ABSTRACT
                After six years of research in computer assisted
instruction (CAI) using PLATO III, a decision was made at the
University of Illinois to develop a larger system as a national CAI
resource. This document describes the design specifications and
problems in the development of PLATO IV, a system which is capable of
accomodating up to 4,000 terminals throughout the United States. The
design criteria included 1) the need for an average response time of
.25 second or less; 2) an average key input rate per terminal of .5
key per second; 3) 10 percent of the connected terminals would be
requiring output at all times; 4) a central memory requirement of 500
words per terminal; 5) a maximum student terminal cost of $5,000; 6)
a student terminal that would be reliable and simple to operate at
remote locations by relatively unsophisticated users; 7) the
development of a system that would be manageable by a relatively
small staff; and 8) a hardware system architecture that would not
inhibit the development of the software which was trailing behind the
hardware development. The remainder of the document briefly describes
the development and operating characteristics of PLATO IV.
(Author/DGC)

The Evolutionary Development of CAI Hardware

John E. Stifle
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After some six years of CAI research using the PLATO III system, a
decision was made in 1966 to develop a much larger system which could
better provide the facilities for evaluating CAI concepts. Whereas PLATO III
was a small system containing only 20 student terminals attached to a
computer in the same building, PLATO IV would contain as many as 4,000
terminals which would be remotely located throughout the United States.
While PLATO III utilized student terminals containing CRT (cathode ray
tube) displays, similar to the picture tubes in television receivers,
PLATO IV would use a new display technology called the plasma panel. Briefly
described, this device is a transparent flat sandwich of glass plates in
which the computer can write information and on the rear of which images from a
slide projector can be displayed. Such a technique allows the superposition
of computer-generated information on locally stored slide information.

The challenge was to design a system containing a computer, up to
4,000 student terminals, and a communication network to connect the latter
to the former.

From an engineering point of view, the experience gained from the
PLATO III system provided a minimum of specifications on which to base the
design of PLATO IV. This was so primarily because of the different technology
involved and the local nature and small size of PLATO III as compared to the
large size and remote terminal deployment to be used in PLATO IV. There
were, however, four critical parameters derived from PLATO III which would
heavily influence the design of PLATO IV. These were:

1. the need for an average response time of .25 second or less.

2. an average key input rate per terminal of .5 key per second.

3. that 10% of the connected terminals would be requiring output
    at all times.

4. a central memory requirement of 500 words per terminal.

Added to the above were the following design goals:

5. a maximum student terminal cost of $5,000.

6. a student terminal that would be reliable and simple to operate at remote locations by relatively unsophisticated users, i.e., personnel not experienced in the use of computer technology.

7. the development of a system that would be manageable by a relatively small staff.

8. a hardware system architecture that would not inhibit the development of the software which was trailing behind the hardware development.

Armed with the above information, the design of PLATO IV was launched. Little was known at the time about the plasma panel characteristics other than in the future one would exist. At that time only postage-stamp-sized versions existed. The minimum allowable resolution was determined by making drawings of characters using a dot format and then photographically reducing them to sizes corresponding to 40, 50, and 60 dots per inch. From this rather crude simulation, a minimum resolution of 50 dots per inch was established. (Fortunately, industry was able to produce a panel containing 60 dots per inch). A screen size of approximately 10" on a side was desired requiring. therefore, at least 500 lines of dots. The actual number of lines used was 512 since this is easily addressed using binary information ($512 = 2^9$).

To attempt to design a computer terminal whose characteristics would present few limitations to any potential user and keep the cost reasonable would appear to be a formidable task. However, by recognizing at the outset the impossibility of trying to anticipate all possible future applications and concentrating instead on the basic nature of information display a practical design was developed.

All forms of information display are actually composed of many dots arranged into an easily recognized pattern. Therefore, by providing the ability to display single dots, it is possible to construct all possible displays. Unfortunately, while this is the most basic form of displaying information, it is also the slowest since the address of each dot must be supplied to the terminal. By observing that all objects can also be drawn using line segments (lines of dots) it is possible to overcome the above mentioned speed limitation. Using this technique only the two end points of the line need to be specified, the terminal can perform the necessary calculations to generate the points required to draw the line. A third widely used form of information display is a set of standard patterns of dots commonly known as alphanumeric characters. Using this form of display,

only a pattern identifier need be supplied to the terminal. The terminal then displays the dots in that particular pattern. In the case of the PLATO IV terminal, only six bits of information are required to display up to 128 dots in one of these patterns.

The PLATO IV terminal contains only these three modes of display data, single points, lines, and characters (patterns), the latter two of which are locally generated. In the case of characters, the terminal contains a fixed set of 126 of the most commonly used English alphanumber characters. These include upper and lower case alpha characters, numbers 0-9, standard punctuation set, and some commonly used mathematical symbols. A very important feature of the PLATO IV terminal is the inclusion of a second set of 126 characters, the patterns of which are not fixed, but are specified by the user. Although this alterable character set was included to permit use of various foreign alphanumerics, it became an even more powerful feature when used to display graphic information. Examples of this type of use are shown in Figure 1. The use of this character set also makes possible a limited form of animated display.

Other features included in the terminal are the ability to operate unspecified external devices which might be encountered in laboratory experiments and the use of an automatic yet simple technique for recovering from transmission errors. Often the error recovery occurs so quickly that the operator observes no effects of the error.

As alluded to earlier, the use of local character and line generation maximizes the amount of information displayed per bit of information supplied to the terminal. These features permit the terminal to be operated over low band width facilities such as telephone circuits and still be able to generate complex graphical displays reasonably fast. To further improve the information display/bandwidth rates, a unique data format was developed for use in PLATO IV. Whereas the standard ASCII (American Standard Code for Information Interchange) would require 25% - 40% overhead (information which must be transmitted for control purposes but which is not displayed), the PLATO data format contains only 10% overhead.

The design of the PLATO IV communication network posed somewhat different problems from the terminal design. Here the .25 second response time re-quirement dictated the design. Because all keys generated at the terminal keyboard must be transmitted to the computer, processed, and then returned

to the terminal before they are displayed, there is little delay that can be tolerated in the communication network. Thus, there can be no "store and forward" equipment in the network where messages may be temporarily stored until communication conflicts can be resolved. There must be a communications "pipe" available at all times between each terminal and the computer center. Only then can data race from the terminal down the "pipe" to the computer and back again, incurring no delay and leaving each terminal user with the impression that he has the entire computer facility available to himself.

The communication network had to be defined as a set of functional modules which could be added as the system grew. The network had to present a simple interface to the computer. There would be no time available for exchanging protocals or "handshaking" between the computer and the network. The computer should be able to pour data into the network and drain data from it as fast as it arrives.

The network designed for PLATO I" contains only two types of modules, one called a Network Interface Unit (NIU) and the other called a Site Controller. One NIU and 32 Site Controllers comprise a network capable of servicing 1,000 terminals. The NIU interfaces the computer to a network of up to 32 Site Controllers each of which can service up to 32 terminals.

The NIU was designed to provide distribution of the PLATO information over conventional CATV (cable television) facilities which anticipated the future growth of this kind of service. The Site Controllers were designed to service terminals in the same locality or at locations thousands of miles away. Although the Site Controllers originally serviced only one terminal per telephone circuit, as the system grew, modems were added which combined the output of 4 ports on a Site Controller and allowed 4 terminals to be operated on one telephone circuit. The addition of this latter class of service required no basic change in the design of the Site Contoller, thereby testifying to the flexibility of the original design. In addition, even chough the proportion of active terminals in PLATO IV increased to 20% from 10% in PLATO III, the communication network handled the increased load without degrading the system performance. In fact, if all 1,000 terminals were generating data at five times the rate observed in PLATO III (2.5 keys per second), the network would still deliver every key to the computer.

In terms of manageability, PLATO III required 1 technician for every 5 to 8 terminals while PLATO IV requires only 1 technician for every 80
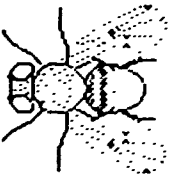
terminals.

At the time of this writing (March, 1975), there are approximately 850 PLATO IV terminals in operation in the PLATO IV system, many performing tasks not even remotely anticipated when the terminal was designed.
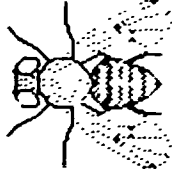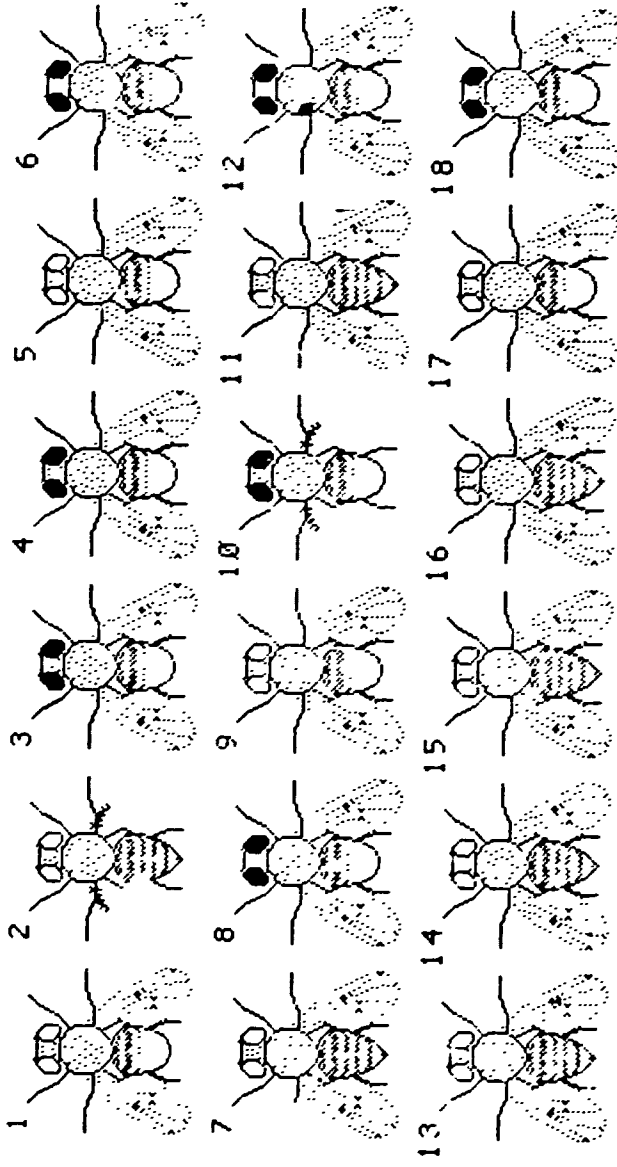
САМЕЦ — ИВАН
САМКА — НАТАША
ПОТОМСТВО 1–18

ЕСЛИ ДЛЯ СЛЕДУЮЩИХ ОПЫТОВ ВЫ ХОТИТЕ СОХРАНИТЬ, КАКИХ-НИБУДЬ ИЗ ЭТИХ ОСОБЕЙ, ТО Я ИХ ДЛЯ ВАС СОХРАНЮ. КАКАЯ БУДЕТ ВАША КОМАНДА ДЛЯ СЛЕДУЮЩЕГО ЭТАПА?

Figure 1. This figure is a direct copy from a PLATO IV display showing both standard and loadable characters.

ABSTRACT
          A six-month internship at the Stanford University
Library allowed the author to observe the processes of setting
objectives, planning services and programs, coordinating activities,
and motivating personnel to work for common goals both within and
outside the library, and to draw conclusions from this experience
relevant to her own library. This report outlines the segments of the
internship program and the observations made on the structure of
library governance at Stanford. An analysis is made of the value of
the internship program and its implications for changes in management
style. (SL)

INSIDE STANFORD UNIVERSITY LIBRARIES

"Implications for The Frederick Douglass Library"

University of Maryland, Eastern Shore

Part I

March, 1975

Jessie C. Smith
Mellon - ACRL
Director-Intern

INTRODUCTORY STATEMENT

The material included in this summary covers much of what I have observed over a six month period which indicates how Stanford University Library administrators are proceeding to set objectives, plan services and programs, coordinate activities and motivate personnel to work for common goals both within and outside the library. I have also been made more aware of the complexity of managerial concepts on all levels of management. Established patterns of decision making and courses of action have been realistically presented, and there are positive implications for administrators who are promoted to higher administrative positions as well as for those who are thrust abruptly from staff membership into administrative positions as such was my case.

This experience has most assuredly exposed me to many real practices in leadership, supervision, and interpersonal relations.

In view of our University's expressed concern with long-range planning, the Chancellor's call for innovative, qualitative education, and our up-coming re-evaluation by the Middle States Accrediting Association, this exposure has strengthened my awareness that the Frederick Douglass Library must expand its role in order to meet the challenges which the academic community are constantly placing before it -

- to achieve better procedures for the acquisition of materials

- to develop innovative methods of presenting and relating the library to students, faculty and staff.

INTERN STRATEGY

IMPLEMENTING

SUMMARIZING

HYPOTHESIZING

ORGANIZING

COLLECTING DATA/IDEAS

PARTICIPATING

OBSERVING

OBSERVING:

- Techniques by which top-line library administrators broaden the base
  for gathering necessary information in order to assist in the formulation
  of management objectives.

Examples:

- Monthly meetings where Associates and Assistants discuss operations
  and policies, and respond to needs for policy reviews within their
  respective areas of responsibilities.

- Associates and Assis'ants function as an advisory unic to the
  Director as requested or required.

- Frequent meetings of miudle-managers and smaller operating units
  to identify and report success or failure of specific policies.

- Ad Hoc staff groups working on short-term and long-term projects
  with specific charges.

- Other meetings where functionally related personnel deal with policy
  reviews, monthly agenda items and identify resource persons within
  the group.

- Use of resource persons from other segments of the University.

- Departmental meetings for departmental cohesiveness and documentation
  of staff achievements and aspirations.

- Outside involvement by the Director and other members of the staff
  in State and National meetings.

- Professional Literature routing on a regular basis usually after
  review by the Director and Associate Director to staff members for
  whom the literature will benefit directly.

Observing five fundamental groups as they identify issues, formulate policies, review policy decisions and initiate action has been a major element of growth during the period covered in this report. The five groups are described below:

ACADEMIC COUNCIL COMMITTEE ON LIBRARIES:

General charge to the Committee by the Senate of the Academic Council with specific duties upon receipt of recommendations of the Director of the University Libraries, and heads of the libraries of schools and institutions of the University. The Committee makes determinations in four basic areas:

1. Coordination of the activities of the several libraries with respect to the areas of special emphasis in their holdings and with respect to their serving the entire University;

2. The establishment, continuance, or disestablishment of branch libraries;

3. The recommendations for the appointment of Honorary Curators in the various libraries of the University;

4. The appropriate means of encouraging schools and institutions, by means of professional staff and local faculty committees, to exercise special care for their libraries.

ADMINISTRATIVE CONFERENCE:

Specifically an Administrative coordinating group of representatives of the University Libraries with all library operations within their scope of interest, such as:

- Acquisitions policies

- Bibliographic standards

- Binding Agencies

- Personnel practices

- University wide projects, ex. (Union List of Serials.)

DIRECTOR'S CONFERENCE:

Initiate review, discuss, and formulate library policies for their areas
of responsibilities, and respond to needs for policy review as expressed by the
Director on his own initiative or as issues emanate from other University or
non-University areas.

UNIVERSITY LIBRARY COUNCIL

An administrative panel under the general guidelines for committees,
appointed by the President, to advise the various University Libraries about
matters requiring coordination and cooperation among University and Coordinate
units. The Council aims to coordinate acquisitions policies, cataloging policies,
service privileges and procedures, professional personnel standards and professional
staff development programs. joint physical facility planning, library automation
and any other coordination efforts that may seem useful.

COMMISSION ON LIBRARIANSHIP

Commissioned, by the Director of University Libraries to examine the role
and status of librarians at the University and to issue a report on it's findings.
I sat with Commission representatives on one occasion to note progress and the
redefining of several issues.

OTHER GROUPS:

SULA (Stanford University Library Association)

Paid membership, attended lectures, and engaged in fellowship with the
other members.

CIN (Cooperative Information Services)

To provide improved and expanded sharing of information and program
resources within four counties through the development of a communications
network among all types of libraries (public, school, academic, special)
for the purpose of expanding and improving services to residents, organizations
and businesses.

OTHER

Observations of proceedings in a myriad of other organizations or functional areas including:

- The Council of the Dean

- The ERIC Clearing House Advisory Board

- The University Senate

- BALLOTS (on-site visit)

- Lockheed Dialog Services Oversight Committee

- DIS (Data Information Services)

- TIS (Technical Information Services)

- Minority Recruitment (San Jose State project)

- Financial and Planning Office (Continuous Budget Adjustment Proceedings)
  (an operation not an organization.)

- SULS (Stanford Union List of Serials)

I observed departmental operations within the Main Library and in several Research branches for the specific purpose of noting procedures, making inquires as to significance of varying techniques, relating methods to my specific needs, screening purposeful activities, and collecting pertinent material for further study and probable use.

Observations were made in the following areas:

- Main Library

Planned periods of time were spent in each department and several divisions of the department. The period of time was predicated on assumed need and possible adaptability.

Acquisition Department: Order Division (automation support) Serial Record Division, Gift and Exchange Division, and Binding and Finishing Division.

Catalog Department: A first-hand look at the way in which BALLOTS (Bibliographic Automation of Large Library Operations Using a Time-Sharing

System) supports the cataloging procedures. I also reviewed procedural manuals and methods of compiling meaningful statistics.

Central Circulation: Statistics, Loan Operation, Stacks, and Newspaper and Microtext Divisions revealed similiar manual procedures as are ordinarily found in most types of libraries. Coordination of exhibits was a worthy undertaking as observed in this department.

General Reference Department: The Data Information Services, Current Periodicals Division, Central Map Collection, Theatre Collection, and the various collections of reference bibliographie materials held high interest to me and many ideas were gathered which may augment Reference Services at my home institution.

Government Documents Department: An in-depth tour with detailed explanations of Federal, State and Local documents reinforced my philosophy concerning the usefulness of documents and a need to do more in the way of selling the idea to my own faculty and student body.

Library Personnel Office: The process for the recruitment of librarians and close coordination with the University Personnel Office in supplying appli-cants for non-professional positions. I also examined the student work pay schedule and am encouraged by the successful method of encouraging students to serve the library on a continuous basis. Classified Staff Job Re-Classification proceedings, the Affirmative Action Plan, Staff Orientation and Development techniques have all been useful observations related to this office.

Resources Development Program: Brief periods with Curators in Romance and Germanic Language materials yielded information in reference to basic sources for collecting in those areas. The Collection Development Officer consented to answer several questions on tape regarding Acquisition Policies, Faculty Liaison, etc. This taped interview will become a part of my collection of items which will be used with Administration, Library Staff and Faculty for information purposes. 9

Research Branch Libraries: Considerable time was spent in the following Research Branches for the general purpose as stated previously and also for the purpose of examining specific related literature, conferring with experts in the disciplines, and giving a great deal of thought to collection building in order to meet the needs of our patrons. Research branches visited:

Art	Computer Science	Engineering	Physics
Biology	Earth Sciences	Mathematical Sciences	
Chemistry	Education	Music	

PARTICIPATING

- In administrative meetings:

    Academic Council Committee on Libraries - as Recorder, and to better understand the importance of such a committee as advisory to library administrators.

    Acquisitions Council - to hear issues and answers to problems such as vendor selection, bindery decisions and duplicate buying.

    Administrative Conference - to listen to deliberations by Administrators and supervisory-level staff as they proceed to coordinate across-the-board activities and to tackle problems which confront them in meeting the needs of the academic departments and supporting the University's goal of a responsive community service.

    Director's Conference - as a participant-observer in order to link negotiations which take place there with lower-level dministrative meetings and to determine whether my idea of caucasing with professional staff for similiar purposes would be advisable. Policy making and policy review are important elements in Director's deliberations and warrant worthy advisement.

Education Seminars

Ed.322 - ESTABLISHING HIGHER EDUCATIONAL POLICY

An analysis of recent efforts to establish educational policy such as
the Carnegie Commission on Higher Education, with special emphasis on
implications for institutions and systems of institutions.

Ed.424A - STRUCTURE and FUNCTIONING OF INSTITUTIONS OF HIGHER EDUCATION

A detailed examination and critique of existing and emerging forms of
administration, organization, and governance of institutions of higher
education. Administrative structures of liberal arts colleges. junior
college, state colleges, universities and mult -institutional organizations
were analyzed.

Employment Interview Workshop - to learn interview techniques, kinds of profitable
or necessary interviews, types of questions and comments which might develop
into a repertoire for eliciting spontaneous and meaningful information and
skill in evaluating interview material.

Management Rap Sessions - to engage in informal problem-solving discussions
on specific topics with other supervisors and resource persons who possess
expertise on particular topics. Some topics of discussion in which I
participated:

- "With ever increasing administrative requirements, I don't have
  time to manage!"

- "How can I provide growth opportunities for my employees and
  still meet my first obligation to get the work done?"

- "What can be done to bring about affirmative action and still have
  equal opportunity?"

- "How can I get feedback from my staff about their ideas of effective
  supervision?"

- "How can I evaluate performance without "turning off" employees?"

COLLECTING

- Data

A vast amount of material has been compiled in file folders, properly headed, to include data from a broad segment of Stanford University Libraries covering many topics such as:

Administration, Acquisitions, Annual Reports, Automation,

BALLOTS, Bibliographies, Commission on Librarianship, Exhibits,

Interviews, Microforms, Privileges and Fees and several others.

Material in these categories consists of highly adap able suggestions which will be screened for possible use. Included are:

Select bibliographies, a variety of form formats, procedural

manual styles, detailed job descriptions, departmental publications,

glossary of terms and annual reports.

- Ideas

Ideas too numerous to enumerate have been gleaned throughout this period. Some of the most obvious ones are listed:

Administrator's techniques, on all levels;

Cooperation among libraries (a growing trend and necessity);

How library tasks are affected by automation;

Importance of Interview Methodology;

Interdepartmental cooperation; and

Departmental organization and work-flow processes.

ORGANIZING:

Materials which have been collected are analyzed weekly and filed appropriately or routed to related departments within the library at my home institution. All materials are scrutinized for possible adaptability with our present organizational structure as a basis for selection of specific items.

HYPOTHESIZING:

- Issues identified:

  Out of a total of seven professional librarians excluding the director,

  four supervise support staff. All four are recent Library School

  graduates without formal or i   .l ..anagement training. The Director

  is presently participating in an Internship program which exposes her

  directly to the work life of a much more experienced administration.

  This direct contact will evidently re-shape her attitudes and better

  fit her to play the role of administrator upon completion of the program.

  She has discovered that the knowledge of principles and techniques of

  interpersonal rela.ions can be developed through various means such as

  lectures, reading, and discussion, but she has also realized more fully

  that the ability to apply this knowledge comes through actual practice,

  through learning on-the-job, or in a laboratory situation such as an

  Internship program or in a role playing situation.

- Focus:

  She envisions introducing role playing as an auxiliary procedure which

  will supplement the on-the-job learning, which the four professionals

  are getting as a part of their day-to-day routines.

- Objectives:

  To develop each librarian's philosophy of management which will serve as

  the foundation for his or her future as a leader.

  To have each person gain an understanding of the basic functions of

  management (planning, organizing, staffing, and controlling) and their

  application to administration.

  To provide practice in decision making, possible through a case method

  approach. Each librarian will identify problems, search for alternative

  courses of action, consider consequences, evaluate and make a final

  decision.

To promote effective group thinking.

To expose the participants to background reading in management.

- Plans:

Motivate the four professionals to formulate a rationale for further development in the area of management.

Outline a procedure.

Set a time-table.

Encourage all professionals to participate.

SUMMARIZING:

As first-line supervisor in our library operation, I realize that I am the most critical member of the team. I must therefore continue to build on the two basic foundations which are required for effective leadership. The ability to deal constructively with people and the ability to solve problems. I must also continue to improve my expertise in the components of effective leadership namely: know the work, organize and administer the operation, relate to the group, communicate, use the problem-solving approach, and believe in my staff.

This Internship program was designed to foster continuing education for administrators and I have accepted it as a challenge to move from ideas to action in administration, and in library staff development and service to the University of Maryland, Eastern Shore.

"Implications for the University of Maryland, Eastern Shore"

The Internship program has been a definitive means of helping me to become more socialized into administration. I should, as a result of this experience, become more of an activating element in setting objectives, planning services and programs, coordinating activities, and motivating the staff to work for common goals.

- Consider using a causus of my professional staff in an advisory capacity
  without a decision-making role.

- Involve the staff extensively in providing essential and desirable
  information.

- Commission a "miniature" group to study issues which are of concern,and
  coordinate findings with studies being done at The University of Maryland
  main campus.

- Stress the importance of regularity in departmental meetings to keep
  staff informed of operational up-dates and expectations.

- Utilize resource persons from various segments of the University
  (The Personnel Officer).

- Encourage skilled staff members to initiate information-sharing
  strategies which will involve and benefit the entire staff.

- propose a Union List of Serials for UMES (University of Maryland, Eastern
  Shore) and SSC (Salisbury State College), in preference to print-outs
  which are presently exchanged. SSC is within 13 miles of UMES.

- Review interview procedures for hiring new personnel and work with
  Personnel Officer for improvement.

- Review scheduling procedures.

- Experiment with "Brown-Bag" lunches on a limited basis for wiser use
  of time.

- Encourage outside involvement for professional growth.

- Extend professional literature routing and encourage staff to be more
  informed.

- Encourage a different approach for Library public relations.

IMPLEMENTING

- Re-examine present structural organization.

- Solicit more staff in-put in an advisory capacity.

- Plan with staff for continuing staff development programs.

- Use outside resource personnel on a broader basis

- Utilize materials collected by Intern for informational staff meetings

  printed material

  slides

  taped interviews

- Encourage supervisory-level staff to seek development programs such as
  an Internship Program whenever possible.

- Evaluate effectiveness of innovations.