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THESIS

PLANNING AN INTEGRATED ON-LINE LIBRARY SYSTEM (IOLS)

by

Caroline J. Miller

March 1989

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Planning an Integrated On-line Library System (IOLS)

by

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

Requirements for an Integrated On-line Library System (IOLS) to automate the acquisitions, cataloging and circulation functions of the Dudley Knox Library of the Naval Postgraduate School were matched against the capabilities of commercial IOLSs available for purchase. NOTIS was the recommended choice. A cost analysis and implementation plan were developed for installing NOTIS on the Naval Postgraduate School's IBM mainframe computer.

Keywords: Library automation, Cost analysis, NOTIS (Northwestern University Online Total Integrated System), Information systems management, Theses, Navy

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These four, plus Gordon Greeson, Louis Oven, Roger Martin, and Phyllis Anderson have given generously of their time to describe the logical processes in the current workplace. Staff members who generated ranked functions desired in the the IOLS include Candace Walker, Terry Britt, Paul Spinks, and Sam Hornbeck, in addition to all aforementioned people. It has been a team effort.

David Norman and Jack Starr have been invaluable in estimating system needs and costs, and in providing expert verification of detailed software support requirements. Larry Frazier has responded to countless questions about text processing commands, tables, fonts and figures for formatting the final output. His expertise and patience are certainly appreciated. Sonja Preston took hand-drawn charts and transformed them into graphics files for description of workflows, not only saving hours of effort, but also adding clarity to the finished product. Doug Williams provided the impetus for this project, and has been a source of practical advice and encouragement during the entire effort. Thank you all!

I. EXECUTIVE SUMMARY

Manual work processes are predominant in the Dudley Knox Library. Ordering, cataloging, physical processing and circulation of books and periodicals, statistical reporting, fund accounting, claiming of missing items, recalls for overdue materials, etc. are all done "by hand". The Library would like to abandon its manual workflow; it is interested in automation of standard library processes.

Functions considered important for an Integrated On-line Library System (IOLS) were enumerated, then ranked by a cross-section of the Library staff. Library personnel identified an on-line catalog with Boolean search capability and automated circulation as their highest priority. The desired IOLS must be 1) Research Library Information Network (RLIN) compatible, 2) IBM-compatible, and 3) able to be supported by the local Computer Center.

When automated library systems reported in the literature were compared against IOLS criteria developed by the Library staff, three systems were identified as possible IOLS candidates. These three were the Biblio-Techniques Library and Information System (BLIS), GEAC Computers, Ltd. (GEAC), and the Northwestern University On-line Total Integrated System (NOTIS).

GEAC, which meets many of the constraints and requirements of the Library, was a strong candidate. Although not IBM-compatible, it is a complete turnkey system heavily installed in Europe and well-ranked in the literature. Consideration of the GEAC system was terminated when it was reported in bankruptcy. Vendor reliability is important in long term satisfaction and support, and a financially troubled vendor is not a sound choice.

BLIS software is both IBM- and RLIN-compatible. Many BLIS features are highly desirable; however, it has no serials control capability, and it uses ADABAS data base management and the Software AG teleprocessing monitor, COM-PLETE, neither of which can be supported, considering the expertise of the existing Computer Center staff. Lack of software support plus the extreme high estimated cost of the software makes this system impractical for the Library. The software company has recently gone out of business.

NOTIS is the recommended IOLS. It is IBM- and RLIN-compatible, and uses software products that our Computer Center can readily support (MVS, CICS, SAS).

While it does not offer all of the functions desired by the Library, NOTIS satisfies a high proportion of these functions. In the current marketplace, NOTIS is the only IBM- and RLIN-compatible IOLS available.

Estimated present value costs for purchase, installation, customization, and support of NOTIS on the existing IBM mainframe at the Naval Postgraduate School over a 10-year life cycle total $856,800. Estimated present value of total benefits, both tangible and intangible, for the IOLS system during the same period total $1,243,400. These estimates were based on the following assumptions:

1. the average future workload of the Library will approximate the past average workload;
2. staff positions will not be cut as the result of automation;
3. a new position, Systems Librarian, will be needed to coordinate the automation efforts within the Divisions of the Library.

Because the estimated present value benefits are greater than the estimated present value costs of the project, NOTIS is recommended for acquisition. An implementation plan for NOTIS is described in Chapter VI.

II. INTRODUCTION

> For centuries, [libraries] have been bound by what mankind could do to collect, classify, and disseminate information using laborious, time-consuming methods. Now, at last, libraries can escape those limitations if they have the courage and the foresight to do so. For the first time ever, lack of proper technology is no longer an obstacle. The computer power, data base storage, and software are all available to provide the desired services. What remains for libraries to do is to see that they are on the threshold of a new world; to be open to new ideas about how information may be produced, distributed, retrieved, and used; to let users tell them what they need and then to provide those services as quickly, capably, and cheaply as possible. [Ref. 1: p. 11]

The Dudley Knox Library is a general reference and research library located at the Naval Postgraduate School, Monterey, CA. It serves a user population of 2,700, primarily military students, faculty and staff members of the university. The Library is also open to the public. The staff of 33, including 15 professional librarians, is organized into five functional areas: Administration, Acquisitions, Bibliographic Control, Reader Services, and Research Reports Divisions.

Library size and holdings within the multiple collections as of November 1988 are shown in Figure 1 on page 4, taken from [Ref. 2]. Most materials are in the areas of engineering, science, operations research, management, economics, military and naval science, international affairs and military history.

The 50,000 square foot facility has recently installed compact shelving to help alleviate congestion in the stacks. Eighty-five percent of the total shelf space was full, and it was estimated that return of all items in circulation would exceed shelf capacity. Lack of space remains a problem throughout the Library.

A. PRESENT LIBRARY METHODS

The Dudley Knox Library has outgrown its "normal" way of doing business. Its acquisition processes are largely manual; circulation processes are completely manual. Cataloging is done via access to an on-line database provided by the Research Libraries Information Network (RLIN), which also prints catalog cards. Excessive clerical and professional time is spent filing/checking cards in the old catalog. The card catalogs are congested and hard to use since cards are packed so tightly. No floor space is available for additional catalog cases.

Information on books and periodicals is duplicated for ordering, cataloging and processing, since there is little shared data and little overlap of work flow between these

Library Collections:	
Books added during fiscal year	7,967
Total books held, June 30	271,101
Documents, pamphlets, technical reports held	190,000
Microforms, units held	449,691
Number of periodical titles currently received	1,830
Videorecordings, titles held	341
Library Activities:	
Circulation, all materials	44,252
Items borrowed: ILL from other libraries	3,052
Items lent: ILL to other libraries	3,683
Reference questions, computer searches, projects	44,229
Library Operating Expenditures:	
Library materials: books, periodicals, audiovisuals	$ 528,132
Salaries and benefits	$ 929,675
Other operating expenses: supplies, services, contracts	$ 164,791
Total library operating expenditures	$1,622,598

Figure 1. Statistical Synopsis of the Dudley Knox Library, 1988

independent departments. Manual circulation provides inadequate information on status of books, and no statistics on use of the collection; there is no basis for informed decisions on discarding unused materials, although shelf space is at a premium. Library Division heads agree that automation offers the most promising solution to the problems that beset the Library.

1. Model of Operational Processes

"The basic model of a system is one in which inputs are taken from the environment, transformed in some way into outputs which are put back into the environment." [Ref. 3: p. 16] This definition is graphically illustrated in Figure 2.

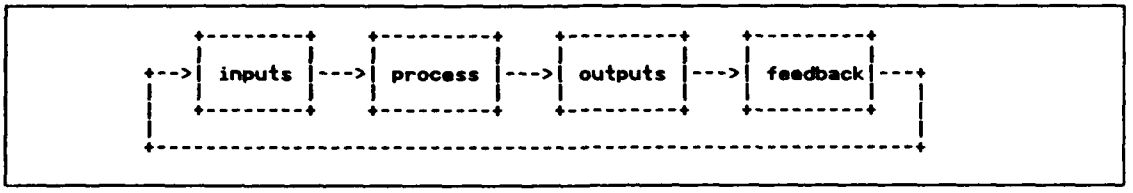


Figure 2. Generalized System Model

The system uses the feedback loop to get information on its own performance (praise or criticism), which is used to adjust the next process cycles. Library inputs come from staff, users, funds, materials, and external information sources.

> The library actually creates something which did not previously exist when it performs its transformation. Books and other "knowledge packages" are acquired by the library. The transformation occurs when the staff, using their energy, analyze the materials to create records which represent the materials, and label them in order to organize the library's collections. The true output of the library is the intangible process of relating the physical item--the book, recording, or film--to a concept or idea. This process is accomplished in two ways: by classifying items to integrate them into a set of items treating the same subject, and by describing them so that records representing the item can be displayed in the catalog according to different principles of arrangement. The result, of course, is a collection of materials arranged according to a classification scheme and a catalog providing a subject index to the same materials. Maintaining a collection of items which can be lent to members of the user community is another form of output; its value, however, depends on the organization of the items and the index (catalog) which aids in finding them. [Ref. 3: p. 23]

The cyclic nature of the library as a system is easily discerned. Publications are ordered, received, and paid for. New materials are added to the collection; old materials are discarded. Items are checked out, returned, and checked in again.

> Each library, to some extent, provides the same services and the same types of materials. Each, however, demonstrates idiosyncratic differences in the procedures, policies, and organizational climate of the library. The goal remains the same in its most general form, but the means differ in many ways from library to library. [Ref. 3: p. 25]

Processes within the library system may be manual or automated. At present, the various subsystems within the Dudley Knox Library (administration, acquisitions, cataloging and classification, circulation, reference) rely primarily upon manual means to transform inputs into outputs, that is, to do the "work" of the Library. In the figures that follow, each process is described in detail only once, even though it may be a part of another process described by a later figure. Dash-lined boxes refer to previously described processes or subprocesses.

2. Acquisitions Workflow

Monographs are books. Serials are publications "issued in successive parts, usually at regular intervals, and intended to be continued indefinitely" [Ref. 4: p. 138]; they include periodicals, annuals, irregular publications, and monographic series. Periodicals are serial publications which are received more than once a year, "each issue of

which is numbered or dated consecutively and normally contains separate articles, stories, or other writings" [Ref. 5: p. 166].

The Acquisitions Division orders and receives both monographic materials and serials for the Library's research collections. It is also responsible for ordering supplies, furniture, equipment, and services to support the physical and intellectual needs of staff and patrons, for keeping accurate records of funds expended, for distributing incoming materials to the proper Division or routing it via all interested parties, and for claiming unreceived or overdue orders. Acquisitions records provide much of the input for Library management reports.

Initial selection of all Library items (monographs and serials, including periodicals) is by request. Library professionals are responsible for recommending titles to be ordered within their specialty subject area; faculty suggestions are encouraged, as are requests by students. For each item, a green Order Request Card is completed; the card includes identifying bibliographic information and indicates the relative importance of the item to the requestor. Priority "A" items are purchased immediately if funds are available. Other priorities are less critical and may be ordered as funding allows.

Periodical titles must be approved by the Librarian before purchase. Because of space and budget limitations, one title must often be dropped before another can be ordered. Library liaisons within each academic department on campus help to evaluate periodicals within their area of expertise so that budget constraints and research needs may both be met.

During pre-order searching, information from the green Order Request Card is verified as correct and complete, a price is obtained for the item, and, for books, a tissue-paper "order slip" is filed in the catalog under the expected main entry. The "in process" records are used to prevent duplication, and to provide status information for patrons.

All paperwork for ordering Library materials is prepared by Acquisitions' personnel, but actual ordering and payment is done by the Supply Department. Therefore, purchase orders and supporting data must be sent outside of the Library for official action. Invoices for items received are checked for accuracy by the Acquisitions' staff; price information is copied into local files, for use in generating reports and for updating Library ledgers, before the invoice is forwarded to Supply for payment.

Manual workflows for the major processes within the Acquisitions Division (see Figure 3 on page 8, and Figure 4 on page 9) were provided by Sharon Serzan, former head of the Division. This position is now vacant. Because of a shortage of personnel

and the press of keeping the Division functional with a minimum of staff, no further detail is available on acquisition information flow.

3. Cataloging and Classification Workflow

The Bibliographic Control Division is concerned with the description and identification of all items in the Library, so that the intellectual content of the collection is made available to the users. The Dudley Knox Library uses the *Anglo American Cataloging Rules* (AACR2) for original descriptive cataloging, and the *Library of Congress Subject Headings* for subject specification. For "copy cataloging," *i.e.*, using a cataloging record from a standard source rather than doing original cataloging locally, the facilities of RLIN, an on-line bibliographic utility, are used. RLIN has an extensive database of Machine Readable Cataloging (MARC) records from the Library of Congress; these are standard, authoritative records that can be copied for local use. Copy cataloging is an efficient way to create high quality descriptive cataloging records for local collections. It is important that every item be cataloged to Library of Congress standards.

Catalog mainenance includes filing catalog cards for new or revised entries into the Author/Title (A/T) and/or Subject catalogs. This filing is done by professional catalogers and checked by the head of the Reader Services Division. No checking is done in the Subject catalog.

Subject heading changes, series changes, and name changes (corporate or personal) comprise another area of catalog maintenance known as authority work. When a standard entry changes, catalogers must check to see whether the term has been used in the local catalog(s), and, if it has, remove all cards reflecting the old entry and correct them to show the new term. Obsolete headings can either be erased and the heading retyped, or new cards can be reordered via RLIN. In any case, the cards musts be refiled after correction.

Physical processing of incoming materials is accomplished by a subdivision of the Bibliographic Control Division. Processing consists of typing identification information on book cards and pockets, inserting the cards and pockets into the books, gluing labels on the spine of each item to identify call numbers for shelving, and affixing security strips for sensor detection. Processing personnel prepare worksheets for the professional catalogers by searching the RLIN database and printing out records found, then inserting them into the described item. They also repair damaged materials, prepare periodicals for professional binding, and do some binding in-house.

Major workflows in the Bibliographic Control Division are illustrated in Figure 5, Figure 6, and Figure 7.

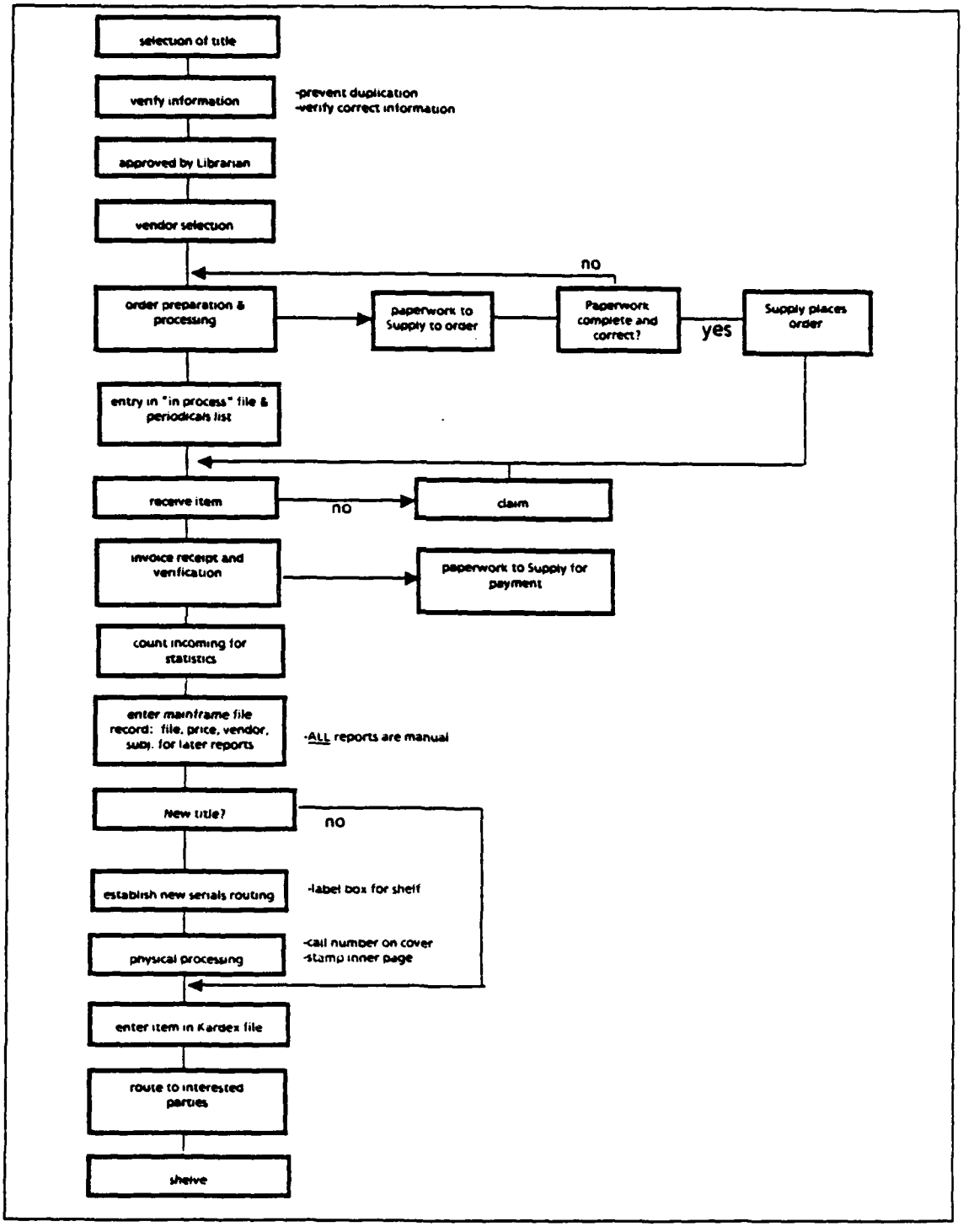


Figure 3. Logical Workflow for Serials Acquisitions

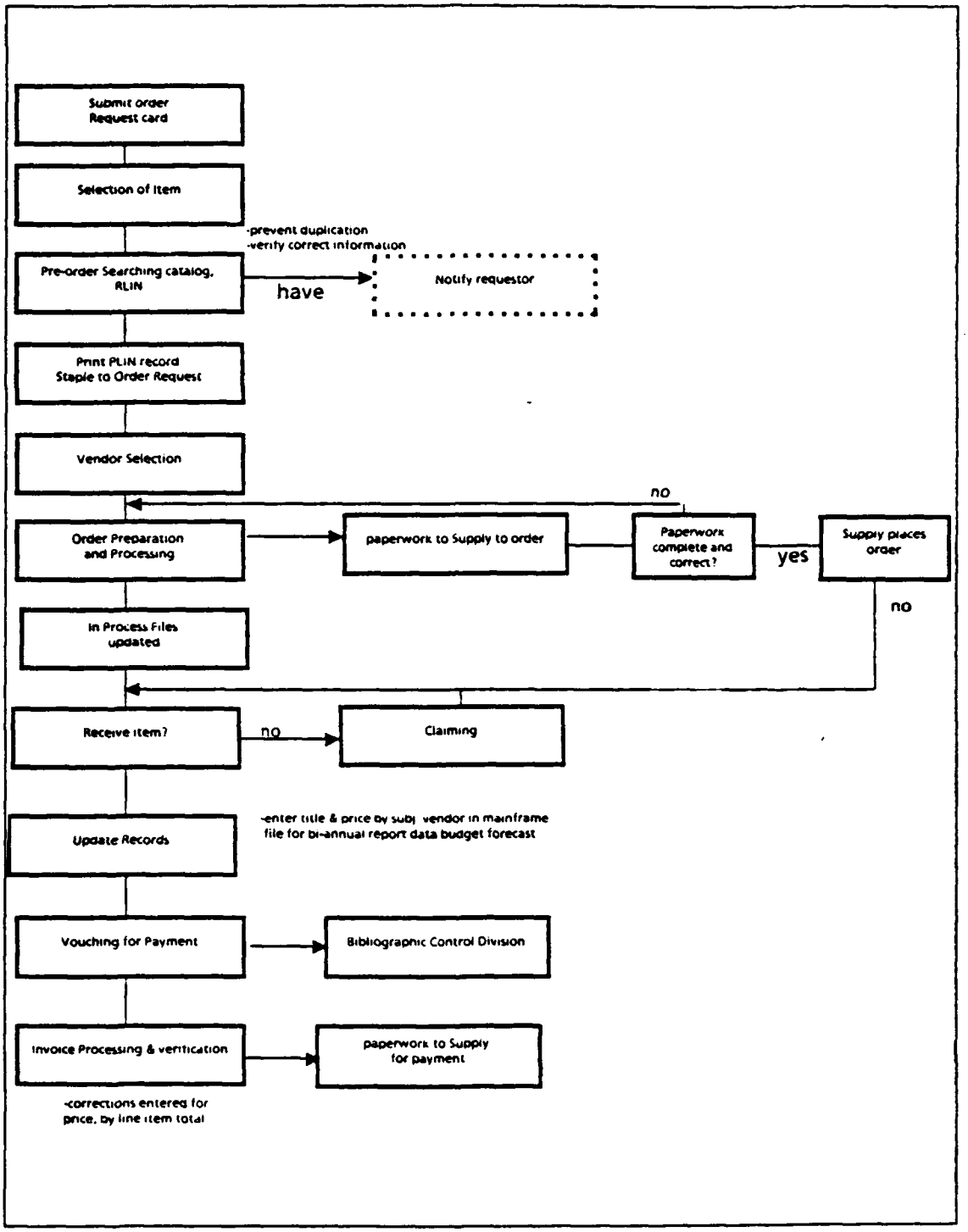


Figure 4. Logical Workflow for Acquisition of Monographic Materials

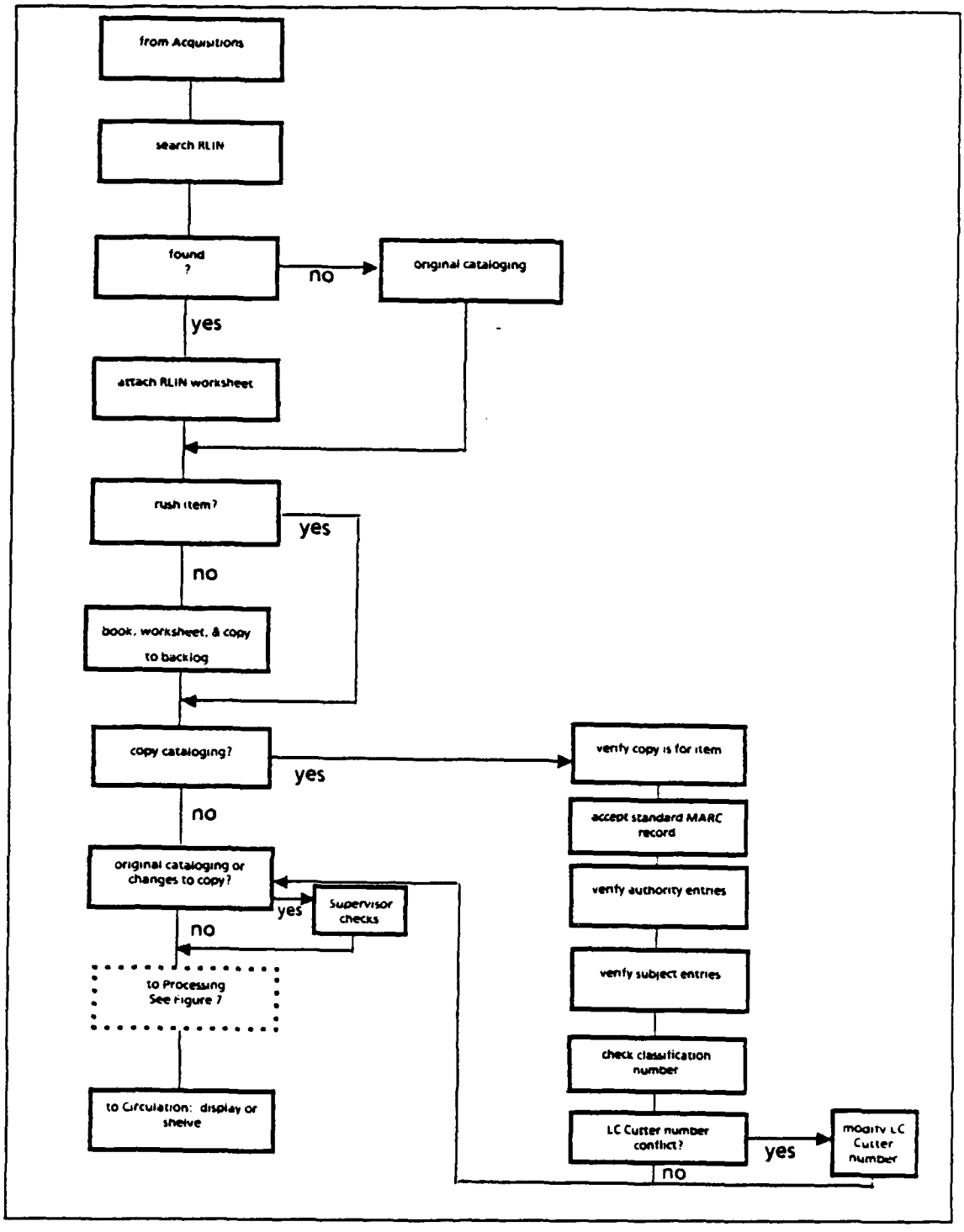


Figure 5. Logical Workflow for Cataloging Incoming Monographs

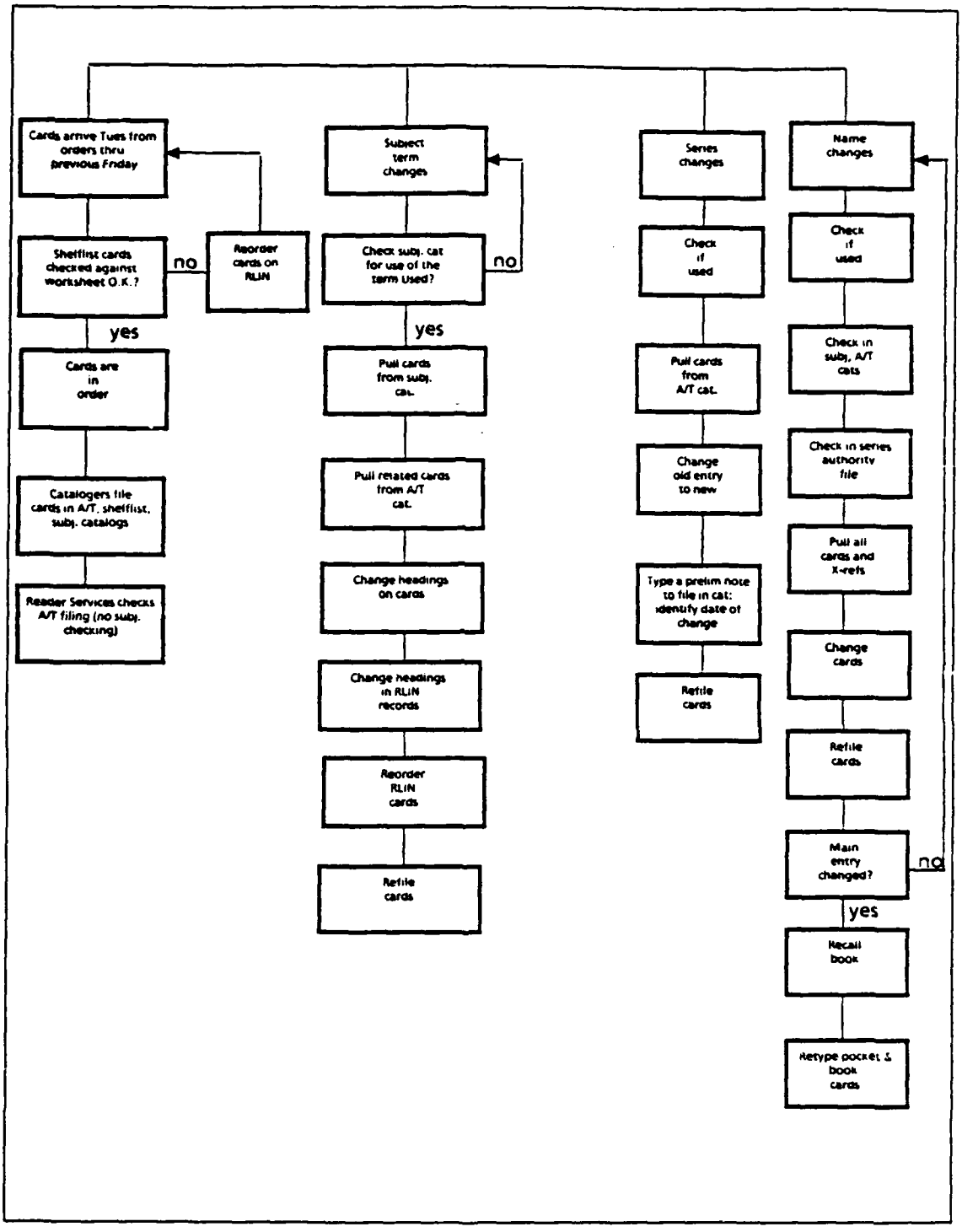


Figure 6. Logical Workflow for Catalog Maintenance

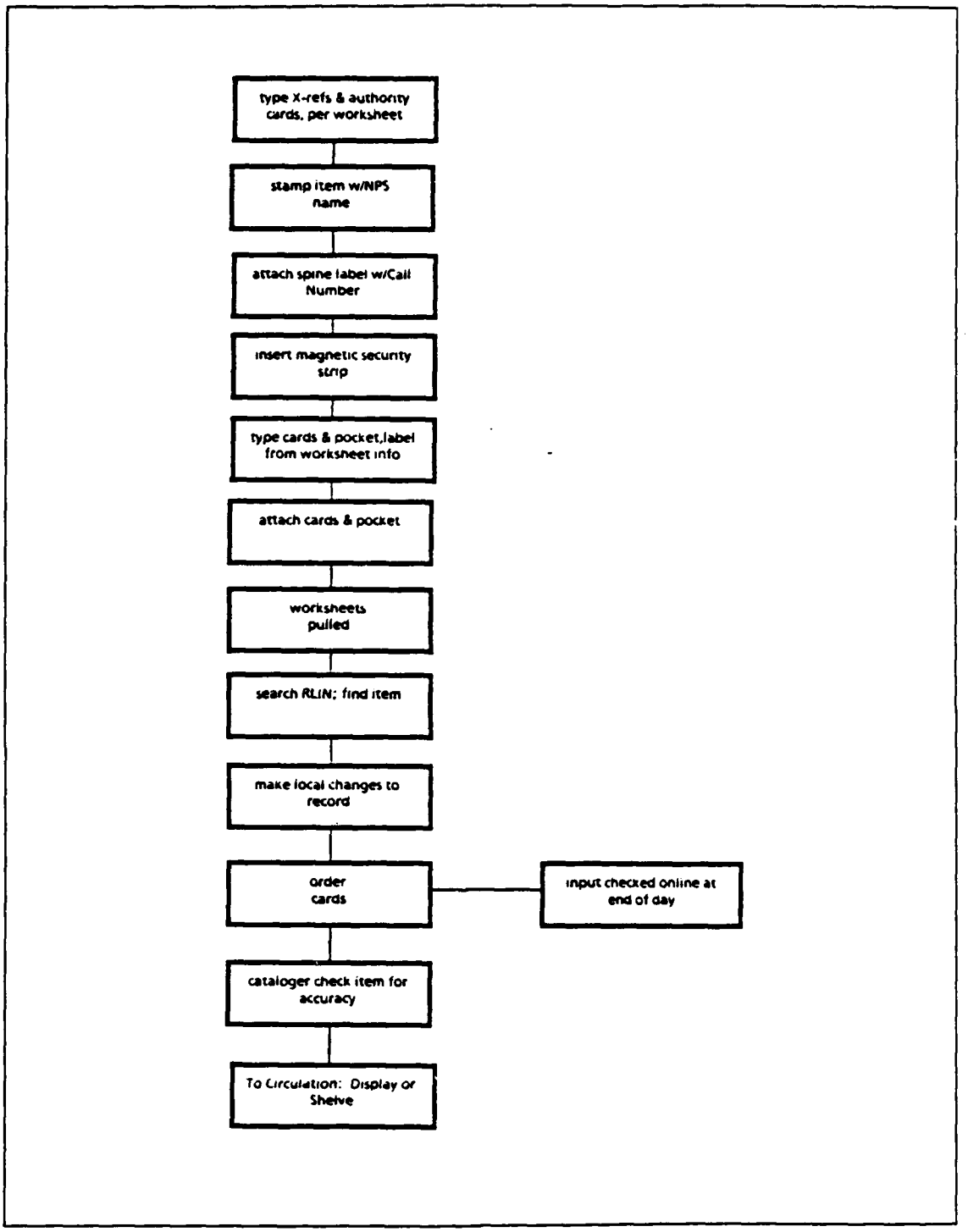


Figure 7. Logical Workflow for Physical Processing

4. Circulation Workflow

The Reader Services Division performs both Circulation and Reference functions. Circulation functions include borrowing and returning of materials, recall of overdue materials, holds, searching for lost or misplaced publications, and sorting and shelving of items used in or returned to the Library. Reserve books are managed by the Circulation Desk. Statistics of use are also compiled by Circulation Desk clerks, by counting book and patron cards before they are filed each morning. See Figure 8 on page 14 for a logical description of the general Circulation process. Figure 9 on page 15 shows the check-out process; check-in is detailed in Figure 10 on page 16. Renewal of Library materials is described in Figure 11 on page 17.

5. Reference Workflow

The goal of Reference service is to respond as soon as possible to inquiries about specific facts ("ready reference") and requests for information or assistance. The response must be both accurate and timely. Inquiries can come by phone, in person or by mail. Primary users are faculty and students of the Naval Postgraduate School (NPS) but the Library is also open to the community. Resources used to field inquiries include the catalog (and the collections it represents), on-line subscription information services (BRS, DIALOG, NEXIS, ONTYME, RLIN, WILSONLINE), printed indexes, microform data, local files/records, etc. See Figure 12 on page 18 for workflow synopsis.

Reader Services also handles interlibrary loan, bibliographic searching services, bibliographic instruction, library tours and orientation, dial retrieval, and video services.

> The reference subsystem uses the output of the cataloging subsystem as a primary means of locating publications from which responses can be obtained to meet the user's needs. While the experience and skill of the person performing the reference function will effect the use of the catalog, the quality and responsiveness of the catalog will determine the efficiency with which it can be used. [Ref. 3: p. 27]

The manual processes described above are the *baseline* for evaluating Library workflows. An automated system must successfully duplicate these functional areas before it can be considered for adoption. Library staff have identified additional functions that they want included in any automated system as well.

B. POSSIBLE IMPROVEMENTS VIA AUTOMATION

> Generally, the librarians have viewed the library as a total system and recognized the limitations of their resources. As a result of the need to focus on the most productive applications, attention turned first to circulation because of the volume of processing, to cataloging because of the costs associated with catalog production and maintenance, and to acquisitions because of the combination of similiarities to

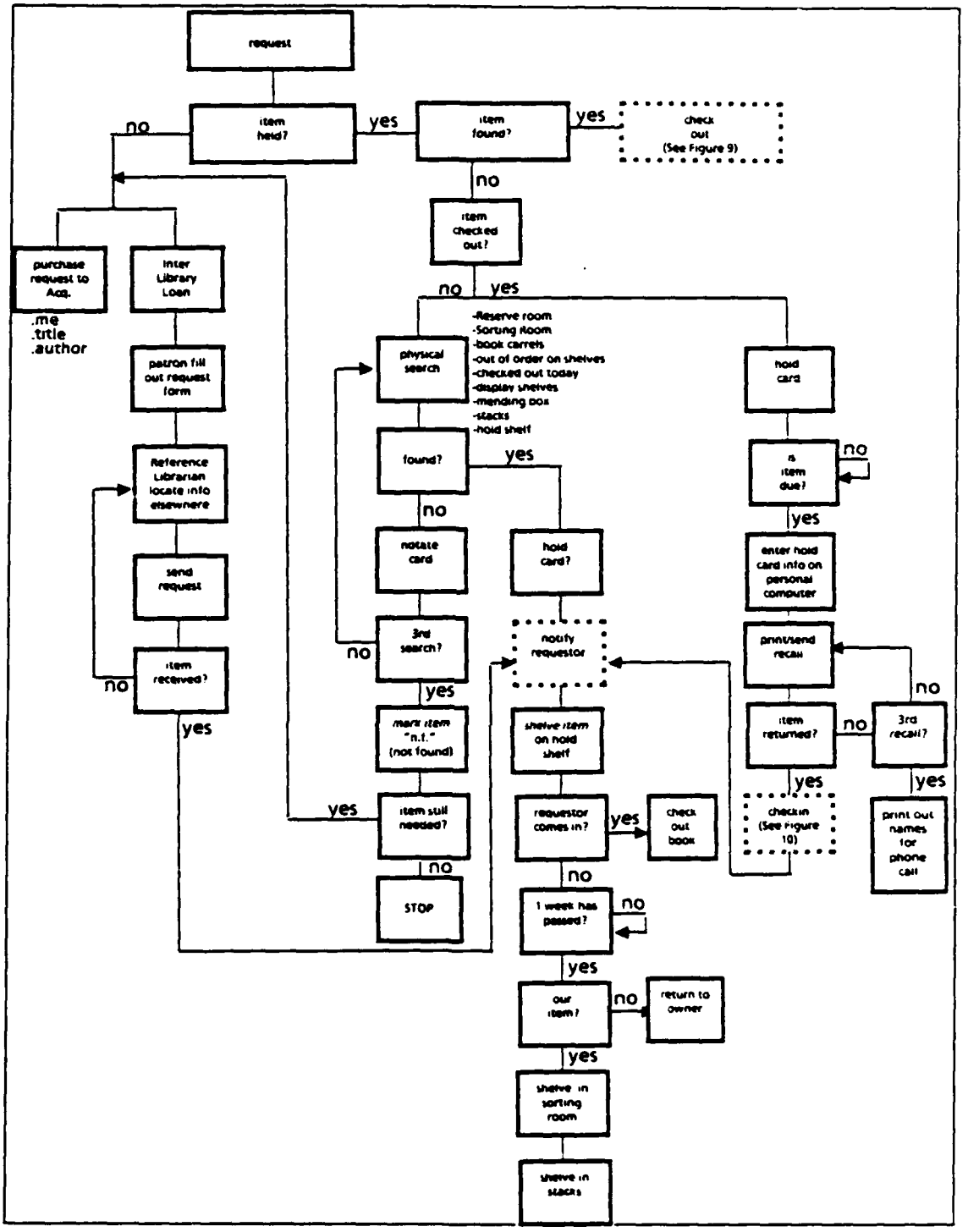


Figure 8. Logical Workflow for Circulation of Library Materials

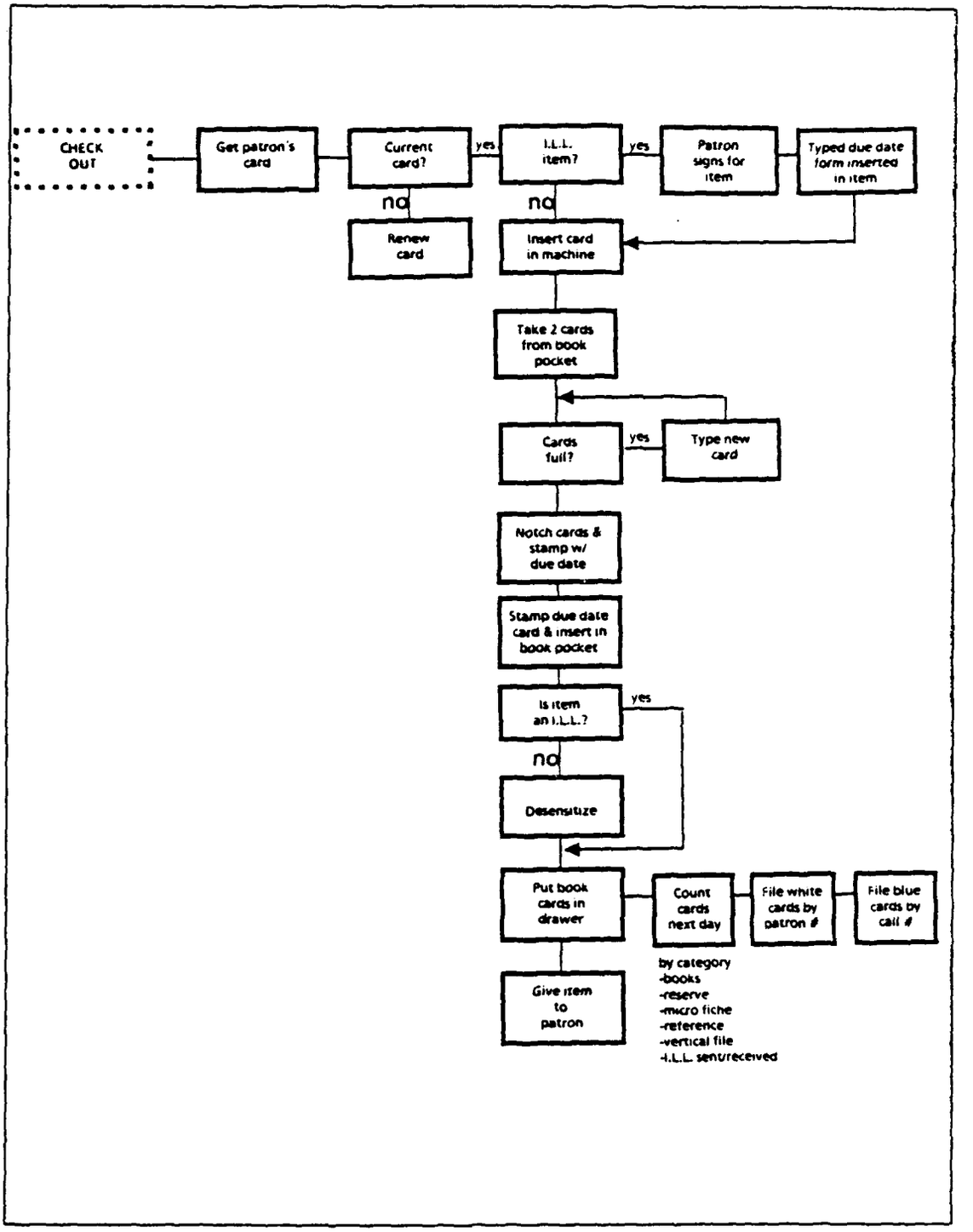


Figure 9. Detail of Circulation of Library Materials

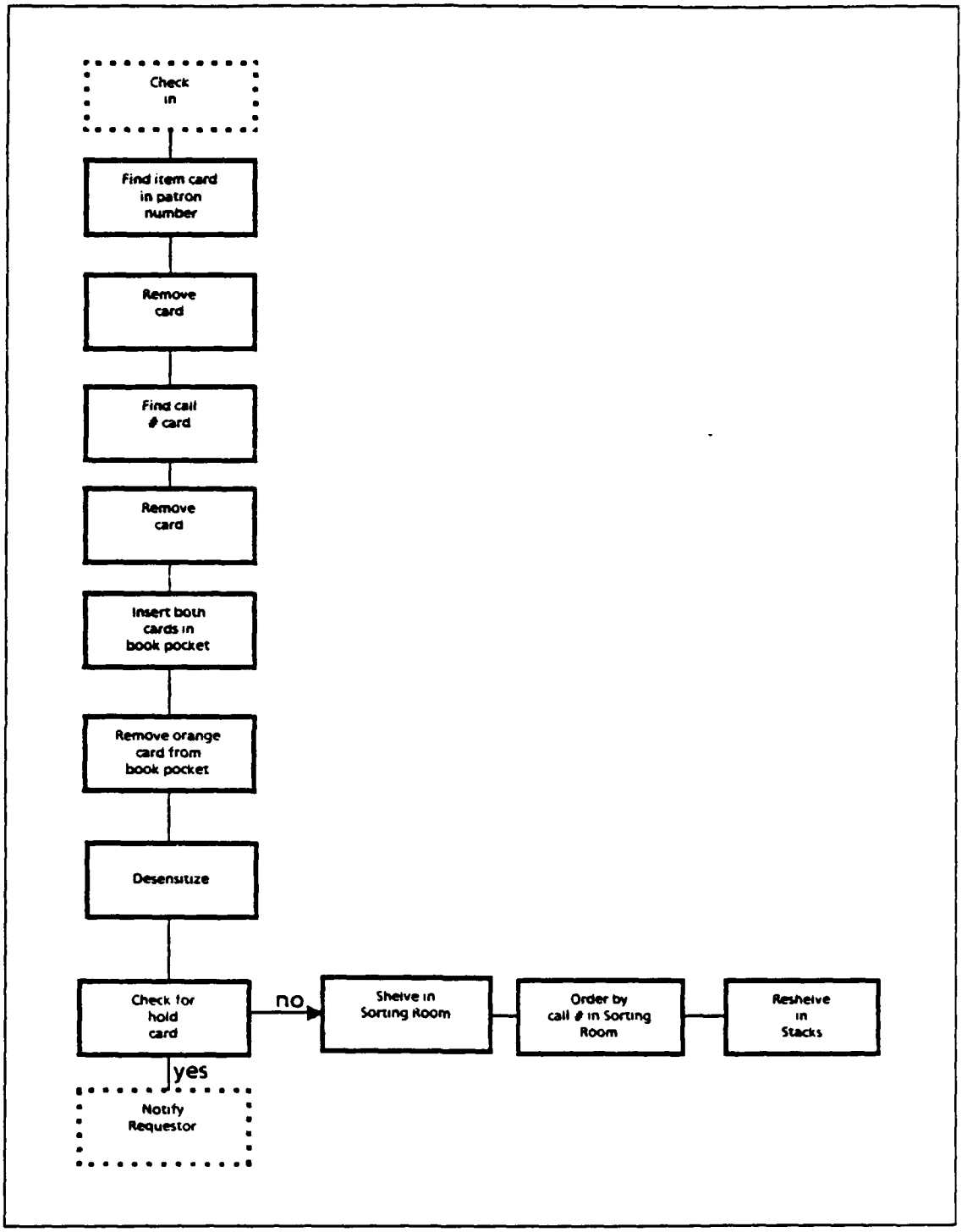


Figure 10. Detail of Return of Library Materials

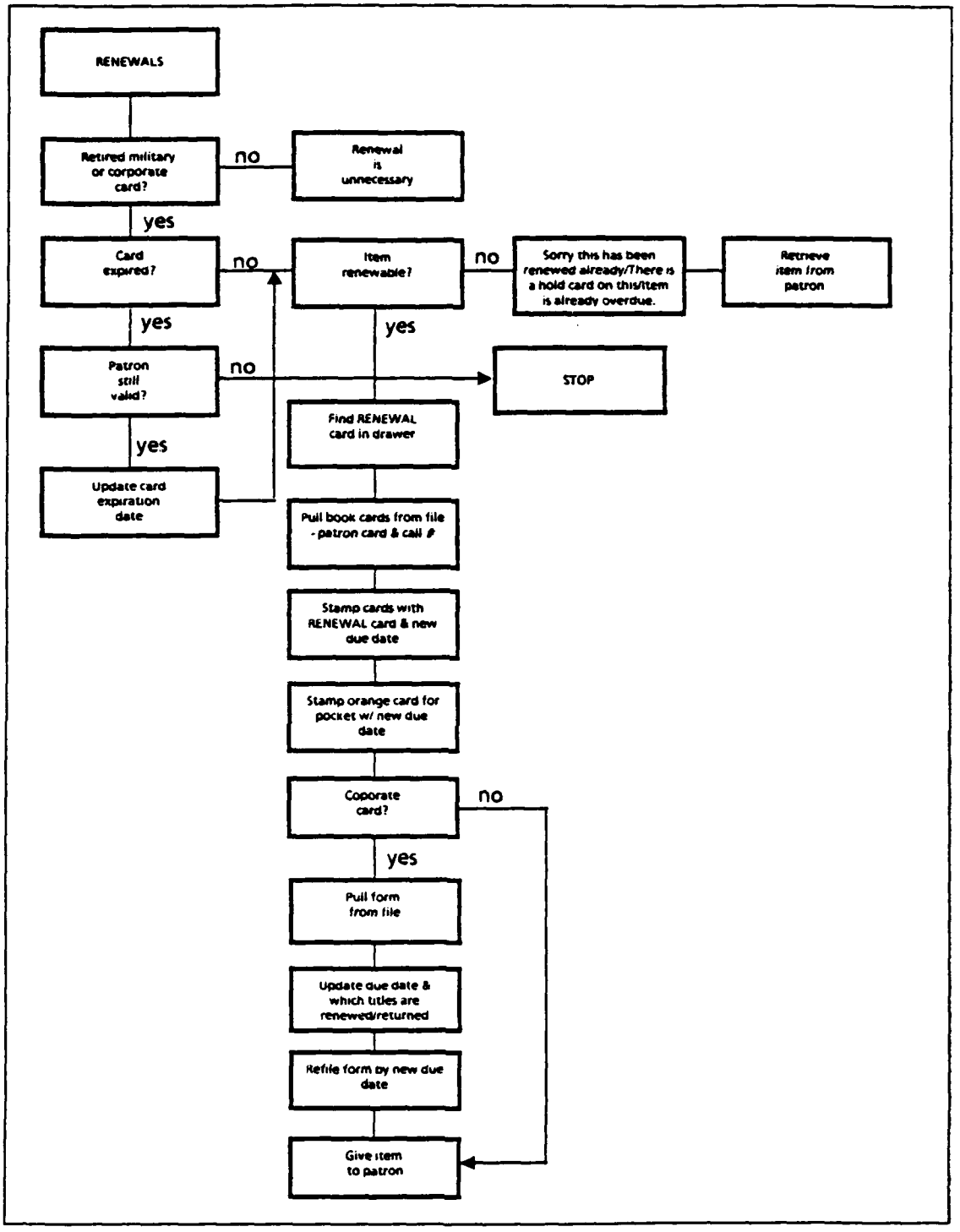


Figure 11. Detail of Renewal of Library Materials

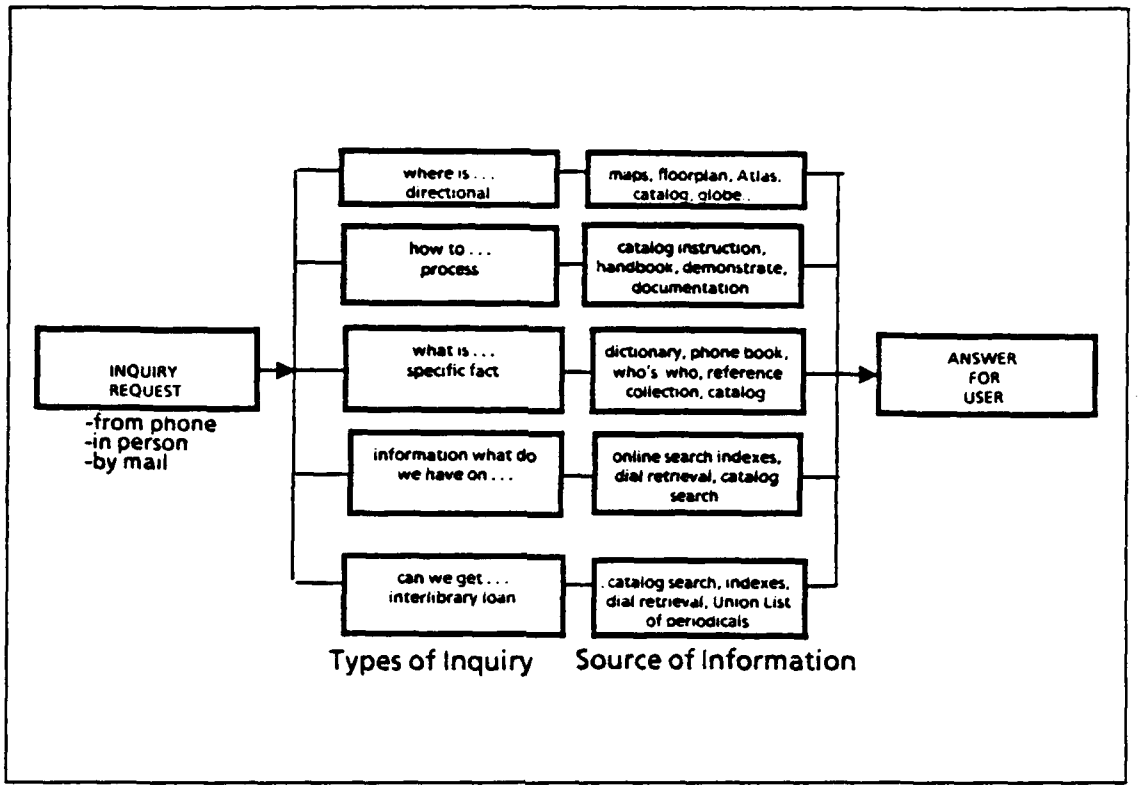


Figure 12. Logical Workflow for Reference Functions

purchasing activities in other types of organizations and the application of accounting procedures to maintain control of budget allocations, and, finally, to serial records systems because of the recurring nature of posting the receipt of current issues and the periodic renewal of subscriptions. [Ref. 3: p. 80-81]

Reusability of data and flexibility in manipulating it are the foundations of library automation. "By the 1980s, many academic libraries had made great progress in using computer technology to keep records and to assist patrons in their use of library materials. ... almost all academic libraries, no matter how small, were using specific automated processes ...." [Ref. 6: p. 8] The two most frequently cited reasons for the development of computer-based library systems are

1. To provide a *better service* for the same/less cost;
2. To give *added benefits* for the same/less cost.

The provision of online access (by users or staff) to a library's catalogue, the ability to access much more information via the online services than would have been possible via printed sources and the ability to produce easily management information such as the average cost of new books, number of books lent to undergraduate

physics students in one term, etc., are just some examples of new or improved services to both library staff or library users that are possible with computer-based systems. [Ref. 7: p. 7]

The advantages of online searching are clear. In the first place, it permits a type of searching that could not be done manually. ... The online search system is able to use the Boolean operators "and," "or," and "not," thus allowing a search for items that contain the terms computers **and** lasers **and** printing. Online search systems can also truncate terms so that, for example, using the term "comput," a searcher can retrieve all items containing terms such as computers, computing, or computation. The flexibility of online searching permits many access points to the data, and the interactive nature of online searching gives the searcher immediate feedback on the relevance of a search so that the search strategy can be modified at any point to make it more effective.

Another advantage of online searching is its speed, even in a situation where only a single topic is being searched. A searcher can get results in a few minutes that would take days to compile manually. ... Finally, the online search usually produces more current information than use of the printed equivalent as databases are updated regularly, some even daily. [Ref. 6: p. 17]

Another reason for the development of computer-based library systems has been to save money (and not necessarily provide better service or added benefits, although these are obviously desirable) and to contain the cost of future expansion. [Ref. 7: p. 8]

Cost containment, not cost reduction, seems a reasonable objective. Once the system is installed it can usually absorb additional work at little increased cost. Usually, the unit cost of additional work drops. [Ref. 8: p. 11]

A further reason for implementing a computer-based system in the library may be that with such a new system the tasks may be completed more accurately, more quickly and with increased control than with previous systems. Typically such tasks are clerical, routine and repetitive and thus prone to human error. [Ref. 7: p. 8]

The Division Heads at the Dudley Knox Library share the viewpoints quoted above, and believe the only way to provide better service to the students and faculty of the Naval Postgraduate School, given limited physical space, budget constraints and fixed staff size, is through automation. They think the time is right for pursuing an integrated, online library system (IOLS) that encompasses at least the cataloging, acquisition, and circulation functions.

An integrated system is one "in which a single bibliographic file support[s] a variety of library functions, such as acquisitions, serials, cataloging, and circulation. These integrated systems [have] the advantage of needing only one input or update to keep the entire database current for all functions." [Ref. 6: p. 8] The central bibliographic file is accessed by terminals sharing dedicated or dial-up lines to the computer. Access is not restricted to a single physical location.

The Dudley Knox Library has been preparing for an automated catalog since 1978, when it joined RLIN and began collecting holdings data on tape in machine-readable form. This machine-readable data encompasses the most current ten years of the Library's collection, which is the most active portion of any library holdings. Records are in LC MARC (Library of Congress Machine Readable Cataloging) format, which is the national standard used in most major databases. This data can serve as the basis for an online public access catalog.

> The purpose of a library catalog is to organize a library's collection and to permit easy access to the materials it owns. ... One of the most exciting developments in catalogs is the public access online catalog, which provides speedy online access to all the library's holdings by means of a computer terminal. ... The online catalog will make the computer's retrieval capabilities directly available to library users and will permit users to have access to information in a more decentralized manner. [Ref. 6: p. 21-22]

The aims of the proposed IOLS are:

1. To facilitate access to and control of the collection by replacing old card catalogs with an online public access catalog;
2. To create a bibliographic record when an item is selected and to use the *same record* in the acquisition, cataloging, and circulation functions at the Library;
3. To provide a data source showing the *status* of all Library materials current to the past working day.

C. INFORMATION ENGINEERING

The IOLS will affect the workflows of the Library. Typically, automation pressures result in a stronger integration of technical services activities. At both Northwestern University and Stanford University, IOLS-related staff reductions resulted from combining functional services and reducing duplication of processes in various departments. Stanford's BALLOTS, operational in 1972,

> had a tremendous impact on Stanford's operation, such as integrating technical processing functions more closely than ever before. The Acquisitions and Cataloging departments, although remaining under separate supervision, were physically consolidated. ... In addition, the number of staff was reduced. One-third of the staff positions in the Order Division were eliminated, as were several positions that previously had been responsible solely for typing unit entry cards, duplicating and typing headings on them, and sorting them into filing order: all functions that were computerized under BALLOTS. [Ref. 9: p. 53]

A high-level view of the logical relationships in the IOLS will help clarify details shown in workflow diagrams; see Figure 13 on page 21.

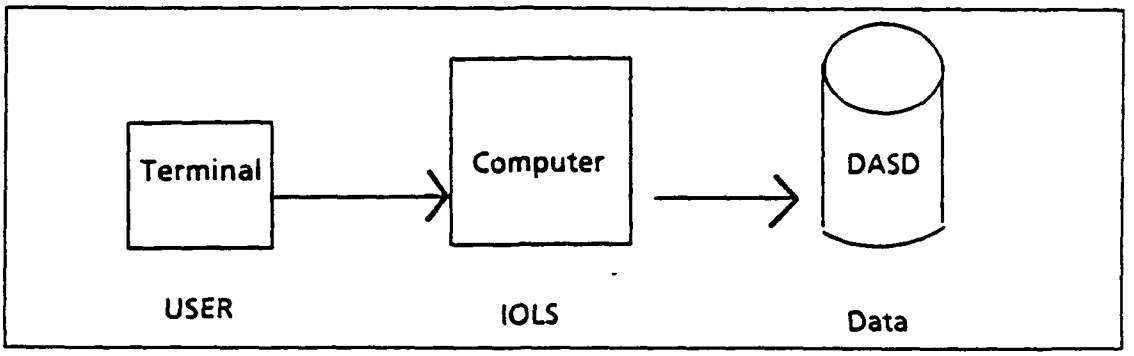


Figure 13. IOLS Component Relationships

The terminal is all that the users, whether library patron or library staff, are aware of when they work with the IOLS. All interactions are on-line. The computer, using a transaction processor and IOLS custom software, executes the search strategies, commands and inquiries entered by users. The informational files stored on direct access storage devices (DASD) are available without noticeable delay, and the results of the request or command are displayed on the terminal monitor almost immediately.

Several applications use the same integrated database file, thus eliminating problems of synchronization, redundancy and currency. Information about individual transactions is entered at on-line terminals and used to update master files on DASD. These files are backed up regularly to another disk, and to tape cartridge. Journal files on DASD can be used to rebuild a day's activity from a checkpoint.

Updates made by the library technical staff are immediately available to library patrons. An order record entered in Acquisitions is accessible to the Cataloging staff, to the Reference Librarian, or to a student via a subject/title/author/keyword search; the displayed record shows not only the bibliographic information but also the status of the item. A book checked out this morning is tagged as "in circulation" and the due date is part of the display. Currency of information and accessibility of data without replication of effort are two of the primary features of an IOLS. That is why *integration* is important in the system.

Another feature of the IOLS is ease of access. Not only does computer searching offer more index points than manual catalogs can provide, but also the On-line Public Access Catalog (OPAC) is physically easier to reach. Any terminal with connections to the mainframe computer at NPS also has connections to the Library OPAC. The patron no longer has to be in the library to do library research.

At present, all terminals and data communication devices at the Naval Postgraduate School are directly connected to a host computer. Microcomputer labs scattered around the campus are stand-alone Local Area Networks (LANs). When the campus-wide Local Area Network is available, (see Figure 14) the IOLS will be accessible via the LAN (RING topology), dial-access (telecommunication), and direct-connect terminals. All offices with terminals, all PCs with a modem and terminal emulation capability, and all microlabs on campus will have full library service via the IOLS.

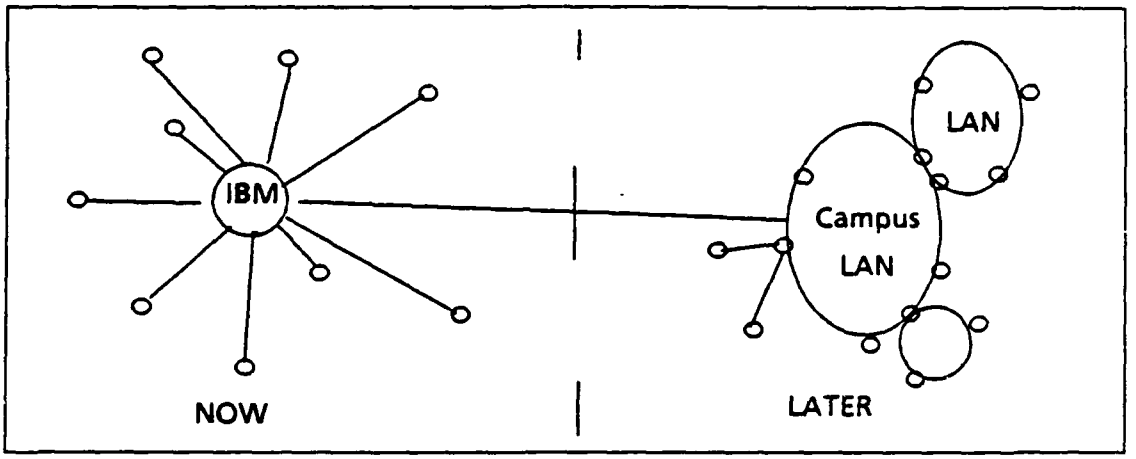


Figure 14. IOLS Network Access: STAR then RING

1. Proposed Acquisitions Workflow

Automation will have a major impact on the Acquisitions Division. Pre-order searching will be done in Acquisitions, and records for books, serials and periodicals will be created in the on-line bibliographic database at the time they are ordered from the vendor or publisher. RLIN records will be downloaded to the OPAC by a process called Generic Transfer Overlay (GTO). GTO copies the RLIN record into a local micro-computer, where the data is reformatted to match OPAC requirements. The new record is then added to the on-line database that supports the OPAC, and is flagged as "on order" in the status field display. These records will be searchable by keyword, or by title, author, publisher and publication date. Order records are usually brief, but still offer more points of access than the manual "order slips" filed in the card catalog under main entry only. See Figure 15 for other changes in workflow.

2. Proposed Cataloging and Classification Workflow

The Bibliographic Control Division performs three functions. The first two are interrelated activities: descriptive cataloging and the production of the library catalog.

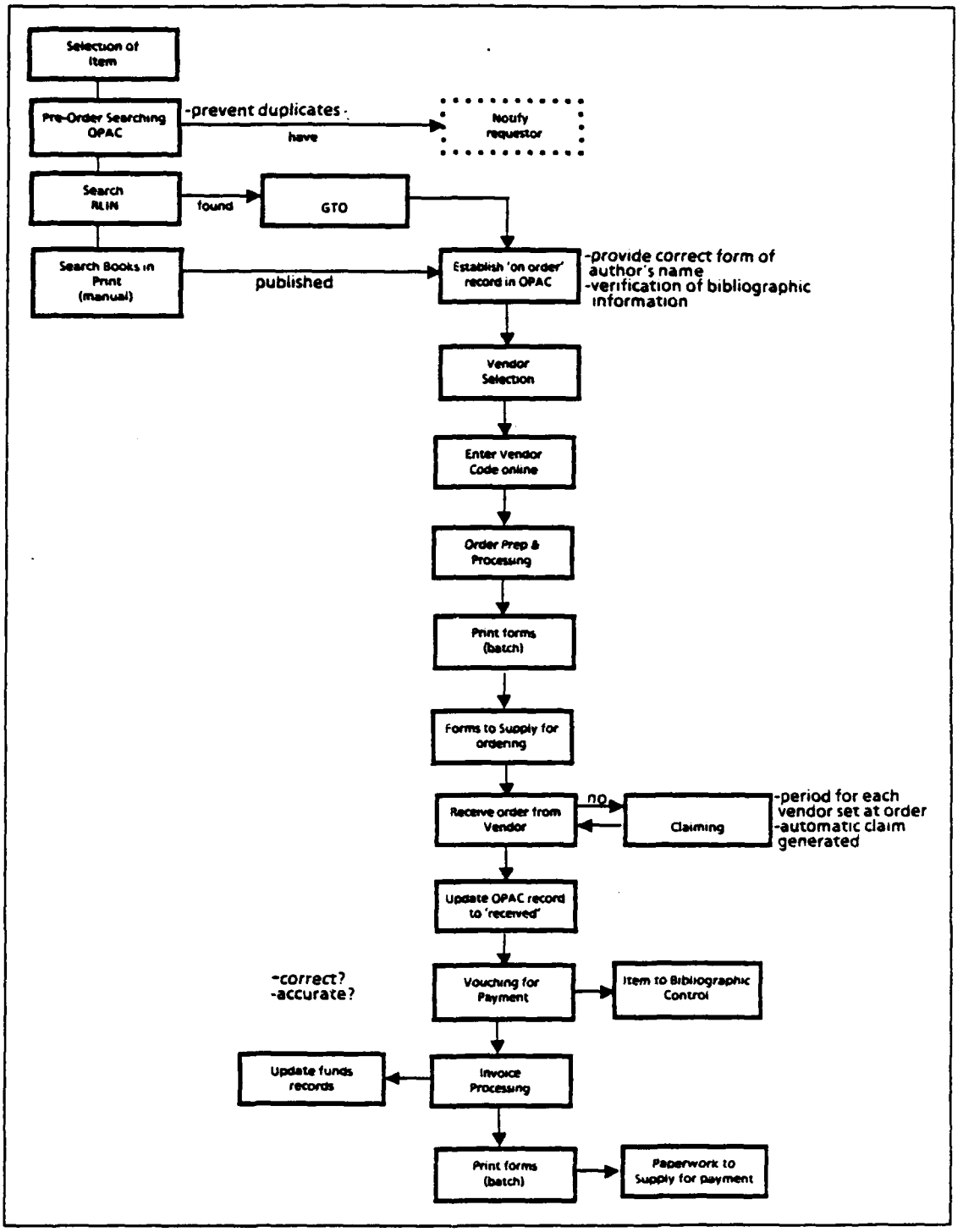


Figure 15. Logical Workflow for Automated Book Acquisitions

Physical processing is the third function. Figure 16 details descriptive cataloging processes that build the catalog; Figure 17 describes physical processing of library materials.

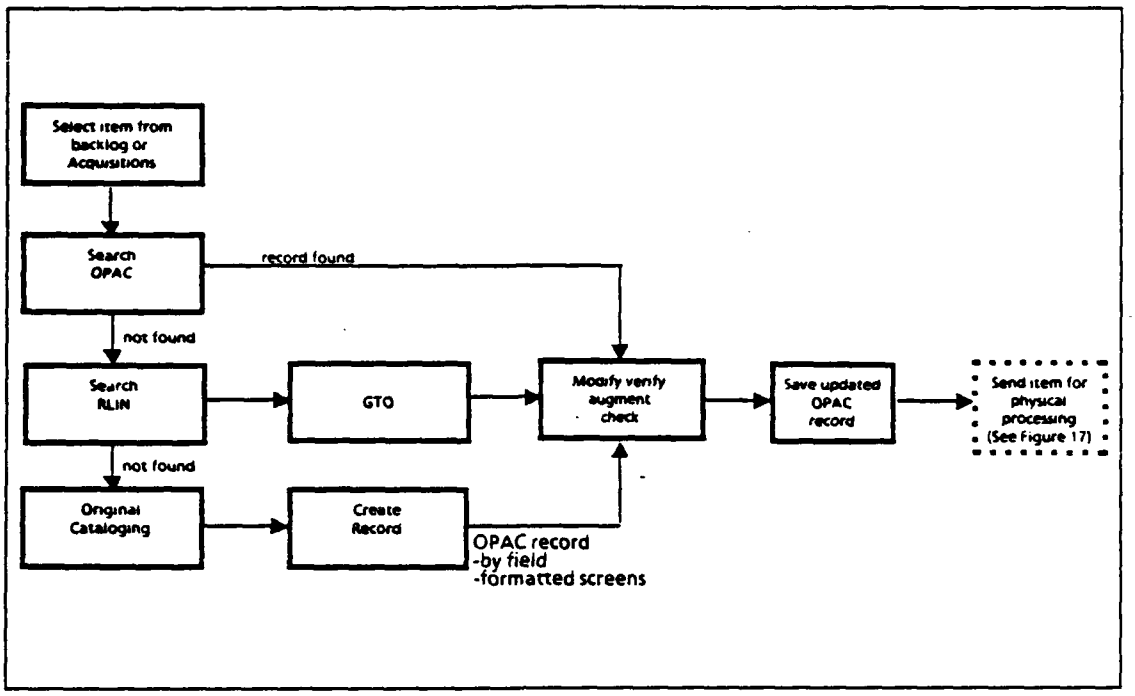


Figure 16. Logical Workflow for Descriptive Cataloging

The aim of descriptive cataloging is "to produce informative bibliographic and physical descriptions of library materials in sufficient detail to permit the conclusive identification of a given item and its differentiation from other, possibly similar items" [Ref. 10: p. 177] according to AACR2 standard rules. In a manual system, the level of detail is limited to what can be conveniently printed on a 3x5 catalog card set. With an OPAC, no limits exist except those set by the policies of the cataloging library. Full analytics[1] can be included in the on-line record if desired, so that the contents of chapters, of collected works, of short stories, etc., are accessible to search. Serials can be cataloged down to the journal article level. Automation supports a change in the relative degree of descriptive cataloging, not in the logical cataloging process.

Automation has been part of the cataloging workflow at NPS via RLIN since 1978. RLIN's database includes MARC records for books, serials, maps, films, music

1 Analytical cataloging is detailed descriptive cataloging that reveals the specific contents of a bibliographic item.

and sound recordings plus original cataloging records contributed by member libraries for materials not held by the Library of Congress. Access to desired entries is available on-line via a series of indexes for main entry/title, LC classification number, LC card number, and International Standard Book Number (ISBN). The numerical searches are straightforward and can easily be done by clerical staff on the dedicated terminal connected to RLIN via leased telephone lines. Unique search parameters give quite rapid retrieval.

RLIN records have been used as a source of printed catalog cards for the past ten years at the Library. The same information that produces the manual card catalog can be kept in an on-line database; this is how an OPAC is created. Figure 16 on page 24 shows the sources of on-line records.

If Acquisitions has established an "on order" record during the initial search and order process described in Figure 15, then this record will be in the OPAC, and the cataloger will use it as the basis for full descriptive cataloging. If no order record exists, the Processing staff will search RLIN's database for a MARC record, then upload the record to the OPAC, using GTO. Original cataloging is done only if no record is found.

Once this record is complete, *i.e.*, once the "on order" record is augmented by descriptive cataloging to reflect full bibliographic and physical details, it is a valuable resource within the on-line catalog. The catalog is a tool used for locating ideas; an individual record with full description in the OPAC can be found via the mechanisms of computer-aided searching by a combination of main entry, LC card number, ISBN, LC classification number, and individual words from any part of the record. This is a powerful tool for locating very specific ideas. The OPAC is useful for Reference service because of this expanded search capability.

Note in Figure 16 that descriptive cataloging may involve creation of a new record or enhancement of an existing record. When a bibliographic record is established, the IOLS provides a formatted screen with labelled MARC fields to prompt for complete, standard data. No printed worksheets are necessary.

Checking, adding to, or changing information is a straightforward process. The record is displayed on a terminal, and changes are made directly to the record. These changes are immediately visible within the OPAC. Catalog maintenance thus becomes a subprocess within descriptive cataloging, accomplished from a terminal at the cataloger's desk.

Automated processing involves attaching human-readable as well as machine-readable labels to the physical item. The call number on the spine label is for human

convenience. The label may be typed locally, as shown in Figure 17, or may be a printed byproduct of an on-line transaction with the OPAC record.

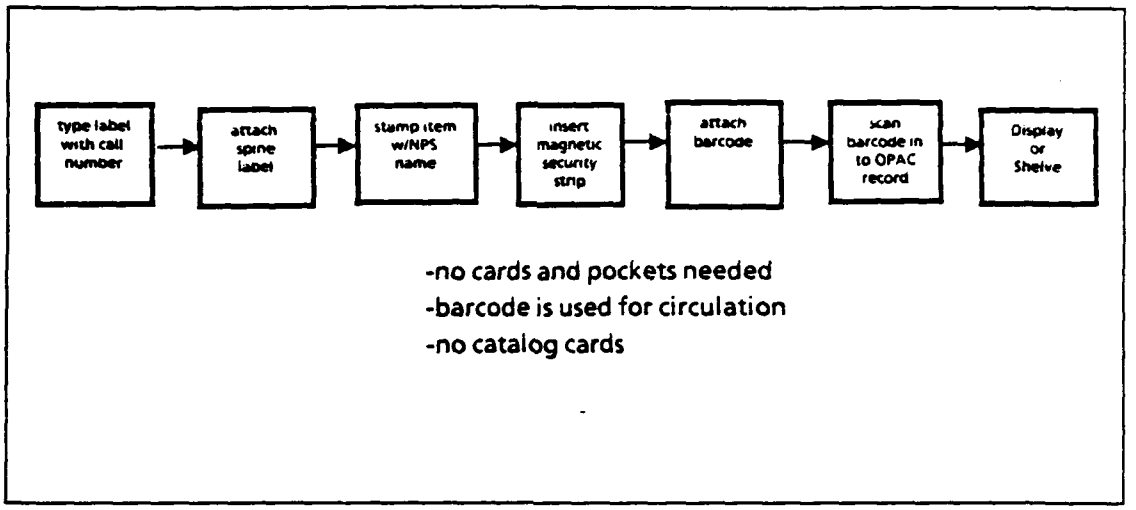


Figure 17. Logical Workflow for Physical Processing

Note in Figure 17 that there are no cards and pockets to be typed and glued into the books. The barcode is all that is needed to link the physical item with the logical description. The barcode label provides a unique identification down to the copy level. Use of the barcode substantially improves the Library's ability to obtain information about item circulation and patron use of the Library.

3. Proposed Circulation Workflow

> Library interest in automated circulation control is in large part based on a long-standing awareness of the problems inherent in manual circulation systems. These problems include labor-intensive and time-consuming record-keeping work routines, inaccuracy, high personnel turnover, an inability to generate conveniently statistics about circulation activity, and the lack of any interface between circulation files and other library files which contain much of the same bibliographic data. [Ref. 10: p. 173]

Most of these problems, present in the manual Circulation processes, will be alleviated by the IOLS. The barcode label is central to automated circulation, as can be seen in Figure 18. Scanning the patron library card and the barcode on the book are all that is necessary to check-out a barcoded book. Check-out will be at least three times faster than manual check-out procedures, since automation requires only one pass beneath the scanner, and manual procedures require that three cards (patron, book and date due) be inserted into the charge machine and stamped.

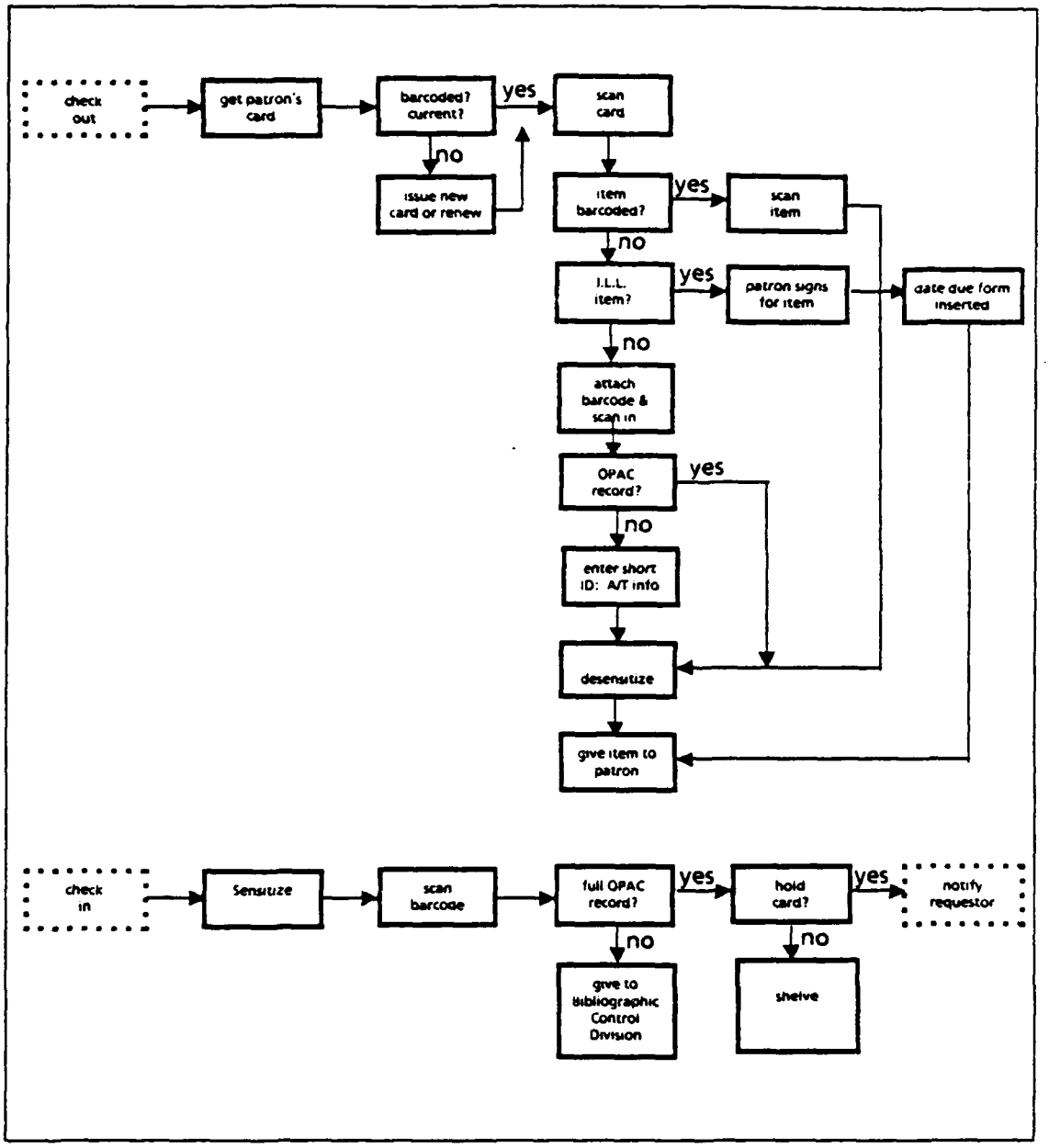


Figure 18. Logical Workflow for Automated Circulation

For items not yet barcoded, the Circulation clerk must attach a barcode, and must sometimes create a short "circ record" in the OPAC, to identify the item, before giving it to the patron. Upon its return, the book will be given to the Bibliographic Control Division, where the OPAC record will be augmented.

All circulation transactions will be reflected in the OPAC immediately. Both patron and book statistics are automatically generated during the check-out and check-in processes.

4. Proposed Reference Workflow

As seen in Figure 19, the Reference function uses the catalog in whatever form it appears. Searchable NOTES fields in the expanded bibliographic records, and the capability of applying Boolean logic to multiple indexed fields yield very specific search results. The speed and thoroughness of using an OPAC for Reference are advantages for the user. Results can be found quickly, and sources of relevant information are unlikely to be overlooked.

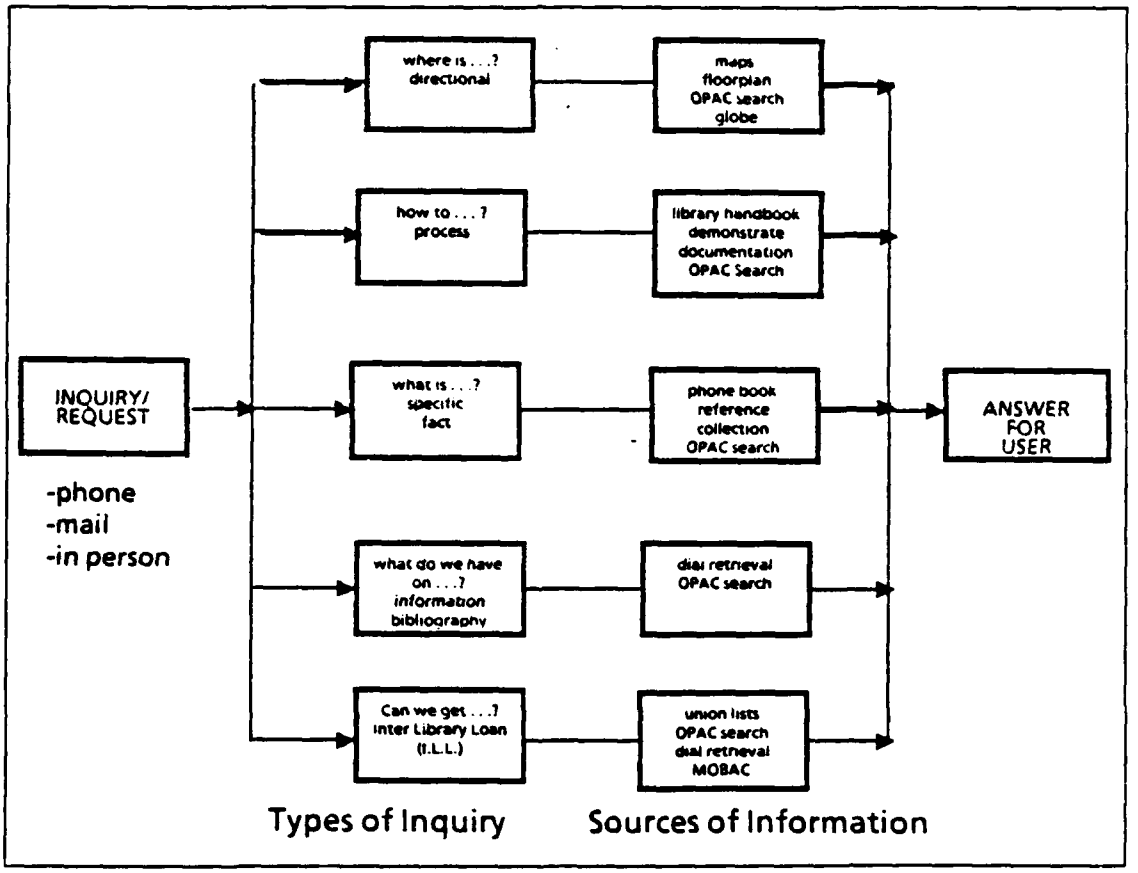


Figure 19. Logical Workflow for IOLS-Aided Reference

III. REQUIREMENTS ANALYSIS

The characteristics of library applications differ from most other types of data-processing activities. The files are primarily alphabetic rather than numeric. Except for a relatively small amount of business processing in accounting procedures, most of the tasks are sorting, merging, collating, or comparing, and usually these operations are performed on very large files. The typical library record consisting of bibliographic and user data tends to be larger than typical business records and less easily standardized in terms of the number of characters. The use of computers in sorting large files in alphabetical sequence is more complicated in library applications because of the filing rules needed for bibliographic records. [Ref. 3: p. 72]

A. METHOD OF STUDY

Identification of required IOLS functions, description of the existing manual Library work flow, comparison of three alternative IOLS systems, and a detailed analysis of NOTIS costs, machine requirements, and implementation scheduling comprise the bulk of this study. Information presented is based on:

1. interviews with selected Library staff members, including Bobbie Carr, Catalog Librarian; Sharon Serzan, Acquisitions Librarian; and Ora Wagoner, Assistant Reader Services Librarian,
   - to identify the functions of importance to each Division,
   - to rank these functions in order of preference,
   - to clarify current work flow in the Library's Acquisitions, Bibliographic Control, and Reader Services Divisions;
2. surveys of available literature describing IOLS systems currently on the market;
3. interviews with Computer Center Director Doug Williams to discuss the estimated costs of IOLS support, and Jack Starr, IBM Software Engineer, who advised on system configuration and support;
4. telephone conversations with vendors, notably Tim Tamminga and Mary Burgett, Marketing Librarians with NOTIS.

Automated library systems from many vendors were investigated during the ALA Conference in San Francisco in June, 1987. Because of budget constraints, on-site visits were limited to NOTIS installations at Long Beach Public Library, Long Beach, California, and at Northwestern University, Evanston, Illinois. Hands-on experience with NOTIS by Library and Computer Center staff has been positive.

B. SYNOPSIS OF FUNCTIONS DESIRED BY THE LIBRARY IN AN IOLS

Listing IOLS capabilities important to the Library was the initial phase of this study. Figure 20 is a synopsis of the functions important to the Library, summarized from the first meeting of the author and the Library staff.

FUNCTIONS DESIRED	PERCEIVED BENEFITS
authority control	uniformity of entry
global changes to files	ease of maintenance
automated circulation	saves time, item status available
circulation statistics realtime	immediate, automatic update spot "hot" areas (collection development) weeding (easier, more accurate)
Boolean searching of on-line catalog	efficient, specific access enhanced subject searching
access via menu or commands	help for new users, quicker for expert
catalog update overnight	current info about collection
terminal interface capabilities	access to remote systems
machine access to all financial records	
budget information automated	budget reports
standard reports predefined	currency, ease
custom reports definable	flexibility
bibliographic files for serials	missing issue control, holdings binding program current
no card catalog	no card filing, checking, maintenance
on-line catalog	more points of access indexed access from remote sites
automatic checkin	save time, recall alerts, holds
print forms automatically	neat, on time, standard
on-line order file for monographs	see what is on order, received
automated order form generation	
automatic claims/cancellation	efficient, fiscal control by vendor, subject code
automated management reports	control, currency, tracking
on-line access to Supply for ordering	control, speed, accuracy
archive capability for old data	save space
Reserve Book control	statistics on use, location status
interface w/RLIN	access to upload, download records
name, subject authority control	uniform entry, cross references
automatic deblinding	accuracy, catch blind cross references
access to commercial databases	same hardware for many uses
FULL MARC	LC standard cataloging
ability to extract information	customized reports
mainframe interoperability	Computer Center support

Figure 20. Functions Desired by Library in an IOLS

C. LIBRARY STAFF'S RANKING OF DESIRED FUNCTIONS

In Figure 21, the IOLS functions have been ranked in order of their importance to the Library by representatives of the Bibliographic Control Division, Acquisition Division, Reader Services Division, Administrative Division and the Research Reports Division. Scores range from 1 to 100 for each function, with 100 being highest. Lower numbers reflect less priority.

The Carnegie Report [Ref. 11] suggests that the local IOLS should be composed of *integrated components* rather than discrete automated units, and that the "basic device for user interaction" should be a full screen CRT terminal. It also identifies a strong "need to show circulation and acquisition status to patrons searching the catalog," which was reflected in the Library staff's priorities, shown in Figure 21.

FUNCTION DESIRED	CASE#	1	2	3	4	5	6	7	8	9	10
AUTHORITY CONTROL		95	93	87	89	80	2	99	99	*	*
GLOBAL CHANGES TO FILES		93	92	86	88	79	1	100	100	*	*
AUTOMATED CIRCULATION		75	99	97	92	88	*	*	*	100	100
CIRCULATION STATISTICS REALTIME		70	*	92	92	85	92	*	*	99	99
BOOLEAN SEARCHING OF ON-LINE CATALOG		98	97	98	97	89	95	92	92	75	75
SHOW STATUS OF EACH ITEM ON-LINE		73	96	91	91	87	88	30	30	98	98
ACCESS VIA MENU OR COMMANDS		90	95	90	87	84	91	*	*	60	60
CATALOG UPDATE OVERNIGHT		91	94	88	80	86	89	91	91	*	*
TERMINAL INTERFACE CAPABILITIES (DIALOG, DTIC...)		85	*	73	81	35	8	*	*	30	30
CAPABILITY OF INCORPORATING TECHNICAL REPORTS		100	*	74	40	25	90	*	*	*	*
MACHINE ACCESS TO ALL BIBLIOGRAPHIC RECORDS		87	98	*	100	*	18	29	29	40	40
MACHINE ACCESS TO ALL FINANCIAL RECORDS		19	87	81	99	91	77	*	*	*	*
BUDGET INFORMATION AUTOMATED		29	86	80	98	90	97	*	*	60	60
STANDARD REPORTS PREDEFINED		37	80	79	*	92	93	*	*	*	*
CUSTOM REPORTS DEFINABLE		45	79	77	*	94	93	*	*	50	50
BIBLIOGRAPHIC FILES FOR SERIALS		28	91	83	96	98	11	50	50	94	94
NO CARD CATALOG		94	90	*	*	100	*	95	95	45	45
ON-LINE CATALOG		99	100	100	100	100	96	94	94	80	80
DOWNLOAD FROM RLIN		5	60	89	94	95	3	*	*	*	*
AUTOMATIC CHECKIN		34	61	96	86	*	5	*	*	95	95
PRINT FORMS AUTOMATICALLY		35	62	82	85	81	17	*	*	85	85
ON-LINE ORDER FILE FOR MONOGRAPHS		30	85	95	84	99	76	*	*	*	*
AUTOMATED ORDER FORM GENERATION		25	84	94	83	97	15	*	*	*	*
AUTOMATIC CLAIMS/CANCELLATION		20	84	93	82	96	16	*	*	*	*
MANAGEMENT REPORTS		80	83	78	95	93	99	*	*	*	*
ON-LINE ACCESS TO SUPPLY FOR ORDERING		60	82	*	79	70	9	*	*	*	*
ARCHIVE CAPABILITY FOR OLD DATA		55	73	*	70	83	74	*	*	*	*
RESERVE BOOK CONTROL		15	*	76	50	75	75	*	*	83	83
INTERFACE W/RLIN		6	89	89	94	95	4	20	20	*	*
AUTOMATED REPORTS		65	81	75	*	92	98	*	*	70	70
NAME, SUBJECT AUTHORITY CONTROL		97	88	85	*	80	3	98	98	*	*
AUTOMATIC DEBLINDING		96	*	84	75	78	6	97	97	*	*
INTERFACE W/CD ROM SERVICES		16	*	72	78	30	12	*	*	*	*
ACCESS TO COMMERCIAL DATABASES		54	78	*	*	35	*	*	*	29	29
FULL MARC		10	*	99	90	82	7	96	96	*	*
ABILITY TO EXTRACT INFORMATION		53	73	*	*	94	94	*	*	69	69
MAINFRAME INTEROPERABILITY		69	74	82	*	65	14	*	*	*	*
ELECTRONIC MAIL		40	75	*	73	55	87	*	*	*	*
ENHANCED SUBJECT ACCESS		88	76	*	*	*	13	93	93	*	*
AUTOMATED MANAGEMENT REPORTS		80	77	78	*	93	100	*	*	*	*

NOTE: Missing values have been entered as "*".

Figure 21. IOLS Functions Ranked in Preference Order

1. Histogram of Functions in Ranked Order

The IOLS functions have been ranked by members of the Library staff as to the relative importance to their respective Division. All areas of the Library are represented in this survey. The average score for each element was graphed to produce an ordered list of "IOLS requirements" (see Figure 22). Items receiving average scores of 70 or higher were considered important. Most elements listed averaged 50 or higher. Note: Missing values have been *excluded* from averages.

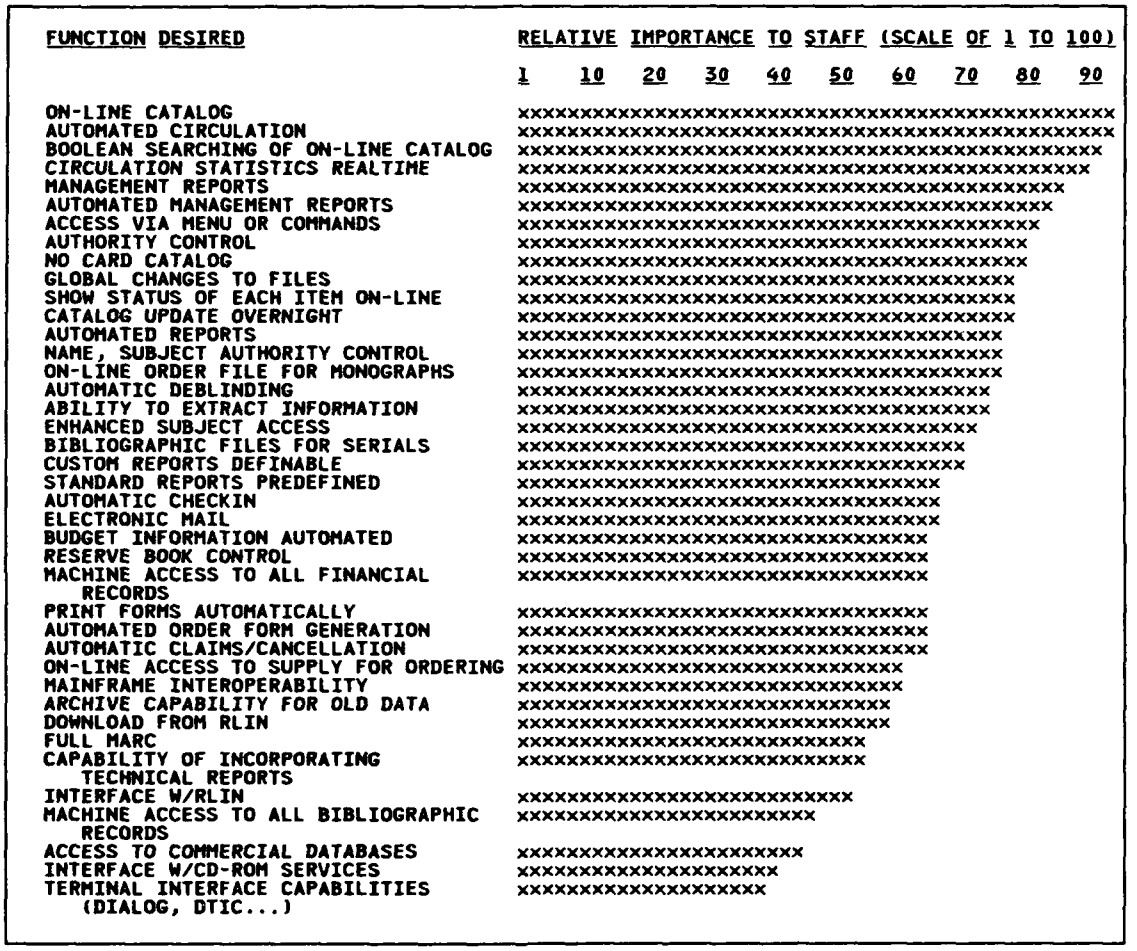


Figure 22. Histogram of IOLS Functions as Ranked by Library

D. STATEMENT OF IOLS REQUIREMENTS

The proposed computer based Integrated On-line Library System (IOLS) will support services of the Dudley Knox Library at the Naval Postgraduate School and will be central to the operation of this facility. For reasons of accuracy, timeliness, and

economy, it is essential that the library functions be integrated to operate from a common data base where bibliographical information is entered at the time an item is ordered and used in all functional areas of the library therafter. The IOLS must include subsystems addressing library requirements in the following areas:

- ***Acquisitions*** including a complete fiscal accounting systems with detail and summary reports as well as generation of procurement documents and print orders;
- ***Cataloging*** with an embedded full screen data entry and edit capability which allows modifications and additions to any single data element in the data base as well as global changes to the data base;
- ***Circulation*** including inventory control, on-line check-in and check-out, renewals, holds and overdue notice generation. The system must also support generation of statistical reports relating to circulation of library materials and the demographics of the user community;
- ***Serials Control*** with support for item check-in, routing, claims and bindery records;
- ***Research Library Information Network*** (RLIN) compatible data formats for use of existing machine-readable catalog records held by the library. This subsystem must allow loading of existing catalog archive tapes plus downloading of electronically transmitted data records directly from RLIN.

The system acquired must operate in the IBM 370 MVS/CICS environment in existence at the Naval Postgraduate School and provide for database access from the installed network of 600 IBM 327X display terminals. The system installed must be supportable using existing IBM 3350 and 3380 type disk drives and not require the installation of any third-party data base management system or other software. In terms of capacity, the acquired system must be able to provide database storage and access for at least 300,000 titles and support circulation control and record keeping for a minimum of 50,000 transactions per year.

Acquisition of a system that does not meet the requirements listed above would adversely impact the function of the Library in support of the Naval Postgraduate School's academic and research mission. A system that did not operate from a single integrated database would require duplicate data entry and multiple data files which in a large high-volume academic library could never be kept in synchronization. A system that did not offer support for all of the library functions listed above would require that the Government invest additional resources in developing the subsystems and functions not supported in the base product.

In 1983, William Saffady described the problems inherent in custom developed software:

> ... customized software development can prove to be a time-consuming and expensive activity that can result in significant delays in implementation and substantial costs. Post-implementation costs will likewise be incurred by the continuing requirement for software modification or other maintenance. As a result, customized system development is usually viewed as an implementation alternative of last resort, to be seriously considered only in those applications where other approaches to automated [functions] are clearly unacceptable. [Ref. 10: p. 271]

Obviously, the Library's requirements must be met by an existing software product, rather than by augmenting the software after purchase.

The Naval Postgraduate School's Computer Center operates in an IBM 370 environment. Two operating systems are supported: VM for general purpose timesharing and MVS for batch and transaction processing applications. The School also has an extensive network of IBM 327X terminals installed. Any system which did not operate in this environment and provide access from the existing terminal network would require acquisition and support of additional automatic data processing resources and the possible installation of a parallel data terminal network. This would be a costly undertaking.

Library and Computer Center staff members have conducted an extensive literature search to identify potential suppliers of computer-based integrated library support systems. Table 1 summarizes the results of this study, and the applicability of the systems to the Library's requirements.

Table 1. AVAILABLE IOLS SYSTEMS

	IBM CICS Compatible	RLIN Compatible	Hardware Other Software Required
NOTIS Systems, Inc. (NOTIS) 1007 Church Street Evanston, IL 60201-3622 (312) 866-0150	*	*	IBM 370
BIBLIO-TECHNIQUES, Inc. (BLIS) ** Out of business **		*	IBM 370 with third party database manager
ADVANCED Libraries & INFORMATION, Inc. (ALOHA) 2570 S. Beretania St., Suite 207 Honolulu, HI 96826 (808) 947-4441			IBM 370 with PICK Operating System
DATA RESEARCH ASSOCIATES, Inc. (ATLAS) 9270 Olive Blvd. St. Louis, MO 01775 (314) 432-1100			DIGITAL EQUIPMENT CORP.

	IBM CICS Compat-ible	RLIN Compat-ible	Hardware Other Software Required
COMSTOW INFORMATION SERVICES (BIBLIO-TECH) 301 Boxboro Road Stow, MA 01775 (617) 897-7163			DIGITAL EQUIPMENT CORP.
EYRING LIBRARY SYSTEMS (CARL) 5280 S. West, Suite E260 Salt Lake City, UT 84107 (801) 263-9200			TANDEM SYSTEMS
DYNIX INC. 1455 W. 820 North Provo, UT 84601 (801) 375-2770		*	IBM 370 with PICK Operating System
GEAC COMPUTERS, INC. (GEAC) 515 N. Washington Arlington, VA 22314 (703) 836-0225		*	Contractor furnished dedicated hardware
INLEX P.O. Box 1349 Monterey, CA 93942 (408) 646-9666		*	HEWLETT PACKARD 3000
INNOVATIVE INTERFACES 1409 5th St. Berkeley, CA 94710 (415) 644-3600		*	Contractor furnished dedicated hardware
LIAS PROGRAM OFFICE (LIAS) E511 Pattee Library Pennsylvania State University University Park, PA 16802 (814) 865-1858			HONEYWELL
CLSI, INC (LIBS 100) 1220 Washington St. West Newton, MA 02165 (617) 965-6310		*	DIGITAL EQUIPMENT CORP.
GEORGETOWN UNIVERSITY MEDICAL CENTER (LIS) 3900 Reservoir Road Washington, DC 20007 (207) 625-7673			DIGITAL EQUIPMENT CORP.
SOBECO GROUP, INC. (MULTILIS) 505 Dorchester Blvd West Montreal, Quebec, Canada (514) 878-9090			DIGITAL EQUIPMENT CORP.
UTLAS INTERNATIONAL (T SERIES 50) 1611 N. Kent St. Arlington, VA 22209 (703) 875-8678		*	TANDEM SYSTEMS

	IBM CICS Compat-ible	RLIN Compat-ible	Hardware Other Software Required
INFORMATION DIMENSIONS, INC. 655 Metro Place South Dublin, OH 43017 (614) 761-8083		*	IBM 370
UNIVERSAL LIBRARY SYSTEMS, LTD (ULISYS) 1609A Broadway Bellingham, WA 98225 (206) 767-4624			DIGITAL EQUIPMENT CORP.
McDONNELL DOUGLAS COMPUTER SYSTEMS (URICA) P.O. Box 19501 Irvine, CA 92713 (714) 250-1000			Contractor furnished dedicated hardware
VIRGINIA POLYTECHNIC INSTITUTE (VTLS) 416 Newman Library Blacksburg, VA 24061 (703) 961-0823			HEWLETT PACKARD 3000

Staff members also attended recent meetings of the American Library Association where they visited trade show booths of all offerors of these systems. Most vendors acknowledged that they were unable to meet the School's compatibility and operating environmental requirements. Professional contacts and telephone calls to other offerors by senior library staff members have substantiated the limited availability of a complete library support system which meets the School's needs.

Table 1 summarizes the results of the staff's study of computer based library support systems and their features. From the literature search and personal contacts described above, three systems were identified for more thorough investigation:

NOTIS Systems, Inc. (NOTIS)
Evanston, IL

BIBLIO-TECHNIQUES, Inc. (BLIS)
Olympia, WA

GEAC Computers, Inc. (GEAC)
Arlington, VA

E. COMPARISON OF REQUIREMENTS TO VENDOR SYSTEMS

In the following table (Table 2), the functional requirements of the Library are compared by vendor; additional information is taken from Appendix A in [Ref. 12]. Blanks in the table indicate that the information was not available.

Table 2. DETAILED COMPARISON BY VENDOR (PART 1)

REQUIREMENTS:	BLIS	GEAC	NOTIS
IBM Compatible	Yes	No	Yes
RLIN Compatible	Yes	Yes	Yes
ONSITE Training	Yes	Yes	Yes
Documentation Supplied	Yes	Yes	Yes
ON-LINE Catalog	Yes	Yes	Yes
AUTOMATED Circulation	No	Yes	Yes
BOOLEAN Searching of On-line Catalog	Yes	Yes	Yes
AUTOMATED Management Reports	Yes	Yes	Yes
Access via MENU or COMMANDS	Yes	Yes	Yes
Name, Subject AUTHORITY Control	Yes	Yes	Yes
GLOBAL Changes to Files			Yes
Inter-Library Loan Function	No	Yes	Yes
Show Status of each Record On-line			Yes
Catalog Update Overnight		Yes	
ON-LINE ORDER File for Monographs			Yes
SERIALS Checkin	No	Yes	Yes
CUSTOM REPORTS Definable	Yes		
STANDARD REPORTS Definable	Yes		
BUDGET Information Automated	Yes		
RESERVE Book Control			Yes
SCREEN Oriented	Yes	Yes	Yes
AUTOMATED ORDER Form Generation		Yes	Yes
AUTOMATIC CLAIMS/Cancellation			Yes
DOWNLOAD From RLIN	Yes	Yes	Yes
FULL MARC	Yes	Yes	Yes
MACHINE Access to ALL Records	Yes	Yes	Yes

Table 3. DETAILED COMPARISON BY VENDOR (PART 2)

REQUIREMENTS:	BLIS	GEAC	NOTIS
IOLS VENDOR Support for HARDWARE	No	Yes	No
IOLS VENDOR Support for SOFTWARE	Yes	Yes	Yes
CONTEXT-SPECIFIC ON-LINE HELP	Yes	No	Yes
SUPPORT for Software by Computer Center	No	No	Yes
Tape Loading of Bibliographic Records	Yes	Yes	Yes
MARC Database Match of Bib. Records	Yes	No	Yes
Adaptation of Bibliographic Records	No	Yes	Yes
Keyboarded Prompted Record Input	No	Yes	No
Blank Screen Fill-in Record Input	No	No	Yes
Form Fill-in Record Input	Yes	No	Yes
Customized Prompted Fill-in Record In	No	Yes	No
Batch Loading Item Records	Yes	Yes	Yes
Keyboarding Item Records	Yes	Yes	Yes
Lightwand Item Records	Yes	Yes	Yes
Error Checking Batch Mode, MARC Format	Yes	Yes	No
Error Checking Batch Mode, ISSN/ISBN	No	No	Yes
Error Checking Batch Mode, Barcode	Yes	Yes	No
Error Checking, Keyboarded, MARC Format	Yes	Yes	Yes
Error Checking, Keyboarded, ISSN/ISBN	No	No	Yes
Error Checking, Keyboarded, Barcode	Yes	Yes	Yes
Error Checking, Lightwand, Barcode	Yes	Yes	Yes
On-line Shelflist Search	Yes	Yes	Yes
Labeling Spine Labels	No	Yes	Yes

The NOTIS system designed and implemented in the library at Northwestern University is the system which best meets the designated Library requirements listed above. The NOTIS system operates in an MVS/CICS environment, is self-contained, does not require purchase of an additional database management system, is RLIN-compatible, and fully meets the needs of the library in terms of functional subsystems.

IV. COMPARISON OF IOLS CANDIDATES FOR BEST FIT

Considering the functional requirements the Library has established, and the twin constraints of IBM- and RLIN-compatibility, few IOLS systems on the market meet the criteria. BLIS, GEAC and NOTIS all support a critical mass of integrated local functions, are actually in use in libraries, and have been favorably reported in the literature.

These systems have also been recommended, with reservations, by the Research Libraries Group. RLG encourages its members to move toward a full function local system that supports an on-line public access catalog (OPAC), circulation control, serials control, automated support of acquisitions, cataloging with authority control, and interlibrary loan. These are the same functions valued by the Library, so RLG approval for BLIS, GEAC and NOTIS is encouraging.

Extensive cost-benefit analysis of BLIS and GEAC is non-productive, for both companies declared bankruptcy during the course of this research. NOTIS was the recommended choice based on supportability and cost in the initial comparison. It now appears to be "the only game in town". Initial cost comparisons in this section are 1984 costs, taken from the Carnegie Report to the RLG. 1988 costs for the NOTIS system are included in the next chapter.

A. BLIS

Biblio-Techniques, Inc., based in Olympia, Washington, marketed a vendor-supported "object code only" version of the software system owned and operated by the Washington Library Network (WLN). BLIS, the Biblio-Techniques Library and Information System, ran on IBM-compatible mainframes, and used 3270-compatible terminals with full MARC/ALA character sets. It could be installed using off-the-shelf hardware without user programming.

Although BLIS used IBM's DOS/VSE, VS1 or MVS as its operating system, it used Software AG of North America, Inc.'s ADABAS for a database management system, and their teleprocessing monitor COM-PLETE. COM-PLETE includes a terminal mapping utility that makes it easy to design custom input screens. Software AG also provides a report writer, called NATURAL, that makes report definition very flexible. All three software packages were used by BLIS.

All software was maintained by Biblio-Techniques over a remote teleprocessing link. New software releases were included in the monthly maintenance fee.

On-site training and documentation were provided by Biblio-Techniques. On-line help was "well designed, being context-specific and oriented toward directing the user toward correction". The on-line catalog had a public access interface which was "highly flexible and extremely well conceived". The authorities system was integrated into cataloging; full Boolean searching capability was supported. MARC formats were supported (except for Maps, Archives and Manuscripts). The acquisitions system provided "virtually complete procurement and fiscal capabilities, and [was] reasonably flexible". [Ref. 11: p. 18] Serials control and circulation control were not implemented. Figure 23 summarizes initial installation and maintenance costs for BLIS.

1984 COSTS	
Hardware	$448,000
Installation, documentation, training	17,500
Software licenses (incl. AG)	225,000
Annual software maintenance	$ 39,600
Annual hardware maintenance	40,740
TOTAL INITIAL COST	$770,840
ANNUAL MAINTENANCE COST	$ 80,340

Figure 23. BLIS System Costs - 1984 Dollars

During the course of this research, Biblio-Techniques has gone out of business.

B. GEAC

GEAC Computers, Inc., a Canadian company with U.S. offices in Arlington, Virginia, markets turnkey systems for libraries and financial institutions. It has a number of systems in production all over Europe and the U.S., including installations at the Naval Academy and at West Point.

GEAC manufactures its own computers. The multiprocessor model has a communications processor to manage attached terminals and printers, a disk processor to manage disk storage, and an applications processor. The operating system is unique to GEAC, as is ZOPL, the implementation language for both system and applications. The system requires 2-3 full-time employees for operations; operator documentation and procedures are available. Hardware maintenance is performed by GEAC; software diagnostics are provided for all supported software. Error corrections and functional enhancements to software are provided without charge.

Integration of the on-line catalog with data created in other subsystems "appears quite complete" [Ref. 11: p. 34]. All U.S. MARC formats are supported in database

searching. The full MARC/ALA character set is supported. Help screens are available whenever the user desires. Both tutorial mode and command modes are available. The authorities subsystem, the acquisitions system, and serials control are in place within the IOLS software. GEAC is well-known for its circulation support, according to the Carnegie Report [Ref. 11].

Figure 24 summarizes initial installation and maintenance costs for GEAC.

1984 COSTS	
GEAC CPU	$ 90,850
128K Memory (2)	11,460
Disk drives (2), 332MB	40,000
Tape drive, 100 IPS	6,800
Printer, 300 LPM	6,400
Dial-up modem	1,230
GEAC software	100,000
Installation & conversion	9,000
Software maintenance	10,800
Hardware maintenance	16,080
INITIAL TOTAL COST	$292,620
ANNUAL MAINTENANCE COST	$ 26,880

Figure 24. GEAC System Costs - 1984 Dollars

GEAC meets many of the constraints and requirements listed above although it is not IBM-compatible. Installation of this system would require acquisition of an additional complete ADP complex and terminal network. GEAC's recent bankruptcy effectively removes the company from consideration.

C. NOTIS

The NOTIS system has been designed and implemented in the Library at Northwestern University, which markets the system and assists in installation and training. It has been installed in over one hundred libraries world-wide, and is the current choice for installation at the Naval War College.

NOTIS is RLIN-compatible and IBM-compatible. It uses IBM's DOS VSE or MVS operating systems, and IBM's CICS transaction monitor. The VSAM access method is used as a record manager; VTAM is the access method to support terminal communications. On-line support is in IBM 370 Assembler language and in PL/1. The Computer Center is familiar with each of these IBM products, and can provide support for them. Hardware can be installed from off-the-shelf components, but software is likely to require tailoring.

Hardware maintenance is provided by the hardware vendor. NOTIS software maintenance includes all enhancements to the product and its documentation. Telephone support is provided for trouble-shooting, problem isolation and correction; this service is both competent and friendly. (My call was promptly returned and questions were fielded professionally.) NOTIS provides 15 days of training to every new user, with a software engineer on-site during installation (2-3 days) and on-site training scheduled on demand.

The Carnegie Report [Ref. 11] was positive about several aspects of NOTIS:

> Help screens are context-specific, and are designed to assist the user in solving the immediate problem. ... NOTIS is designed to complement or enhance efficient work flow: input, update screens are cleanly presented, multi-screen transitions are minimized for any given function, and prompts and defaults reflect a real understanding of library practices. [Ref. 11: p. 44]
>
> The patron access component is well-constructed, with straightforward tutorial facilities and very simple syntax. [Ref. 11: p. 45]

The authorities control module, acquisitions module, serials check-in module, and circulation system are in place within the IOLS software. Global changes are possible; Boolean searching is available. The InterLibrary Loan (ILL) function is limited, but because it shows the item status and date due in the on-line record, it meets the Library's functional requirement.

Figure 25 summarizes initial installation and maintenance costs for NOTIS.

1984 COSTS	
IBM 4321 CPU, 1MB	$ 60,342
System console	2,988
Maintenance terminal	1,462
Disk drives (2), 371MB	52,768
Tape drives (2)	18,279
Line printer, 650 LPM	28,794
IBM software licenses	17,000
NOTIS software licenses	58,000
SAS licenses (reports)	8,500
IBM rentals	3,540
NOTIS maintenance	7,000
SAS maintenance	595
Hardware maintenance	17,886
INITIAL COST	$277,154
ANNUAL MAINTENANCE COST	$ 25,481

Figure 25. NOTIS System Costs - 1984 Dollars

The conclusion of the technical staff of the School, based upon literature search and personal contacts, plus initial cost analysis, is that NOTIS is the single responsible source for integrated library software that meets the School's requirements.

V. RECOMMENDED IOLS: NOTIS

Normally several possible alternatives are valid in any feasibility study, with one option being recommended. In this case, there is a single valid IOLS to be recommmended, as other alternatives are unacceptable, or currently unavailable. If the Library decides to automate, and if an IOLS is installed, NOTIS is the clear choice.

A. NOTIS SYNOPSIS

NOTIS, Inc. is 22 months old as a standalone company, but it has 15 years of development history as part of Northwestern University's library system. Its primary product is an integrated, on-line library management system; future developments will feature remote linkages between library holdings and informational databases using the same search software which now supports bibliographic searching. A "scholars' workstation" with access to Chem Abstracts, ERIC, Medline, etc., using the standard user interface now present in the existing on-line catalog, is NOTIS, Inc.'s goal.

Figure 26 summarizes the growth of NOTIS Inc.

	1988	1987	1986
Revenue	$5M		
Installed Systems:			
Academic	73	N/A	N/A
Corporate/Special	7		
State/National	6		
Public	6		
Consortia	7		
School	2		
Total Installed Systems	101	81	57
Staff:			
Customer Services:			
System Engineering	9	N/A	N/A
User Services	11		
Conversion	8		
Documentation	4		
Development	17		
Marketing	5		
Admininstration	7		
Total Staff	72	47	

Figure 26. Growth of NOTIS Inc.

At the NOTIS Users' Group Meeting, in June of 1988, Library and Computer Center staff members met with representatives from many libraries already using NOTIS. In general, the NOTIS users interviewed had a favorable opinion of NOTIS. IBM installations said it is the "only product available" and is "the best for their purposes". The consensus of opinion was that NOTIS is a very efficient, well supported, and fully functional IOLS.

The annual maintenance fee covers all enhancements, including the new releases which come out about twice a year. Release 4.5 will be available in late 1988. Twenty-three modules will be added, with an increase in processor utilization of about 5% over Release 4.4. The highlight of Release 4.5 is increased performance in keyword Boolean searching, which is said by NOTIS, Inc. to be three times faster in execution and display of search results than in previous releases; no additional memory is required for this increased performance. Users testing the new software confirmed NOTIS Inc.'s statement of increased search speed.

1. Size of System Required

According to the NOTIS and IBM representatives, the size of files to support a NOTIS IOLS for a collection of approximately 300,000 titles and an annual circulation of approximately 50,000 is as shown in Figure 27.

NOTIS Software (program libraries, workspace)	200MB
Other Software (MVS, CICS, PL/1 Libraries, SAS...)	200MB
TOTAL SOFTWARE REQUIREMENTS	400MB
DATABASE	
Catalog (3,000 bytes per record per title) (includes Boolean keywords; 300,000 records)	900MB
Authority Records (800 bytes per record) (name, subject, series; 501,529 records)	401.2MB
Order Records (400 bytes per record) (10,000 orders per year)	4MB
Circulation Records (100 bytes per record) (50,000 circulations p/yr for 10 years)	50MB
Patron Records (650 bytes per record) (about 4750 patrons, growing 2-5% p/yr)	5MB
Vendor Records (300 bytes per record) (250 vendors, publishers)	1MB
TOTAL DATABASE DASD REQUIRED	1361.2MB
TOTAL SYSTEM DASD REQUIRED	1761.2MB

Figure 27. NOTIS System Size - DASD Requirements

The eight 3350 DASDs proposed for the system have a combined capacity of 2536MB. This covers the initial requirements and the projected growth of files indicated above for archival use (Bibliographic data, Circulation, Patron records), and provides additional space for application programs such as report generators, statistical archives, etc. Tape will be used to archive old historical files that do not need to be on the DASD.

B. BENEFITS

Direct cost benefits of the IOLS exceed $91,000 the first year; each year thereafter realizes another $73,200 in documented benefits. The estimated value of intangible benefits is $83,930 a year.

1. Direct Benefits of an IOLS

> The most serious deficiency of automation in the Catalog Division is our dependence upon a card catalog. A great deal of time is expended in filing cards for new books; even more time is spent on catalog maintenance. New holdings must be added to shelflists, and headings frequently change. Each addition or change means that cards must be pulled, corrected, and re-filed. -- Bobbie Carr, Head of the Bibliographic Control Division, 1986.

Since 1979, the Dudley Knox Library has paid an average of $1,604.31 every year to purchase catalog cards from RLIN. This cost will be unnecessary with an IOLS. Implementation of an on-line catalog will also eliminate the 9 hours per week of professional time spent filing catalog cards, and the 13 hours per week of professional cataloger's time spent on catalog maintenance. This is equivalent to adding an additional half-time professional to the staff, in terms of available man-hours. The average hourly wage of a cataloger in the Library (2 GS-9s, 1 GS-11, 1 GS-12) is $13.71 per hour; the present cost to the Library is $15,684.24 per year just for filing and card maintenance in the card catalog. Rather than eliminating half of a full-time employee, the Cataloging Division will use the reclaimed time to do jobs -- like rare book cataloging, analytics, shelf-reading, weeding the collection of little-used materials -- that simply cannot be done now. More thorough original cataloging of NPS theses is another goal of the Bibliographic Control Division, when time is freed from catalog maintenance. Bobbie Carr even envisions the end of the cataloging backlog that has been an institution in the Library for the past ten years.

There are an estimated 2500 volumes in the cataloging backlog. According to Acquisitions Librarian Mary Kuntsal, a conservative estimate of the average purchase price for each volume is $37.00. The minimum cost paid for the books in the backlog is $92,500. The IOLS, in speeding the availability of the backlog, will make $92,500

worth of research materials accessible at no additional cost to the School. Information has a time value. A book, especially in the fields of science and technology, is most useful in the first three to five years after it is published. The recurring value of having the books available 18 months sooner with the IOLS than they would have been with the manual system is $34,687 per year. (18 months is 37.5% of the average four-year lifespan of a technical book; 37.5% of $92,500 is $34,687.) The benefit is recurring because, with the IOLS in place, the backlog is prevented from developing.

At present, the Circulation Desk clerk must count the previous day's circulation every morning, then sort the book cards and file them. Each item has two cards in the pocket: the blue card is filed in call number order, and the white card is filed behind the library patron's id number. There are between 125-150 cards to be filed on a typical day. Cards accumulate over the weekend, so that Friday, Saturday and Sunday's circulation cards are counted and filed on Monday morning. An average Saturday produces 80 cards, while Sunday numbers 60. It is not unusual for the card filing on Mondays to take two hours. Other week days range between 45 minutes to 1 1/2 hours of filing time.

The Library cost of counting circulation by hand and then filing the book cards is $2,434 per year, given the average 6.5 hours per week of filing time and an hourly cost for a GS-4 employee of $7.20. With the IOLS, not only would this cost be saved, but the automatically generated circulation "counts" would be more accurate, more readily available for reporting, and more easily divided into groups and subgroups for statistical analysis, *i.e.* percentage of students using QA-prefixed call numbers in relation to total student circulation. Use patterns captured by circulation statistics are powerful tools for better collection management.

Book cards are not used with an IOLS. Pockets for cards are also unnecessary. The $854 average cost per year of purchasing all cards and pockets would be immediately saved.

The Circulation Desk clerk would be able to display what each patron has checked out by issuing one command at the terminal; the patron who wants an inventory of his/her library materials could get a printout of this display. Lists of materials for which a patron is responsible are not now prepared, because of the time and effort involved in their generation. If such a printed inventory helped locate a forgotten book for even 1% of the patron population every year, it could save $1,000 a year in "lost books". (1% of 2700 users is 27 people; 27 lost books at an average cost per book of $37.00 is $999.) Given the transient nature of the student population, this estimate of savings is probably conservative. Too often, by the time a student checks out of the

Library and finds that he/she has not returned all the materials that have been checked out, the movers have already packed the household goods and there is no way to search for the missing item(s).

Each book has identifying information typed on the blue card, white card, and book pocket in a standard format. Processing clerks spend 16-18 hours a week physically preparing library materials for display or shelving. This work is then checked by a supervisor. Bobbie Carr estimates that clerical time for processing cards and pockets is 750 hours a year. At an average processing cost per hour of $7.86, (1 GS-6 supervisor, 1 GS-5 and 2 GS-4 clerks), the Library would gain $5895 worth of available time every year, since the IOLS does not use cards and pockets.

The Periodicals Librarian (GS-9) spends roughly one-third of his/her time on updating holdings, bindery work, and record keeping for serials. This work is largely duplicated in Acquisitons and would be unnecessary with NOTIS. The released time for the Periodicals Librarian is worth $8,487 ($12.20 per hour x 696 hours per year, one third of the 2087 hours per year used by the Government for standard pay purposes).

Eventual removal of the card catalog cases would free 506 square feet of Library floorspace. The terminal clusters that will replace the card catalogs for patron searching of the OPAC would take approximately 360 square feet, leaving a net gain of 146 square feet. The value of this one-time gain is $17,812, based on the actual $122 per square foot cost of the proposed Library expansion (now in the approval process).

The switch to an IOLS, and the eventual closing of the card catalog would save space. Additional lobby floorspace would enable Reader Services to rearrange the Reference Desk and provide more convenient access to desktop reference books and display cases. It would also allow more flexible positioning of the security checkpoints.

Other direct savings can be ascribed to the IOLS. At present there are over 10,000 items on the "missing issues" list, which chronicles periodicals that must be acquired before binding can take place. Items may be missing because they were stolen or mutilated, because back runs were donated to the Library incomplete, or because the issue was never received on subscription. Acquisitions Librarian Sharon Serzan believes that at least 10% of the missing issues fall into the last category--items that the Library paid for but were not received. Each back issue purchased from USBE costs a minimum of $5.84 (not including the time it takes to order it). Bound volumes are $9.00 each. The minimum total cost to replace all missing issues comes to $58,400; ten percent, or $5,840, represents the savings to the Library if automated claims had been in place.

The missing issues list grows at an estimated rate of 1115 items per year. The IOLS, by automatically claiming all items not received on subscription, would prevent 10% of the missing issues from ever appearing on the list. The savings to the Library for these 116 items would be $677 annually. This would be a recurring benefit.

A GS-4 clerk in Acquisitions claims an average 10 issues a week from among the 1830 periodical titles currently received by the Library. Each claim takes between 10-30 minutes, with foreign titles taking even longer. Some claims must be repeated several times. At an average 20 minutes per claim, with a follow-up on half the cases, the labor cost to the Library for claiming periodical issues not received on schedule is $1872 per year. This cost is separate from missing issues that are never noticed and therefore never claimed. Automatic claiming would free this time for other work.

The total value to the Library of having automatic claiming would be $2549 each year. ($1872 claim time saved + $677 missing issues = $2549).

Direct cost savings discussed above exceed $91K (see Figure 28). This total represents actual cost savings, as well as money already spent by the Library for which the IOLS would return a fuller value. Release time value and missing issues savings are recurring benefits; they would continue to profit the Library during the entire life cycle of the IOLS.

DIRECT COST SAVINGS	RECURRING ANNUALLY	ONE-TIME
Catalog Card Purchase	$ 1,604	$
Catalog Filing and Maintenance	15,684	
Backlog Book Availability	34,687	
Circulation Filing	2,434	
Book Cards and Pockets Purchase	854	
Inventory of Checked-out Items	1,000	
Processing Book Cards and Pockets	5,895	
Periodicals Librarian Time	8,487	
Library Floor Space		17,812
Automatic Claiming	2,549	
Subtotals	73,194	17,812
TOTAL BENEFIT	$ 91,006	

Figure 28. Summary of Direct Benefits of IOLS

2. Indirect Benefits of an IOLS

Indirect benefits of the IOLS are as real as the direct benefits. Students and faculty alike would profit from concomitant IOLS support of managed collection development, increased intellectual organization, more searchable access points in bibliographic records, improved currency, and faster processing of materials.

The Library is the heart of graduate education. The mission of the Dudley Knox Library is "to achieve the highest standards of library service on behalf of the faculty, student body, and staff and thereby support in a vital manner the academic and research programs of the Naval Postgraduate School." The current reliance on traditional manual processes is a handicap to achievement of the level of support the Library is mandated by its accrediting body to provide.

More readily accessible bibliographic data in an on-line public access catalog would be a boon to all users of the Library. Information in the collection would be easier to find. Circulation would be faster. Patron requests for status of individual items would be handled without delay or reliance on physical searching in the stacks and shelving/sorting areas. Lists of items charged to a patron would be equally available, on demand. Detailed, accurate statistics of use would enable a more balanced collection development program. Current fiscal accounting data would enable more effective control of funds. Integration of information and automatic collection of statistical data would result in better management decisions, more accurate control, and less disruption of bibliographic processes. Administrative records would be more complete, more accurate, and more timely. This amounts to better overall support for the academic and research programs of the Naval Postgraduate School.

> When we refer to improved library services, we make a number of statements: we wish to make more documents available, we wish to interpose as few barriers to effective use as possible, we wish to keep the operating costs as low as possible and divert funds to more effective collections, and we want these publications to be available as soon after their appearance as possible. [Ref. 3: p. 92]

> Automation almost always speeds the rate at which work is performed by relieving the staff of repetitive chores, improving the accuracy and integrity of files, eliminating the multiple entry of data, and facilitating the reformatting of data to accommodate changing needs. [Ref. 8: p. 11]

General benefits of the integrated system are summarized in Figure 29. The aggregate benefits suggest improved use of the Library and better service. Each intangible benefit can be assigned an average value for the purposes of cost benefit analysis.

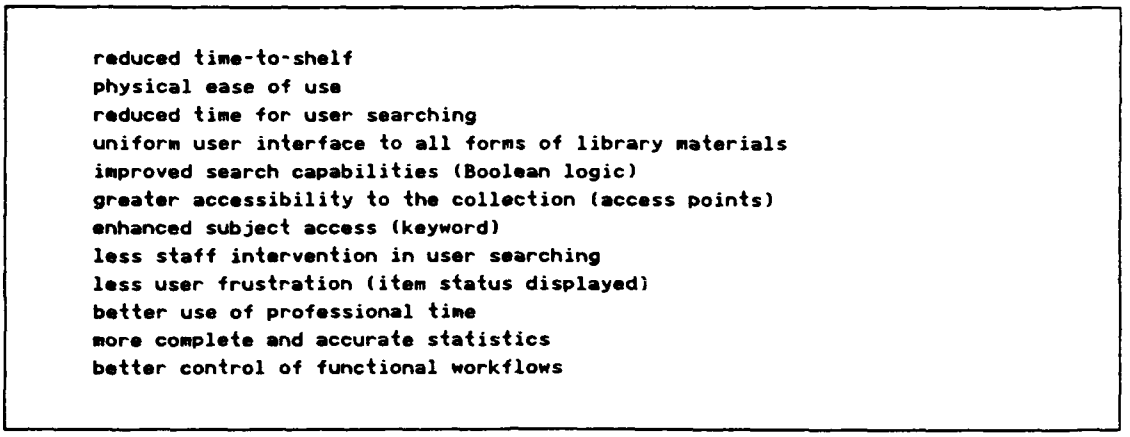


Figure 29. Intangible Benefits of IOLS

Better statistics support both administrative functions and improved collection management. Accurate order circulation figures enable Reader Services to track demand and usage patterns. If a particular title is recalled every time it comes due, because patrons are waiting in line for the book, a second or even third copy may be needed. An item borrowed several times from another library may need to be evaluated for purchase. A demand trend for a subject, rather than a title, may signal a weak area in the collection that needs special attention. Complete and accurate statistics make these demands visible, thereby enabling active collection management.

The Library spent $3,000 for Inter-Library Loan (ILL) fees in 1988, and $3,540 for ILL fees in 1987, in order to obtain information not found in the local collections. The equivalent of one full-time employee (half of a GS-9's and half of a GS-6's time) is needed to support ILL activities. Assume that ILL activity is reduced 10% as a result of active collection management. The reduction in borrowing would save an average $327 in fees annually, but more importantly would release 4 hours a week of personnel time for other work. Total annual savings for the Library would be $2530. ($10.59 per hour x 208 hours per year = $2203, plus $327 in fees.)

Having information resources available when needed, which is the result of active collection management, saves the 4-6 weeks it would take to order the material for a patron. Active collection management saves the 2-4 weeks it takes to borrow an item from another library. It also saves a great deal of frustration.

To estimate a value for collection management, assume that 10% of the InterLibrary Loans (3052 in 1988) would be unnecessary, thereby saving an average

3-week wait per patron. Also assume that 1% of the user population would not have to wait 5 weeks while an order was placed for needed materials. So far, 42,000 hours of user wait time would be avoided. (305 ILL not needed x 120 hours (3 weeks) = 36,600 hours saved; 27 users x 200 hours (5 weeks) = 5400 hours saved; 36,600 + 5400 = 42,000). If the convenience value of *having* library materials rather than *waiting* for library materials is set at $0.10 per hour, the total value of improved collection management would be $4,200. This $4,200 is the estimated value for improved collection management due to the IOLS-generated statistics.

Each of the affected users saved another half hour by not having to search for complete bibliographic information and then not having to fill out the requisite forms for obtaining the item(s); this 166 hours can be added to the total manhours saved below.

Management reports, based on statistics generated automatically by the daily functioning of the IOLS, are both more accurate and more detailed than manual reports. Depending upon need, IOLS reports generated can include all details of transactions from every department, summaries over a given time period, or exception reports that simply highlight error or non-standard situations that need attention. In a study of the benefits of automation, hours needed to produce manual reports were compared to hours needed to prepare reports with a computer; the study concluded that for every dollar spent for data processing, $2.40 must be spent for manual processing [Ref. 13: p. 99]. Other benefits, such as fewer delays, earlier preparation, and quick response to inquiries, were also noted.

The Library estimates that at least 196 staff hours are spent in preparation of manual reports every year. Most of the responsibility for report generation falls at the highest professional levels (an estimated 108 hours is spent by the Associate Librarian (GS-13); 64 hours is spent by Division Heads (GS-12)). These 196 hours cost the Library an estimated $3,592 in hourly wages. For each $2.40 of this figure, only $1.00 would be required with the IOLS' automated management reports, by extension of [Ref. 13: p. 99]. The total savings would be $1,497.

The primary benefit of ease of use, more points of access to library materials, and faster user searching, is time saved for the user. In a test of NOTIS done at the Naval Postgraduate School, using a database of over 34,000 bibliographic records, a keyword Boolean search was entered for "library and automation". It took exactly 10 seconds for NOTIS to generate a list of 66 items that satisfied the search, and to display a brief identification of each at the terminal. Detailed descriptive catalog records were

available at the touch of one key, with no discernable delay. To prepare a bibliography of this scope using the manual card catalog would have taken at least an hour, and it is unlikely that all access points would have been found. Another search for "computers and math" located a single item, *Combinatorics for Computer Science*, by S. Gill Williamson, that would *never* have been found in a manual search, either by author, title, or subject, as it was identified by the series statement ["Computers and Math Series"]. There is research value in both the breadth of search capability and in the specific access provided by the IOLS.

If every faculty member saved an hour once a quarter in preparing a search for classroom preparation or for research, and if every student saved an hour once a quarter in his preparation for a class assignment or for thesis work, the total hours saved would be 2076, *every quarter*. That is 8304 manhours per year.

Once the IOLS is fully operational, and the campus network is in place, any user on a PC, LAN, or terminal would be able to search the OPAC from his/her own office or from home. Library access from home probably saves an average of a half-hour of transportation time per access, since there is no transit time involved. Access from an NPS office would save approximately 15 minutes per access. If every faculty member and every student library patron accessed once from home and once from another NPS location only *once a year*, the total time saved would be 1557 hours.

The average hourly wage for faculty, according to the Comptroller's Office, is $27.13 (not including fringe benefit costs). The Disbursing Office identified the "average NPS student" as an "O-3 over 4", that is, a Navy Lieutenant with more than four years of service, with an hourly wage of $18.55 (including no special duty pay).

Figuring (hourly wage)x(hours saved), the value of IOLS access for research use at NPS is $75,703. This is a recurring benefit to the scholarly community at the Naval Postgraduate School, and to the Government it serves. Research time saved has a significant dollar value.

Indirect benefits of the IOLS are summarized in Figure 30.

INDIRECT COST SAVINGS	RECURRING ANNUALLY	ONE-TIME
ILL Reduction	$ 2,530	$
Collection Management	4,200	
Reports	1,497	
Research Time Saved	75,703	
Subtotals	83,930	0
TOTAL BENEFIT	$ 83,930	

Figure 30. Summary of Indirect Benefits of IOLS

Approximately 1775 students attend the Naval Postgraduate School. The costs of their graduate education average $10,700 apiece (in direct support). Even without considering the value of IOLS benefits, the total projected cost of purchasing, installing, and maintaining NOTIS would add only $48 (.4% increase) to the cost of support per student per year over the projected life cycle of the IOLS.

3. Total Benefits

Estimated direct benefits and indirect benefits accruing to the Library as a result of the IOLS and its associated effects total $174,936. All but $17,800 are recurring benefits. See Figure 31 for a tabular summary of discounted benefits over the life of the project.

PROJECT YEAR	NON-RECURRING BENEFITS	+	RECURRING BENEFITS	=	ANNUAL BENEFIT	10% ** DISCOUNT FACTOR	DISCOUNTED ANNUAL BENEFIT
1	$ 17.8K		$157.1K		$174.9K	.954	$166.9K
2			165.0K*		165.0K	.867	143.0K
3			173.2K*		173.2K	.788	136.5K
4			181.9K*		181.9K	.717	130.4K
5			191.0K*		191.0K	.652	124.5K
6			200.5K*		200.5K	.592	118.7K
7			210.6K*		210.6K	.538	113.3K
8			221.1K*		221.1K	.489	108.1K
9			232.2K*		232.2K	.445	103.3K
10			243.8K*		243.8K	.405	98.7K
							=======
TOTAL 10-YEAR PROJECT BENEFITS (Discounted)							$1,243.4K

* 5% inflation added
** equal to 5% real rate plus 5% for expected inflation

Figure 31. Present Value Benefits for NOTIS System

The total non-recurring discounted benefit for the ten year life cycle is $17.0K. Discounted recurring benefits of the IOLS total $1,226.4K.

C. COSTS

Faculty and administrators must accept and support the library's growing need to spend money, not only for traditional books and journals, but also for computer systems, telecommunication, network participation, and to pay the various charges

and fees that go with access to information in new ways and new forms. [Ref. 14: p. 1205]

To minimize costs, the Library is retaining obsolete Computer Center equipment, rather than declaring it surplus and removing it. This is the basis for the No Cost (N C) entries in the cost analysis; see Figure 32 and Figure 33.

1988 COSTS

Component Description	Purchase Price	Maintenance Cost (Annual)
HARDWARE:		
Processor (4381; 8MB Memory)	N/C	9K (750 p/mo.)
System Console	2K	(incl.)
Terminals (3163: 23 @ $681 ea)	15.7K	1K (45 p/yr ea.)
Terminal Controller (3174: 2 @ 9K)	18K	.5K (264 p/yr. ea.)
Tape Drives (3420; 2 @ N/C)	N/C	8.8K (365 p/mo. ea.)
Disk Drives (3350; 8 @ N/C)	N/C	18.3K (190 p/mo. ea.)
DASD Controller (3830 @ N/C)	N/C	2K (160 p/mo. ea.)
Line Printer (4245; 2000 LPM)	27K	8.6K (715 p/mo.)
Tapes, Tape Cabinet	2.5K	
TOTAL HARDWARE COST	65.2K	48.2K
SOFTWARE:		
NOTIS Software License	95K	15K (1st yr. free)
MARC Record Conversion	18K	(incl.)
Item Conversion (NOTIS)	5K	(incl.)
Report Writer Software License (SAS)	8.5K	.6K
CICS Processor License	5K	1.6K
MVS/370 DFP License	1.4K	.5K
MVS/SP JES3 License	N/C	2.2K
ACF/VTAM License	4.4K	1.5K
PL/1 Processor License	N/C	.3K
TOTAL SOFTWARE COST	137.3K	6.7K (1st year)
TOTAL INITIAL COST	202.5K	69.9K
INCREMENTAL COST (Final System Size):		
Additional Terminals (27 @ $681 ea.)	18.4K	1.2K
Replacement Tapes		2K
Hardware Maintenance		48.2K
Software Maintenance		22.9K
TOTAL ANNUAL MAINTENANCE COST		73.1K
Systems Librarian		38.8K
TOTAL ANNUAL OPERATING COST		111.9K

Figure 32. Gross Cost of Implementing NOTIS with No Pre-Existing System

The "Systems Librarian" is a GS-12 position that supports all phases of automation within the Library. As envisioned, this person will report directly to the Associate Librarian, and be responsible for planning and coordinating automation activities for the entire Library. This person will supply "in-house expertise" for the IOLS, and will be responsible for a formal, well-organized training program. The Automation Committee will be chaired by the Systems Librarian; each Division will have a member on the

Committee to help implement policy decisions in its functional area. Systems analysis, workflow analysis and design, development of documentation, liaison with the Computer Center, troubleshooting, and procedural training will all be part of the position. The Library does not have a Systems Librarian at present, but the need has been recognized for the past several years. The proposed life cycle costs include expenses to support this position.

> It is commonly accepted that automation allows efficient and accurate sharing of bibliographic information, but the extent to which it leads to savings in staff time or enables a less expensive staffing configuration has been a matter of some debate. In part because of the natural tendency not to relinquish budgeted staff positions, but to try instead to do additional tasks with existing personnel, the number of staff is often not reduced after introducing automation, although assignments may be substantially altered. [Ref. 15: p. 69]

This analysis makes no prediction of staff reduction at NPS as a result of IOLS installation. At Northwestern University, where NOTIS was developed and where it has been in place since 1970, a "substantial cost savings" has resulted from the "relocation, reclassification, and elimination" of staff positions. "There are currently 17 librarians and 45.44 support staff carrying out the technical services activities previously handled by 19.5 professionals and 50.97 support staff." [Ref. 15: p. 74] Annual savings at Northwestern total $86,393 [Ref. 15: p. 76]. While staff reorganization at NPS may allow an existing librarian to assume the duties of System Librarian, thus saving 44% of the projected recurring costs of the entire project, no assumption is made that this will occur.

D. ECONOMIC ANALYSIS OF COSTS

Present Value Analysis is "a means of bringing all future costs and benefits back to their present worths. This technique is employed in economic analyses whenever the economic life is greater than three years." [Ref. 16: p. 2-7] Planning for the IOLS is based on ten years, since a computer-based library system represents a long-term commitment and will be used into the foreseeable future.

The costs in Figure 32 include licensing and maintenance fees that would be incurred by the Computer Center whether or not an IOLS were installed, so are truly "gross annual operating costs". The CPU is not totally dedicated to IOLS support, being shared with other CICS production systems. SAS, CICS, MVS, VTAM and PL 1 software are similarly available to all users of the IBM mainframe complex. Tape drives are used for all Computer Center jobs. Although available for Library use, these

resources are not dedicated solely to this application. Therefore, it is reasonable to exclude these costs from further analysis.

Only the 3350's are dedicated to IOLS support, so it is fitting to charge the Library for these support costs. Direct total costs to be borne by the Library are nearly $25K less than gross support costs cited above. Figure 33 shows the relevant costs for an existing data center to add IOLS support to its current systems. It reflects the actual cost of implementing NOTIS; these figures will be used for present value analysis.

1988 COSTS

Component Description	Purchase Price	Maintenance Cost (Annual)	
HARDWARE:			
Terminals (3163; 23 @ $681 ea)	15.7K	1K	(45 p/yr ea.)
Terminal Controller (3174; 2 @ 9K)	18K	.5K	(264 p/yr. ea.)
Disk Drives (3350; 8 @ N/C)	N/C	18.3K	(190 p/mo. ea.)
DASD Controller (3830 @ N/C)	N/C	2K	(160 p/mo. ea.)
Line Printer (4245; 2000 LPM)	27K	8.6K	(715 p/mo.)
Tapes, Tape Cabinet	2.5K		
TOTAL HARDWARE COST	63.2K	30.4K	
SOFTWARE:			
NOTIS Software License	95K	15K	(1st yr. free)
MARC Record Conversion	18K	(incl.)	
Item Conversion (NOTIS)	5K	(incl.)	
TOTAL SOFTWARE COST	118K	0	(1st year)
TOTAL INITIAL COST	181.2K	30.4K	
INCREMENTAL COST (Final System Size):			
Additional Terminals (27 @ $681 ea)	18.4K	1.2K	
TOTAL SYSTEM COST	199.6K	46.6K	
Replacement Tapes		2K	
Hardware Maintenance		31.6K	
Software Maintenance		15.0K	
TOTAL ANNUAL COST		48.6K	
Systems Librarian		38.8K	
TOTAL ANNUAL OPERATING COST		87.4K	

Figure 33. Relevant Costs of Implementing NOTIS on an Existing System

By the nature of the system being acquired, the commitment to a computer-based library support system is a long-term one. The costs of database conversion and user training mitigate against changing systems except for the most compelling reasons. The IOLS will have an economic life of ten years. This is a long-term project, but to figure costs for longer than ten years is unrealistic. Technology changes so rapidly that a ten-year span is as far into the future as can be reasonably estimated. A 5% inflation factor has been added to the recurring maintenance costs, beginning with Project Year 2. This

figure is the heuristic value recommended by Dr. David R. Henderson, Naval Postgraduate School professor of Administrative Sciences.

Software and hardware maintenance costs are difficult to predict, but more importantly, the age of the current hardware used in the support configuration is such that it is certain to be replaced within a decade. It is reasonable to assume that the costs per megabyte of storage will continue to fall dramatically, and that it will be economically feasible to replace existing 3350s with new and faster DASD. The purchase price will be offset by lower maintenance costs. The same may be true of terminal support, printers, etc.

Figure 34 describes the discounted life-cycle costs for NOTIS.

	Non-Recurring		Recurring		10%	
Project Year	R&D	Investment +	Operations =	Annual Costs	Discount Factor	Discounted Annual Cost
1	$31K	$181.2K+	$ 30.4K	$242.6K	.954	$239.8K
2		18.4K++	91.8K*	110.2K	.867	96.3K
3			96.4K*	96.4K	.788	76.0K
4			101.2K*	101.2K	.717	72.6K
5			106.3K*	106.3K	.652	69.3K
6			111.6K*	111.6K	.592	66.1K
7			117.2K*	117.2K	.538	63.1K
8			123.1K*	123.1K	.489	60.2K
9			129.3K*	129.3K	.445	57.5K
10			135.8K*	135.8K	.405	55.9K
						=======
TOTAL 10-YEAR PROJECT COST (Discounted)						$856.8K

\+ not discounted because paid up-front
++ discounted by 1/1.10 because paid at beginning of 2nd year
* 5% inflation added

Figure 34. Present Value Costs for NOTIS System

The total present value non-recurring cost for the ten year cycle is $227.5K. Discounted maintenance totals $629.3K. Maintenance is 73% of the project's life cycle costs. According to LCDR Bob Knight, an instructor at the Naval Postgraduate School who has fifteen years of experience in project management and information resource management within the Department of Defense, "the Fleet averages 80%" for maintenance costs on long-term projects. Since the hardware is primarily "no cost", the percentage is relatively higher than it would be if the non-recurring investment reflected

purchase costs for the CPU and disk drives. The age of the hardware DASD designated for Library support is another factor tending to raise maintenance costs.

A full 44% of the recurring costs over the project's life are due to the personnel costs of the proposed Systems Librarian, a GS-12 position which does not yet exist, and for which no billet points are available. However, this position is strongly recommended to support the IOLS, and so has been included in estimated costs. Expense for the Systems Librarian includes a starting salary of $32,567, plus 19% of the base salary for fringe benefits cost, as recommended by the NPS Comptroller's Office. Annual raises of 5% per year are reflected in Figure 34.

The only available option for establishing an IOLS at NPS, other than acquisition of NOTIS, would be a detailed functional specification of great complexity which specified processing requirements down to the basic process flow and data element level. This specification would allow the custom programming of a library support system. The cost to develop this specification and follow-on costs, including development of benchmark performance and capability tests to insure that the specification was met, would clearly exceed the cost of a standard off-the-shelf package. The development time for such a specification and testing protocol would be measured in years. Additional concerns about on-going support and maintenance of a custom designed and programmed package make this option definitely not in the best interest of the Government.

Total present value costs for the IOLS 10-year life cycle are estimated to be $856.8K. This represents the costs of purchasing and installing NOTIS software on the existing NPS mainframe computer, of purchasing hardware, services, and supplies to support NOTIS, and of purchasing maintenance for both hardware and software. See Figure 33.

Total present value benefits for the NOTIS life cycle exceed $1,243.4K. These values accrue from both direct and indirect cost savings, detailed in Figure 28, and Figure 30.

The present value of the benefits substantially exceeds the present value of the costs for the project. Therefore, investment in NOTIS should be made.

VI. RECOMMENDED IMPLEMENTATION PLAN

It goes without saying that automation is supposed to reduce the number of staff required to do the same amount of work. That is, after all, the whole idea of automation.

One must consider, however, that this potential reduction will not be effected until the system is in full production, all modules running full tilt, all conversion complete. The implementation plan must be based on the current staffing levels and the realistic appraisal of what staff can be allocated to the implementation process.

There may be numerous projects involving manual to machine data conversion. Probably, there will be areas of the machine readable data that will require clean up work. There will be the seemingly endless meetings and task forces that cut into the normal work time. All these things must be considered in developing the implementation plan. [Ref. 17: p. A.4]

A. PROJECTED SCHEDULE

The official NOTIS installation schedule takes approximately 18 months (see Figure 35), and includes a great deal of time for customization and gradual implementation, with on-line circulation one of the last modules to become operational.

LIFE CYCLE STEPS	PERSONNEL TIME	PROJECTED SCHEDULE	ELAPSED TIME	ESTIMATED COST*
Feasibility	.5MM	|-|	1 Month	$ 1.25K
Analysis	1MM	|---|	3 Months	2.5K
Contract Negotiation	2MM	|---|	3 Months	5.0K
Initial Installation	.1MM	|-|	.5 Months	181.5K
Customization	9MM	|----------|	12 Months	22.5K
Maintenance	1.2MM	|--->	9 Years	87.4K p/yr.

*Labor costs for the analyst, based on an hourly wage of $14.32 (GS-11), total $31K for the first year's R&D.

Figure 35. Projected Schedule for NOTIS Project

This plan shows a proposed life cycle assuming things go smoothly. There may actually be gaps between steps while awaiting a favorable decision to proceed, notification

of fund availability, etc. If all goes as planned, the IOLS could be functioning within 18 months after purchase.

B. PROJECT MANAGEMENT ANALYSIS

The first step in the project scheduling process is to specify *all* of the jobs or activities that constitute the project. The entire scheduling process is based on this list. See Figure 36 and Figure 37 for the list of tasks involved in NOTIS implementation.

> The immediate predecessors for any activity are those tasks or jobs that must be completed before the specified activity can begin; there can be more than one predecessor. Designating the activities in sequence this way allows specification of the ***interdependencies***, which eases construction of the network diagram describing the project. [Ref. 18: p. 438-439]

The next step in the scheduling process involves constructing the network that connects all the activities. Each task is shown as a box; boxes may be connected by a line (arrow or branch) to other boxes. Branch lengths have no significance; they merely show the relationships between the activities. When a number of activities terminate at one event, this indicates that no activity starting from that event may start before *all* activities terminating at the event have finished.

Once the network is in place, information on the time required to complete each activity is used to compute the total time required to complete the project. Obtaining accurate estimates of completion time is difficult, due to uncertainty, and to the subjective nature of the process.

TIMELINE, a PC project manager from Breakthrough Software, is the tool used for analysis of the tasks involved in the NOTIS implementation plan. The PERT report is most useful in showing task relationships. See Figure 38 through Figure 52.

Personnel available to work on the NOTIS project are listed as "resources" for project scheduling. Not every person is available full time; these individuals are identified in Figure 53 by a decimal value in the "Maximum Available" column. Numbers greater than one indicate that a pool of people are available.

Schedule Name: NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date: 1-Jun-88 12:18am Schedule File: C:\TLDATA\NOTIS

Task	Early Start	Early End
IOLS Selected	1-Jun-88 9:00am	1-Jun-88 9:00am
Assign Tech1	1-Jun-88 9:00am	1-Jun-88 9:00am
Assign Lib1	1-Jun-88 9:00am	1-Jun-88 9:00am
Contract Negotiation	1-Jun-88 9:00am	2-Aug-88 6:00pm
Parameter Decisions Made	1-Jun-88 9:00am	30-Jun-88 6:00pm
Resources Specified	1-Jun-88 9:00am	7-Jun-88 6:00pm
Terminal Locations Chosen	1-Jun-88 9:00am	14-Jun-88 6:00pm
Support Software Available	8-Jun-88 9:00am	8-Jun-88 9:00am
Cabling Ordered	8-Jun-88 9:00am	9-Jun-88 6:00pm
System Configuration Set	8-Jun-88 9:00am	21-Jun-88 6:00pm
Electrical Circuits Ordered	15-Jun-88 9:00am	16-Jun-88 6:00pm
Circuits Installed	17-Jun-88 9:00am	14-Dec-88 6:00pm
Batch Reports Specified	22-Jun-88 9:00am	4-Aug-88 10:00am
CICS Region Defined	22-Jun-88 9:00am	23-Jun-88 6:00pm
Processor Memory Upgraded	22-Jun-88 9:00am	6-Jul-88 6:00pm
RLIN Conversion Form Filled In	1-Aug-88 9:00am	3-Aug-88 6:00pm
Terminals Ordered	3-Aug-88 9:00am	4-Aug-88 6:00pm
Preinstallation Visit	4-Aug-88 10:00am	5-Aug-88 10:00am
Scanners Ordered	5-Aug-88 9:00am	9-Aug-88 6:00pm
Printers Ordered	5-Aug-88 9:00am	12-Aug-88 6:00pm
Contract Signed	5-Aug-88 10:00am	12-Aug-88 10:00am
NOTIS Tech Questionnaire Done	5-Aug-88 10:00am	5-Aug-88 11:00am
VTAM Cross-Domain Established	5-Aug-88 5:00pm	5-Aug-88 5:00pm
Scanners Received	10-Aug-88 9:00am	12-Oct-88 6:00pm
GTO Ordered	12-Aug-88 10:00am	19-Aug-88 10:00am
Sign BRS INFOREC Agreement	12-Aug-88 10:00am	12-Aug-88 11:00am
Printers Available	15-Aug-88 9:00am	17-Oct-88 6:00pm
Funding Document Received	18-Aug-88 9:00am	18-Aug-88 9:00am
NOTIS Paid	23-Aug-88 9:00am	23-Aug-88 9:00am
Documentation Received	23-Aug-88 9:00am	23-Aug-88 9:00am
NOTIS Tape Mailed	23-Aug-88 9:00am	23-Aug-88 10:00am
NOTIS Tape Received	23-Aug-88 10:00am	25-Aug-88 10:00am
Keyword/Boolean "Installed"	13-Sep-88 9:00am	13-Sep-88 9:00am
Technical Training Onsite	13-Sep-88 9:00am	13-Sep-88 6:00pm
Conversion Specifications	14-Sep-88 9:00am	14-Oct-88 6:00pm
Module Order Chosen	14-Sep-88 9:00am	22-Dec-88 6:00pm
Patron Records Available	19-Sep-88 9:00am	22-Dec-88 6:00pm
RLIN tapes to BNA for cleanup	30-Sep-88 3:00pm	30-Sep-88 4:00pm
Scanners Installed	13-Oct-88 9:00am	19-Oct-88 6:00pm
Accept Conversion Sample	17-Oct-88 9:00am	21-Oct-88 6:00pm

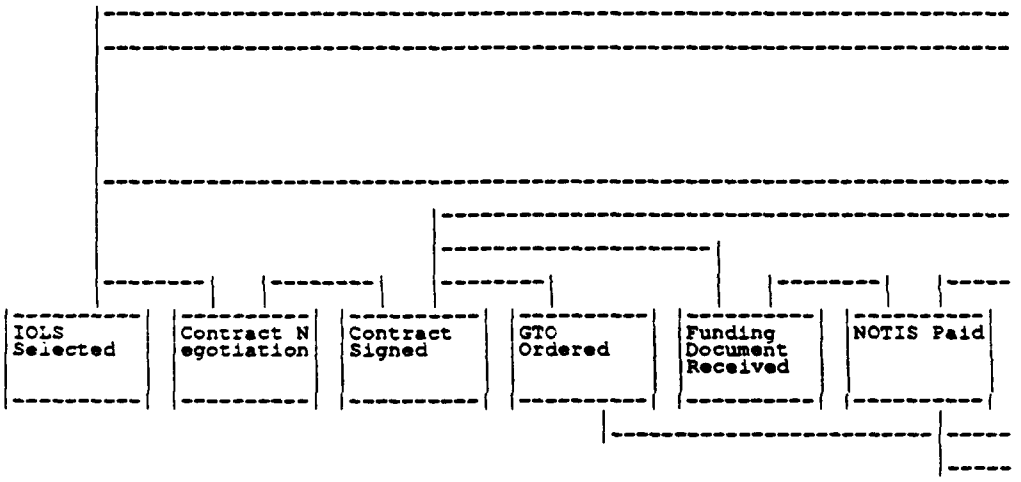
TIME LINE Task Table Report

Figure 36. Task List for NOTIS Implementation - Part 1

Task	Early Start		Early End	
Customization S/W Delivered	24-Oct-88	9:00am	4-Nov-88	6:00pm
Purchase Orders, Forms Design	26-Oct-88	9:00am	28-Nov-88	6:00pm
GTO Received Inhouse	7-Nov-88	9:00am	7-Nov-88	9:00am
Custom Loader Available	7-Nov-88	9:00am	7-Nov-88	9:00am
Software Complete	7-Nov-88	9:00am	7-Nov-88	9:00am
Clean Bibliographic Database	7-Nov-88	9:00am	7-Nov-88	9:00am
Local Holdings Data Available	7-Nov-88	9:00am	14-Nov-88	6:00pm
RLIN Interface in Place	7-Nov-88	9:00am	14-Nov-88	6:00pm
Smart Barcode Tape Available	7-Nov-88	9:00am	8-Dec-88	6:00pm
NOTIS Tape Loaded	7-Nov-88	9:00am	16-Nov-88	6:00pm
Bib Data Available	17-Nov-88	9:00am	17-Nov-88	9:00am
NOTIS "Installed" Officially	17-Nov-88	9:00am	17-Nov-88	6:00pm
Load NPS Records	18-Nov-88	9:00am	25-Nov-88	6:00pm
Demo Catalog Open	28-Nov-88	9:00am	28-Nov-88	6:00pm
Feedback from Staff	29-Nov-88	9:00am	29-Nov-88	9:00am
Training Materials Designed	29-Nov-88	9:00am	12-Dec-88	6:00pm
Customization of Tables	29-Nov-88	9:00am	29-Nov-88	9:00am
Tables Generated	29-Nov-88	9:00am	16-Jan-89	6:00pm
Barcodes Ordered	9-Dec-88	9:00am	22-Dec-88	6:00pm
ALA Terminals Received	15-Dec-88	9:00am	15-Dec-88	9:00am
Terminals Installed	15-Dec-88	9:00am	15-Dec-88	9:00am
Hardware Complete	15-Dec-88	9:00am	15-Dec-88	9:00am
Printers Installed	15-Dec-88	9:00am	29-Dec-88	6:00pm
Computer Resources Available	15-Dec-88	9:00am	15-Dec-88	9:00am
Barcodes Received	23-Dec-88	9:00am	23-Dec-88	9:00am
Barcodes Attached to Books	23-Dec-88	9:00am	25-Jan-89	6:00pm
Clean Data from BNA Received	3-Jan-89	9:00am	3-Jan-89	9:00am
Production OPAC Available	3-Jan-89	9:00am	16-Jan-89	6:00pm
Module2 Customized	17-Jan-89	9:00am	30-Jan-89	6:00pm
Module2 Tested	31-Jan-89	9:00am	13-Feb-89	6:00pm
Module2 Training	14-Feb-89	9:00am	16-Feb-89	6:00pm
Module2 Released in Production	17-Feb-89	9:00am	17-Feb-89	9:00am
Module3 Customized	17-Feb-89	9:00am	3-Mar-89	6:00pm
Vendor Records Available	21-Feb-89	9:00am	22-Mar-89	6:00pm
Funds Accounts Available	21-Feb-89	9:00am	22-Mar-89	6:00pm
Module3 Tested	6-Mar-89	9:00am	17-Mar-89	6:00pm
Module3 Training	20-Mar-89	9:00am	22-Mar-89	6:00pm
Module3 Released in Production	23-Mar-89	9:00am	23-Mar-89	9:00am
Module4 Customized	23-Mar-89	9:00am	5-Apr-89	6:00pm
Module4 Tested	6-Apr-89	9:00am	19-Apr-89	6:00pm
Module4 Training	20-Apr-89	9:00am	24-Apr-89	6:00pm
Module4 Released in Production	25-Apr-89	9:00am	25-Apr-89	9:00am
Module5 Customized	25-Apr-89	9:00am	8-May-89	6:00pm
Module5 Tested	9-May-89	9:00am	22-May-89	6:00pm
Module5 Training	23-May-89	9:00am	25-May-89	6:00pm
Module5 Released in Production	26-May-89	9:00am	26-May-89	9:00am
Maintenance (Ongoing)	26-May-89	9:00am	26-May-89	9:00am

Figure 37. Task List for NOTIS Implementation - Part 2

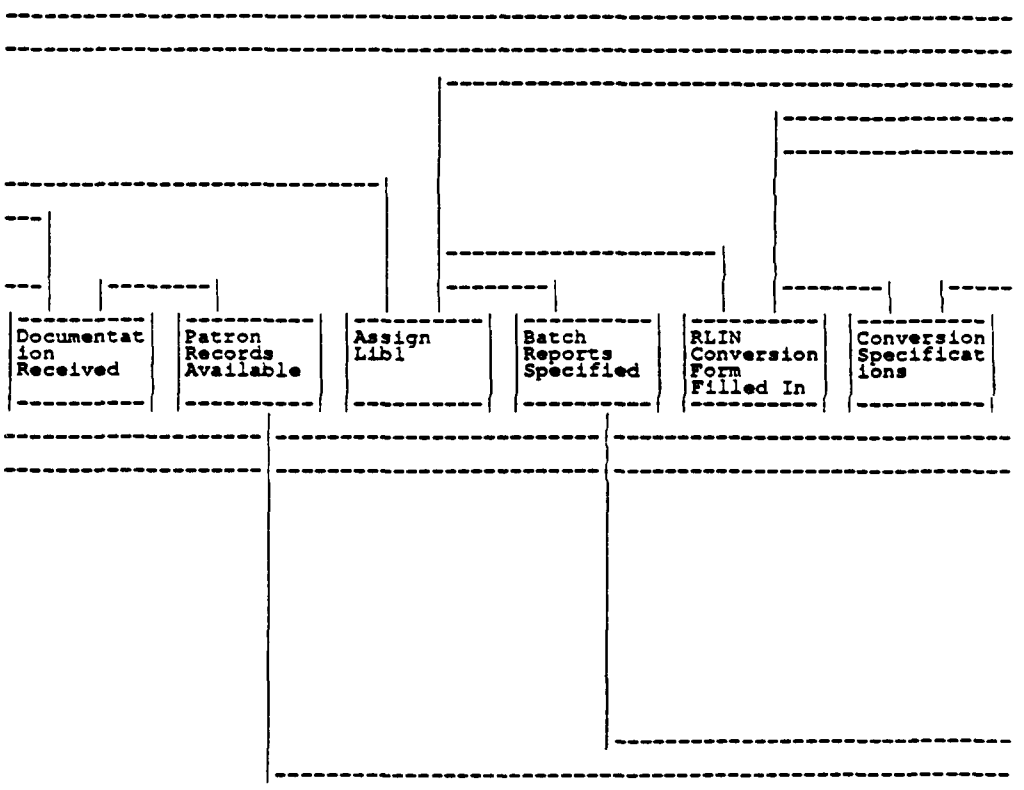
Schedule Name: NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date: 1-Jun-88 12:14am Schedule File: C:\TLDATA\NOTIS



TIME LINE PERT Chart Strip number 1 of 15.

Figure 38. PERT Chart for NOTIS Implementation - Part 1

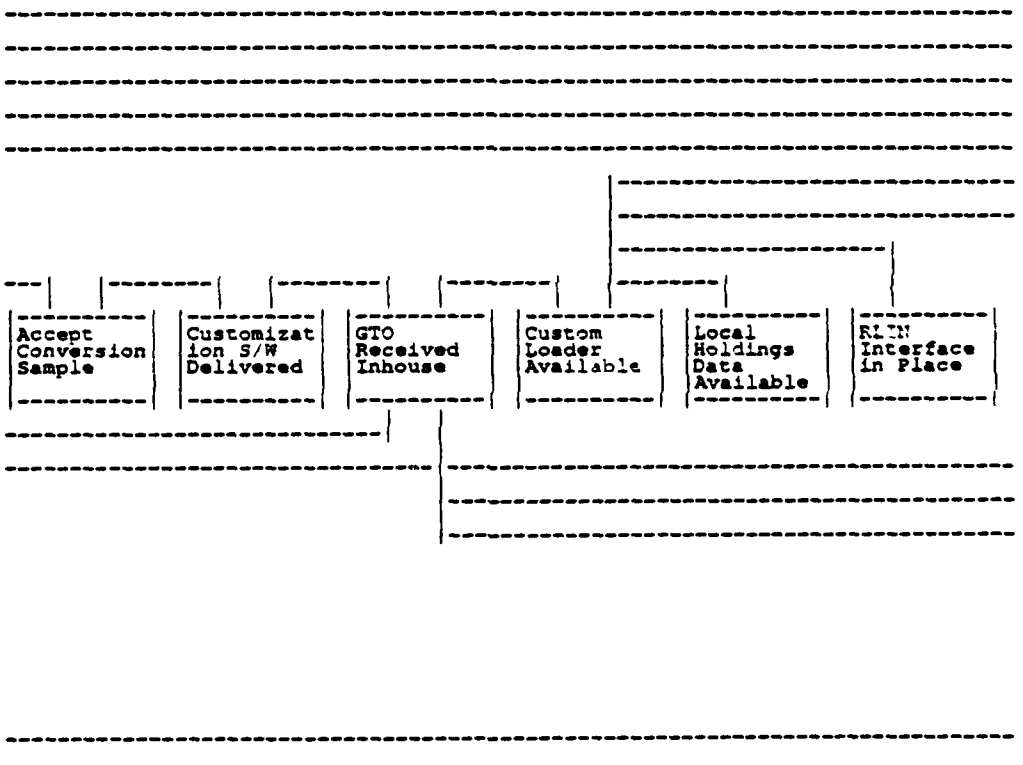
```
Schedule Name:   NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date:      1-Jun-88 12:14am     Schedule File: C:\TLDATA\NOTIS
```




```
TIME LINE     PERT Chart     Strip number 2 of 15.
```

Figure 39. PERT Chart for NOTIS Implementation - Part 2

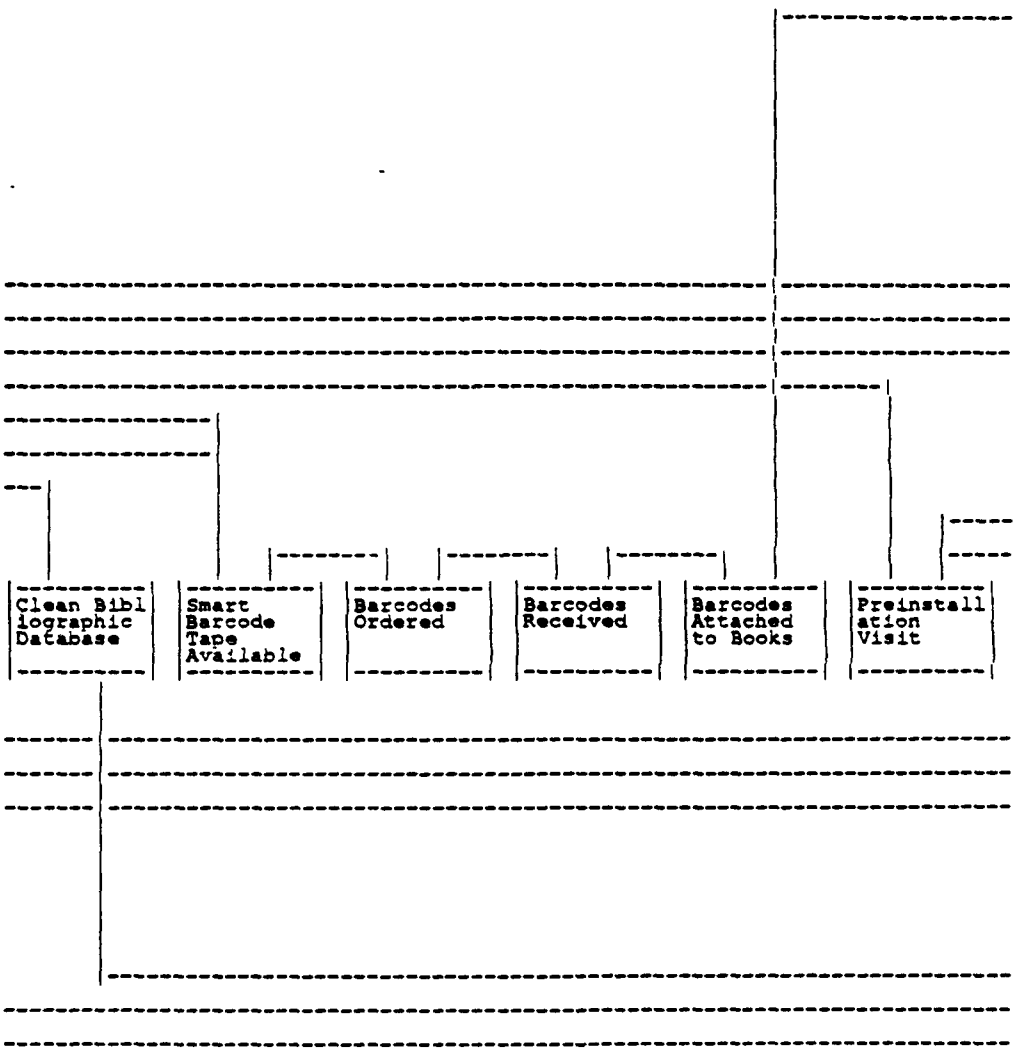
```
Schedule Name:   NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date:      1-Jun-88 12:14am    Schedule File: C:\TLDATA\NOTIS
```



TIME LINE PERT Chart Strip number 3 of 15.

Figure 40. PERT Chart for NOTIS Implementation - Part 3

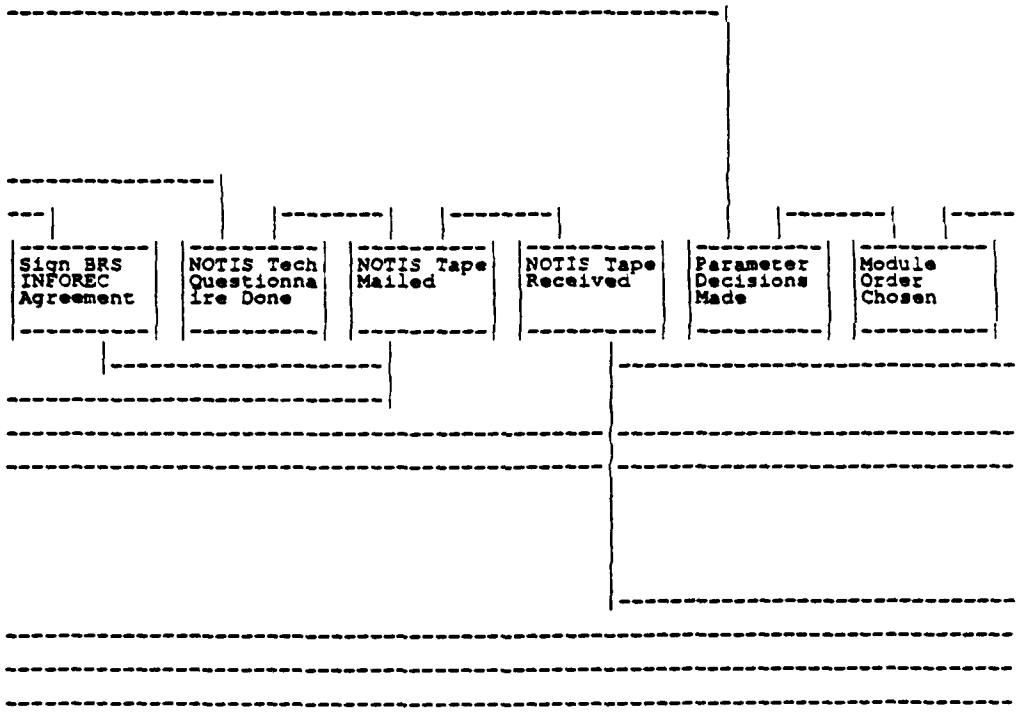
Schedule Name: NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date: 1-Jun-88 12:14am Schedule File: C:\TLDATA\NOTIS



TIME LINE PERT Chart Strip number 4 of 15.

Figure 41. PERT Chart for NOTIS Implementation - Part 4

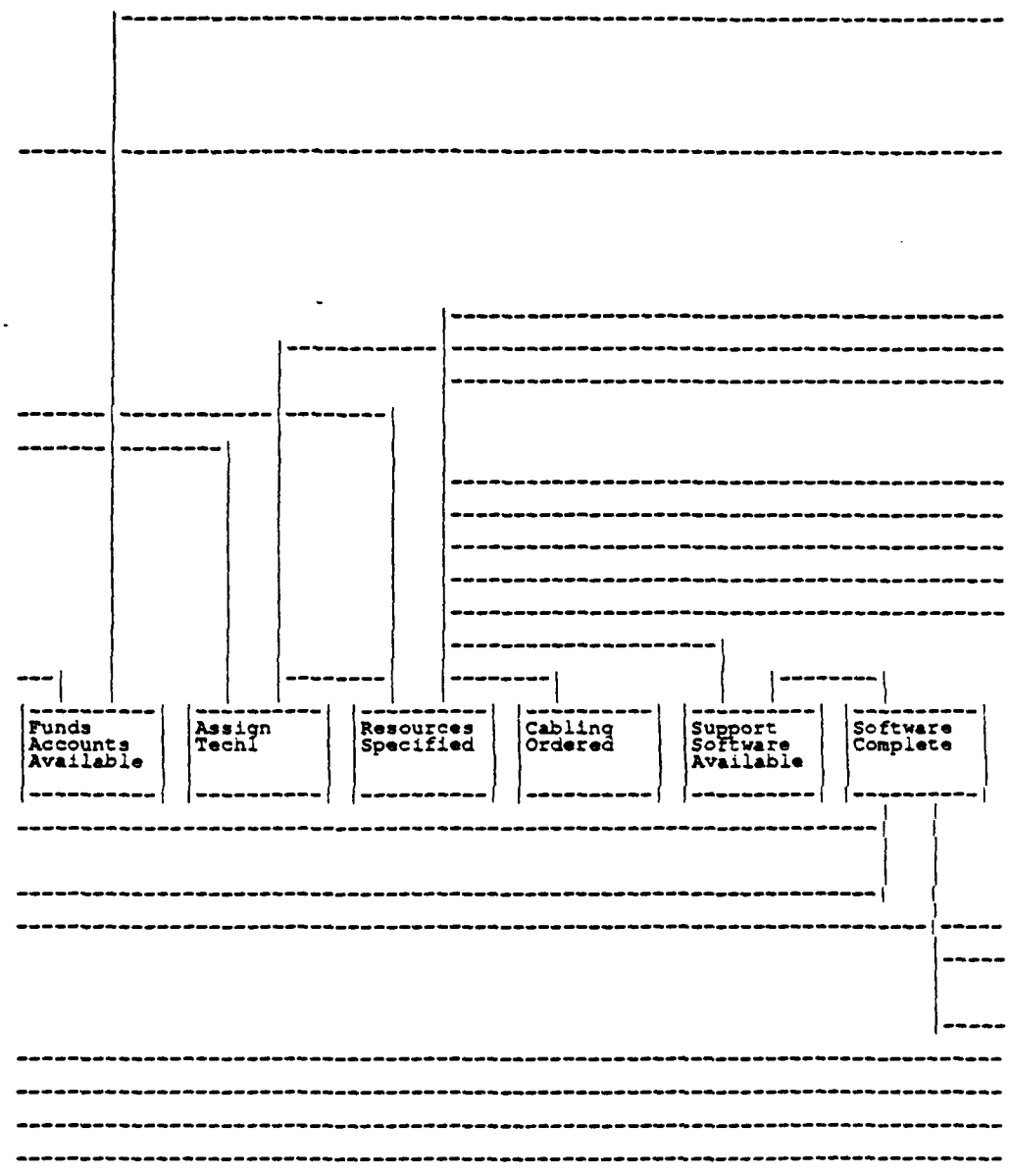
Schedule Name: NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date: 1-Jun-88 12:14am Schedule File: C:\TLDATA\NOTIS



TIME LINE PERT Chart Strip number 5 of 15.

Figure 42. PERT Chart for NOTIS Implementation - Part 5

Schedule Name: NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Catoline J. Miller
As of date: 1-Jun-88 12:14am Schedule File: C:\TLDATA\NOTIS



TIME LINE PERT Chart Strip number 6 of 15.

Figure 43. PERT Chart for NOTIS Implementation - Part 6

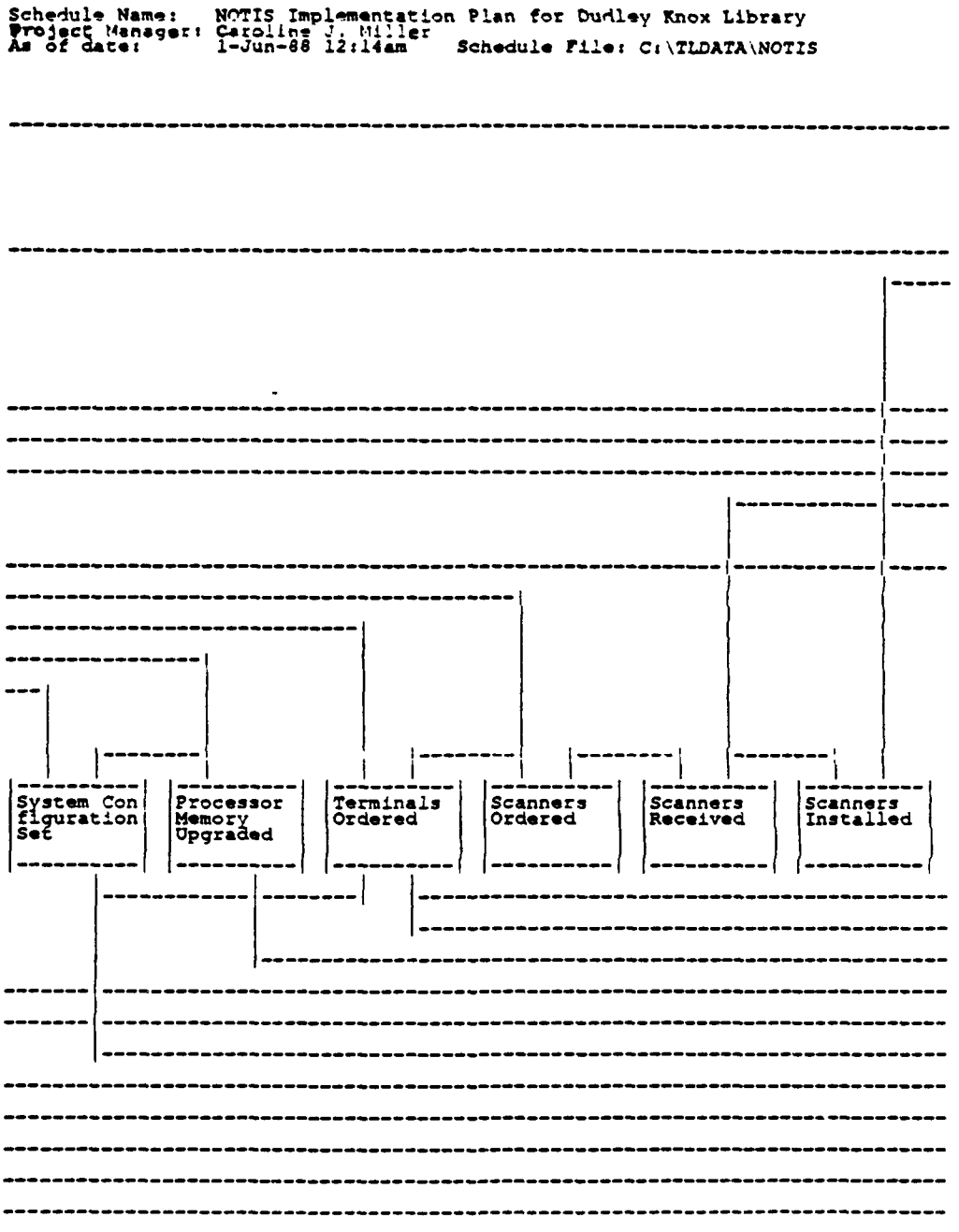


Figure 44. PERT Chart for NOTIS Implementation - Part 7

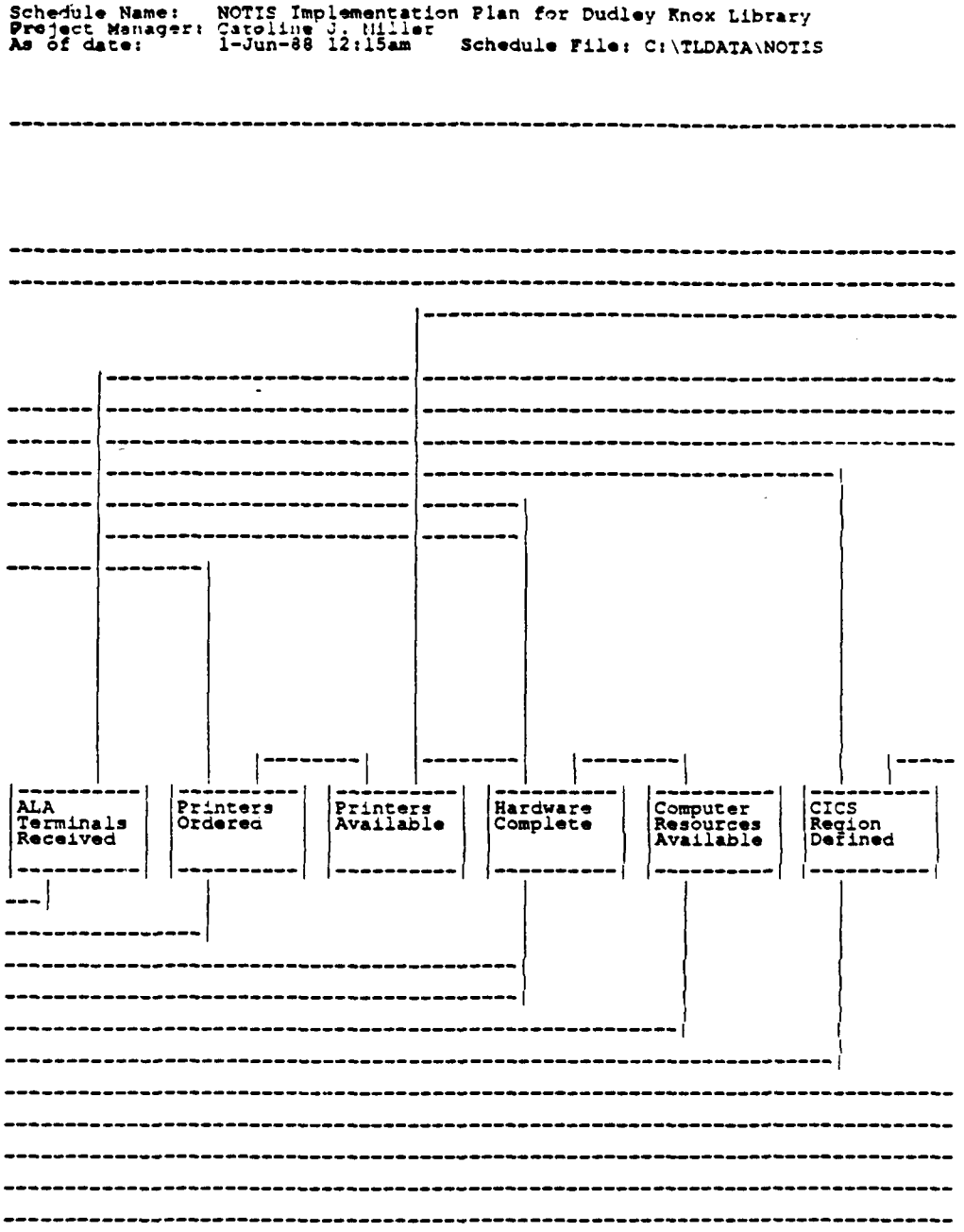


Figure 45. PERT Chart for NOTIS Implementation - Part 8

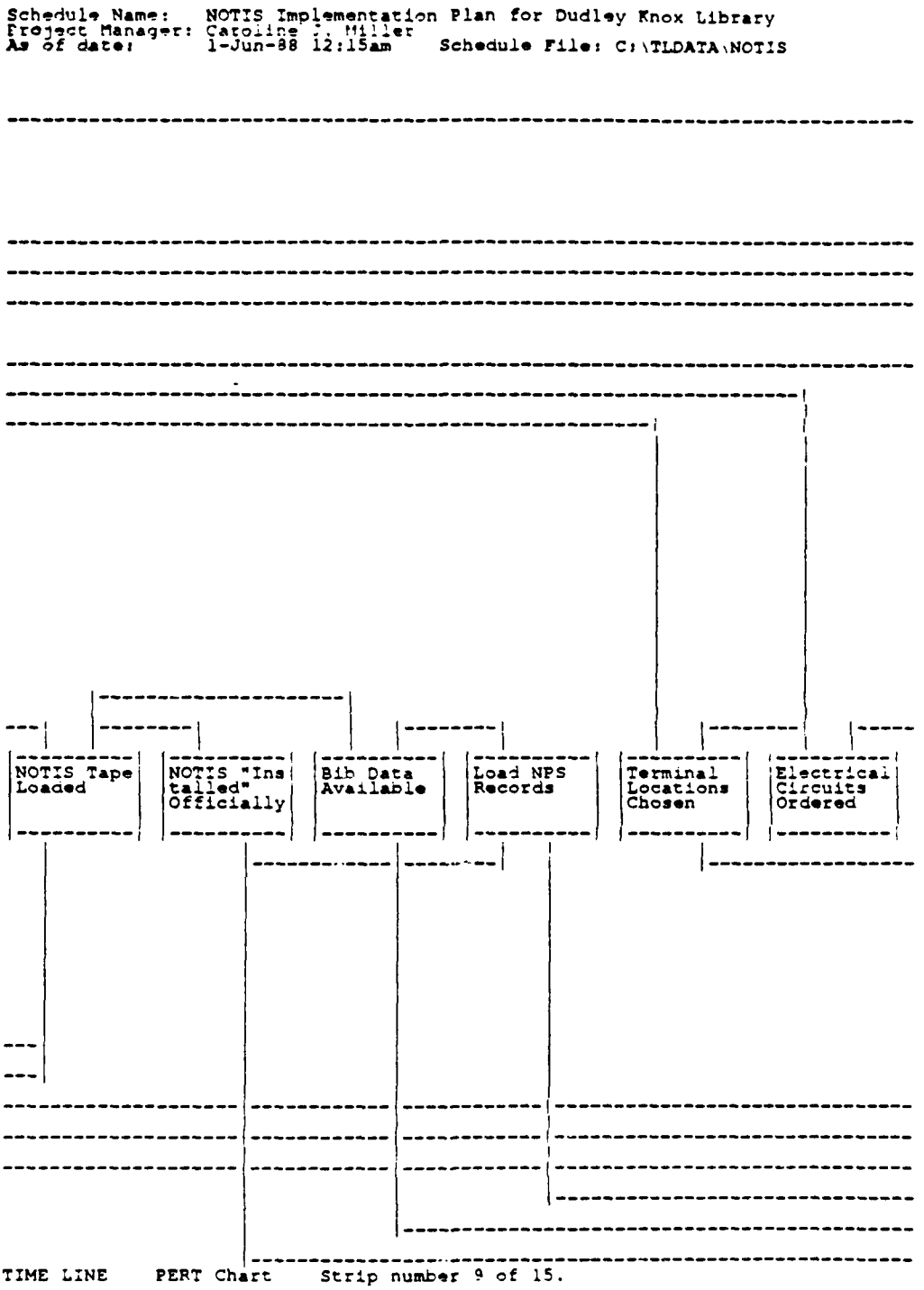


Figure 46. PERT Chart for NOTIS Implementation - Part 9

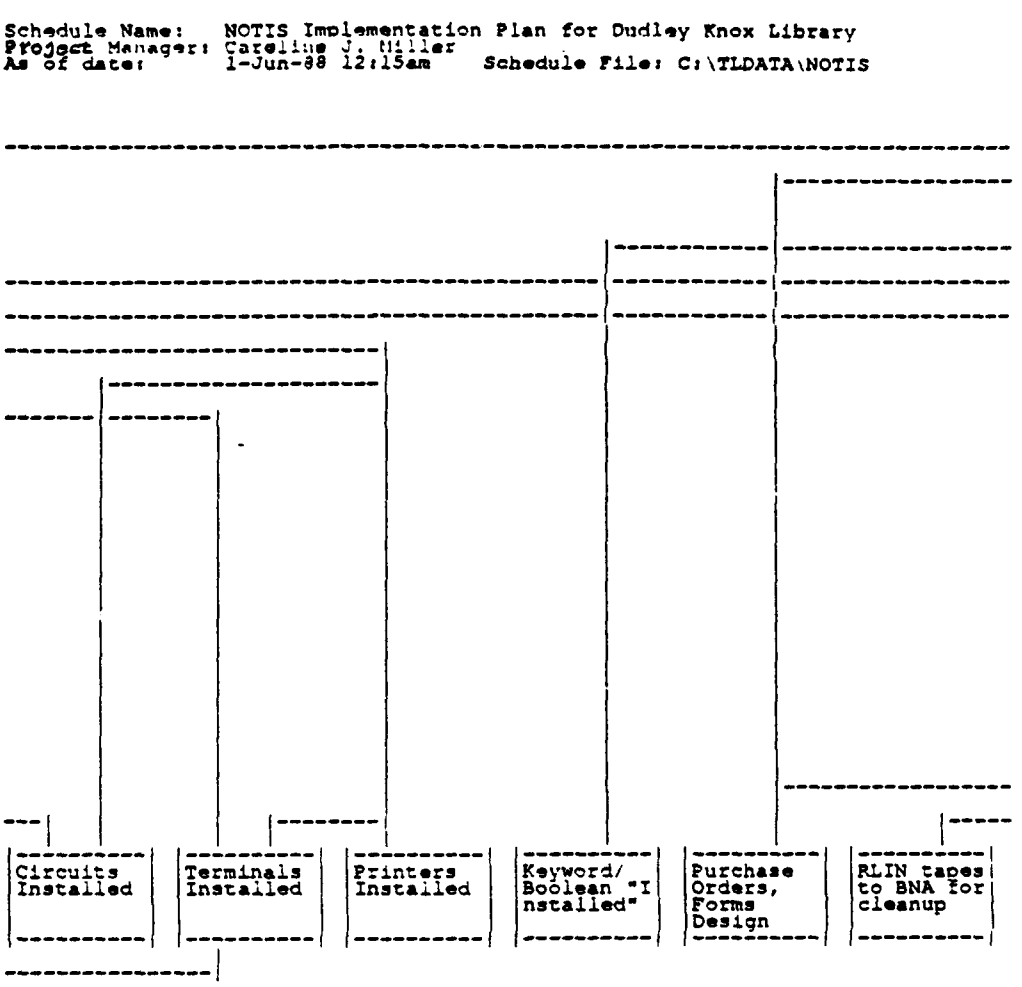
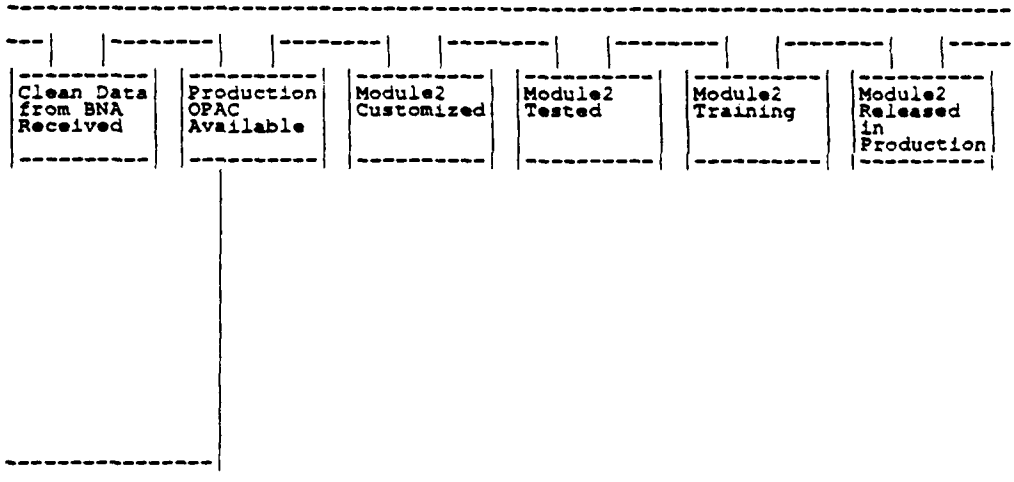


Figure 47. PERT Chart for NOTIS Implementation - Part 10

```
Schedule Name:   NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date:      1-Jun-88 12:15am    Schedule File: C:\TLDATA\NOTIS
```




```
TIME LINE    PERT Chart    Strip number 11 of 15.
```

Figure 48. PERT Chart for NOTIS Implementation - Part 11

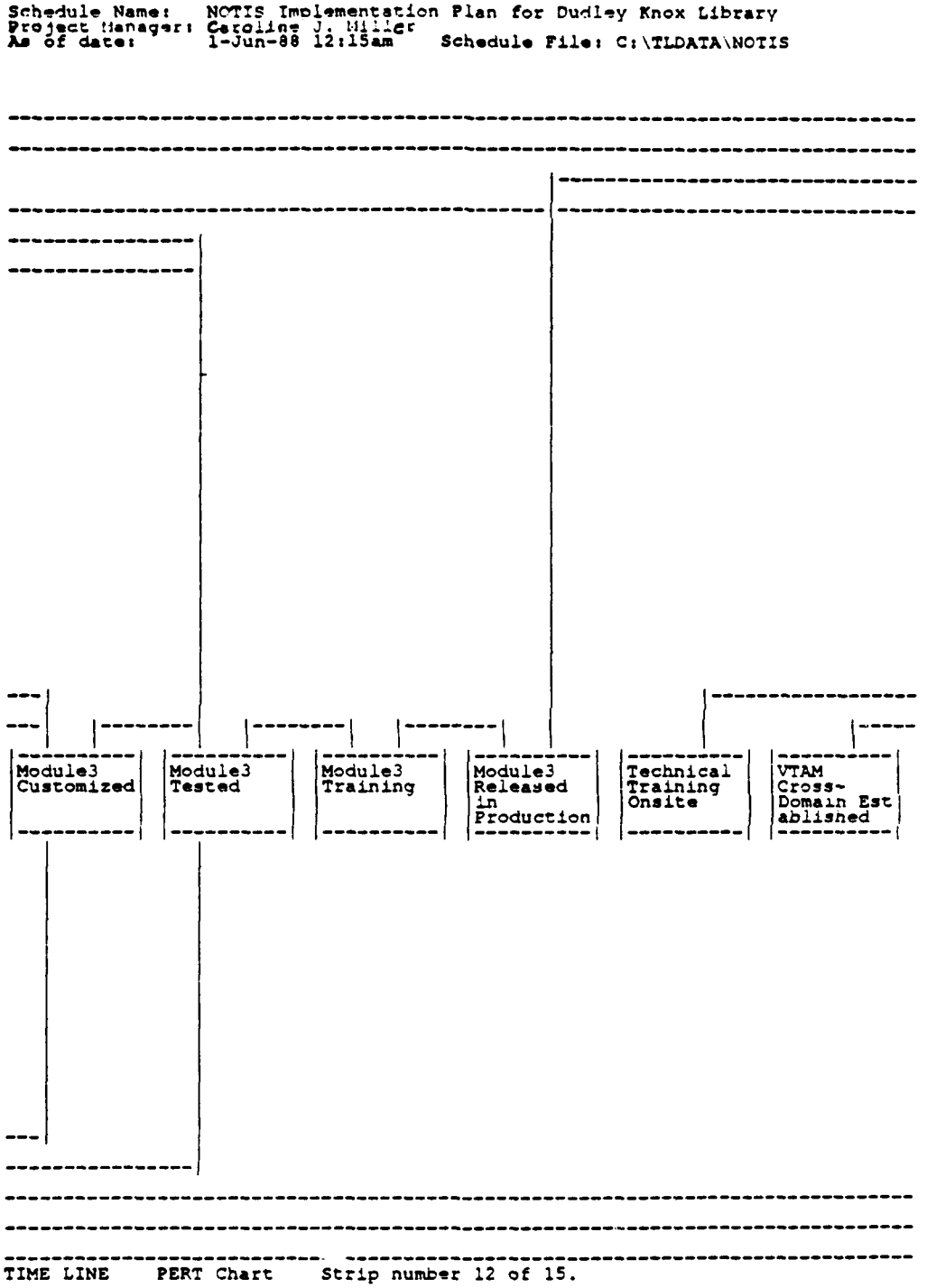


Figure 49. PERT Chart for NOTIS Implementation - Part 12

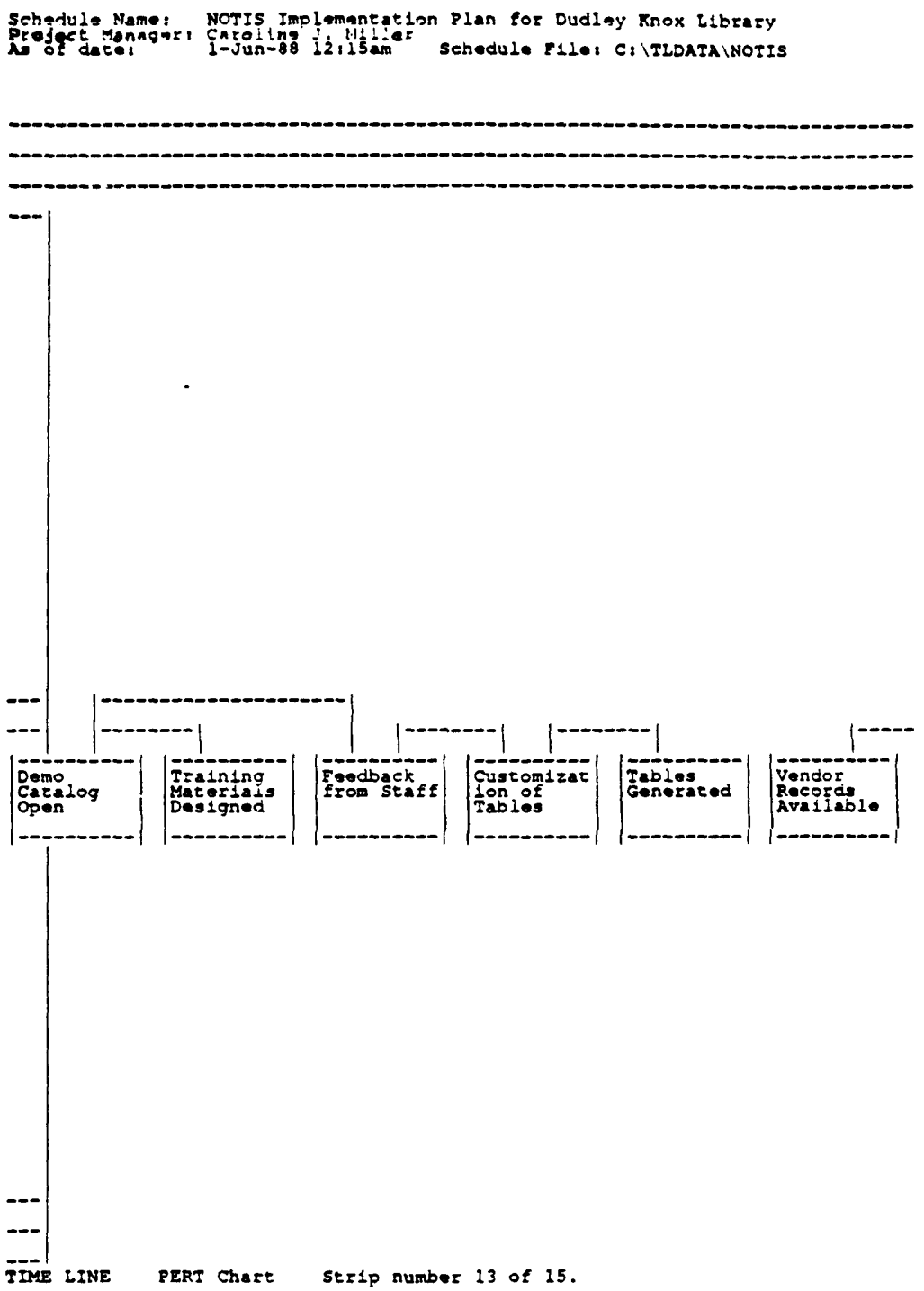
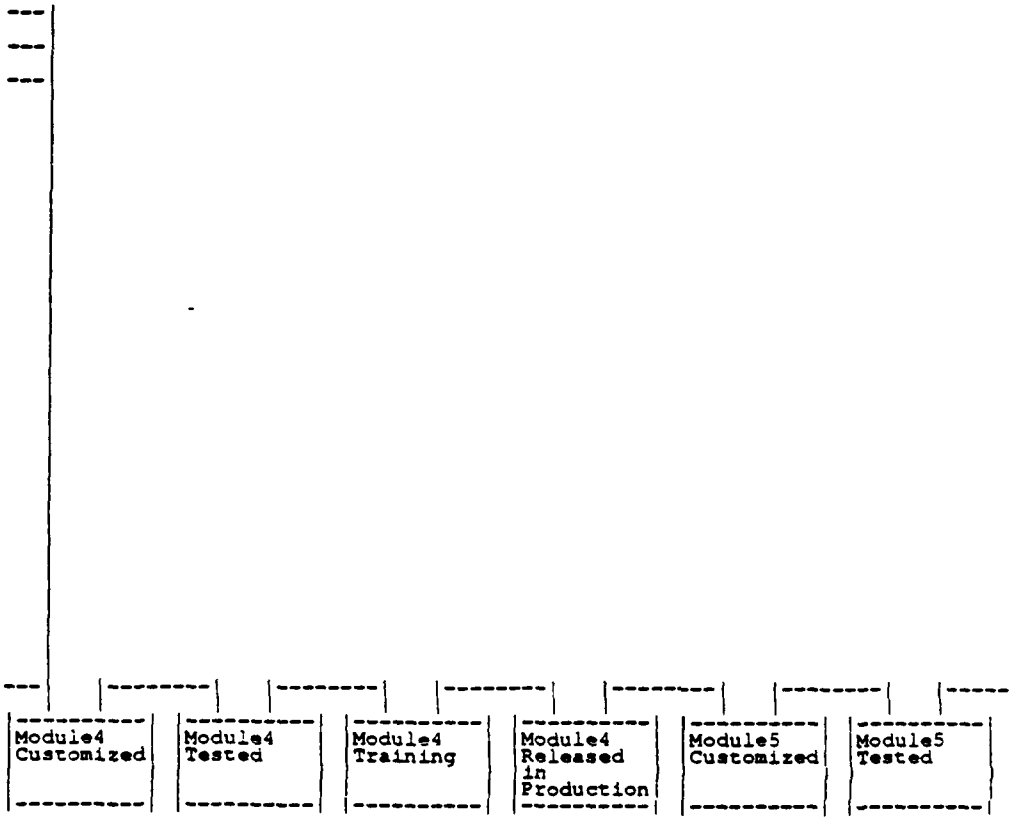


Figure 50. PERT Chart for NOTIS Implementation - Part 13

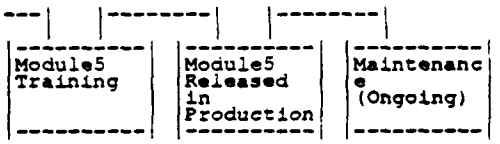
Schedule Name: NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date: 1-Jun-88 12:15am Schedule File: C:\TLDATA\NOTIS



TIME LINE PERT Chart Strip number 14 of 15.

Figure 51. PERT Chart for NOTIS Implementation - Part 14

Schedule Name: NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date: 1-Jun-88 12:15am Schedule File: C:\TLDATA\NOTIS



TIME LINE PERT Chart Strip number 15 of 15.

Figure 52. PERT Chart for NOTIS Implementation - Part 15

Schedule Name: NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date: 1-Jun-88 12:16am Schedule File: C:\TLDATA\NOTIS

Name	Full Name	Type	Maximum Available
Admin	Administrative Support	Resource	0.50
CICS3	Linda Mauck, CICS Programmer	Resource	0.20
IBM	IBM Support Personnel	Resource	1.00
Lib1	Bobbie Carr	Resource	0.70
Libn	Paul Spinks, Knox Librarian	Resource	1.00
Libs	Librarians, Knox Library staff	Resource	12.00
Network	Alyce Austin, VTAM Network	Resource	1.00
NOTIS1	NOTIS Reps, 15 days free per yr	Resource	2.00
NOTIS2	NOTIS Reps, after free training	Resource	2.00
Ops	Roy Romo, Operations Manager	Resource	0.20
PubWks	Public Works Dept. Personnel	Resource	4.00
Sys	David Norman, Systems Manager	Resource	0.20
Tech1	Caroline Miller	Resource	0.50

TIME LINE Resource Table Report

Figure 53. Resources Available for NOTIS Implementation

The GANTT chart (see Figure 54 and following) shows the tasks as bars on a calendar; each bar represents the time scheduling and duration of the task. Placement in the schedule is mandated by task interdependencies, by resource availability, and by milestone dates entered by the project manager. The GANTT chart and PERT report use the same task list. The GANTT chart assumes that the IOLS decision was made on 1 June 1988, and has arranged the tasks for optimal efficiency, within the constraints cited above.

To read the GANTT chart, note that tasks are listed down the left side of the report. Resources asigned to each task are listed in the next column, then the status of the task is shown. The horizontal bars (= = = =) show the timing and duration of the task activity.

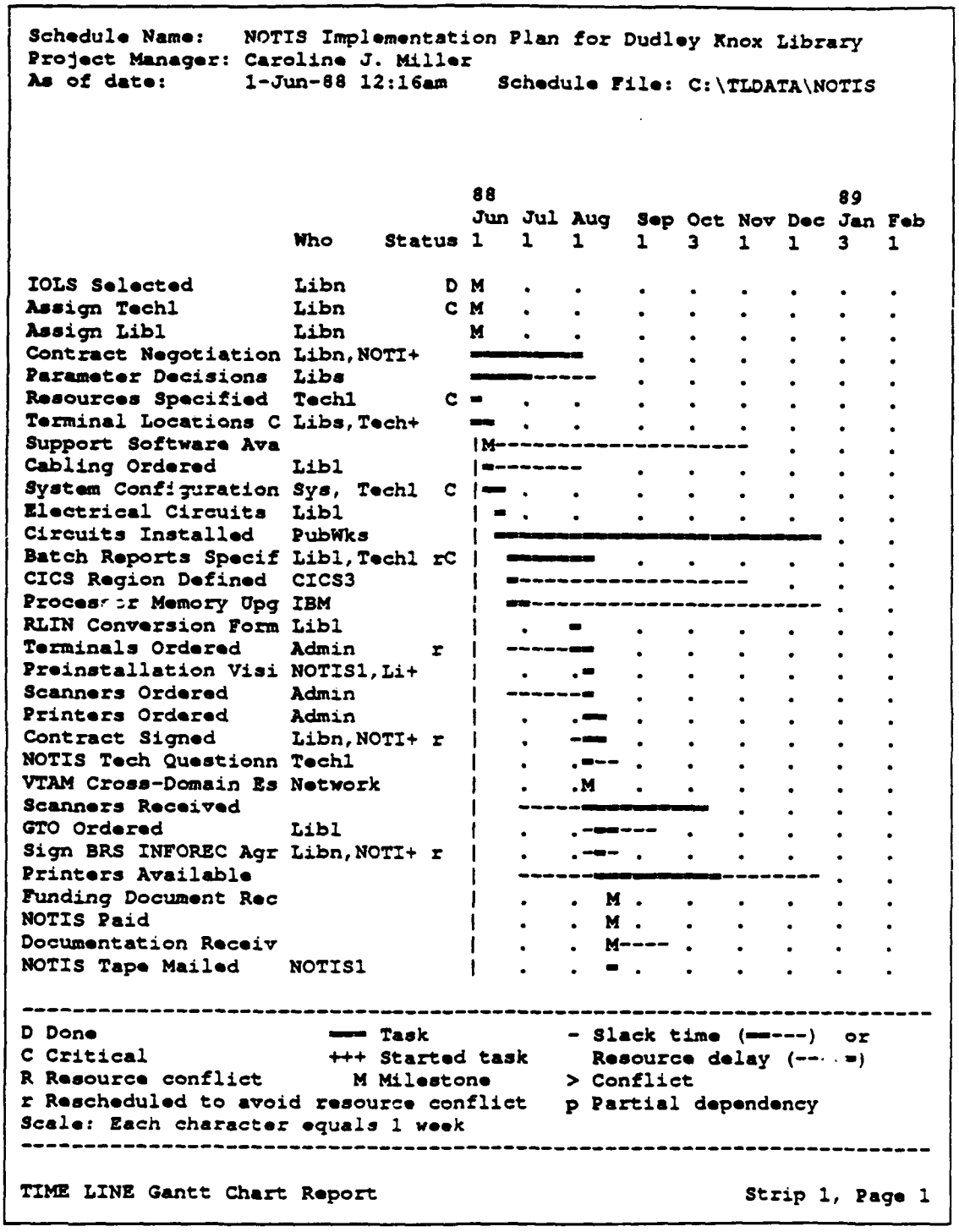
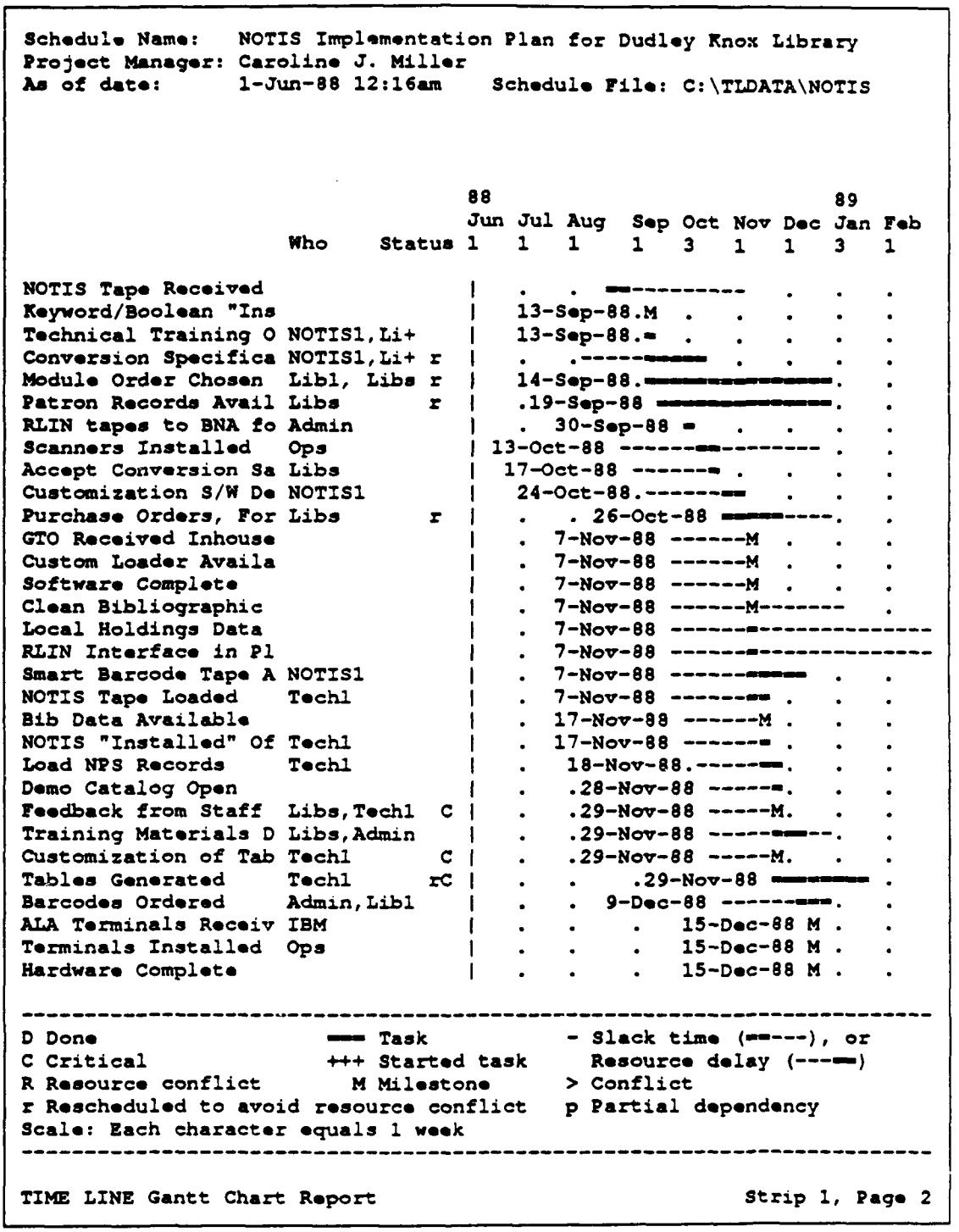
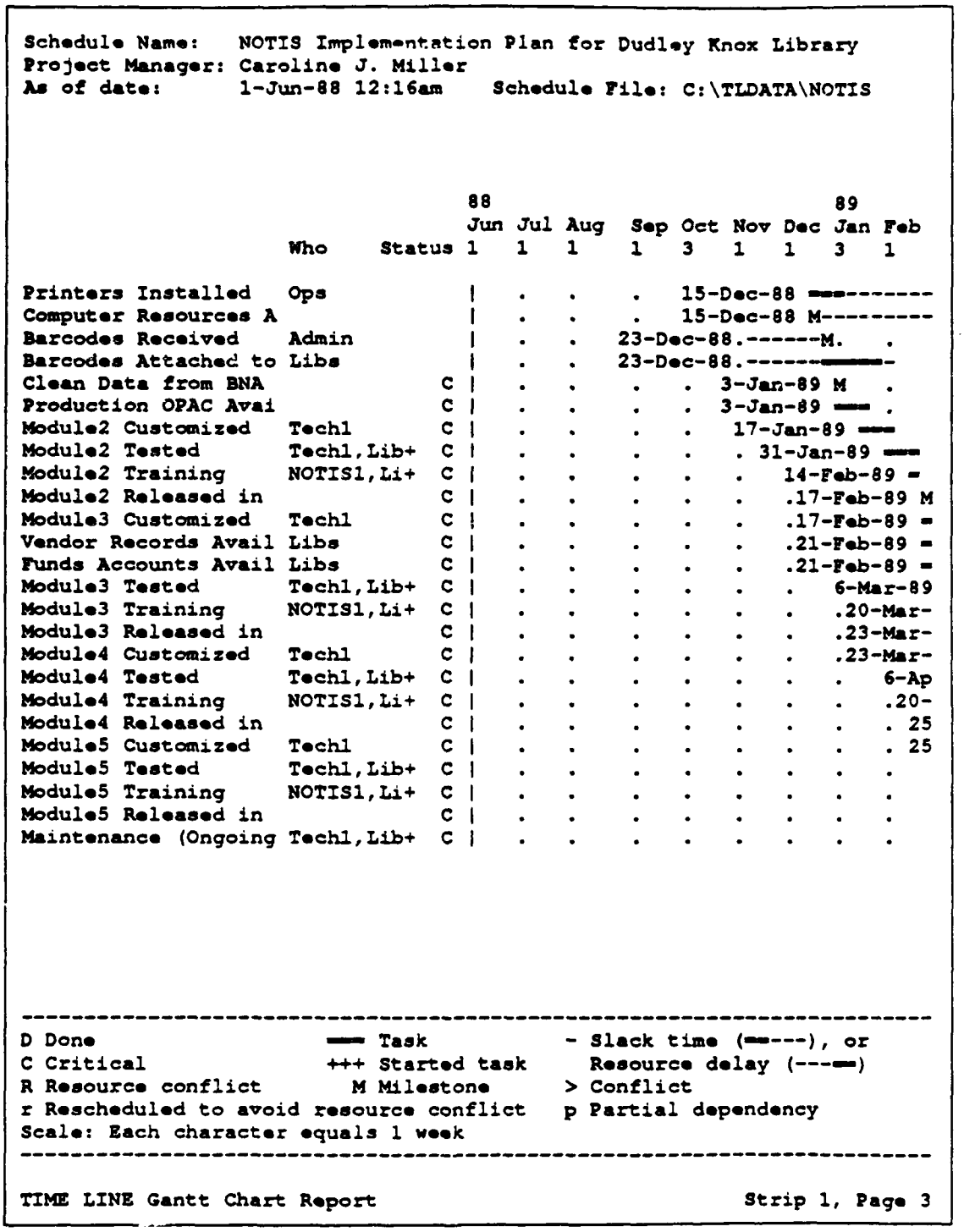


Figure 54. GANTT Chart for NOTIS Implementation - Part 1.



```
Schedule Name:   NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date:      1-Jun-88 12:16am    Schedule File: C:\TLDATA\NOTIS



                                    88                                    89
                                    Jun Jul Aug  Sep Oct Nov Dec Jan Feb
                      Who    Status 1   1   1    1   3   1   1   3   1

NOTIS Tape Received                 |   .   .  ==---------   .   .   .
Keyword/Boolean "Ins                |   13-Sep-88.M  .   .   .   .   .
Technical Training O NOTIS1,Li+     |   13-Sep-88.=  .   .   .   .   .
Conversion Specifica NOTIS1,Li+ r   |   .   .-----=====  .   .   .   .
Module Order Chosen  Libl, Libs r   |   14-Sep-88.==========.   .   .
Patron Records Avail Libs       r   |   .19-Sep-88 ==========.   .   .
RLIN tapes to BNA fo Admin          |   .  30-Sep-88 =   .   .   .   .
Scanners Installed   Ops            | 13-Oct-88 ------==------   .   .
Accept Conversion Sa Libs           |  17-Oct-88 -------=  .   .   .   .
Customization S/W De NOTIS1         |   24-Oct-88.-------==   .   .   .
Purchase Orders, For Libs       r   |   .   . 26-Oct-88 ======----.   .
GTO Received Inhouse                |   .  7-Nov-88 ------M  .   .   .
Custom Loader Availa                |   .  7-Nov-88 ------M  .   .   .
Software Complete                   |   .  7-Nov-88 ------M  .   .   .
Clean Bibliographic                 |   .  7-Nov-88 ------M-------   .
Local Holdings Data                 |   .  7-Nov-88 ------=----------
RLIN Interface in Pl                |   .  7-Nov-88 ------=----------
Smart Barcode Tape A NOTIS1         |   .  7-Nov-88 ------=====  .   .
NOTIS Tape Loaded    Tech1          |   .  7-Nov-88 -------==  .   .   .
Bib Data Available                  |   .  17-Nov-88 ------M .   .   .
NOTIS "Installed" Of Tech1          |   .  17-Nov-88 ------= .   .   .
Load NPS Records     Tech1          |   .   18-Nov-88.-----==.   .   .
Demo Catalog Open                   |   .   .28-Nov-88 -----=.   .   .
Feedback from Staff  Libs,Tech1  C  |   .   .29-Nov-88 -----M.   .   .
Training Materials D Libs,Admin     |   .   .29-Nov-88 -----=--.   .   .
Customization of Tab Tech1       C  |   .   .29-Nov-88 -----M.   .   .
Tables Generated     Tech1       rC |   .   .    .29-Nov-88 ======= .
Barcodes Ordered     Admin,Libl     |   .   .  9-Dec-88 ------==.   .
ALA Terminals Receiv IBM            |   .   .    .   15-Dec-88 M .   .
Terminals Installed  Ops            |   .   .    .   15-Dec-88 M .   .
Hardware Complete                   |   .   .    .   15-Dec-88 M .   .

-------------------------------------------------------------------------
D Done                  === Task          - Slack time (==---), or
C Critical              +++ Started task    Resource delay (---==)
R Resource conflict       M Milestone     > Conflict
r Rescheduled to avoid resource conflict  p Partial dependency
Scale: Each character equals 1 week
-------------------------------------------------------------------------

TIME LINE Gantt Chart Report                          Strip 1, Page 2
```

Figure 55. GANTT Chart for NOTIS Implementation - Part 2.



```
Schedule Name:   NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date:      1-Jun-88 12:16am    Schedule File: C:\TLDATA\NOTIS



                                    88                                  89
                                   Jun  Jul  Aug   Sep  Oct  Nov  Dec  Jan  Feb
                      Who    Status 1    1    1     1    3    1    1    3    1

Printers Installed    Ops            |    .    .     .   15-Dec-88 ==========
Computer Resources A                 |    .    .     .   15-Dec-88 M---------
Barcodes Received     Admin          |    .    .  23-Dec-88.------M.    .
Barcodes Attached to  Libs           |    .    .  23-Dec-88.------=====-
Clean Data from BNA                C |    .    .     .    .  3-Jan-89 M   .
Production OPAC Avai               C |    .    .     .    .  3-Jan-89 ===.
Module2 Customized    Tech1        C |    .    .     .    .   17-Jan-89 ===
Module2 Tested        Tech1,Lib+   C |    .    .     .    .    . 31-Jan-89 ===
Module2 Training      NOTIS1,Li+   C |    .    .     .    .    .   14-Feb-89 =
Module2 Released in                C |    .    .     .    .    .   .17-Feb-89 M
Module3 Customized    Tech1        C |    .    .     .    .    .   .17-Feb-89 =
Vendor Records Avail  Libs         C |    .    .     .    .    .   .21-Feb-89 =
Funds Accounts Avail  Libs         C |    .    .     .    .    .   .21-Feb-89 =
Module3 Tested        Tech1,Lib+   C |    .    .     .    .    .    .   6-Mar-89
Module3 Training      NOTIS1,Li+   C |    .    .     .    .    .    .   .20-Mar-
Module3 Released in                C |    .    .     .    .    .    .   .23-Mar-
Module4 Customized    Tech1        C |    .    .     .    .    .    .   .23-Mar-
Module4 Tested        Tech1,Lib+   C |    .    .     .    .    .    .    .   6-Ap
Module4 Training      NOTIS1,Li+   C |    .    .     .    .    .    .    .   .20-
Module4 Released in                C |    .    .     .    .    .    .    .   . 25
Module5 Customized    Tech1        C |    .    .     .    .    .    .    .   . 25
Module5 Tested        Tech1,Lib+   C |    .    .     .    .    .    .    .   .
Module5 Training      NOTIS1,Li+   C |    .    .     .    .    .    .    .   .
Module5 Released in                C |    .    .     .    .    .    .    .   .
Maintenance (Ongoing  Tech1,Lib+   C |    .    .     .    .    .    .    .   .



-------------------------------------------------------------------------------
D Done                  ==== Task          - Slack time (====---), or
C Critical              +++ Started task     Resource delay (---===)
R Resource conflict       M Milestone      > Conflict
r Rescheduled to avoid resource conflict   p Partial dependency
Scale: Each character equals 1 week
-------------------------------------------------------------------------------

TIME LINE Gantt Chart Report                              Strip 1, Page 3
```

Figure 56. GANTT Chart for NOTIS Implementation - Part 3.

```
Schedule Name:   NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date:      1-Jun-88 12:16am    Schedule File: C:\TLDATA\NOTIS



                                        89
                                       Mar  Apr May Jun Jul Aug  Sep Oct
                        Who     Status 1    3   1   1   3   1    1   2

IOLS Selected           Libn         D      .   .   .   .   .    .   .
Assign Tech1            Libn         C      .   .   .   .   .    .   .
Assign Lib1             Libn                .   .   .   .   .    .   .
Contract Negotiation    Libn,NOTI+          .   .   .   .   .    .   .
Parameter Decisions     Libs                .   .   .   .   .    .   .
Resources Specified     Tech1        C      .   .   .   .   .    .   .
Terminal Locations C    Libs,Tech+          .   .   .   .   .    .   .
Support Software Ava                        .   .   .   .   .    .   .
Cabling Ordered         Lib1                .   .   .   .   .    .   .
System Configuration    Sys, Tech1   C      .   .   .   .   .    .   .
Electrical Circuits     Lib1                .   .   .   .   .    .   .
Circuits Installed      PubWks              .   .   .   .   .    .   .
Batch Reports Specif    Lib1,Tech1   rC     .   .   .   .   .    .   .
CICS Region Defined     CICS3               .   .   .   .   .    .   .
Processor Memory Upg    IBM                 .   .   .   .   .    .   .
RLIN Conversion Form    Lib1                .   .   .   .   .    .   .
Terminals Ordered       Admin        r      .   .   .   .   .    .   .
Preinstallation Visi    NOTIS1,Li+          .   .   .   .   .    .   .
Scanners Ordered        Admin               .   .   .   .   .    .   .
Printers Ordered        Admin               .   .   .   .   .    .   .
Contract Signed         Libn,NOTI+   r      .   .   .   .   .    .   .
NOTIS Tech Questionn    Tech1               .   .   .   .   .    .   .
VTAM Cross-Domain Es    Network             .   .   .   .   .    .   .
Scanners Received                           .   .   .   .   .    .   .
GTO Ordered             Lib1                .   .   .   .   .    .   .
Sign BRS INFOREC Agr    Libn,NOTI+   r      .   .   .   .   .    .   .
Printers Available                          .   .   .   .   .    .   .
Funding Document Rec                        .   .   .   .   .    .   .
NOTIS Paid                                  .   .   .   .   .    .   .
Documentation Receiv                        .   .   .   .   .    .   .
NOTIS Tape Mailed       NOTIS1              .   .   .   .   .    .   .

-------------------------------------------------------------------------
D Done                  ===  Task          - Slack time (==---), or
C Critical              +++  Started task    Resource delay (---==)
R Resource conflict       M  Milestone     > Conflict
r Rescheduled to avoid resource conflict   p Partial dependency
Scale: Each character equals 1 week
-------------------------------------------------------------------------

TIME LINE Gantt Chart Report                          Strip 2, Page 1
```

Figure 57. GANTT Chart for NOTIS Implementation - Part 4.

```
Schedule Name:   NOTIS Implementation Plan for Dudley Knox Library
Project Manager: Caroline J. Miller
As of date:      1-Jun-88 12:16am    Schedule File: C:\TLDATA\NOTIS



                                        89
                                       Mar  Apr May Jun Jul Aug  Sep Oct
                        Who     Status  1    3   1   1   3   1    1   2

NOTIS Tape Received                         .   .   .   .   .    .   .
Keyword/Boolean "Ins                        .   .   .   .   .    .   .
Technical Training O NOTIS1,Li+             .   .   .   .   .    .   .
Conversion Specifica NOTIS1,Li+ r           .   .   .   .   .    .   .
Module Order Chosen  Libl, Libs r           .   .   .   .   .    .   .
Patron Records Avail Libs       r           .   .   .   .   .    .   .
RLIN tapes to BNA fo Admin                  .   .   .   .   .    .   .
Scanners Installed   Ops                    .   .   .   .   .    .   .
Accept Conversion Sa Libs                   .   .   .   .   .    .   .
Customization S/W De NOTIS1                 .   .   .   .   .    .   .
Purchase Orders, For Libs       r           .   .   .   .   .    .   .
GTO Received Inhouse                        .   .   .   .   .    .   .
Custom Loader Availa                        .   .   .   .   .    .   .
Software Complete                           .   .   .   .   .    .   .
Clean Bibliographic                         .   .   .   .   .    .   .
Local Holdings Data                     ----------.   .   .   .    .
RLIN Interface in Pl                    ----------.   .   .   .    .
Smart Barcode Tape A NOTIS1                 .   .   .   .   .    .   .
NOTIS Tape Loaded    Tech1                  .   .   .   .   .    .   .
Bib Data Available                          .   .   .   .   .    .   .
NOTIS "Installed" Of Tech1                  .   .   .   .   .    .   .
Load NPS Records     Tech1                  .   .   .   .   .    .   .
Demo Catalog Open                           .   .   .   .   .    .   .
Feedback from Staff  Libs,Tech1  C          .   .   .   .   .    .   .
Training Materials D Libs,Admin             .   .   .   .   .    .   .
Customization of Tab Tech1       C          .   .   .   .   .    .   .
Tables Generated     Tech1       rC         .   .   .   .   .    .   .
Barcodes Ordered     Admin,Libl             .   .   .   .   .    .   .
ALA Terminals Receiv IBM                    .   .   .   .   .    .   .
Terminals Installed  Ops                    .   .   .   .   .    .   .
Hardware Complete                           .   .   .   .   .    .   .

-------------------------------------------------------------------------
D Done                  ===  Task          - Slack time (==---), or
C Critical              +++  Started task    Resource delay (---==)
R Resource conflict       M  Milestone     > Conflict
r Rescheduled to avoid resource conflict   p Partial dependency
Scale: Each character equals 1 week
-------------------------------------------------------------------------

TIME LINE Gantt Chart Report                          Strip 2, Page 2
```

Figure 58. GANTT Chart for NOTIS Implementation - Part 5.

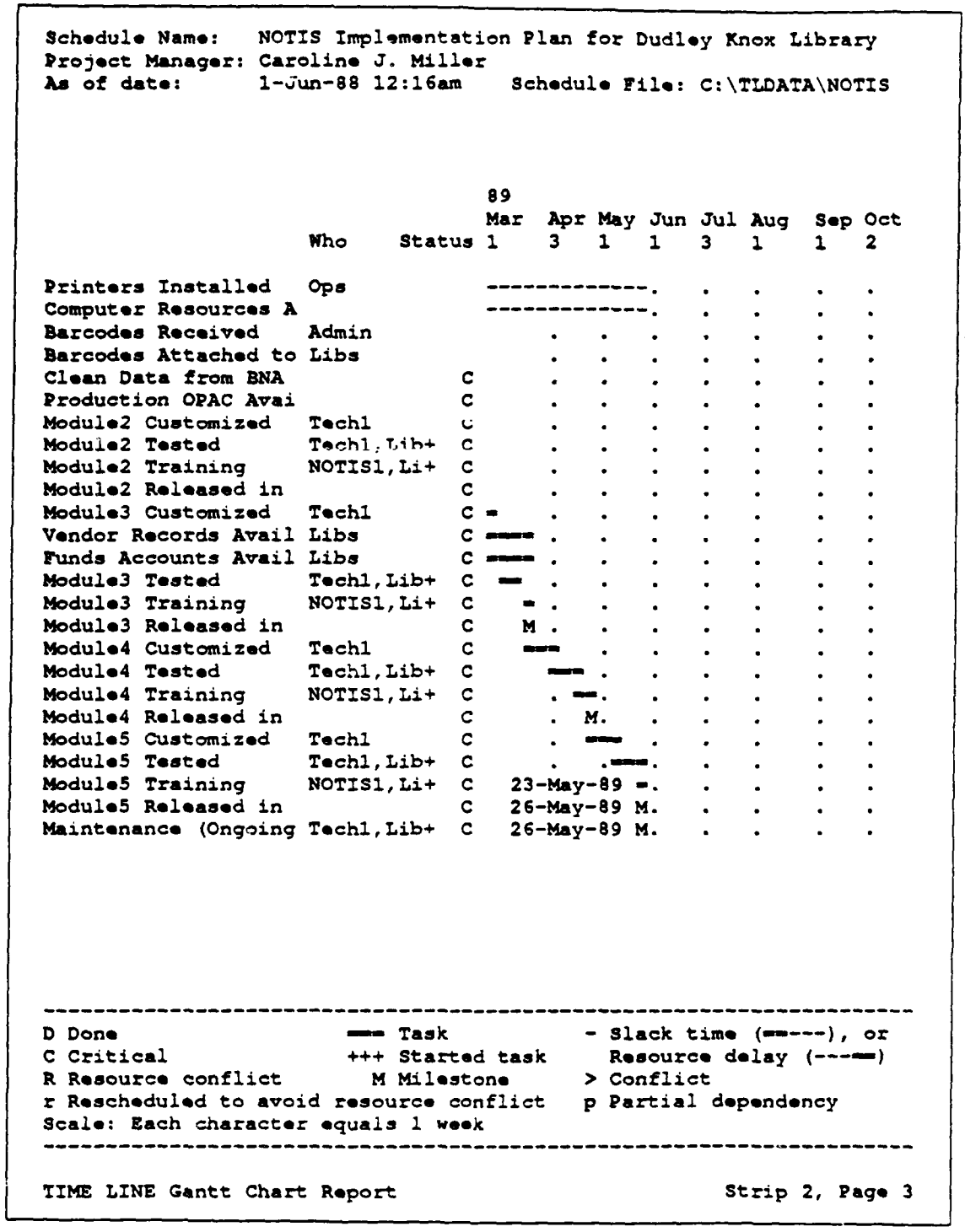


Figure 59. GANTT Chart for NOTIS Implementation - Part 6.

VII. CONCLUSIONS.

> While library literature contains much discussion of the increasing cost of the labor required to maintain card catalogs and of the declining cost of computing resources, there has been no comprehensive analysis of the costs involved in developing and implementing an online catalog, nor has there been a detailed exposition of the way in which these costs might be recovered through saving in labor or other expenses associated .... [Ref. 10: p. 225]

According to Howard Schaeffer [Ref. 19: p. 83], the most promising criteria for gaining approval for any new system are

1. improved user service,
2. more efficient processing,
3. reduced cost.

The first point has been thoroughly discussed in Chapters 2 and 5. The benefits of automation are well documented in the literature, in interviews with library staff, and from surveys of user satisfaction in librarys where IOLSs have been in place for an extended time. There is little doubt than an IOLS improves services to library users.

Efficiency has been demonstrated by improved workflow, closer relationships in technical services functions, currency of information, automatic collection of statistics, and predefined report generation. Automated circulation will free one person from "desk duty" to work on projects in the Reader Service office. Lower unit costs are expected as a result of more effective use of staff time.

It is the last item that is the most controversial. The Library expects no staff reduction, only rearrangement of duties.

> It is clear that any institution installing NOTIS will need a staff of at least a couple of people. NOTIS is not a turnkey system. It requires a fair amount of customization, at the very least to set up all the tables, choose all the options that are needed, write programs to generate special reports and so on. [Ref. 20: p. 38]

Libraries that have published reports of cost-savings have been much larger than the Dudley Knox Library, and have had the benefits of automation for as long as 15 years. While it is likely that full projected costs for the Systems Librarian will not be spent, no guarantee of staff reduction can be given. This does not mean that a strong economic justification cannot be made for installation of an integrated, automated system.

An estimated present value can be applied to the indirect benefits that the IOLS will bring to Library users. If the present value of the benefits is equal to or greater than the

present value of the costs of NOTIS installation and maintenance, then clearly NOTIS meets the criteria for "reduced cost", and the project should be approved.

This is the case with NOTIS at the Naval Postgraduate School. By estimating how much time Library users save in a year by accessing NOTIS from their office, by finding research materials faster, and by having materials available sooner, a dollar benefit has been established for the intangible benefits of the IOLS. Better teaching has value to the Government, and this value has been quantified for the purposes of this study.

The estimated Present Value of the benefits of NOTIS over the 10-year life cycle is $1,243,400. The estimated Present Value of the costs of NOTIS installation and support over the 10-year life cycle is $856,800. Given the benefits of vastly improved service, fuller value for funds already spent, and more effective Library workflows, it seems reasonable to recommend the purchase and installation of NOTIS as the IOLS of choice for the Dudley Knox Library.

APPENDIX A. SUPPORTING DATA

A. DEFICIENCIES IN CURRENT MANUAL PROCESSES

The existing manual Library procedures are not adequate for current needs. Bibliographic information, once found, is entered and used independently by each Division, with almost no overlap. This redundant effort is time consuming, labor-intensive, inefficient, and expensive.

Deficiencies in the current system have been documented by the staff in a formal report to the Administration:

> RLIN does not support a complete fiscal accounting system, and Acquisitions reports are not as detailed or as cumulative as could be desired. Direct access through RLIN to vendors is not possible. The authorities subsystem is not adequate for the Catalog Division, and all divisions are hampered by dependence on a card catalog... Reader Services has no on-line access to our collection, and circulation statistics are manually kept. The Administration does not have at its disposal automatically generated reports. [Ref. 21]

All statistics collected and all reports generated by the Library are prepared manually.

An integrated system is one in which several functions share a common data base, and all functions can be accessed using a common sign-on and related commands. Not all automated systems are integrated. A central source, with bibliographical information entered at the time of item ordering and used in all functional areas (ordering, receipt, invoicing, cataloging, processing, circulation), would not only save effort, but would be more accurate, more timely and more accessible.

B. IOLS SPECIFICATIONS

A strong statement of Dudley Knox Library's IOLS requirements is found in Bobbie Carr's Catalog Division Analysis paper of April 9, 1986: [Ref. 22]

> ***DETAILED SYSTEM OBJECTIVES:***
> ...give us truly interactive programs, increased extracting capabilities, and extensive indexing. Patrons should be able to search our lists of periodicals and faculty publications on-line.
>
> An online catalog should permit full authority control with global change capabilities. It should permit interactive information on the status of library materials. It should permit full interactive record editing capabilities. And of course it should provide copy-level information. Retrospective conversion of all holdings into machine readable form is a necessary first step.

An integrated library system should include the following subsystems: acquisitions, fund accounting, serials control, cataloging, circulation, and an online public access catalog. The system should run from one bibliographic data base consisting of full MARC records (MARC in and out) to the copy level. The system should permit various levels of access. Each subsystem should be online interactive with the online public access catalog.

Acquisitions must have a complete fiscal system with fund accounting and summary reports. The system should be capable of generating online direct orders as well as print orders.

Catalog requires full screen editing, the capability of modifying any field, and a linked authority system which will automatically evaluate, create headings and cross references and perform global changes.

Circulation should include inventory control, online checkin, checkout, renewals, holds, and overdue notice generation. The system should be capable of compiling statistical reports of patrons by category and circulation of items by subject and format.

The online public access catalog should allow for a choice of dialogue mode. Search capabilities should include Boolean, keyword, subject, instring, and full text searching from any fields that the Library specifies. It should allow browsing and inform patrons of the status of the item.

The serials subsystem must include checkin, routing, claim, and bindery records. Administration should be able to retrieve reports on acquisitions, cataloging, circulation, online public access catalog use, and serials. An electronic mail system should be included.

CONSTRAINTS: The system should be compatible with RLIN and must allow loading of existing archive tapes. Records must be able to be downloaded directly from RLIN.

The system should be IBM-compatible.

APPENDIX B. INTERVIEWS WITH NOTIS USERS

> A valuable source of information for any type of automation project is other libraries. Institutions that have already undertaken a similar project can lend valuable insight into the general planning process, and a great deal can be learned about specific systems or services from libraries already using them. [Ref. 9: p. 231]

A. NOTIS USERS' GROUP MEETING (NUGM) INTERVIEWS

NOTIS Systems, Inc. hosts an annual meeting of their users. Representatives from libraries all over the world gather to learn more about NOTIS, to share their expertise with others, and to help shape the emphasis of the company in the coming year. Jane Burke, President of NOTIS Systems, Inc., is interested in feedback from NOTIS users, and uses the NOTIS Users' Group Meeting (NUGM) as a forum for ideas and relative priorities.

Library and Computer Center staff members attended the 1988 NUGM as "prospective new users". The following information was gleaned from representatives of installed libraries, and from NOTIS Systems, Inc. staff.

1. Installation

An average installation team is five or six people, divided 50-50 between librarians and programmers, according to a NOTIS Systems, Inc. customization staff member. CUNY had five programmers involved in their NOTIS installation, which took 3 1 2 days. Programming staff included three application programmers, one CICS person, and two systems programmers, in addition to the two NOTIS, Inc. system engineers on site.

2. Transaction Rates

There are no "average transaction rates". CPU utilization depends on the system load, resources available, level of patron activity, number of bibliographic records in the database, and whether you have keyword-Boolean search active or whether the workload is primarily simple query (author lists, search by title). Most users get their transaction rates from CICS; CICS rates are tabulated by the month, not as transactions-per-second.

Florida's university consortium, with 1000+ dedicated terminals and 5M bibliographic records, has 8.6M CICS transactions per month. Loyola has 348K transactions per month, with no response problems. A typical library running 150 terminals and a half-million bibliographic records can expect 250K transactions per month. The

Knox Library system will be smaller than that. John Kolman, head of NOTIS Systems, Inc. systems development, says NPS can expect between 150-180K transactions per month.

A transaction is one author title search, or one charge discharge of a book at circulation. Some activities contain multiple transactions.

3. Response/Configuration

I heard no complaints at all about response time from any users. NOTIS is "very efficient", and "very reliable", according to those with whom I spoke. Says a Penn State user, "you won't know NOTIS is on the machine, except for keyword". It is "an order of magnitude faster" than Penn States's best package, and runs twice as fast as their "average" package, according to their job accounting statistics. They are very pleased with it.

If there should be a problem with response time, then NOTIS Systems, Inc. would want to check the local system configuration "to make sure that resources are available" to run NOTIS. NOTIS Systems, Inc. does not pre-approve individual configurations because "in 100 installations it has never been a problem".

4. General Support

Documentation for both Library and Programmer is complete, and is improving in quality and format. NOTIS Systems, Inc. staff numbers 72, which is a 53% increase in support personnel during the past 18 months. The Customer Services division functions as a "clearing house" for information. It collects, documents, and propagates problems and fixes, using an on-line tracking system. The *Trouble-Shooting Guide* is updated monthly, and mailed out to all user libraries.

5. Onsite Support

Of the fifteen days a year provided by NOTIS Systems, Inc. for on-site support, three or four should be for data processing staff, and twelve should be for library staff. Additional training days can be contracted for $500 per day plus expenses.

After NOTIS is up and running in production, it takes less than 50% of a programmer's time to keep the tables, security, and indexes current, for a "vanilla" installation. The more modifications to the standard code, the more time it takes a programmer to maintain it, and the longer it takes to get new releases up and running.

B. SYNOPSIS OF ON-SITE VISIT TO LONG BEACH PUBLIC LIBRARY

Roger Martin, Bobbie Carr, and Caroline Miller visited the Long Beach Public Library (LBPL) on June 3, 1988, to see and talk with those responsible for the installation and day-to-day operation of NOTIS. Tim Winkey, head of the LBPL Cataloging Department and NOTIS project manager, was our host.

The applications programmer for the NOTIS project at LBPL is Warren Seek. He has been with the project since February 1985, and provided most of the systems-related information. Warren Seek works on one other project (Police Department support) besides NOTIS. A synopsis of the discussion follows.

1. Installation

LBPL was already on an automated system when it transferred to NOTIS; therefore its NOTIS installation does not reflect the same problems as a manual-to-IOLS conversion would. They also obtained the MVS version of NOTIS before it was available for beta testing,[2] so LBPL experienced many more delays than normal. LBPL staff helped debug the MVS version, and had to wait for fixes to be researched and written, not just identified and sent.

Three full-time programmers were involved in the NOTIS installation at LBPL. One worked only on conversion of data; two others worked on both the load and conversion processes. "Conversion" (i.e. customization) is the hardest part of the installation, requiring close cooperation between the Library and the applications programmer for an extended period, as library policy is translated into tables directing the NOTIS modules.

NOTIS modules are assembler-based (on-line portions and batch) and all reports are in PL/1. Because LBPL had no PL/1 experience, and NOTIS was not able to support extensive customization of the PL/1 programs, all reports were rewritten in COBOL, locally.

Documentation is complete. The installation manuals are quite detailed, being clear, explicit, and filled with examples for installation. One two-inch binder contains Installation information, and two two-inch binders comprise a Programmers' Reference set. Five two-inch binders contain information for the librarians. Two copies of

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2 Beta testing is a pre-production release of software packages to designated volunteer sites that get the software free in return for running the software in production, for reporting on performance and problems, and for helping to debug the system. Only after this "stress testing" is the software offered for sale.

documentation come with the NOTIS software; LBPL keeps one in the data processing office, and one in the main library. Updates are sent out "all the time".

New releases come out about every six months. The old release is supported for six months after the new release becomes available. The last new release took about two weeks to remodify after it was installed; the process is generally smooth.

Customization is the key to usability with NOTIS. The "vanilla" version is suitable only for training. Allow at least three months for customization. (LBPB took five months to extract and change the data from their Ulysses system to NOTIS). The screen verbiage and appearance and the help files are the major areas of change for the on-line portion. Privacy laws mandated minor changes in displayable information. Major changes to the on-line portions should be avoided, as they must be remodified with each new version, and it is much more complex than just inserting the few lines of changed added code into the new code. Sometimes entire modules must be rewritten to incorporate changes.

The batch mode required more modification than the on-line portions of NOTIS. They rewrote the reports completely, as noted above.

LBPL has no demand printer. Daily, weekly, and monthly reports are generated by batch programs and are printed at the data center. Normally less than 3-inches of paper output is generated for the library on any given day.

2. Systems Details

IBM 3380s are used to store the NOTIS source and data. File sizes vary. All files reside on one 3380; there has been no contention problem. There are seventeen different data files stored; index files are small. The major files are:

Type	Number of Records	Cylinders
Bibliographic records	360K	350
Patron records	160K	80
Item records	1.6M	210

Total storage required is over 1,110 cylinders. This includes the load libraries.

Backup is done on IBM tape cartridges. All files are backed up every night. Four generations of data are kept. Nightly backup takes only half an hour, and two cartridges. Weekly "cleanup" runs (IDCAMS copy, delete, redefine) take slightly longer, 45-50 minutes. Warren Seek says that 100-150 cartridges are enough to support NOTIS.

Transaction rates vary. High-volume days are Saturday and Tuesday, when 82,00 transactions day are normal. A low volume runs about 10,000 transactions and the overall average is 45,000.

Response time is "instantaneous", according to Tim Winkey. NOTIS has little impact on the 500-terminal IMS shop run by the data center, according to Warren Seek. It uses less than 5% of the CPU resource on the shared processor. It is "efficient, smooth-running" and has no impact on other on-line users.

3. Training

Training of the staff was done by NOTIS for a group of six Librarians (branch heads) onsite. The librarians then trained the rest of the staff. New hires are trained individually as they come. Group sizes are kept to six or less, with two people to a terminal.

User training is informal, consisting of a single 8x10 sheet by the public access terminal, and of answering questions that the user brings to the "Information Desk". The card catalog has been closed, and prominent signs on the cases instruct patrons to check the computerized catalog for all materials newer than February 1986.

Mr. Seek feels that user training is unnecessary because of the meticulous attention paid to the on-line help screens. This was the most time-consuming effort in tailoring NOTIS to LBPL--wording, arrangement, highlighting were all carefully suggested, changed, used, and changed again. A committee met once a week for months to evaluation and suggest modifications, use the new screens, and make further changes.

LBPL has no systems librarian on the staff, because the data center supports the installation and maintainence, and does programming for NOTIS. They have one applications programmer (Warren Seek), who tells systems support (CICS person) the parameters NOTIS needs. The systems programmer maintains CICS.

4. Physical Layout

There are 14 terminals in the technical services area, and more are needed. Terminal positions are dictated by line availability and by cables which were installed for the previous on-line system; in some cases, telephone lines are used.

Every branch library has two terminals at the circulation desk, for checkout of materials, and to answer questions. Each branch has four public access terminals either by the catalog or in the stacks.

The main library has terminals spread throughout the stacks in clusters (doubles or groups of four) or singly. There is a 10-minute time limit on the use of the public access terminals.

Security is provided by RACF and NOTIS, with access tied to the user ID. Access is defined to the field level, so that staff may see some parts of a record, but update only one or two items of what they can see. Privacy concerns limit access to the minimum. All links between a patron and an item are broken when the item is returned from circulation. (No past history of a patron's reading preferences is kept.)

Data accountability is created by journal entries. Everything that is keyed goes into journal four. Operators' initials are part of some records.

5. Impact of Automation

Warren Seek thinks that the on-line catalog and on-line editing have had the biggest impact on the library. "There is no typing anymore!" By this he means LBPL uses no worksheets, and no printed MARC records; all files and records are on-line.

No additional billets have been added to the library staff, but there is a tremendous need for one full-time person to support NOTIS. Tim Winkey is a full-time cataloger plus the NOTIS project manager; he spends more than full-time at his job. Plans are to hire a replacement Cataloging Department Chairman when funding is available, and let Mr. Winkey devote full-time to NOTIS.

The data center has added one applications programmer as the NOTIS primary support person. It took a full man-year to install NOTIS and customize it, and then half a man-year to keep it up and running smoothly. Every new release takes six weeks of full-time effort, after which the programmer can walk away, to juggle other responsibilities with the NOTIS reports and modifications. Most of the problems will occur in the batch jobs; NOTIS is "real clean on-line". The amount of problems will be directly related to the amount of modification the library requires. The amount of programmer support is less if the NOTIS system stays as "vanilla" as possible. Massive customization makes it full-time.

6. General

LBPL has been on NOTIS since February 1986. They had no problems with staff or user acceptance since they were already running an automated system. Their old system was "breaking down rapidly" and had to be replaced. NOTIS wasn't perfect, but was much better than what they had. The transition to NOTIS was undoubedly harder for LBPL than it would be for the Knox Library, as LBPL helped to debug a new version.

If they had it to do over again, they would, but not with Telex terminals. They would prefer IBM terminals with ALA-character set support; they also would want more printers.

The major problems have been in the batch programs. Test data did not disclose the difficulties that arose in batch programs; only in production-sized runs do the errors occur. LBPL has the luxury of a full-size test system that runs "real" data. Warren Seek suggests that we try to maintain the same sort of test system, unless we are DASD-constrained. "It is important to process in a test environment the production system."

Mr. Seek repeatedly stressed the importance of close interaction between the Library representative and the Programmer. They must work closely to define the initial job flow and tables.

There must be a primary contact point between the library and the data center. The responsibility of defining clear library policy (for rules about type of patron, type of materials, length of circulation, schedule of notifications, wording of notices...) which is reflected in NOTIS tables must be delegated to a library person. That person should not be expected to fill other positions during the time of NOTIS installation. The NOTIS programmer must also spend full-time on the installation. This is a critical area.

LBPL had a Management Team consisting of Program Project Manager plus two programmers, the Library Director, Main and Branch Librarians, Circulation and Cataloging Chairmen, and floating staff members who came when their expertise was needed.

There was also a committee to decide on the help screens; this was an open meeting held once a week to collect all input, and to see the changes from the previous week, then to criticize and suggest a better way. This feedback cycle proved very useful in formatting the final on-line screen layouts.

The policy decisions were not made by committee. The library representative met with the Librarians and subcommittees once a week (or more often) but worked one-on-one with the programmer for table definition. Often policy had to be clarified (or invented) before it could be defined.

A "freeze point" was declared during NOTIS installation to accommodate the switchover. No new entries were made from Feb. 19 until NOTIS "went live" on Feb. 24, providing a "snapshot for conversion". The systems were run in parallel for a time after NOTIS went into full operation. All returned items were checked in on both systems; only after the first overdue period (3 weeks) had passed was the old system phased out. About 35 overdue items were "abandoned" rather than keeping the old system up to track them.

The circulation report was written locally, taking about 6 months of programmer time. It is run daily (summaries by location) and monthly for more specific detail (statistics on adult juvenile, by Dewey number within location...). It is so specifically tied to LBPL that it does not have general applicability to other libraries. Standard NOTIS circulation reports tend toward summary, not breakdown, according to Warren Seek.

APPENDIX C. ACRONYMS

AACR2	*A*nglo *A*merican *C*ataloging *R*ules, 2nd Edition
ALA	*A*merican *L*ibrary *A*ssociation
BLIS	*B*iblio-Techniques *L*ibrary and *I*nformation *S*ystem
BRS	*B*ibliographic *R*etrieval *S*ervices
CAI	*C*omputer *A*ssisted *I*nstruction
DASD	*D*irect *A*ccess *S*torage *D*evice; peripheral device for on-line data storage
IOLS	*I*ntegrated *O*n-line *L*ibrary *S*ystem; a system in which various library functions are interrelated in generation and processing of data
ISBN	*I*nternational *S*tandard *B*ook *N*umber
LC	*L*ibrary of *C*ongress
MARC	*MA*chine *R*eadable *C*ataloging
NOTIS	*N*orthwestern *U*niversity *O*n-line *T*otal *I*ntegrated *S*ystem
NPS	*N*aval *P*ostgraduate *S*chool
OKAPI	*O*n-line *K*eyword *A*ccess to *P*ublic *I*nformation
OPAC	*O*n-line *P*ublic *A*ccess *C*atalog
PERT	*P*rogram *E*valuation *R*eview *T*echniques; *scheduling diagram that uses a* network chart to show events (nodes) and time (links) each event is expected to take.
RLG	*R*esearch *L*ibraries *G*roup
RLIN	*R*esearch *L*ibraries *I*nformation *N*etwork

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