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ABSTRACT
                The proposed Minnesota Computer-Aided Library System
will provide a basis for the unification of developing programs of
library services for academic, research, and public libraries in
Minnesota. This report outlines the requirements for the proposed
system to automate the University of Minnesota Libraries and to
provide automated support via on-line remote access terminals to
libraries throughout the state. A basis for providing the University
Computer Services Specialists and others who will develop the
necessary equipment configurations are described. The first three
sections of this report deal with the descriptions of the general
system, the background and rationale, and the developmental stages.
The last four sections deal with the requirements for the operating
system performance, hardware, software, and service and support. (MF)

HARDWARE/SOFTWARE REQUIREMENTS INFORMATION

for a

MINNESOTA COMPUTER-AIDED
LIBRARY SYSTEM

March, 1970

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PURPOSE OF DOCUMENT

The purpose of this document is to describe the requirements for a proposed system to automate the University of Minnesota Libraries and to provide automated support via on-line remote access terminals to libraries throughout the state. This document will provide a basis for the University Computer Services Specialists and others who will develop the necessary equipment configuration.

Note that we do not feel it necessary to confine our configuration to equipment of a single manufacturer. System components will be selected separately based on the merits of that component alone. Of course compatability with other system components will be essential. Many of the specifications contained in this document are system performance requirements. This provides for considerable flexibility of final hardware configuration.

University Computer Services Specialists have the combined knowledge and experience regarding equipment which is considerably greater than that available within the Systems Division and thereby would be able to develop possible alternatives for equipment configurations in a shorter period of time.

Questions pertaining to any material presented in this document or to any other aspect of the problem may be directed to either Mrs. Audrey N. Grosch, Technical Director of the Systems Division, or to Mr. Eugene D. Lourey, Research Analyst in the Systems Division, University of Minnesota Libraries. They may be reach during working hours at 612-373-4533.

CONTENTS

I   GENERAL SYSTEM DESCRIPTION

        The MINNESOTA COMPUTER AIDED LIBRARY SYSTEM will provide a basis for
the unification of developing programs of library services for academic,
research, and public libraries in Minnesota. Its objectives are:

1.)   Improve access to all collections throughout the state for users
      and libraries.

2.)   Improve service by reducing the time it takes to order, catalog,
      process, and locate library materials throughout the state.

3.)   Increase the ability of libraries to cope with the growth of col-
      lections and the increased demands for new and better services.

4.)   Better use of professional librarian's time in providing direct
      service to users in each library.

5.)   Enable Minnesota Libraries to make full use of the national library
      networks which are now taking form.

        The state-wide program will require about eight years of progressive
development divided into three stages as follows:

STAGE 1.   Basic applications systems development, installation, and
           evaluation within the University of Minnesota.

STAGE 2.   State-wide services development and functional decentralization.

STAGE 3.   State-wide operations, evaluation, and modification.

        In brief, the program for a MINNESOTA SYSTEM will provide a large central
file of bibliographic information for use by all libraries in the state. It
will provide a computer system designed specifically for handling library
processing requirements with the capability of receiving requests from one
library and switching them to another. The computer facility will also pro-
vide a laboratory for library and information sciences students in graduate
study and research. Ultimately it will enable the state of Minnesota li-
braries to be a full participating unit in developing national information
networks, and will in fact be a pace setter in such developments.

        The challenge of the seventies for library service focuses on the
need for providing more sophisticated services for library users whether
they are in academic, research or public libraries. Libraries must improve
their abilities to provide information when it is needed, not months later.
Yet, this lag in obtaining information occurs daily primarily because there
have been few changes in libraries since 1900. Modern technology provides

one answer to many library information service problems. The typewriter
speeded production of legible catalog records, the photocopy machine made
possible more extensive use of materials and the microfilm storage has
helped solve space and acquisitions problems. Now the computer provides a
potential to help solve the library problems of increased use, more sophisti-
cated information requests, and the flood of available information.
Technology now enables libraries to interlink collections, share resources,
improve operating efficiency and reduce costs.

Library operations and bibliographic materials are complex. Fifteen
years of effort on the part of many specialists have been applied solving
the unique problems of library computer-based systems. Library systems or
networks are presently being developed in other states through various
programs. Some are public library oriented such as NELINET (New England
Library Network); some are academic library oriented, such as the Ohio
College Library Center; and some are subject oriented, such as the SUNY
Bio-Medical Communications Network.

In the future the nation's libraries will be linked through regional
and national networks. It is only in this manner that libraries will be
able to cope with burgeoning demands for materials with wide access to all
types of information resources throughout the nation. The time is now very
appropriate to embark on development of a Minnesota library system as part
of the evolving national network and to unify the already developing co-
operative programs in the State.

The University of Minnesota Libraries represents the largest single
collection of research materials within the state. It's collections have
depth of resources in many special fields which are not found in other
Library collections in the state. Its resources, therefore, are the most
logical to form the initial central bibliographic file for a Minnesota
Computer-aided Library system. The central file could then be expanded to
reflect academic collections held elsewhere throughout the state, especially
unique materials. Various union catalogs could be produced from these files
and participating libraries could query the central file from terminal devices.

The MINNESOTA SYSTEM as now envisioned would be developed through
cooperation between the University of Minnesota Libraries and the Higher
Education Coordinating Commission. Other cooperative programs such as the
Cooperating Libraries in Consortium (CLIC), and the Metropolitan Library
Service Agency (MELSA), could use the bibliographic system as self sufficient
cooperative bodies. The system would be developed and operated by the
University of Minnesota Libraries, and the necessary technical staff would
be employed as University staff. The University of Minnesota Libraries
Systems Division staff with six years prior library systems experience
would form the nucleus of staff, since this staff is presently the only
such technical staff within a Minnesota Library.

The hardware envisioned at this time for the MINNESOTA COMPUTER AIDED LIBRARY SYSTEM includes:

- a high speed, third generation CPU with real-time on-line capabilities;

- a compatible but less powerful CPU to serve as the back-up processor and as the scheduler;

- on-line mass memory devices fast enough to support the query system, large enough to contain all essential information, and yet inexpensive enough to be economically justifiable;

- additional random access memory devices (possibly, but not necessarily, the same type of equipment) which will contain information not essential to the query system but necessary continuously in the operation of the total system;

- additional machine processable storage capability for low volume and sequential processing activities (probably 4 magnetic tape drives);

- a card reader/punch;

- one or more high speed printers with print suitable for the character set required;

- possibly some special purpose output devices for producing non-standard printed materials;

- enough remote terminal devices to adequately meet the need of all branches of the University Library and to provide subscriber libraries with on-site real-time capability.

This general configuration is suggested because it seems best suited to the demands of the proposed operating system. However, all alternatives will be considered if they also meet those demands.

For instance, if two identical computers can be linked so that the real-time system can be supported and backup provided at a cost advantage over the suggested method, we would consider this a definite improvement. This would undoubtably reduce software development costs. Similiarly, if a single type of mass storage can be used for both on-line mass storage and less time critical random access needs it would be preferrable.

The need for special purpose output devices for non-standard materials is governed by the capabilities of the high speed printers proposed. They will only be necessary if some of the required computer products cannot be produced by the primary printer. However, there may well be some advantage to specialized printers incurred by the opportunity they provide to locate the devices in an operational unit rather than at the computer facility.

The terminal devices must satisfy a wide range of operational requirements. It is not expected that a single device will be suitable for all purposes. However, we cannot allow an infinite variety of devices to be employed in this capacity due to the software developments which will be necessary to support each type employed. We expect to choose a minimum of four devices from which the terminal device for each site must be chosen. These will likely have the following characteristics:

* all will transmit and receive 8 bit character codes with a parity bit;

* one device will have only a typewriter to transcribe input and record output;

* a second will have a CRT but will produce no hard copy output or input;

* a third will have a CRT and the capability to produce hard copy of input and output;

* a fourth will have a CRT and hard copy capabilities and in addition will input and output machine readable materials (e.g. cards or paper tape).

A single device to which modules could be attached at will to build any terminal configuration would be preferable to different devices for each level of capability due to the compatability in software requirements which would result. For this reason, modular devices will be given special consideration. However, consideration of software development economies are not more important than considerations of acquisition and operating economies and are less important than ease of use by system users.

II. BACKGROUND AND RATIONALE FOR PROPOSED SYSTEM

In considering any automated system of the magnitude of the system proposed here, it is, of course, essential to coordinate the efforts with all on-going and future programs for library cooperation or state-wide automation of public service functions. Two programs of a state-wide nature are now operative and would be served by the proposed system. MINITEX is a service to facilitate inter-library loans through the use of teletype communication between participating libraries. The Technical Information Service (TIS) program set up under the State Technical Service Act makes the library resources of the state available to private industry.

Three groups are involved with planning for inter-library cooperation and potential automation of library services. The Metropolitan Library Service Agency (MELSA) is a cooperative service agency for public libraries. The Cooperating Libraries in Consortium, Inc. (CLIC) services private academic institutions within the Twin Cities area. The Minnesota Higher Education Coordinating Commission (MHECC) is concerned with library services to public academic post-secondary institutions.

The plans and programs of the State Planning Agency and the Library Division of the State Department of Education with respect to inter-library cooperation and library automation are reflected by MELSA and MHECC.

A. Inter-Library Cooperation

Throughout the nation libraries have cooperatively served users for many years. Such cooperation was fostered through the inability of any one library to acquire collections covering all fields, or many fields in depth. Other developments, such as cooperative cataloging, designed to save administrative or technical processing work also demonstrated that systems of bibliographic infor-mation interchange were successful. With the growth of published literature, the need for further cooperation on a broad scale becomes immediately apparent.

The concept of a state-wide library system for Minnesota began at an Academic Section of the Minnesota Library Association meeting in May 1965. An Ad Hoc Committee on Inter-Library Cooperation grew out of this. Their proposal was quite simple -- that the state library agency set up a central service agency which would perform one or more of the following services:

1. Secure and maintain a central file of journals on microfilm from which print-out could be furnished to any public or academic library partici-pating in the center.

2. Purchase and maintain for inter-library loan a complete set of everything reviewed in CHOICE.

Shortly after the AD Hoc Committee made its report, the state library agency in Minnesota made a grant to the Twin City Metropolitan Library Study Committee for a study of the potential development of public library services.

Dr. Herbert Goldhor, a well-known library services expert, was retained to carry out this study. The recommendation by Dr. Goldhor was to establish an organization called Metropolitan Library Service Agency (MELSA) as a cooperative service agency for public libraries.[1]

Through Title III of the Library Services and Construction Act, interlibrary cooperative networks for the state of Minnesota were made possible. Under Title III, "It shall be the general objective...to create a state-wide network of cooperating libraries, with efficient inter-communications between participating libraries, so organized that information, data, knowledge, and related library materials can be made available to library users of all kinds of libraries, everywhere in the state."[2] Further, "Every appropriate local, county, regional, academic, or school agency shall have the right to participate in any network or network established under this plan. Furthermore, it shall be policy to require the fullest possible cooperation and coordination with any and all public agencies having responsibility for information programs toward the end of making the best possible use of all agencies and all sources of information appropriate to or interested in the activities of the network."[2]

Title III further provides that, "It will be a policy and objective to design whatever system is developed in such a way that it can take advantage of scientific advances in the storage, retrieval, and dissemination of information as rapidly as it becomes operational, desirable, and economically feasible to do so."[2]

With support from Title III and the Goldhor recommendations MELSA was established and today functions for the public libraries in the Twin Cities metropolitan area. Certainly it is desirable, if not mandatory, that all public libraries join this cooperative program. In the founding agreement which establishes MELSA as a public library service agency, Section V 1. states, "And, further it is the full intention of all concerned to involve the agency herein created to the fullest extent possible with any system or method of inter-library cooperation established in or available to libraries in the state of Minnesota."[3]

Clearly the plan for a public library system has been soundly structured as one part of a total state-wide network. As an independent public library cooperative MELSA can effectively cooperate with similar programs for other types of libraries throughout the state.

Another program with its beginnings in the same time period is the Cooperating Libraries in Consortium, Inc. (CLIC) which serves private academic institutions within the Twin Cities area in much the same manner as MELSA. CLIC has as its headquarters or central node the James J. Hill Reference Library in St. Paul, long established as a prime private research library with one of the major large collections in the state outside of the University of Minnesota Libraries. It would be logical for CLIC to expand

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1) Smith, Hannis S. Minnesota: 1st Assembly on Inter-Library Cooperation. Report no. 1, July 19, 1967.

2) LSCA. Plan Section 4.0 State: Minnesota Fiscal Year 1967.

3) An agreement creating a Metropolitan Library Service Agency June 10, 1968.

its activities to include all of the private academic institution libraries within the state. Here is another major kind of cooperative library program with differing service objectives from the public library, yet with just as great a need for shared bibliographic resources. The service programs of both CLIC and MELSA will require a substantial supportive program using various products of modern technology -- foremost at this time will be the need to structure a computer aided communications system to maintain union catalog information services, together with the whole spectrum of support needed for administrative and service related functions in each participating library. The need for such a system can be seen through the experimental inter-library loan cooperative system called MINITEX.

MINITEX expedites inter-library loan services to its participating libraries through the use of teletype communication. The heavy, exponential growth of this service has demonstrated that the present large catalogs maintained at the University of Minnesota cannot function as locators of bibliographic materials as rapidly or effectively as a computer maintained up-to-date record. This project represents but a taste of the kind of inter-loan services every large library will eventually be called upon to offer. For this reason MINITEX represents a service which needs a better, more timely control of the entry of library materials into the collection and their location. MINITEX will form a very important element of a total state-wide system and needs to be expanded. A union catalog, therefore, is almost a necessity for this service. And the current production of union catalogs is best handled through use of the computer.

Another group of libraries should also be inter-connected within the state-wide area. These are the state junior and four year college libraries and area-vocational technical schools. The University of Minnesota Libraries serves as the major research collection for the state colleges. A parallel cooperative to CLIC could be established through the University to serve these state college libraries. The area vocational technical schools could depend upon the nearest state or private college, or public library for assistance. Central procurement and processing of materials for these schools could be investigated as one answer to effective development of course-related collections.

These various existing cooperative enterprises can only be linked into the state-wide system through a computer-aided system of library service. The existing entities such as CLIC, MELSA, and MINITEX fit very well into a state-wide system as self sufficient cooperative enterprises -- in effect nodal centers for certain types of libraries and services.

There is yet another factor to be considered as having great influence on the establishment of a Minnesota Computer-Aided Library System. This is the regional development zones set up under the auspices of the Minnesota State Planning Agency. The purpose of these economic planning regions is "to identify homogeneous subregions of the state that possess similarities in the characteristics associated with them, for the purpose of developing location guidelines in developing economic adjustment action programs at regional and local levels across the state."[4]

4) Hoyt, Jr., John S. Regional development systems in Minnesota. University of Minnesota, Agricultural Extention Service, Minnesota State Planning Agency. January, 1969, p. 19.

The Minnesota Higher Education Coordinating Commission is using these economic regions as their organizational guide. Areas of concern for Southwest State College and Bemidji State College are shown on state maps.[5] Figure II-1 shows the private colleges and professional schools within the economic planning regions. Note the concentration is heaviest within the surrounding 75 mile radius of the Twin Cities. For a more complete picture of the total library services picture for all types of educational institutions, Appendix A shows a table of Minnesota Post-Secondary Institutions by Planning Regions, Type, Student Body, Calendar System, Control/Affiliation, Location, and year of establishment.[6]

The eleven planning regions for the state library system presently used by the Library Division, State Department of Education are quite similar to those eleven economic regions used by the Minnesota Higher Education Coordinating Commission. Through study and evaluation these two regional planning systems offer a basis upon which the Minnesota Computer-Aided Library System may structure its services. One method which may be used would be the establishment of a system of nodes, one in each region which would act as switching centers for direct connection via teletype terminal to the University Libraries MINNESOTA COMPUTER-AIDED LIBRARY SYSTEM headquarters.

Current programs can very effectively be a part of the envisioned state-wide system. Moreover, other private special libraries or services such as the Technical Information Service (TIS) program set up under the State Technical Service Act to serve industry can, on subscription, share in the state-wide program. Even now, TIS is linked to the public library network through Teletype to the Library Division, State Department of Education.

Differing types of nodal cooperative systems should result within the state-wide program -- some organized by type of library, such as MELSA, CLIC, etc. -- some by subject specialty, such as the planned state-wide medical library services involving the University of Minnesota Bio-Medical Library, Mayo Clinic, and county or hospital medical libraries. Through use of a standard method of structuring bibliographic records provided through the Library of Congress MARC II format, the interface of the Minnesota system to the other regional, national, and international networks is assured.

B. State-wide Educational Computing Environment

The computer needs for libraries differ from those for instructional uses. The ability to perform complex character string manipulation within files having nested hierarchies of records and subrecords, either on-line or batch, requires character oriented processors for optimum cost and efficiency. An increasing share of Library School and Information Sciences research requires larger amounts of computer support. Thesaurus construction, file organization, search strategy

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5) Ibid. p. 224.

6) IJI Minnesota Post-Secondary Institutions. Minnesota Higher Education
    Coordinating Commission. November, 1969.

systems, and automatic indexing or translation are examples of the kinds of projects now being undertaken which require computer support. For this type of computer, the file sizes would be relatively small; whereas even the smaller college library catalogs would require 100 million characters. For a state-wide library system the files needed would be close to or in excess of 3 billion characters.

The computing needs of the MINNESOTA COMPUTER AIDED LIBRARY SYSTEM are best met by a special type of computer system having primarily character manipulative features, 8 bit byte features, and sufficient core to permit on-line file query by various member libraries within the state. Moreover, special printing requirements are needed to handle diacritical and lower case character codes. Small libraries could compromise on these printing requirements to no real detriment, but it would be impossible for large libraries to do so since they must maintain standards of compatibility with the other large libraries in the nation and with the three national libraries.

The Library of Congress, in cooperation with the other national libraries, has established the MARC II (Machine Readable Cataloging Tape Service) record format as the official bibliographic communications format between libraries. Along with this is specified a special computer character set which has also been adopted as standard by the large research libraries in the United States. To maintain compatibility with evolving computer aided national information networks a similar set of standards for encoding of bibliographic information must be used by every library if they are to cooperate effectively.

The Computer Advisory Committee of MHECC has recognized the need for developing computing needs to support library services in its report as follows:

"Services for educational programs which can involve the use of computer such as: extension services; educational media; information retrieval and distribution, especially library information."[7]

The Computer Advisory Committee further points out the need for a state-wide communications system including voice, data, and video needs.

Libraries in Minnesota and throughout the nation are using Teletypewriters for inter-library loans. But much more sophisticated kinds of communication are needed for connections to a large central data base of bibliographic information.

The special purpose computing system for the MINNESOTA COMPUTER AIDED LIBRARY SYSTEM should logically be integrated within any state-wide computer development plan. In this way the most effective equipment may be acquired and the heavy terminal support for these information needs will not interfere with other instructional tasks within the state-wide computing environment.

7) Minnesota Higher Education Coordinating Commission. Computer Advisory Committee. Recommendations for Coordinated computer developments in Minnesota Post-Secondary Education. March 1969. p. A-9.

Figure II-1

(S) SENIOR COLLEGE   (J) JUNIOR COLLEGE   (P) PROFESSIONAL SCHOOL

3. Carleton (S)
4. Concordia (Moorhead) (S)
6. Dr. Martin Luther (S)
7. Gustavus Adolphus (S)
9. Lea (S)
14. St. Benedict (S)
16. St. John's (S)

17. St. Mary's (S)
18. St. Olaf (S)
20. St. Scholastica (S)
21. St. Teresa (S)
26. United Theological Seminary (P)
28. Bethany Lutheran (J)
29. Corbett (J)
30. Crosier (J)

A. ST. PAUL-RAMSEY COUNTY

2. Bethel (S)
5. Concordia (S)
8. Hamline (S)
10. Macalester (S)
15. St. Catherine (S)
19. St. Paul Bible (S)
22. St. Thomas (S)
23. Luther Theological Seminary (P)
24. N.W. Lutheran Theo. Seminary (P)
25. St. Paul Seminary (P)
27. Wm. Mitchell College of Law (P)

B. MINNEAPOLIS-HENNEPIN COUNTY

1. Augsburg (S)
11. Minneapolis School of Art (P)
12. Minnesota Bible (S)
13. North Central Bible (S)
31. Golden Valley Lutheran (J)
32. St. Mary's (J)

Miinnesota Economic Regions

PRIVATE HIGHER EDUCATION INSTITUTIONS

III. DESCRIPTION OF DEVELOPMENTAL STAGES

The three stages of the system development program are shown graphically in figure III-1. Details for each stage are discussed below. Stage 1 and Stage 2 are discussed in more detail than Stage 3. Stage 3 is primarily for solidifying the gains made in earlier efforts and preparing for the inevitable system changes in the continuing efforts to improve library services with automation technology. Thus the details are not predictable at this time.

Stage 1: Basic Applications System Development, Installation, and Evaluation

During Stage 1. the basic overall systems design program will be codified. The basic segments of this stage are:

1. Personnel recruitment and training.
2. Wilson Library physical site architectural and mechanical design, procurement, and installation.
3. Computer or other peripherial equipment configuration design, procurement, and installation.
4. System Software evaluation, procurement, and/or creation.
5. Applications Modules design, integration, file conversions, programming, installation, and operation and re-evaluation prior to Stages 2 and 3 implementation.
6. Advanced planning for Stages 2 and 3 systems implementation.

The present Systems Division personnel will need to be increased to include the following kinds of personnel:

1. Systems analysts/programmers
2. Systems librarians trained both in library science/information retrieval and computer sciences
3. Systems Software specialist
4. Systems Hardware specialist
5. Operations personnel such as computer operations, documentation/ control clerks, etc.
6. Clerical staff
7. Departmental liaison librarians
8. State-wide service coordinator

In addition other specialists may be required during Stages 2 and 3.

Space for the computer facility and technical staff is located in the sub-basement of the Wilson Library building located conveniently near one of the major mechanical equipment rooms. The site is composed of two adjacent rooms, one will contain the computer equipment and the other office space for personnel. Both rooms will require modifications, electrical wiring, a raised computer flooring, air conditioning equipment, and partitions.

During the drafting of the proposal, the system hardware configuration will be defined based on bibliographic processing tasks and cost effectiveness. An actual hardware specification to meet these needs will be included in the proposal.

Figure III-1

FIGURE I   PROTOTYPE PLAN FOR COMMUNICATIONS FUNCTIONS IN THE
MINNESOTA COMPUTER AIDED LIBRARY SYSTEM   (MCALS)
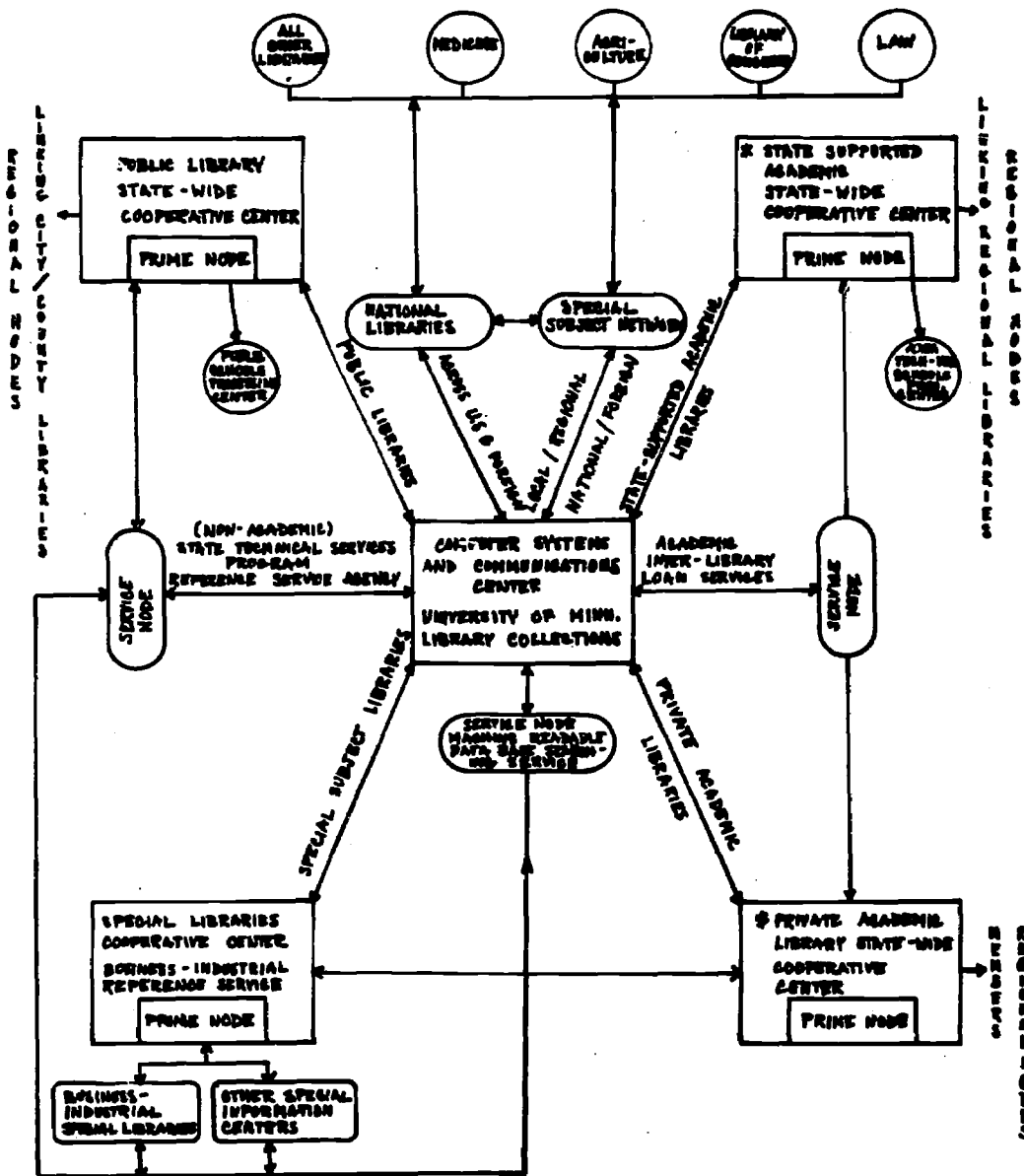
LEGEND
⟷ - COMMUNICATION / INFORMATION FLOW
PRIME NODE - Major message switching point
REGIONAL NODE - To be determined through subsequent study
by library user population, geographic factors,
planning regions, etc. A regional node may
service all types of libraries in its region.

* One prime node may serve both types of academic
library if so designed.

FIGURE 2   BASIC SYSTEMS DEVELOPMENT IMPLEMENTATION SCHEDULE
MINNESOTA COMPUTER AIDED LIBRARY SYSTEM (MCALS)

UNIVERSITY OF MINNESOTA   BASIC SYSTEMS DEVELOPMENT, INSTALLATION, MODIFICATION

FULL OPERATIONS   ALL APPLICATIONS MODULES

A

BEGIN FUNCTIONAL DECENTRALIZATION TO OTHER LIBRARIES

PERSONNEL   RECRUIT   TRAINING
SITE PREPARATION   DETAIL PLAN   CONSTRUCTION
HARDWARE   INTENT   CONTRACT
SYSTEM SOFTWARE   INTENT   CONTRACT

PROPOSAL SUBMISSION

APPLICATIONS DESIGN AND DEVELOPMENT

ACQUISITIONS
ACCOUNTING
SERIALS
CATALOGING & PHYSICAL PROCESSING
FILE QUERY
CIRCULATION
ADMINISTRATIVE MANAGEMENT
STRUCTURE SERIALS PROGRAM DEVELOPMENT

UNIVERSITY OF MINNESOTA LIBRARIES
DECENTRALIZATION DESIGN AND DEVELOPMENT   EXPERIMENTAL PROGRAM

DELIVERY CENTRAL EQUIP   MODULES 1-3   MODULE 4   MODULE 6   CENTRAL EQUIP   MODULE 7   ALL U-M
EQUIP   EQUIP   ADDITIONS   EQUIP   TERMINALS

MODIFICATION, MAINTENANCE, ADVANCED DEVELOPMENT FOR STAGE 2

1 DESIGN PLUS 5% COMPLETED   PROGRAMMING   COMPLETION   INSTALLATION   OPERATION / EVALUATION / MODIFICATION
2 DESIGN   PROGRAMMING   INSTALLATION   OPERATION / EVALUATION / MODIFICATION
3 DESIGN   FILE CONVERSION & PROGRAMMING   CONTINUE FILE CONVERSION   INSTALLATION   FULL SERIALS CURRENT FILE COMPLETION   OPERATION / EVALUATION / MODIFICATION   FULL RETROSPECTIVE FILE
   SUPPORT FILE CAPTURE   RETROSPECTIVE SERIALS CONVERSION PERIOD
4 DESIGN   COMPLETION PROGRAMMING   COMPLETION INSTALLATION   OPERATION / EVALUATION / MODIFICATION
5 DESIGN   COMPLETION PROGRAMMING   COMPLETION INSTALLATION   OPERATION / EVALUATION / MODIFICATION
6 DESIGN   COMPLETION PROGRAMMING   COMPLETION INSTALLATION   OPERATION / EVALUATION / MODIFICATION
   BOOK & RECORD ID PREPARATION   COMPLETION PROGRAMMING   COMPLETION INSTALLATION
7 DESIGN   DEMON OF EXPERIMENTAL PROGRAM   EXPERIMENTAL PROGRAM OPERATIONS
8 BASIC DATA COLLECTION

INSTALL ST. PAUL AND BIO-MEDICAL LIBRARY TERMINALS
INSTALL PRIME NODE TERMINALS
PROGRAM MODIFICATIONS

JULY 1970   JAN 1971   JULY 1971   JAN 1972   JULY 1972   JAN 1973   JULY 1973   JAN 1974   JULY 1974   JAN 1975   JUNE 1975
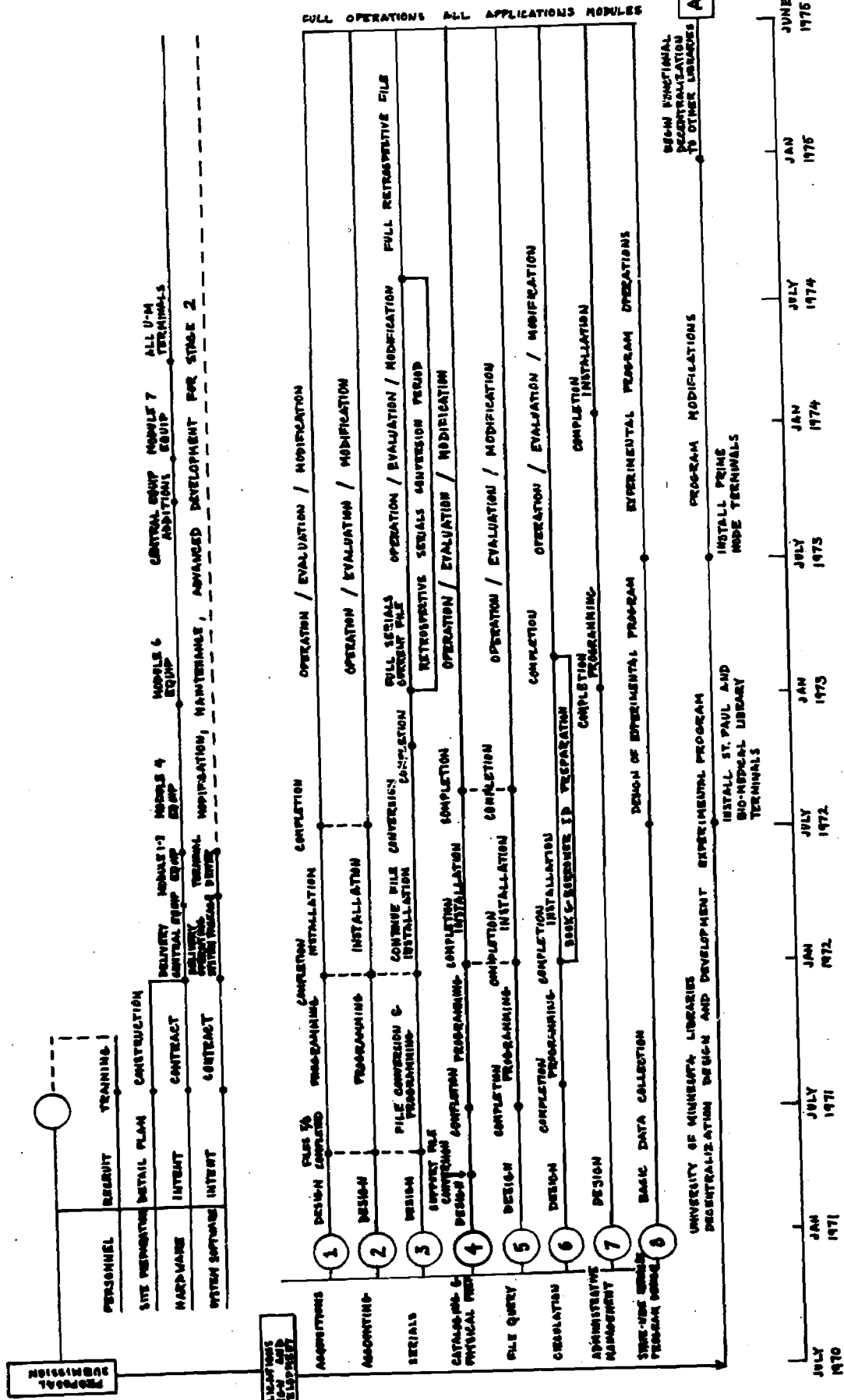
Figure III-2

FIGURE 3 STATEWIDE SERVICES PROGRAM DEVELOPMENT IMPLEMENTATION SCHEDULE
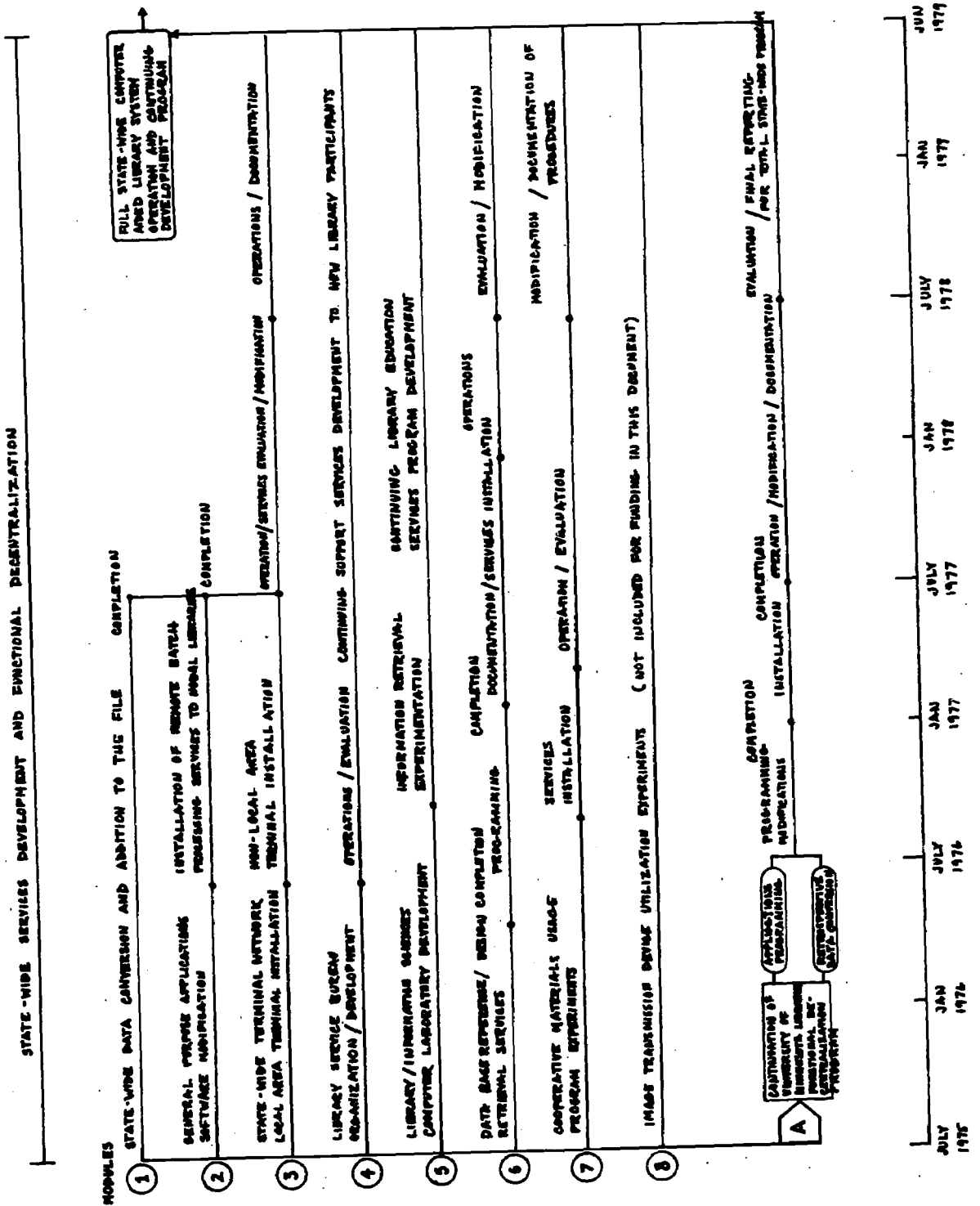MINNESOTA COMPUTER AIDED LIBRARY SYSTEM (MCALS)

Figure III-3

13.

System software needed during Stage 1 will be:

1. Computer Operating System
2. Assembler/macro level instruction set
3. COBOL Compiler, possibly another higher level compiler such as PL-1 dependent upon CPU chosen
4. Text editor system
5. Terminal control software driver
6. Generalized file handling system

It is hoped to modify existing software packages to handle the above. However, depending on terminal equipment, the terminal driver software package may require full development or extensive modification particularly as terminals are added in the later stages in the development of the system.

The design of the applications module must provide for the integrating of various input applications to build the bibliographic/management files at the heart of the system. Identification of the various elements of information, the manner in which the files will be accessed via the Query Module, external/internal record formats, and coding structures will be necessary for each module since the various modules and files have interactive roles. Basic definitions of these relationships, access points, informational elements, and coding structures for the Bibliographic portions of the records and files has been defined through work in the Bio-Medical Library Prototype operations.

During the period between submission of the proposal and its approval and funding, the design of the initial modules will be undertaken, using the hardware and system software specified in the planning document. In this manner programming would start as soon as funding was approved. During the period between funding and installation of the basic hardware, program testing, debugging, and trial operations will be done at the computer supplier's service center. Thus we expect to be able to begin actual use of the computer facility as soon as installed.

The basic applications modules have been defined as follows:

Module 1: Acquisitions

This module will handle the preliminary input of information into the system and provide for bibliographic searching before an item is ordered, the ordering of all types of material, receipt of materials, clearing of invoices, and routing of material to catalogers. Therefore, the Acquisitions operations require a message logging system as well as an ordering system. In this manner audit control of all procurement requests can be maintained.

Module 2: Accounting

The accounting system must be capable of handling all accounting functions for the library system, including book funds, payroll, supplies and equipment funds, and any grants received. This module handles encumbrances as orders are placed, processing of invoices for purchases, and subscription renewals. The function of the accounting module will be to provide an audit trail of all

monetary funds for which the library is responsible in conformance with accepted University auditing procedures. This module will produce the Budget Ledger and handle reconcilliations of funds. The module outputs will be Budget Ledger, cost distribution reports, management accounting reports, and yearly statistical summaries for use in next year's budget allocations.

Module 3: Serials

This module will handle the check-in of all incoming serial materials, claiming of missing issues flagged through the use of a predicted arrival coding system, and serials bindery operations. The computer will recognize completed volumes, produce bindery pick-up lists for each operating unit and bindery instruction slips for attachment to the materials to be sent to the bindery. The ability to handle the binding of unbound books, rebinding, and book repair must into be part of the bindery sub-system. The Bio-Medical Library serials system will become the first operating segment of this module and will input information into the system through a terminal. This remote processing from the Bio-Medical Library will serve to test the decentralization of input functions for Stage 2 of the MINNESOTA COMPUTER AIDED LIBRARY SYSTEM.

Module 4: Cataloging and Physical Preparation

This module receives incoming materials after invoices have been cleared. Call numbers, subject headings, added author entries, marking and other preparations of the book for public use will be handled through this module. The cataloging module in turn enables a fully structured bibliographic file to be constructed for use through the File Query Module, and for the production of specialized catalogs by subject or departmental collection either printed or on microfilm as a replacement for the card catalog.

Module 5: File Query

This module is designed to enable the system files to be accessed through terminals for reference or processing use. The systems bibliographic files would be queried by call number, author, series, or subject with date or language limitations for library users; however, library staff members would operate the terminals. The librarians in the processing areas would have this same access to the files and also by order number, circulation number, or other internal control numbers. This module must be able to service requests for query through teletype terminals, typewriter keyboard terminals and the University Library's visual display terminals.

Module 6: Circulation

This module enables a record of each book or item charged out to be recorded in a bibliographic status file. The book identification number and the borrower's identification number is recorded in this file and a status code is set in the master bibliographic file to denote that the book is in circulation or in a special location along with the record address in the bibliographic status file. In this manner staff members will know whether a book is on the shelf or in use, who has the book, and the date it is due. This module will also enable borrowers' numbers to be recorded on the file for books which are in use so that they can be automatically notified when the book is returned and the book held for them. Certain statistical data on use of the collections by types of material or borrower would be collected by this module to help library administration improve services and build collections.

Module 7:   Management Applications

This module includes programs to handle student payroll, desk scheduling, statistical analysis of data obtained from accounting files, cost effectiveness applications, facilities planning, etc. Other applications such as equipment or personnel capabilities inventories may also be handled through this module. All applications in this area would be in batch mode.

The software for the seven basic applications listed above involve the following general characteristics:

1. On-line entry of information for order requests, purchase orders, cataloging and accounting information.

2. File updating, except for the Circulation Module, would be in batch mode on a daily basis, probably at the close of each day. The circulation module requires real time updating capability since some circulation transactions such as reserve books are for as short a period as two hours.

3. Query operations in the files would be real time. A suitable priority system for the terminals will be required, perhaps in the beginning a contention mode system would suffice but in later stages a polled system would be necessary, for most of the terminals will receive heavy usage.

4. Conversational mode features to enable man-machine interaction on an effective basis.

The first stage of development will cover a three year period. The initial developmental work will be based on the experience gained in developing and operating the acquisitions, accounting and serials systems in the University's Bio-Medical Library. The Bio-Medical Library systems have been operating very effectively and will represent the initial machine readable files to be converted to the new system. These files will become the first operational parts of the planned system and will also serve to test the new programs. The programs developed during this stage will enable other libraries throughout the state to use them for their local needs through the central computing facility. Libraries throughout the state which are part of the MINNESOTA COMPUTER AIDED LIBRARY SYSTEM will save a tremendous amount of costs by being able to have access to personnel who are specialists in bibliographic uses of the computer and access to a computer facility designed for library use.

Stage 2:   State-wide Services Development and Functional Decentralization

The second stage of development of the total program will cover the development of statewide services. The activities during this stage will involve work on the following systems modules:

Module 1:   Decentralization of Certain Library Activities

After the basic systems are functioning and the decentralized operations in the Bio-Medical Library are operating effectively, it will be possible to begin decentralized functions in the whole system.

Decentralization would enable the time period between receipt of materials and cataloging to be further improved. In addition, subject specialists who work with various collections would be able to do more effective subject indexing in their particular field. Only a computer-aided system, with remote terminals connected to a central data base, will permit such decentralization, yet maintain consistency and control over data in the files. Actions which may be decentralized, depending upon experiences in the Bio-Medical Library, may be as follows:

Serial Materials

Input requests for new subscriptions and standing orders.
Receipt and checking in of all incoming journals and serials.
Physical preparation of bindery shipments.
Invoice approval.
Descriptive and subject cataloging.
Physical preparation of materials.

Book Materials

Input book order requests.
Receipt of all incoming materials.
Invoice approval.
Cataloging.
Physical preparation of materials.

The central Cataloging department would establish controls for subjects, author or corporate entries, series, and other cataloging data to maintain consistent records for the system. Physical preparation items such as charge cards, book pockets, spine labels, and cataloging work sheets would be centrally produced on the computer printer and shipped to the appropriate units through daily batch processing.

Module 2: Conversion of Bibliographic Records in Out-state Libraries

When the central bibliographic files for serial and monograph materials are in operation for a year or so, it then becomes practical to enter information on locations of materials which are held by other academic libraries to provide a union catalog for participant libraries. This job could not be done in the early stage of the program because of the difficulty in knowing how many items were unique to any one library. After the University records were converted, additions to the file would consist of matching of each participating library's collection to the existing record, recording locations only for titles already in the system, and converting the records for unique titles. It will in any case still be a large scale effort which will probably take two years to complete. In this manner statewide union catalogs can be constructed.

Module 3: Development of General Purpose Software

The software for the system will be designed to permit modification so that it may be used to support the same kinds of activities for other libraries in the state through remote batch processing terminals or directly at the computer site. In this way the larger libraries will be able to use the full spectrum of computer assisted tasks in internal operations. In locations such as Duluth, Rochester, and elsewhere one such terminal located within a reasonable distance could be shared by several libraries.

Module 4:   State-wide Terminal Network System

Included in this program would be the installation of remote batch pro-
cessing terminals for the larger libraries and ASR Teletype or other keyboard
terminals for query of the central computer-based files. These terminals would
enable inter-library loans to be requested through the system with the central
computer switching the request to the library which held the material needed.
All other queries for bibliographic data contained in the computer file would
be transmitted through these terminals.

Module 5:   Library Systems Service Bureau

Information specialists, programmers and others will be available to assist
participant libraries in the use of the computer for their own use or for the
various developing state-wide services. This staff would assist cooperating li-
braries through each stage of the preparation, installation and operation of
services which utilize the central computer facility.

This part of the program could be self supporting through fees which would
be lower than any commercial service bureau since the library system would be
administered as a non-profit educational program for the state of Minnesota.

Module 6:   Library and Information Science Computer Laboratory

The central computer facility would provide computer support for the graduate
school programs in library and information science. Since the library computer
facility would be dedicated to bibliographic processing tasks, its staff and equip-
ment will be more suitable and less costly than other computer equipment avail-
able on campus. Students and faculty from other schools in the state would also
be extended an opportunity to use these facilities for bibliographic research
projects.

Module 7:   Data Base Reference/Retrieval Services

This module would enable various types of magnetic tapes to be obtained from
commercial or governmental sources to provide reference and information service to
users. Census tapes, Chemical Abstracts and various other fact oriented or biblio-
graphic tapes would form the resources for this program. For a complete discussion
of the development and provision of such services see Appendix B, Machine Readable
Data Bases.

Module 8:   Cooperative Use of Library Materials

Cooperative acquisition of materials in libraries is being undertaken in
various formal or informal arrangements to save on book funds or shelf space.
The MINITEX program has already provided a record use of materials by libraries
in the state which could be used as a pattern to develop state-wide coordination
in the development of resources. This would enable state libraries to make better
allocation of book budgets and provide better service to users with greater depth
of subject coverage by having access to the materials in other library collections.

Module 9: Image Transmission Device Utilization

The University Library has developed plans for experimentation with image transmission devices to allow remote access to printed information as well as bibliographic information. It is difficult to determine how soon libraries will be able to use such equipment on a regular basis. However, a continuing program of experimentation should be considered as part of the state-wide program so that such equipment and services could be incorporated into the system as soon as possible.

Stage 3: State-wide Operations, Evaluation, and Modification

The third and final stage of development of a state-wide system would cover the last two years of the program and would be designed to evaluate and modify any problems or deficiencies which may become evident when the major parts of the system are operating together.

New libraries in the state higher educational system could also be incorporated into the system during this period. At the end of this final development period the full system will be operating under a program to ensure continued development of efficient operations.

Basic computer equipment does not really wear out, so that the life expectancy of this system will be quite long. Only if the equipment's capacity to handle the work declines below acceptable service levels or if greater cost savings may be gained would equipment be changed within the system. Because of the large investment in the development of the program, equipment changes must be carefully planned and the initial central processor chosen to provide sufficient capability to permit at least a ten year operating period. Bibliographic systems in the past have had a life expectancy of at least 50 years. The newly developing bibliographic systems are founded on many years of experience and may be expected to last an even greater period of time.

IV OPERATING SYSTEM PERFORMANCE REQUIREMENTS

From the point of view of services provided, the automated library system will be an on-line information retrieval system. However, like most retrieval systems its internal operation is primarily a record keeping function. The records used most comprise two very large files around which the entire library operation revolves. The largest and the most active file is the catalog file. This file contains all library holdings which are referenced individually and all such materials that are in an "in process" status. The other very large and very active file is the continuations file which includes information on all serials, continuation and series material either active or inactive.

Additional files which must be available for on-line activities are the authorized borrowers file which identifies borrowers who are authorized to take out library materials, the Depository file which contains Library of Congress cataloging records for books not in this library, the Subject Aughority file which contains the subject classifications authorized by the Library of Congress, the Vendor file which contains information on vendors of library materials (publishers may be vendors as well), and the Accounting file which contains the list of accounts used for library accounting.

The tables which follow give relevant information about on-line files, and the processing activities and sizes of the University Libraries. You will note that the files and activities reported here are concentrated on the on-line applications. There are also many batch processing applications within the library (for example management reporting, payroll, staff scheduling, supplies inventory control, and certain bibliographic and other research activities). These applications will be served during off-line hours, or in background mode or on the backup processor during on-line processing. The requirements for these batch processing activities do not add hardware (with the exception of sequential access storage requirements) or system software requirements to those of the on-line operations. For this reason they have been de-emphasized here.

The size of most of these on-line files precludes the possibility of on-line searches of the actual file, thus the indexing of the files takes on considerable importance. Accordingly, in the tables showing operating statistics for the various departments of the University Libraries an effort was made to indicate the effects of activities on the index files.

All proposals for hardware and software must provide for upward expansion of all system components to meet 1980 processing and information storage requirements. We do not believe that a shorter expected life span could be economically justifiable in view of the costs of hardware acquisition and internally developed software which we anticipate.

TABLE IV - 1

ON-LINE SYSTEM FILES[1]

File	Present size		Ave. ann. growth rate to 1980	on-line updates per day	on-line inspec. per day[2]	on-line search items[3]
	no. of records	Ave. rec. size				
1. Continuation file	100000[4]	500	6%	1600	2000	1. Title 2. Vendor 3. Order No. 4. Serial ID
2. Authorized Borrowers file	50000	100	5%	0	5500	1. Name 2. ID
3. Catalog file[5]	3500000	850	7%	7500	6500[6]	1. Title 2. Author 3. Subject 4. Series 5. Item location 6. Proc. status 7. LC card no. 8. Order no.
4. Depository file	430000	500	10%	0	480	1. Main entry 2. LC card no. 3. Subject 4. Series
5. Subject Authority	35000	30	5%	0	250	1. Subject
6. Vendor file	4000	150	2%	0	1000	1. Vendor 2. Bus. off. ID
7. Accounts file	184	100	20%[7]	560	200	1. Account no.

1. All figures are estimates

2. An inspection may involve the examination of several or many records in the file. It is not always necessary to perform an inspection prior to an update (e.g. when adding an entry in the subject authority file).

3. Each search item necessitates an index file. The index file will often contain more than one entry per physical record in the main file (e.g. more than one author for a work).

4. 20,000 are active serial and continuation records, the remaining 80,000 are inactive records.

5. Includes books in process at all stages as well as cataloged materials. This file contains only one record per title or item of material. Index entry points will handle all necessary duplication of references to the item.

6. This figure does not include library user direct access to the file. We do not anticipate direct user access to on-line files during the phases of the system development covered by this document.

7, This figure is based on he assumption that automation of accounting procedures will result in a greater demand for detail.

TABLE IV-2   22.

ACTIVITIES[1]

offline[2]	Transaction Type	Annual Activity[3]		Files[6]		index[7]
		1970 Est.[4]	1980 Ext.[5]	Inspected 1234567	Updated 1234567	7
	Resources					
	Serial Subscriptions					
	reviewed	1200	3000	* **	*	1
	approved	366	730		*	1
X	not appr.ved	834	2270		*	
	Continuation subscriptions					
	reviewed	1500	3750	* **	* *	5
	approved	375	750		* *	2
X	not approved	1125	3000		* *	
	Backorder purchases over $50					
	reviewed	250	625	* **	*	1
	approved	225	550		*	1
X	not approved	25	75		*	
	Monograph purchases					
	reviewed	75600	200000	**	*	4
	approved	41700	100000		*	1
X	not approved	33900	100000			

1. Activity figures are for Wilson and Walter libraries only. All departmental libraries located elsewhere account for their circulation and reference services separately. Bio-Med., Law, and St. Paul libraries also do their own processing and resources activities.

2. An X in this column indicates that the activity is not necessarily performed on-line.

3. Annual activity figures are not easily converted to typical daily or hourly rates. Processing and resources personnel work 251 eight hour days a year, over which the transactions are distributed fairly equally. However, Reference Services and Circulation are open fifteen hours a day, six days a week and eleven hours a day on Sunday with very uneven distribution over the hours of the day and the days of the year. Table IV-5 shows the variation in the utilization of the library over a two month period.

4. These figures are for the fiscal year ending June 30, 1969, when those figures are available, when not available they represent the "best guesses" of the staff involved.

5. These estimates are "best guesses" based on a combination of extrapolations of historical trends, present or anticipated policy affecting growth in a particular area, estimates that libraries should double every ten years; and the ten percent annual growth rate of published material.

6. The numbers 1-7 refer to the file sequence of Table IV-1.

7. The numbers in this column indicate the number of index references which must be updated during the transaction. Blanks indicate no changes in indexes.

TABLE IV-2 cont.
ACTIVITIES[1]   23.

offline[2]	Transaction Type	Annual Activities[3]		Files[6]		index[7]
		1970 Est.[4]	1980 Est.[5]	Inspected 1234567	Updated 1234567	
	Processing					
	Business operations					
	Orders and receipts					
	orders sent (titles)	60000	150000	*	*	2
	orders cancelled	1000	2500	*	*	2
X	claims (non-serial only)	12000	30000	* *	*	
	volumes received					
	ordered separately	58000	145000	*	*	
	blanket orders	4000	6000	* *	*	5
	standing orders	10000	25000	* *	* *	6
	volumes returned	1250	3100	* *		
	correspondence received	2500	6200	*		
	Accounting					
	credit transactions	1600	4000	*	*	
	encumberances	60000	150000	*	*	
	expenditures	80000	200000	**	*	
X	Bindery preparations					
	items bound	33085	65000	* * *	* *	1
	returned items	33085	65000	* *	* *	1
	Serials records					
	Orders and receipts					
	new subscriptions ordered	725	1450	*	*	2
	items received	260000	520000	*	*	
X	claims sent	9100	18200	* *	*	1
	correspondence received	2000	4000	* *		
	Back volumes					
	orders sent (titles)	5000	10000	* **	*	1
	orders cancelled	750	1450	* *	*	1
X X	claims	5000	10000	* *	*	1
X X	quotes sent	1000	2000	* *	*	
	quotes received	900	1800	*	*	
	correspondence received	5000	10000	* *		
	items received	17000	34000	* *	*	2
	Cataloging					
	new titles cataloged using LC, NLM NUC, etc.	25170	62300	**	**	8
	other new titles	4436	11200	**	*	4
	other titles added	22488	56000	***	*	1
	titles withdrawn	2545	6500	**	*	8
	microform items added	497	10000	* *	*	4
	cards filed in catalog and shelf list	250900	627000		*	2
X	LC depository cards filed	218300	545700		*	4
	volumes transferred, recataloged or reclassified	20000	50000	*	*	1

TABLE IV-2 cont.   24.

ACTIVITIES [1]

o f f l i n e [2]	Transaction Type	Annual Activities [3]		Files [6]		i n d e x [7]
		1970 Est. [4]	1980 Est. [5]	Inspected 1234567	Updated 1234567	
	Reference Services					
	card catalog search	80000	320000			
	serials record search	20000	80000			
	subject authority search	5000	20000			
	Circulation					
	Stacks					
	volumes checked out	430000	860000			1
	recalls	14000	28000			
	late notices	25000	50000			
	lost volumes recorded	1400	2800			1
	lost volumes returned	1150	2300			1
	fine notices sent	4000	8000			
	renewals	33700	67400			
	volumes returned	430000	860000			1
	Reserve					
	volumes checked out	210000	420000			1
	late notices	2500	5000			
	lost volumes recorded	200	400			1
	lost volumes returned	20	40			1
	fine notices sent	2100	4200			
	renewals	2000	4000			
	volumes returned	210000	420000			1

TABLE IV-3

LIBRARY HOLDINGS [1]

Library	Volumes	Serial Titles	Micro-form items	Other items [2]	Est. 10 yr growth
Wilson Library	1402432	5434	336557	264418	
General collection	1217647	2800	***	***	
Ames	47011	1373	12	4625	
Bell	7212	0	200	0	
Business Ref. Service	5187	621	0	880	
Documents	1240000[3]	0	174048	1169	
East asian	50085	139	293	4	
Maps	5924	215	0	257740	
Middle East	60	19	16	0	
Newspaper	14574	267	161988	0	
Special collections	54732	0	0	257740	
Walter	316225	3208	2719	1664750	
Chemistry	62472	755	0	948	
College Library	15950	137	0	320	
Education	170290	1306	711	15005	
Immgrant Archives	0	244	1157	25000	
Kerlan collection	25109	0	0	0	
Music	30826	336	679	132432	
Social Welfare History Archives	0	0	172	1216200	
University Archives	11578	430	0	274845	
Architecture	12311	188	0	21366	
Art	17009	172	0	3500	
Bio-Medical	198155	3194	155	0	
Engineering	63418	1160	0	11436	
Geology	22846	702	2	61400	
Journalism	3575	228	3	2600	
Law	320523	0	42989	14	
Marshall high	24174	141	0	2020	
Math-physics	17021	430	0	140	
Mines	22119	650	0	1134	
Natural History	5512	241	0	17392	
Pharmacy	10575	266	0	1663	
Public Administration	50623	38	0	5445	
Total Minneapolis Campus	2486518	16052	382425	2047278	55%

TABLE IV-3 (cont.)   26.

LIBRARY HOLDINGS [1]

Library	Volumes	Serials Titles	Micro-form items	Other items[2]	Est. 10 yr. growth
Bio-Chemistry	10349	201	8182	0	
Entomology	19474	498	7	21006	
Forestry	8153	479	0	27000	
Plant Pathology	4179	103	0	4500	
St. Paul Campus Library	82704	1791	99	400223	
Veterinary Medicine	15318	602	122	4567	
Total St. Paul Campus	140177	3674	8410	457296	95%
Crookston	8065	452	0	4593	95%
Duluth	126273	1369	58332	3748	55%
Morris[4]	44007	708	1242	1394	55%
Waseca	4577	2010	0	4150	150%
Total all libraries	2805040	24265	450409	2518459	55%

1. As of June 30, 1969. Some figures are extimates by shelf space.
2. Such as phamphlets, reprints, slides, maps, etc.
3. The document volumes are not included in any volume totals.
4. Figures for Morris include the West Central School and Experiment Station
   and the North Central School and Experiment Station as well as the University
   of Minnesota, Morris.

***Not Available

TABLE IV-4

LIBRARY STAFF AND CIRCULATION[1]

Library	Staff[2]			Circulation	
	prof.	cler.	misc.[3]	volumes	Est. 10 yr. growth
Wilson Library[4]	64.75	85.4	80.5	380973	
General collection[5]	11.25	34.0	22.7	254754	
Ames	2.00	1.0	0.0	6979	
Bell	2.00	1.0	0.8	**	
Business Ref. Service	1.00	1.5	0.3	3471	
Documents	4.00	2.0	1.0	6354	
East Asian	2.00	0.0	1.4	3192	
Maps	1.00	0.5	1.3	6531	
Middle East	1.00	0.0	0.0	44	
Newspaper	1.00	1.0	1.6	1624	
Special Collections	0.00	0.0	1.1	3226	
Walter Library[6]	14.25	9.0	16.1	210833	
Chemistry	2.00	1.0	1.0	19009	
College Library	1.00	1.0	1.0	9389	
Education	3.50	3.0	9.7	40365	
Immigrant Archives	2.00	1.0	0.5	**	
Kerlan Collection	1.00	0.0	0.0	970	
Music	1.00	1.0	2.6	49209	
Social Welfare History Archives	0.75	1.0	0.6	**	
University Archives	3.00	1.0	0.7	**	
Architecture	1.00	0.0	0.0	18414	
Art	1.00	1.0	1.7	20483	
Bio-Medical	8.00	11.0	10.5	120970	
Engineering	2.00	1.0	1.1	40134	
Geology	1.00	0.0	1.2	6008	
Journalism	1.00	0.0	1.4	**	
Law	10.00	9.0	3.4	**	
Marshall high	2.00	0.6	1.1	15769	
Math-physics	1.00	1.0	0.4	10970	
Mines	1.00	0.0	0.9	11519	

TABLE IV-4 (cont.)

LIBRARY STAFF AND CIRCULATION[1]

Library	Staff[2]			Circulation	
	prof.	cler.	misc.[3]	volumes	Est. 10 yr. growth
Natural History	1.00	0.0	0.6	2413	
Pharmacy	1.00	0.0	0.1	7541	
Public Administration	2.00	0.0	0.4	9777	
Total Minneapolis Campus	111.00	118.0	119.4	855804	80%
Bio-chemistry	0.33	1.0	0.0	4688	
Entomology	1.00	0.0	0.5	8831	
Forestry	0.33	0.0	0.0	6441	
Plant pathology	0.34	0.5	0.0	1822	
St. Paul Campus Library	7.50	8.5	8.3	84423	
Veterinary Medicine	1.50	0.0	0.7	8019	
Total St. Paul Campus	11.00	10.0	9.5	114224	150%
Crookston	1.00	3.0	2.6	5567	150%
Duluth	10.00	7.0	7.6	89072	80%
Morris	3.00	3.0	4.8	32190	80%
Waseca	0.00	0.0	0.7	7028	220%
Total all libraries	136.00	141.0	144.6	1103885	80%

1. As of June 30, 1969
2. The staff growth rate from 1958 to 1968 was 94%. Professional staff grew at the rate of 29%, clerical at 156%, misc. at 157%.
3. Primarily part time student help.
4. Staff figures include all administrative and processing personnel working in Wilson. Circulation figures include the Wilson reserve room statistics.
5. Staff figures are the total of Reference Division and Circulation Department personnel.
6. Staff figures include the Walter Reserve room personnel. Circulation figure includes the Reserve room circulation.

**Not Applicable

TABLE IV-5
Library Utilization
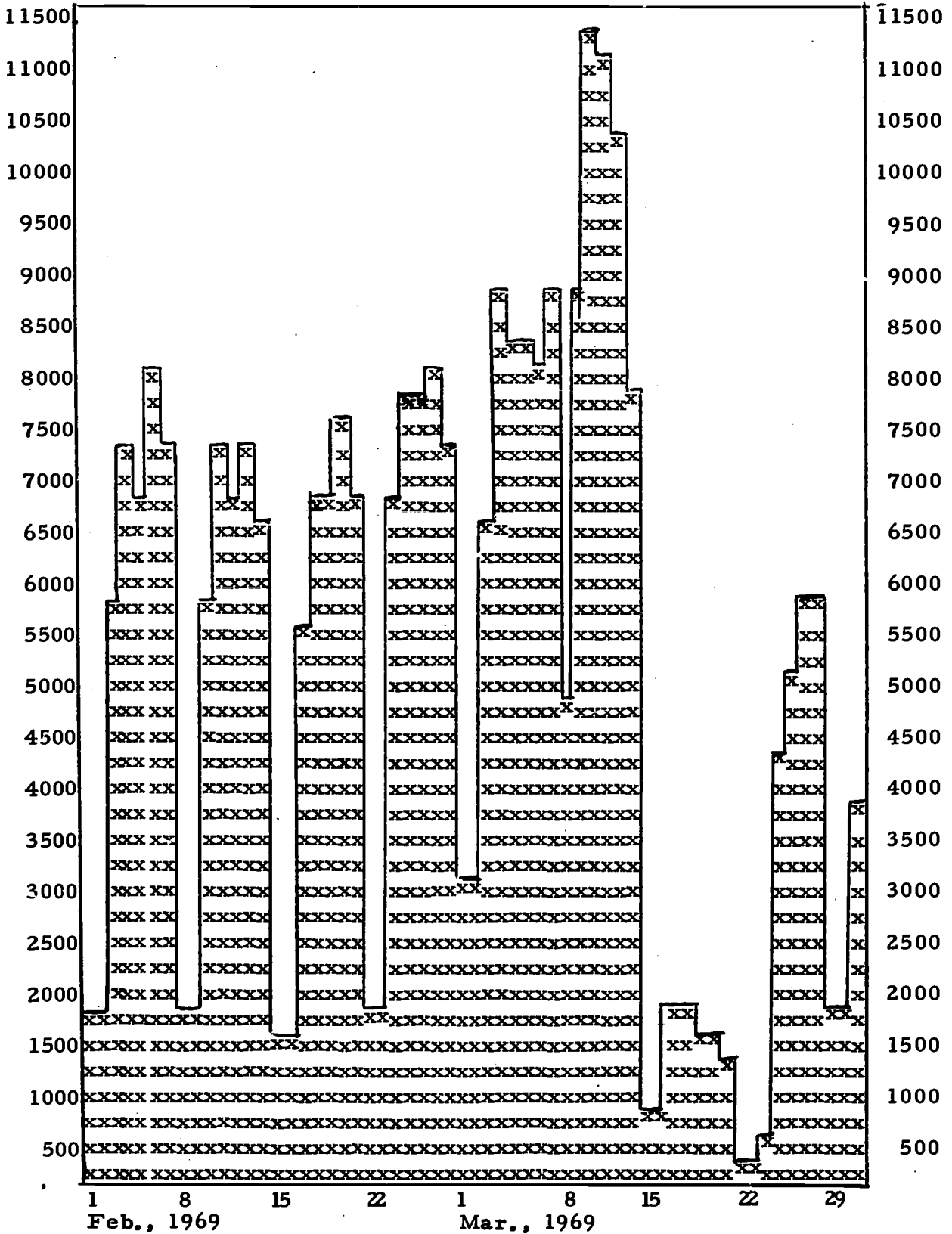
note: Dates identified are Saturdays, most weekend periods are averaged.
note: No months could be described as typical. Holidays, quarter breaks, final
and midquarter times, and summer sessions all have great affect on utilization
rates.

V. HARDWARE REQUIREMENTS

CPU Requirements

Because of the nature of library information storage and processing requirements it is felt that only CPUs with 8 bit byte oriented processors could perform efficiently. All core memory should be character addressable and a full set of character manipulative instructions including character arithmetic, logical, conversion or translation, and load and store instructions must be available. Any word machine which can satisfy these requirements will be quite satisfactory if it is competitive in all other respects.

Since the proposed system is to be on-line and provide services to many libraries and many functions within each library, the utilization rate during prime time will be quite high and will grow rapidly. This suggests many additional CPU requirements. The interupt capabilities must be able to support the proposed system. The vendor must specify how the interupt features of the equipment will function to meet the requirements. The processing speed of the CPU must be sufficient to keep response times for all terminal equipment within an acceptable range (under two seconds for most terminal devices). I/O channels must have direct memory access. Hardware buffering from any core location would be desireable. Memory protect is necessary to insure program security and memory lockout is necessary to insure information security. A program accessable real time clock must be available.

Some hardware backup for the primary CPU will be required to quarantee service even if at some diminished level. Our thoughts are that a completely compatable machine with lesser capabilities might serve in this capacity in the event that the main CPU goes out of service temporarily. Our concern is to provide the necessary backup at the least cost. Dual processors seem an unjustifiable expense in view of the need for maintaining only partial service levels during down times. However, any savings derived from avoiding duality would be lost if a great deal of additional software development was involved. Therefore we believe that a compatable machine with somewhat diminished capabilities could serve our backup needs most efficiently. At the same time, this configuration could permit a gradual build up of hardware (installing only the backup equipment first for preliminary system testing and the earliest stages of system operation), an efficient scheduler for the primary processor, computational support at peak load times, and a separate environment for the on-going debugging and system testing activities.

It is our intention to use a mixed manufacturer configuration if there would be any cost or performance advantages to that approach. Even if

this approach is not pra :tical initially, we desire to keep the possibility
open for future expansion. Thus standard features which would not pre-
clude use of other manufacturers peripherals or terminal equipment are
essential.

Tremendous growth in the size and complexity of the system is
anticipated as library system technology expands to permit the automated
system to take on added service and support functions. Thus core memory
must be modular to permit expansion as necessary. Similarly, the potential
for adding on-line or off-line storage and additional other peripheral or
terminal devices must be almost unbounded.

To facilitate the application software development, several hardware
features are required. Multilevel indirect addressing and at least 7 index
registers are a minimum. The ability to use more than one index register
with memory references would be very desirable. Some form of very fast
core memory to serve as additional temporary registers or-intermediate
storage would also be desirable. And, as mentioned above, the capabilities
of the instruction set with respect to the processing of character data is of
utmost concern in this application.

Terminal Requirements

The computer system envisioned must be structured so that various types of
terminals may be connected to the central computer system. Dependent up-
on the number of devices and their transmission rates various kinds of ter-
minal control may be required.

During Stage 1, Basic Applications Systems Development, the initial terminals
will be within the Wilson Library, the Bio-Medical Library, and the St. Paul
Campus Library. In the latter phase of this first three year period the remain-
ing terminals would be installed.

The types of terminals needed will be of the general description below:

1) Visual display terminals interlinked directly to the computer
system in Wilson Library, elsewhere via Bell System leased
facilities.

2) Non-visual typewriter terminals in the branch libraries, not
having multiple terminals outside Wilson, if appreciably lower
costs can be shown over the use of the visual terminals for
these single stations.

3) Visual display terminals with typewriter type hard copy printers.

4) Hollerith 80 column card/identification badge readers with limited keyed input capability for book circulation control.

Depenuent upon the cost for transmission lines, alternate methods of transmission other than Bell System leased facilities will be considered.

After Stage 1 is completed, there will be the further addition of teletype 33 ASR or compatible terminals to other libraries throughout the state and the University of Minnesota Duluth, Morris, and Crookston campus libraries. Exact locations of these terminals have not yet been determined so their provision will not be included in the system at this time. However, they are mentioned to give growth information to ensure upwards expansion of the initial hardware provided. The probable number of such terminals is estimated to be 20-30 located in 20-25 separate physical locations.

Below is a basic description of required and desirable features for the initial terminal devices.

Visual Display and/or Visual Display With Hard Copy Capability

The number of displayable character positions on the screen shall not be lower than 960. A larger size or flexible expansion up to 2000 characters may be considered desirable, particularly for terminals used within the processing operations of the library. Longer lines (80 characters) are more desirable than shorter ones of 40-50 characters.

Because of the large character set used within the library system to encode bibliographic information, the largest possible number of character codes will be necessary. The character set table included elsewhere in this document demonstrates this need. The terminals must have at least the 64 character set, upwards expandable to 96 characters or more for terminals used for data entry operations. Therefore special function keys may be considered a desired feature for data entry operations. The character code desired would be 8 bit ASCII.

Generation of the character on the screen may be either stroke or dot matrix with variations in size allowable. Ease of reading and good phosphor, with minimum flicker of the display is the prime consideration.

The visual terminal must be EIA TV compatible to permit transmission either direct or through a campus wide closed circuit coaxial cable system which may be suitable for this purpose at some time in the future.

Non-destructive cursor and buffered input/output are required.

The terminal must have as an option a suitable impact printing device. A selectric typewriter is preferred over teletype or other devices.

The keyboard most desirable would permit its movement away from the screen a few feet to permit angling the screen so two people may view the display. Character/line erase and good cursor movement keys are required. Other desirable, although not required, features are:

1)   Roll and scroll paging.

2)   Blinking character.

3)   Power on/off lock.

4)   Tabulator feature.

The terminals must be able to operate in a polled environment because of the large number of high activity terminals.

Included with this report is a map showing the remote terminal locations on the campus and within Wilson library. A summary table showing all devices proposed and their locations is also included.

Non-Visual Device Terminals

Terminals of this type need not be specified if visual terminals are feasible for all remote terminal sites. However if this kind of terminal is specified, it should be of the IBM 2741 type or similar selectric typewriter terminal. These terminals represent an alternate solution to query terminals for the remote locations with lower utilization rates. Since these terminals initially are to be used as file query devices only they should be compatible with other terminals within the system. This will permit easier use later for full input/output functions.

Data Collection Terminals

These terminals' function is to execute charge transactions for materials leaving the library on loan. The book will contain an 80 column card for recording the book I.D. number (an 8 digit accession number). The borrower's plastic card will contain his social security, file or special number. These devices must transmit directly to the computer since real time updating of files will take place to record short duration transactions. The unit should also have an optional keyboard entry capability to permit entry of a transaction without the borrower's I.D. card. An acceptable kind of system is typified by the FRIDEN collectadata units.

Transmission Line Facilities

For the locations within Wilson Library it is proposed that direct hardware connections be used to assure the fastest data transmission rate from heavy input/output usage terminals. For the locations outside Wilson Library on West Bank, East Bank, and St. Paul Campuses leased lines from the Bell System appear to be the best method. For the later expansion to other locations throughout the state the leased line system also appears optimum at this time.

It is to be stressed that these terminals are a major portion of the envisioned system. They need a longer life expectancy than most other components. Since they comprise the only man/machine interface and are relatively independent, they probably will be the last component to be upgraded with new equipment. Since the total system is geared to service queries and I/O from terminals their importance cannot be overstressed.

TERMINAL DEVICE LOCATION SUMMARY

Location	V	VH*	T**	D	Approx. Distance to Computer	Full Character set option	Data Entry & I/O functions	Query only
Wilson Library								
Computer Room	1			1		yes	yes	
Resources/Sp. Bibl.	2					yes	yes	
Orders	4					yes	yes	
Accounting	1					no	yes	
Cataloging	8	4				yes	yes	
Circulation	2			4		no		yes
Reference	1					no		yes
Periodicals	1					no		yes
Serials	5	1				yes	yes	
Administrative	1					yes	yes	
Documents	1					no		yes
Special Coll.	1					no		yes
Reserve	1			3		no		yes
Inter-Loan	1			1		no		yes
TOTAL Direct Coupled	30	5		9				

* This is the number of hard copy options attached to visual terminals in the physical location area.

** These terminals may be visual terminals of the same kind as generally specified if the cost of these terminals and leased cable is equal to or less expensive than leased line, selectric typewriter terminal connection. This would bring the total number of visual terminals to 60. This is an optionally proposed configuration if lower in cost over a full terminal display system using the leased Bell transmission system.

Terminal types
    V- Visual display terminals
  VH- Visual display terminals with associated impact printer
    T- Typewriter type terminal
    D- Data collection device reading 80 column cards and punched laminated badges

TERMINAL DEVICE LOCATION SUMMARY (cont.)

Location	V	VH*	T**	D	Approx. Distance to Computer	Full Character set option	Data Entry & I/O Functions	Query only
Department. Libs.								
Bio-Medical	4	1		3		yes	yes	
St. Paul Campus	4	1		3		yes	yes	
Vet. Med.	1			1		no		yes
Entomology				1				
Biochemistry				1				
Forestry				1				
Plant Path.				1				
Law	4	1		3		yes	yes	
Architecture			1	1		no		yes
Art			1	1		no		yes
Chem/Sci. Tech.			1	1		no		yes
Education			1	1		no		yes
College			1	1		no		yes
Geology			1	1		no		yes
Journalism			1	1		no		yes
Mathematics			1	1		no		yes
Physics			1	1		no		yes
Mines			1	1		no		yes
Music			1	1		no		yes
Natural Hist.			1	1		no		yes
Pharmacy			1	1		no		yes
Public Admin.			1	1		no		yes
Walter Reserve			1	3		no		yes
Archives	1					no		yes
Total Leased Channels	14	3	16	32				
Grand Total	44	8	16	41				

UNIVERSITY OF MINNESOTA
MINNEAPOLIS CAMPUS

SCALE

NORTH

TO ST. PAUL CAMPUS

M I S S I S S I P P I   R I V E R
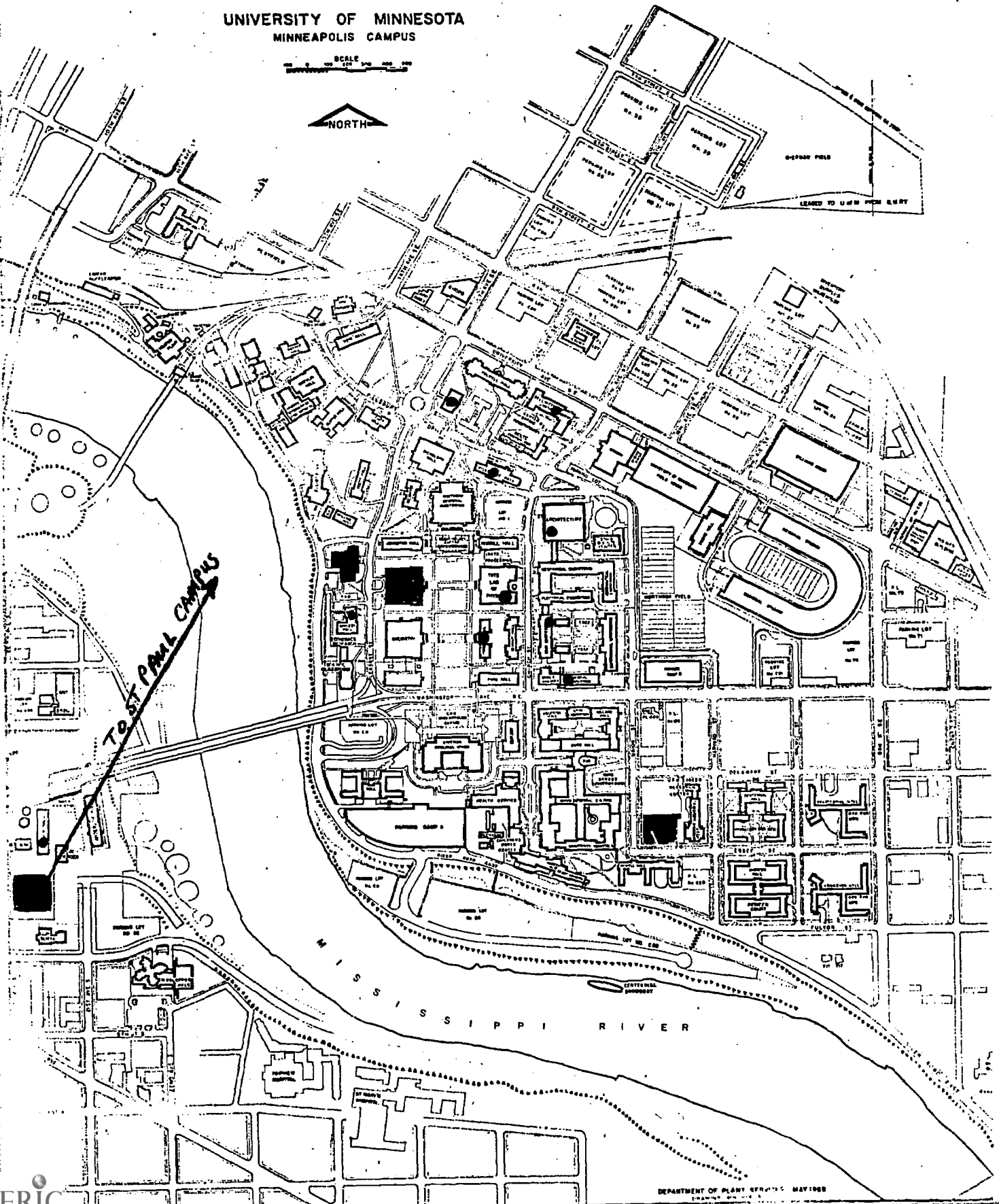
— Multiple video terminal Location

— Single video terminal Location

UNIVERSITY OF MINNESOTA
ST. PAUL CAMPUS

SCALE

NORTH
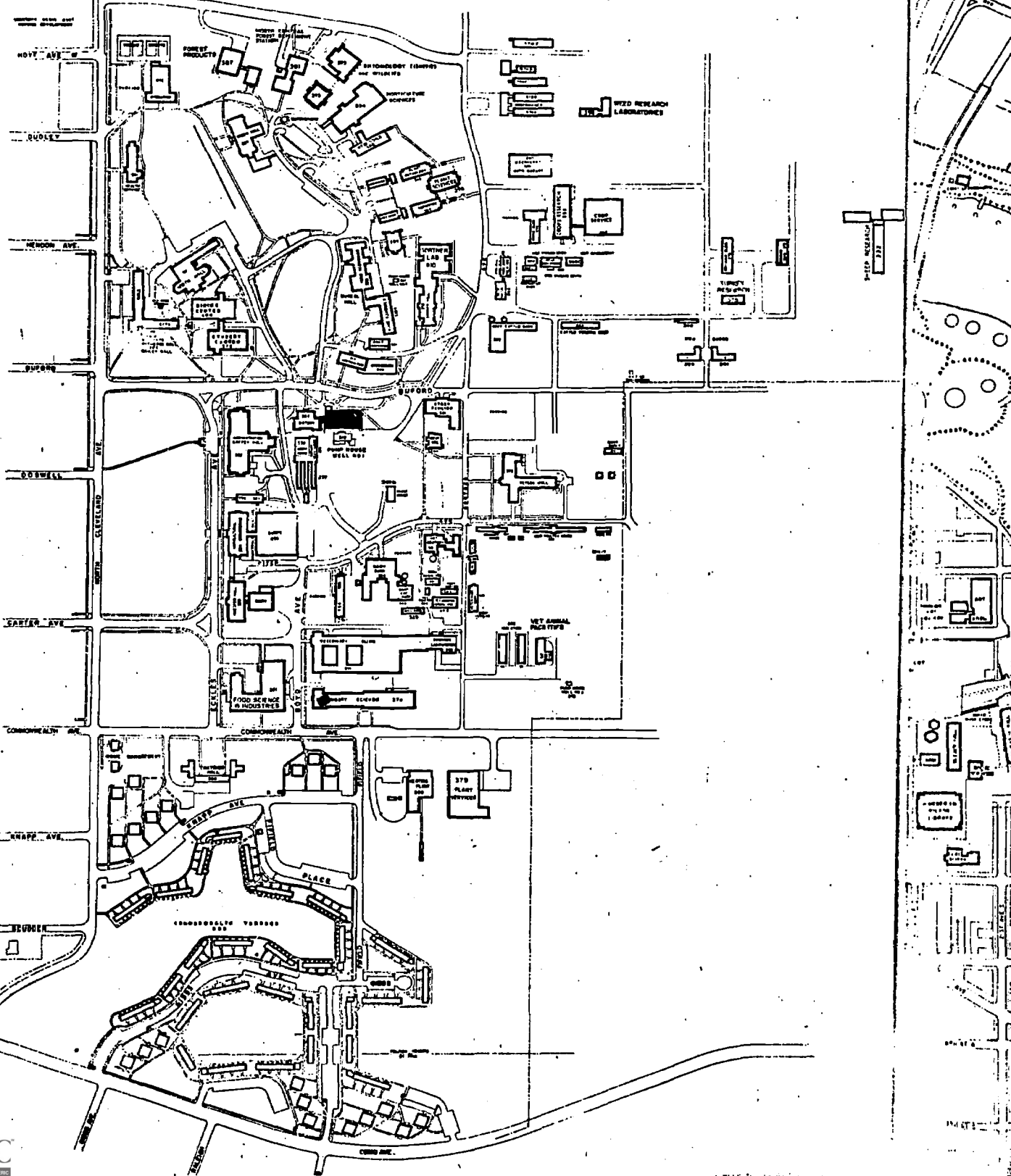
Multiple Direct Wire Connected Terminals

WILSON LIBRARY FLOOR PLANS
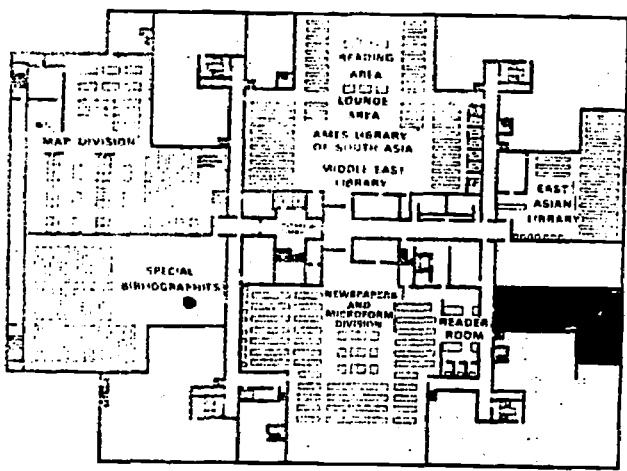
SUB-BASEMENT
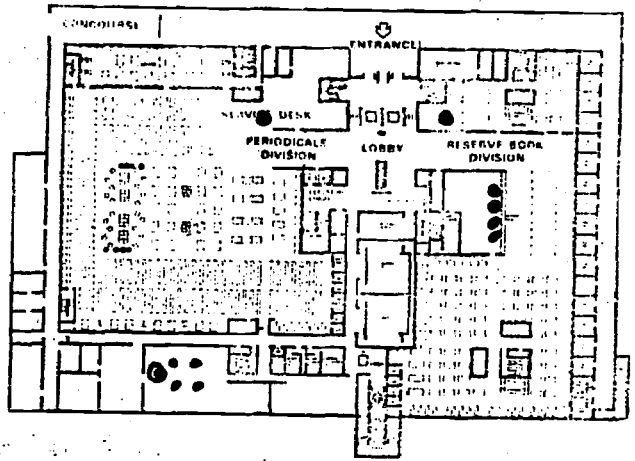
BASEMENT
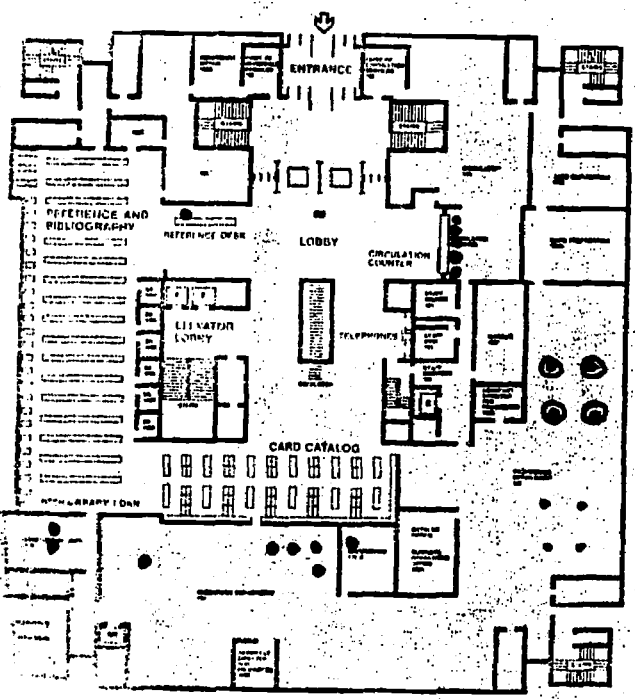
PLAZA LEVEL
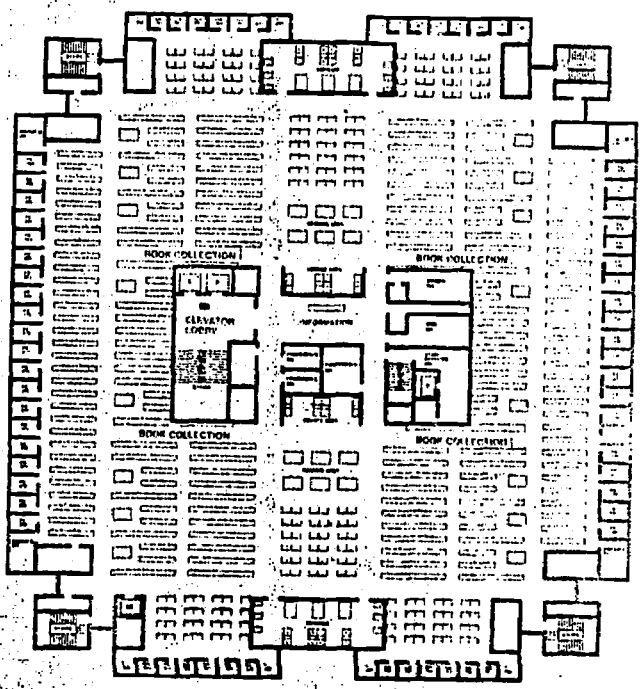
LEVEL TWO

- ● Visual terminal Location
- ◉ Visual terminal with printer Location
- ● Data Collection terminal

LEVEL THREE　　　　**LEVEL FOUR**

CAMPUS LIBRARY LOCATIONS

MINNEAPOLIS CAMPUS LIBRARIES

1 WALTER LIBRARY
2 WILSON LIBRARY
3 ARCHITECTURE LIBRARY 160 Architecture
4 ART LIBRARY 104 Jones Hall
5 BIO-MEDICAL LIBRARY Diehl Hall
6 ENGINEERING LIBRARY 125 Carlson
7 GEOLOGY LIBRARY 204 Pillsbury
8 JOURNALISM LIBRARY 121 Murphy Hall

9 LAW LIBRARY 314 Fraser Hall
10 MATH-PHYSICS LIBRARY 260 Physics
11 MINES AND METALLURGY LIBRARY
　　132 Chemical Engineering
12 NATURAL HISTORY LIBRARY
　　305 Museum of Natural History
13 PHARMACY LIBRARY 203 Appleby Hall
14 PUBLIC ADMINISTRATION LIBRARY
　　304 Wenger Hall

SAINT PAUL CAMPUS LIBRARIES

15 BIOCHEMISTRY LIBRARY
　　240, 242 Gortner Laboratories
16 ENTOMOLOGY LIBRARY
　　375 Entomology, Fisheries and Wildlife
17 FORESTRY LIBRARY 205 Green Hall
18 PLANT PATHOLOGY 202 Plant Pathology
19 VETERINARY MEDICINE LIBRARY
　　410 Veterinary Science
20 ST. PAUL CAMPUS LIBRARY
　　Central Library Building

Leesed Communications Fecilities Terminals

WALTER LIBRARY FLOOR PLAN

BASEMENT

STACK FLOOR NO. 4

MSS AND ARCHIVES OFFICES

LIBRARY

STAFF ROOM

MEN

MUSIC LIBRARY

WOMEN

MANUSCRIPT & ARCHIVES ROOM

FIRST FLOOR

STACK FLOOR NO. 5

MUSIC LIBRARY

RESERVE ROOM

DEPT. LIBRARY OFFICE

SPECIAL COLLECTIONS

SECOND FLOOR

STACK FLOOR NO. 7

CHEMISTRY LIBRARY

EDUCATION LIBRARY

COLLEGE LIBRARY

THIRD FLOOR

STACK FLOOR NO. 11

MEN

WOMEN

IMMIGRANT ARCHIVES

CENTER FOR IMMIGRATION STUDIES

UKRAINIAN COLLECTION

IMMIGRANT ARCHIVES
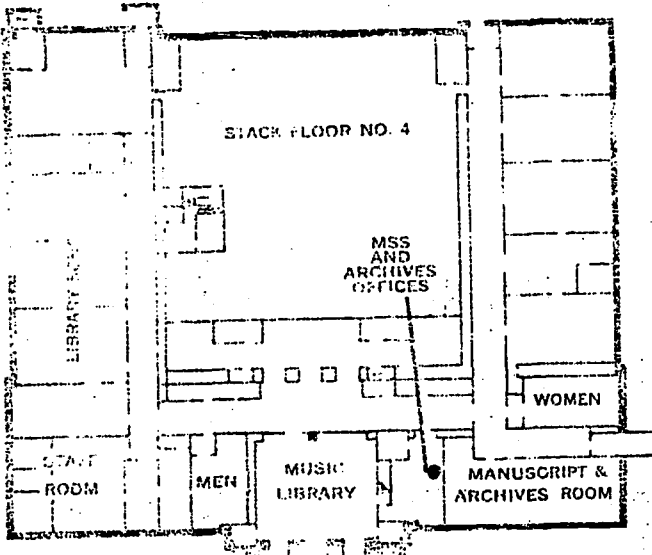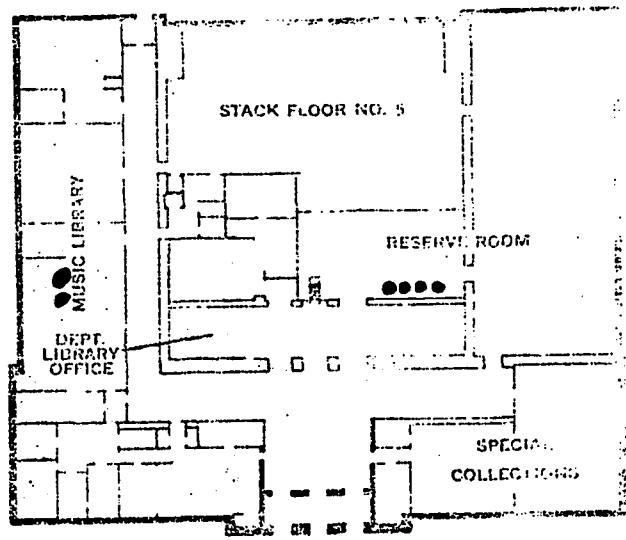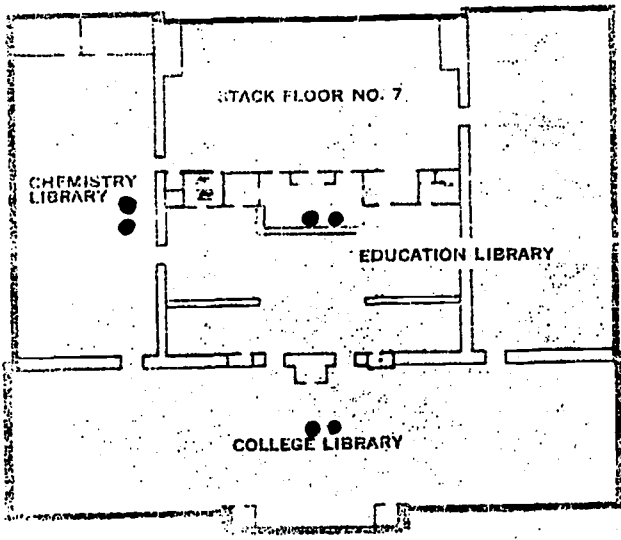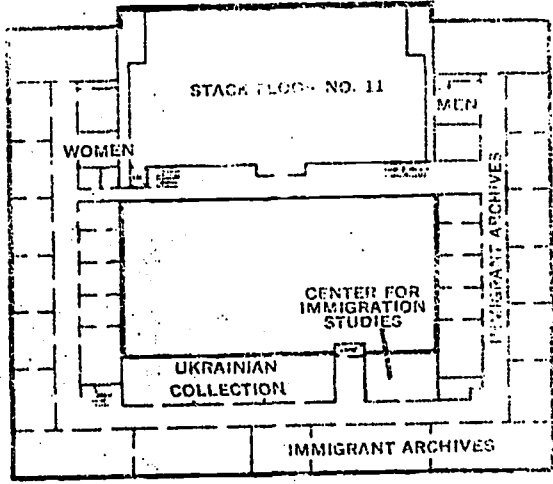
● — Data collection terminal Location
● — Visual terminal Location

ERIC
Full Text Provided by ERIC

Printer Requirements

Due to the heavy printer demands, it is conceivable that eventually two high speed printers will be required. The printer chosen initially should be high speed, with 1000-1200 lpm. maximum rated output. The print train must be able to be interchanged such as in the IBM 1403 unit. Two print trains should be provided in the printer configuration -- one the conventional upper case business character set of the manufacturer, the other the Library of Congress Printer character set shown in Table P. 1., as now implemented on an IBM 1403 printer.

It is foreseen that many printing tasks would be done using an ELECTRON BEAM RECORDER in the University Computation Center or other COM equipment.

Table P. 1. | Proposed Library Print Train |

166 different graphics
74 twice
92 once

GRAPHICS TO BE INCLUDED TWICE

Double dagger	‡	Alphas (cont.) (upper case)	H		e
Parenthesis	(		I		f
"	)		J		g
Comma	,		K		h
hyphen or minus	—		L		i
Period	.		M		j
Numerics	0		N		k
	1		O		l
	2		P		m
	3		Q		n
	4		R		o
	5		S		p
	6		T		q
	7		U		r
	8		V		s
	9		W		t
Col	:		X		u
Semi-colon	;		Y		v
Alphas (upper case)	A		Z		w
	B	Brackets	[		x
	C	"	]	/	y
	D	Alphas (lower case)	a		z
	E		b	Acute	'
	F		c	Umlaut	..
	G		d		

GRAPHICS TO BE INCLUDED ONCE

Name	Symbol	Name	Symbol	Symbol	Name	Symbol	Name	Symbol
Exclamation Point	!			Ő	Double acute	"	Subscript closed parens	)
Quotation Marks	"			ʮ	Candrabindu	˘	" numbers	0
Number or sharp	#	ʻAyn	ʻ	˙	Cedilla	˛		1
Dollar mark	$	Polish L (l.c.)	ł	ł	Right hook	˞		2
Percent	%	Scandinavian O (l.c.)	ø	ø	Dot below	˙		3
Ampersand	&	D with cross bar (l.c.)	đ	đ	Double dot below	··		4
Apostrophe	'	Thorn (l.c.)	þ	Þ	Circle below	○		5
Asterisk	*			æ	Double underscore	=		6
Plus	+			œ	Underscore	—		7
Slash	/	Tvёrdyy znak	"	"	Superscript- plus	+		8
Less than	<	Turkish i (l.c.)	ı	⊥	" minus	-		9
Equals	=	British pound	£	£	" open parens	(	Alpha	α
Greater than	>			σ	" closed parens	)	Beta	β
Question mark	?			ɯ	numbers	○	Gamma	γ
At sign	@	Pseudo-question		?		1		
Polish L (u.c.)	Ł	Grave	`	`		2		
Scandinavian O (u.c.)	Ø	Circumflex	^	^		3		
D with crossbar (u.c.)	Đ	Tilde	~	~		4		
Thorn (u.c.)	Þ	Macron	‾	‾		5		
	Æ	Breve	˘	˘		6		
	Œ	Superior dot	˙	•		7		
Miagkii znak (prime)	ʹ	Haček	ˇ	/		8		
Dot in middle of line	·	Angstrom or Circle	○	○		9		
Musical flat	♭	Ligature	⌣	⌣	Subscript - plus	+		
Subscript patent mark	®			)	" - minus	--		
Plus or minus	±	High comma	'	'	" open parens	(		

VI   SOFTWARE REQUIREMENTS

We expect to develop most of the applications software in-house.   We
also anticipate certain changes in any manufacturer supplied soft-ware
as our system develops.   However, since one of our objectives is to get
the system operating in the minimum time at least in a minimal way, we
must have software from the manufactures which will permit us to go on-
line with internally developed applications immediately upon installation
of the equipment.

Thus, as a minimum the manufacturer must provide with the equipment
an executive subsystem, assemblers and compliers, and various general
purpose support programs.   The executive subsystem must provide a real-
time on-line processing scheduler with at least 6 levels of priority above
background processing.   Furthermore, it must provide a real-time accounting
package to record and report CPU, peripheral, and terminal activity by
type of function.   The executive system must also provide all peripheral
(but not necessarily terminal station) I/O processing, including buffering,
file initialization, error detection and recovery, and I/O interupt processing.

An assembler must be available to produce machine language instructions
for every hardware feature from a symbolic language which is relatively
easy to learn for experienced assembly language programmers.   Of course
this assembler must be compatible with the executive subsystem so application
program/executive subsystem interfaces are easily programmed. In addition
to the assembler, a compiler must be available for COBOL at least, and a
simulation language such as SIMSCRIPT must be provided.   A user oriented re-
port generator language would also be useful for the preparation of off-
line management reports with a minimum of program development time.

Generalized support programs must be available for such activities
as sorts (several programs employing different methods would be pre-
ferrable), standard file up dates, program deck maintenance in some ab-
breviated more easily useable form, and storage medium to storage medium
or display activities.

VII SERVICE AND SUPPORT REQUIREMENTS

The manufacturer will be expected to maintain and provide support for the software supplied as well as the hardware. Technical support to provide information and to correct in a minimum time any software system problems detected must be available locally upon demand. This support will be particularly important if new versions of operating systems or completely new operating systems are installed. If the library systems staff determines that a new or revised version of an operating system is inappropriate for our use, we will expect the manufacturer to provide software system support at an undiminished level for the system in use.

Hardware maintenance personnel must also be available upon demand locally. The maintenance provider or providers will be given preventative maintenance time which will be agreed upon at a later date. This time cannot be during the hours which the library is open to the public.

Machine-Readable Data Bases

Prepared by
Systems Division
University of Minnesota Library

The purpose of this paper is to discuss Library's role in relation to acquiring and serving machine-readable data bases including the conditions and resources which must be present in the Library before these materials can be acquired, the potential uses, and the future implications. In order to consider all aspects of this new type of service, it is necessary to relate this type of service to the existing resources and services now provided by the library. In addition, it is very important to relate the possible services from data bases to the library's future development five, ten or twenty years from now. The Institute of Library Research, UCLA conducted studies under Dr. Robert M. Hayes on this topic and certain points will be discussed in this paper which are based on these reports. [1]

Definition of Machine-Readable Data Bases

These data bases are files of information contained in some machine readable form, such as punched cards, magnetic tape, disk packs, paper tape, or optically scanable printed text. At this time and for the immediate future, magnetic tape will be the primary format for these files. Magnetic tapes have different coding levels, recording density, record lengths and labelling, and these factors must be considered when the tapes are procured. Similarly, the other machine readable formats present handling problems relating to readability of the data and processing time which limit use or acquisition of these files. It is for this reason that magnetic tape appears to offer the greatest promise for the transmission of data for information retrieval usage.

These data files are either publicly available through purchase or subscription, or may be obtained locally for the cost of copying from research institutes, universities, and governmental agencies. The machine readable data files must be accompanied by the documentation materials that are necessary before the files can be used.

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1) California University. Institute of Library Research, Los Angeles. Mechanized information services in the University Library. Final report NSF Grant GN-503. R.M. Hays principal investigator. Dec. 15, 1967. Parts 1-13.

Library Systems Planning Summary

Planning activities are now underway to lay the groundwork for the development of a "Statewide On-line Computer-based Bibliographic System" within the University Library. This system would provide the following services:

1.) A computer based management system for the University Libraries
2.) On-line query and batch mode retrospective searching services for monographs and serials held by the University Libraries.
3.) Later development of state-wide resource files permitting the Library's computer to provide a message switching system for state-wide inter-library loan purposes.
4.) Compilation of various lists, catalogs, and indexes to specialized sets of materials.
5.) Computer facilities for students enrolled in library and information science courses.
6.) Service bureau computer capabilities for other libraries throughout the state.
7.) Retrospective searching and current awareness services utilizing commercially available machine-readable data bases.

The development of a program involving machine-readable data bases would become one segment of future library services which require computer use. Therefore, if any services using these data bases is to be provided, the library must have the necessary staff, software, and computer hardware. Without this capability, the Library would be well advised not to get involved with such data bases.

Nature of Data Bases

The machine readable data bases which the library should consider in the immediate future may be classified as follows:

1.) Bibliograph or Reference. These are magnetic tapes which contain records describing bibliographic materials, ie journal articles, abstracts of papers, monographs, etc. These files may be arranged sequentially by accession no., or be arranged in inverted files by subject, author, series, etc.
2.) Fact Oriented or Non-bibliographic Data. These magnetic tapes contain information in compacted, fixed field records which is classified by some method. Servicing these materials requires tabulation of data or statistical analysis of some sort. For example: U.S. Census tapes 1 in 1000 sample is one type of data base in this category.
3.) Full Text materials. These are magnetic tapes which contain the full texts of such materials as statutes and regulations, or text used for information retrieval or manipulation purposes in the study of auto-indexing techniques. For the foreseeable future tapes containing laws and regulations appear to offer actual operational feasibility. Other files of this sort are yet experimental. Project LAWSEARCH, the New York State Statutes files, is an example of this type of data base.

It is important that difference in these tapes be considered since different staff capabilities are needed to use them.

A Program for Information Services from Computer Processed Data

The development of an information services program utilizing tapes would follow the sequence below:

1.) Development of computer hardware resources.
2.) Development of reference services staff trained to recognize machine searching problems.
3.) Development of staff trained in search formulation.
4.) Development of sufficient computer programs.
   a.) Generalized file searching software.
   b.) Statistical data handling programs.
   c.) File handling/maintenance software.

Computer Hardware Resources

Magnetic tapes or other machine readable data sources require certain computer configurations depending on the kind of programs written to search or manipulate them and the desired speed of processing. Generally speaking a small computer connected to a large scale computer, a medium scale stand alone computer, or a large scale computer system is required. Since program development costs will be substantial, the use of a non-library computer poses some problems, particularly if non-compiler level languages are used. The existing University of Minnesota campus computers are not geared to this kind of processing.

Costs to process this data on the CDC 6600 would be approximately twice of the CDC 3300 system. An IBM Model 40 or 50, which would represent the more optimal type of computer, would lower processing costs significantly, especially if such a service operated in a multi-processing environment with a job mix of terminal communications and batch processing tape searching running concurrently.

Part 10 of the UCLA Final report outlines "Preliminary specificat: ns (hardware and software) for a Center for Information Services" based upon the UCLA local campus computer capabilities. Some of the technical considerations raised in this report are generally appropriate, but the propc3ed hardware configuration would only be suitable if a large scale central IBM computer were available. Otherwise the configuration outlined could not operate such services independently. For the foreseeable future, the University of Minnesota Library's proposed computer facilities would stand alone since coupling at Minnesota is compounded by the need for custom executive software to permit different manufacturer's machines to be linked which have different internal code systems. The economics of such coupling must be carefully considered, since the cheaper route may be a larger in-house system, especially during the initial years of development.

Therefore, the library should control its own hardware, since the search volume should be heavy, and the turn around time should not be excessive. Since tape storage should be in proximity to the computer, the tapes should also be stored within the library. With an appropriate computer configuration, the library's computer center should be in the best position to provide services based upon these tapes.

Trained Public Services Staff

A question which has been raised whenever new services are projected within a library system is "Will the service be a viable one?" In other words, will it provide information and services above and beyond what our reference staff now provide? If program development is sound, the answer from the systems viewpoint is "yes". However, from the users viewpoint it may not be viewed this way, unless the library can develop means by which the reference staff can determine if the usage of tape data bases is in order. This does not mean that we are saying that all reference librarians must be able to formulate search requests or decide what kinds of programs need be run to answer a request. But it does mean that all public service librarians must be taught what kinds of questions, etc. can be so answered, in order that they may refer them to appropriately trained staff within the library's information services and data processing facility.

Trained Search Staff

When questions are referred to the data processing staff, the questions will have to be formulated into the appropriate search strategy by the search strategy staff. These searchers will require some programming knowledge and familiarity with all of the available tapes and associated software. The personnel requirements for such a staff are well prevued in Part 5 of the UCLA study Final Report entitled "Developmental program for a center for information services." This report gives a detailed view of the development of a facility within the library for such services.

Computer Programs

In order to maintain and search tape data, there must be available suitable computer programs. Some of the tape services also have available programs, although the problem is that few installations will be able to use these without modifications. This is because of different equipment, different configurations of the same equipment, different operating system software, or a combination of them. Tape data suppliers have now taken the attitude that a user must create his own software from the documentation supplied with the tape service. Therefore, the library must undertake software development.

Immediately it is evident that if a library were to acquire several or many different services, each with a different tape layout, many different programs would be needed. Another alternative might be to reformat the tapes into a common layout. Both of these approaches are unsound and really unworkable.

The most promising solution to this problem lies in the development of suitable general purpose software, some of which already exists with various manufacturers. This approach was found to be the best one for a library during the course of investigations at UCLA as reported in the Final Report Parts 1-13.

Statistical data handling programs may be adapted from existing programs already installed in other computer centers, and do not represent any major technological problem. If text processing is to be done, a suitable text processor must be installed, either a commercially available package or a custom system.

Inter-Library Cooperation

The Committee on Institutional Cooperation, EDUCOM, and other cooperative groups are very interested in achieving cooperative projects in developing tape data services. From the technical viewpoint together with service considerations, development of information service centers must remain decentralized, with perhaps large selected data bases receiving central service nationally.

However, even this kind of service and cooperation is open to question. What may be needed is a central non-profit agency or university to undertake reformatting of large data bases to compact them and make searching more efficient. A good example of this is the 1970 U.S. Census data for which the University of Pennsylvania has made a grant proposal. It is their well documented belief that reformatting could bring the tape cost down from $200,000 and 3,000 reels, to $20,000 and 200-300 reels. Since the original data tapes emanating from any source have been designed to best provide what the original source needs, the original layouts are not always the best for users who want to search and abstract information, rather than listing the tape contents. This analyst believes this approach to be the most practical for the foreseeable future in the field of cooperative efforts.

Acquisition of Machine Readable Data

The University Libraries should not plan to acquire on subscription or purchase files in any machine processable form until the following conditions are present and working satisfactorily:

1.) A computer-based library information system for the efficient handling of patron queries.
2.) A well developed data processing facility within the library, with programming personnel experienced in bibliographic systems.
3.) The means by which a staff of information services specialists can be trained in search formulation and user problem solving. Along with this the public services staff must also receive specialized training.

When the first two conditions are present, the detailed planning for the creation of the third can take place. Experimental use of selected services will precede the third so that software can be proven and staff trained.

At this time, the acquisition of operational services should be based upon some need as expressed by faculty, researchers, or other user groups. Such services may be reviewed by the Library Committee in the same manner as other major resource acquisitions are now.

Policies as to the kinds of machine readable data to be obtained would have to be drawn up. Bibliographic and fact categories would initially be most important. However, for instructional purposes some text tapes should be available at least on an experimental basis. The form of the data base should be magnetic tape, since this may be handled most economically. If other forms are to be considered, they should be converted to tape before actual use in the library system.

Storage

The tape storage facility should be in close proximity to the computer room, ideally with the humidity and temperature control the same as the computer room. A probable collection size according to the UCLA study would be 2000 reels after five years. Approximately 500 sq. ft. would be needed for storage of up to 3000 reels.

Floor space for search personnel would not have to be near the computer center, but should be within the building in some easily accessible location for library users. For the sciences, a search service center could be set up in the Walter Library or the Bio-Medical Library to collect search requests, formulate them, and then transmit them to Wilson Library.

Service Costs

Part 9 of the UCLA Final Report, "Development program for a center for information services" projects a development cost of $500,000 based on 3 year old salary figures. This figure assumes the presence of a suitable computer for which time charges alone would occur.

In the UCLA study, the costs of purchased services were $500 per tape reel. If 2000 reels were to be acquired over five years, $200,000 per year would have to be budgeted. Like other materials, the cost of these tapes will increase, even though wider use would be expected to bring the price down. This is because production costs continue to rise faster than the wider dissemination of the service. This analyst feels that within six years, when the library should be ready to begin user services to the public in this area, a materials budget of $250,000 per year will be necessary as a minimum.

It would seem that special funds should be procured, since these materials are categorically different from printed materials now covered by book funds, yet supplemental to their effective use for certain kinds of bibliographic problems.

In addition, time charges for computer usage on the Library's computer could be borne by users or departments within the university, at least initially. Personnel support should also be procured separately from the existing library budget, perhaps by grants initially, or departmental subscription, with later funding by the State.

<u>Summary</u>

The addition of services which require computer processing and specialized information services personnel must take place in the near future. Already many such services are in experimental or limited local operation. However, for most effective results it is imperative that computer facilities and systems personnel familiar with bibliographic systems be available. No such computer center exists on the University of Minnesota campus at this time. However, with the long range systems plan to establish a State-wide On-line Bibliographic System, it will provide for such a computer capability in Wilson Library. With the development of this sytem, data processing services should be implemented in the later stages of the projected ten year program, perhaps starting experimentally about year 4 or 5 and become operational about year 6 or 7.

Contents.

SAMPLE LIBRARY OF CONGRESS CARD IN THE MARC II FORMAT

Leader								Record Directory			
00439	n	ᴀ	✦	ƀƀ	2	2	00133	ƀƀƀƀƀƀ	001001300000	008004100013	050001600054

082001300070	100003500083	245008900118	260004800207	300001900255	650003200274 F

LC Card Number			Fixed Length Data Elements													
ƀƀƀ	64	008443	ƀ	681001	s	1964	ƀƀƀƀ	nyu	ƀƀƀƀ	ƀ	ƀ	ƀƀƀƀ	ƀ00100ƀ	eng	0	ƀ F

LC Call Number   Dewey Number   Main Entry

0ƀ	$aPS614$b.L75	F	ƀƀ	$a811.5082	F	1∅	$aLowenfels,ƀWalter,$d1897-$eed.	F

Title

1ƀ	$aPoetsƀofƀtoday;$baƀnewƀAmericanƀanthology.$cWithƀaƀprologueƀpoemƀbyƀ

Imprint

LangstonƀHughes.	F	0ƀ	$aNewƀYork,$bInternationalƀPublishers$c ⌐1964⌐	F

Collation   Subject Heading

ƀƀ	$a143ƀp.$c21ƀcm.	F	⌐0	$aAmericanƀpoetry$y20thƀcent.	R

ƀ = blank   F = field terminator   R = end of record

Lowenfels, Walter, 1897-   *ed.*
    Poets of today; a new American anthology.   With a pro-
logue poem by Langston Hughes.   New York, International
Publishers ⌐1964⌐
    143 p.   21 cm.

    1. American poetry—20th cent.   ɪ. Title.

PS614.L75   811.5082   64-8443

Library of Congress   ◯ ⌐5⌐

Variable Field Tags

Control Numbers
*0 1 0 LC Card Number
*0 1 1 Linking LC Card Number
 0 1 5 National Bibliography Number
*0 1 6 Linking NBN
 0 2 0 Standard Book Number
*0 2 1 Linking SBN
 0 2 5 Overseas Acquisitions Number
          (PL 480, LACAP, etc.)
*0 2 6 Linking OAN Number
*0 3 5 Local System Number
*0 3 6 Linking Local Number

 0 4 0 Cataloging Source
 0 4 1 Languages
*0 4 2 Search Code

Knowledge Numbers
 0 5 0 LC Call Number
 0 5 1 Copy Statement
 0 6 0 NLM Call Number
 0 7 0 NAL Call Number
*0 7 1 NAL Subject Category Number
 0 8 0 UDC Number
 0 8 1 BNB Classification Number
 0 8 2 Dewey Decimal Classification No.
 0 8 6 Supt. of Documents Classification
 0 9 0 Local Call Number
Main Entry
 1 0 0 Personal Name
 1 1 0 Corporate Name
 1 1 1 Conference or Meeting
 1 3 0 Uniform Title Heading

Supplied Titles
 2 4 0 Uniform Title
 2 4 1 Romanized Title
*2 4 2 Translated Title

Title Paragraph
 2 4 5 Title
 2 5 0 Edition Statement
 2 6 0 Imprint

Collation
 3 0 0 Collation
 3 5 0 Bibliographic Price
*3 6 0 Converted Price

*The Library of Congress will not supply
data for these fields at present and,
therefore, they are not described on
the following pages.

Series Notes
 4 0 0 Personal Name-Title (Traced Same)
 4 1 0 Corporate Name-Title (Traced Same)
 4 1 1 Conference-Title (Traced Same)
 4 4 0 Title (Traced Same)
 4 9 0 Series Untraced or Traced
          Differently

Bibliographic Notes
 5 0 0 General Notes
 5 0 1 "Bound With" Note
 5 0 2 Dissertation Note
 5 0 3 Bibliographic History Note
 5 0 4 Bibliography Note
 5 0 5 Contents Note (Formatted)
*5 0 6 "Limited Use" Note
 5 2 0 Abstract or Annotation

Subject Added Entries
 6 0 0 Personal Name
 6 1 0 Corporate Name (excluding
          political jurisdiction alone)
 6 1 1 Conference or Meeting
 6 3 0 Uniform Title Heading

LC Subject Headings
 6 5 0 Topical
 6 5 1 Geographic Names
 6 5 2 Political Jurisdictions Alone
          or with Subject Subdivisions

Other Subject Headings
*6 6 0 NLM Subject Headings (MESH)
*6 7 0 NAL Subject Headings
*6 9 0 Local Subject Heading Systems

Other Added Entries
 7 0 0 Personal Name
 7 1 0 Corporate Name
 7 1 1 Conference or Meeting
 7 3 0 Uniform Title Heading
 7 4 0 Title Traced Differently
 7 5 0 Name Not Capable of
          Authorship

Series Added Entries
 8 0 0 Personal Name-Title
 8 1 0 Corporate Name- Title
 8 1 1 Conference or Meeting-Title
 8 4 0 Title

LIBRARY OF CONGRESS
Information Systems Office
MARC JT INPUT WORKSHEET

Date:

Fig. 4. Example of edited MARC input worksheet - modified record.

MARC

Akademiıa nauk SSSR. ‡ Fizicheskiĭ institut.
Photodisintegration of nuclei in the giant
resonance region, ‡edited by D. V. Skobel'tsyn.
Translated from Russian. New York, ‡Consultants
Bureau, ‡1967.

vii, 191 p. ‡ illus. ‡ 28 cm. (Proceedings
(Trudy) of the P. N. Lebedev Physics Institute,
v. 36)

Translation of Фоторасщепление ядра в
области гигантского резонанса (romanized form)
Includes bibliographies.

adco 19de67   m2   unb   67-27905   tr

Fotorasshcheplenie ⟨ ⟩ v

1. Photonuclear reactions.

I. Skobel'tsyn, Dmitriĭ Vladimirovich, ‡
1892-‡ ed.
II. Title:
(Series: Akademiıa nauk SSSR. ‡ Fizicheskiĭ
institut. ‡ Proceedings, ‡v. 36)

539.7/44   67-27905

Library of Congress

OVER for   MECN
UT IN   → TILA‡C
          ImP

COL
SERD

NOH

NOB

SUTNL

AEPSA‡de
ts

SACN

Languages LANG ENG RUS		
FFD Gov't Pub 1.	Conf/Meeting 2.	
Festschrift 3.	Index H B in body 4. 5.	
Publisher is H B 6.	Juvenile Fiction 10. 11.	
Biography 12.	Subject is M B 13.	
Pub Date Key 20. S	Date 1 1967	
Date 2 22.	Country of Pub 21. N YU	
Repro Form 25.	Contents Forms 26. B	
Bib Level 27.	Modified Record 28. X	

*Denotes shift and character to be punched
for desired diacritical.

NAME	GRAPHIC	EBCDIC HEX	ASCII 8-BIT HEX	ASCII 6-BIT OCTAL ESCAPE CODE*	CODE	LISTED IN EBCDIC SEQUENCE
Null		ØØ	ØØ	73_8	ØØ	*ASCII 6 Bit Code containing no escape code is in standard set
		Ø1				
Double Underscore	⹀ o	Ø2	F5	75_8	65	Escape code =
Angstrom		Ø3	EA	75_8	52	73_8 = ⸱⸱ Standard Set I
		Ø4				78_8 = Non Standard Set II
		Ø5				
		Ø6				
Delete		Ø7	7F		77	
Circumflex	⌃	Ø8	E3	75_8	43	
Cedilla	¸	Ø9	F0	75_8	60	
Superior Dot	·	ØA	E7	75_8	47	
Left Hook	͜	ØB	F7	75_8	67	
Right Hook	͜	ØC	F1	75_8	61	
Inverted Cedilla	͜	ØD	F8	75_8	7Ø	
Hacek	ˇ	ØE	E9	75_8	51	
Acute	´	ØF	E2	75_8	42	
Double Acute	˝	1Ø	EE	75_8	56	
Umlaut		11	E8	$75.$	5Ø	
Dieresis	¨	12	FC	75_8	74	
Tape Mark		13	17		27	
		14				
		15				
Backspace		16	Ø8	73_8	1Ø	
Idle		17	16			
Candrabindu	⌣	18	EF	75_8	57	
Macron	‾	19	E5	75_8	45	
		1A				
Double Dot Below	··	1B	F3	75_8	63	
Dot Below	·	1C	F2	75_8	62	
Circle Below	°	1D	F4	75_8	64	
High Comma	'	1E	FE	75_8	76	
High Comma (off center)	'	1F	ED	75_8	55	
		2Ø				
		21				
		22				
High Question	?	23	EØ	75_8	4Ø	
		24				
Line Feed		25	ØA	73_8	12	
End of Field		26	1E	73_8	36	
		27				
Upadhmaniya	⌣	28	F9	75_8	71	
Tilde	~	29	E4	75_8	44	
		2A				
Grave	`	2B	E1	75_8	41	
Breve	˘	2C	E6	75_8	46	
Double Tilde 1st Half	⁓	2D	FA	75_8	72	
Double Tilde 2nd Half	⁓	2E	FB	75_8	73	

ERIC

NAME	GRAPHIC	EBCDIC HEX	ASCII 8-BIT HEX	ESCAPE CODE	ASCII 6-BIT OCTAL	LISTED IN EBCDIC SEQUENCE
		2F				
Ligature 1st Half	⌒	3Ø	EB	75_8	52	
Ligature 2nd Half	⌒	31	EC	75_8	53	
		32				
		33				
		34				
		35				
		36				
End of Transmission		37	1D	73_8	35	
		38				
		39				
		3A				
		3B				
Patent	®	3C	AA	75_8	12	
Flat	♭	3D	A9	75_8	11	
Open Bracket	[	3E	5B	73_8	73	
Close Bracket	]	3F	5D	73_8	75	
Space		4Ø	20		ØØ	
		41				
		42				
		43				
		44				
		45				
		46				
		47				
		48				
		49				
		4A				
Period	.	4B	2D		16	
Less Than	<	4C	3C		34	
Open Paren	(	4D	28		1Ø	
Plus	+	4E	2B		13	
		4F				
Ampersand	&	5Ø	26		Ø6	
Mīagkiĭ Znak	'	51	A7	75_8	Ø7	
Tvërdyĭ Znak	"	52	B7	75_8	27	
Alif	ﻭ	53	AE	75_8	16	
Ain	ﻉ	54	BØ	75_8	2Ø	
		55				
		56				
		57				
		58				
		59				
Exclamation Point	!	5A	21		Ø1	
Dollar Sign	$	5B	24		Ø4	
Asterisk	*	5C	2A		12	
Close Paren	)	5D	29		11	

NAME	GRAPHIC	EBCDIC HEX	ASCII 8-BIT HEX	ESCAPE CODE	ASCII 6 BIT OCTAL
Semi Colon	;	5E	3B		33
		5F			
Minus, Hyphen	–	6Ø	2D		15
Slash	/	61	2F		17
		62			
		63			
Middle Dot	•	64	A8	75_8	1Ø
		65			
		66			
		67			
		68			
		69			
British Pound	£	6A	B9	75_8	31
Comma	,	6B	2C		1?
Percent	%	6C	25		??
Underline	_	6D	F6	75_8	66
Greater Than	>	6E	3E		36
Question Mark	?	6F	3F		37
		7Ø			
		71			
		72			
		73			
		74			
		75			
		76			
		77			
		78			
		79			
Colon	:	7A	3A		32
Cross Hatch	#	7B	23		Ø3
At Sign	@	7C	4Ø	73_8	4Ø
Prime, Apostrophe, Quote	'	7D	27		Ø7
Equal	=	7E	3D		35
Double Quote	"	7F	22		Ø2
		8Ø			
Lower Case A	a	81	61		41
Lower Case B	b	82	62		42
Lower Case C	c	83	63		43
Lower Case D	d	84	64		44
Lower Case E	e	85	65		45
Lower Case F	f	86	66		46
Lower Case G	g	87	67		47
Lower Case H	h	88	68		48
Lower Case I	i	89	69		51
Lower Case Æ	æ	8A	B5	75_8	25
Lower Case Cross D	đ	8B	B3	75_8	23
Case Eth	ð	8C	BA	75_8	32

NAME	GRAPHIC	EBCDIC HEX	ASCII 8 BIT HEX	ESCAPE CODE	ASCII 6 BIT OCTAL
Lower Case I (without dot)	ı	8D	B8	75_8	3∅
Lower Case Polish Ł	ł	8E	B1	75_8	21
Lower Case Œ	œ	8F		75_8	26
		9∅			
Lower Case J	j	91	6A		52
Lower Case K	k	92	6B		53
Lower Case L	l	93	6C		54
Lower Case M	m	94	6D		55
Lower Case N	n	95	6E		56
Lower Case O	o	96	6F		57
Lower Case P	p	97	7∅		6∅
Lower Case Q		98	71		61
Lower Case R	r	99	72		62
Lower Case Hook O	σ	9A	BC	75_8	34
Lower Case Slash O	ø	9B	B2	75_8	22
Lower Case Thorn	þ	9C	B4	75_8	24
Lower Case Hook U	ư	9D	BD	75_8	35
		9E			
		9F			
		A∅			
		A1			
Lower Case S	s	A2	73		63
Lower Case T	t	A3	74		64
Lower Case U	u	A4	75		65
Lower Case V	v	A5	76		66
Lower Case W	w	A6	77		67
Lower Case X	x	A7	78		7∅
Lower Case Y	y	A8	79		71
Lower Case Z	z	A9	7A		72
		AA			
		AB			
		AC			
		AD			
		AE			
		AF			
		B∅			
		B1			
		B2			
		B3			
		B4			
		B5			
		B6			
		B7			
		B8			
		B9			
		BA			

NAME	GRAPHIC	EBCDIC HEX	ASCII 8 BIT HEX	ESCAPE CODE	ASCII 6 BIT OCTAL
		BB			
		BC			
		BD			
		BE			
		BF			
		C0			
Upper Case A	A	C1	41	73_8	41
Upper Case B	B	C2	42	73_8	42
Upper Case C	C	C3	43	73_8	43
Upper Case D	D	C4	44	73_8	44
Upper Case E	E	C5	45	73_8	45
Upper Case F	F	C6	46	73_8	46
Upper Case G	G	C7	47	73_8	47
Upper Case H	H	C8	48	73_8	5Ø
Upper Case I	I	C9	49	73_8	51
Upper Case Æ	Æ	CA	A5	75_8	Ø5
Upper Case Cross D	Ð	CB	A3	75_8	Ø3
		CC			
		CD			
Upper Case Polish L	Ł	CE	A1	75_8	Ø1
Upper Case Œ	Œ	CF	A6	75_8	Ø6
		DØ			
Upper Case J	J	D1	4A	73_8	52
Upper Case K	K	D2	4B	73_8	53
Upper Case L	L	D3	4C	73_8	54
Upper Case M	M	D4	4D	73_8	55
Upper Case N	N	D5	4E	73_8	56
Upper Case O	O	D6	4F	73_8	57
Upper Case P	P	D7	5Ø	73_8	60
Upper Case Q	Q	D8	51	73_8	61
Upper Case R	R	D9	52	73_8	62
Upper Case Hook O	Ơ	DA	AC	75_8	14
Upper Case Slash O	Ø	DB	A2	75_8	Ø2
Upper Case Thorn	Þ	DC	A4	75_8	Ø4
Upper Case Hook U	Ư	DD	AD	75_8	15
		DE			
		DF			
		EØ			
		E1			
Upper Case S	S	E2	53	73_8	63
Upper Case T	T	E3	54	73_8	64
Upper Case U	U	E4	55	73_8	65
Upper Case V	V	E5	56	73_8	66

NAME | | | | ASCII 6 BIT |

NAME	GRAPHIC	EBCDIC HEX	ASCII 8-BIT HEX	ESCAPE CODE	OCTAL
Upper Case W	W	E6	57	73_8	67
Upper Case X	X	E7	58	73_8	70
Upper Case Y	Y	E8	59	73_8	71
Upper Case Z	Z	E9	5A	73_8	72
		EA			
		EB			
		EC			
		ED			
		EE			
		EF			
Zero	0	F0	30		20
One	1	F1	31		21
Two	2	F2	32		22
Three	3	F3	33		23
Four	4	F4	34		24
Five	5	F5	35		25
Six	6	F6	36		26
Seven	7	F7	37		27
Eight	8	F8	38		30
Nine	9	F9	39		31
Double Dagger	‡	FA	1F	73_8	37
		FB			
		FC			
		FD			
		FE			
		FF			

NAME	GRAPHIC	EBCDIC HEX	ASCII 8-BIT HEX	ASCII 6 BIT	
				ESCAPE CODE	OCTAL
		BB			
		BC			
		BD			
		BE			
		BF			
		CO			
Upper Case A	A	C1	41	73_8	41
Upper Case B	B	C2	42	73_8	42
Upper Case C	C	C3	43	73_8	43
Upper Case D	D	C4	44	73_8	44
Upper Case E	E	C5	45	73_8	45
Upper Case F	F	C6	46	73_8	46
Upper Case G	G	C7	47	73_8	47
Upper Case H	H	C8	48	73_8	5Ø
Upper Case I	I	C9	49	73_8	51
Upper Case Æ	Æ	CA	A5	75_8	Ø5
Upper Case Cross D	Đ	CB	A3	75_8	Ø3
		CC			
		CD			
Upper Case Polish L	Ł	CE	A1	75_8	Ø1
Upper Case Œ	Œ	CF	A6	75_8	Ø6
		DØ			
Upper Case J	J	D1	4A	73_8	52
Upper Case K	K	D2	4B	73_8	53
Upper Case L	L	D3	4C	73_8	54
Upper Case M	M	D4	4D	73_8	55
Upper Case N	N	D5	4E	73_8	56
Upper Case O	O	D6	4F	73_8	57
Upper Case P	P	D7	5Ø	73_8	60
Upper Case Q	Q	D8	51	73_8	61
Upper Case R	R	D9	52	73_8	62
Upper Case Hook O	Ơ	DA	AC	75_8	14
Upper Case Slash O	Ø	DB	A2	75_8	Ø2
Upper Case Thorn	Þ	DC	A4	75_8	Ø4
Upper Case Hook U	Ư	DD	AD	75_8	15
		DE			
		DF			
		EØ			
		E1			
Upper Case S	S	E2	53	73_8	63
Upper Case T	T	E3	54	73_8	64
Upper Case U	U	E4	55	73_8	65
Upper Case V	V	E5	56	73_8	66

NAME

	GRAPHIC	EBCDIC HEX	ASCII 8-BIT HEX	ESCAPE CODE	OCTAL (ASCII 6 BIT)
Upper Case W	W	E6	57	73_8	67
Upper Case X	X	E7	58	73_8	70
Upper Case Y	Y	E8	59	73_8	71
Upper Case Z	Z	E9	5A	73_8	72
		EA			
		EB			
		EC			
		ED			
		EE			
		EF			
Zero	0	F0	30		20
One	1	F1	31		21
Two	2	F2	32		22
Three	3	F3	33		23
Four	4	F4	34		24
Five	5	F5	35		25
Six	6	F6	36		26
Seven	7	F7	37		27
Eight	8	F8	38		30
Nine	9	F9	39		31
Double Dagger	‡	FA	1F	73_8	37
		FB			
		FC			
		FD			
		FE			
		FF			