conference Proceedings, Vol. 34, pp. 475-481. 1969 Spring Joint Computer Conference, May 14-16, 1969, Boston, Massachusetts. AFIPS Press, Montvale, New Jersey, 1969.

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