The Library Circulation and Finding System discussed here is implemented at the Newman Library at Virginia Tech. Virginia Tech is an educational sanctuary that is located somewhere between the Blue Ridge Mountains and the Appalachian Mountains in southwest Virginia. We have a student population of 19,500 and the faculty and staff add up to 5,000 in number. So the library has approximately 25,000 patrons to serve. The library has a collection of one million volumes and is growing at the rate of approximately 10% a year, or 100,000 volumes a year. The manual circulation system was becoming totally inadequate to handle the 225,000 circulation transactions that we have each year. The obvious route in which to go was to see if some of the functions could be computerized.

In order to support circulation alone it is only necessary to use absence files. Absence files imply that a machine readable record be kept of only those items that are currently in circulation. Typically, this would be anywhere from 5 to 15% of the entire collection. Thus, a system based on absence files would require less resources than one that is predicated on having the entire collection in machine readable form. Very early in the decision making process it was agreed to have a system based on the entire collection being in machine readable form. Whereas this approach is initially more expensive to implement, it has some significant long term benefits. For instance, it allows for a computer based searching and finding capability which would not be possible otherwise. It permits the production of microfiche catalogs that can be easily distributed

to locations within and outside the University. It allows for a proper monitoring of the usage and trends in the library collection.

The design and implementation of the system was divided into two phases. Phase I of the system involved the development of the functional aspects of the system. Phase II, not yet implemented, involves the development of management analysis reports and statistics. Phase I is divided into four functional areas. They are:

1. Circulation control functions
2. Searching and finding functions
3. Data entry functions
4. Backup recovery and other utilities

The circulation control functions included checkout and checkin, holds/recalls, overdue notices and fines, bindery control, and inter-library loan. One of the primary objectives of the system was to provide a quick and efficient method for the check-in and check-out process. In order to facilitate this it was necessary to have a machine readable record associated with each item in the collection and with each patron using the Library. Accordingly, a barcoded label was (or will be) placed on each item of the entire collection. This barcoded label is machine readable and uniquely identifies the item. The ID-numbers of all patrons are also barcoded on the ID-cards. The checkout process simply consists of running a light pen (which reads the bar coded labels) across the label on the ID-card which identifies the patron to the system. This is followed by running

the light pen across the labels on the books to be checked out. This essentially completes the check-out process for the operator since the system automatically assigns the due dates for the items.

Whereas the check-out process is externally very simple, the system performs several functions before it permits the successful completion of the process. On reading the patron ID-card the system makes two checks. First, it checks to see if the patron is delinquent. If the patron is delinquent he has to first clear his record or receive special permission to check out the book. Next the system identifies the type of patron (staff, student, etc.). Associated with each type of patron is a default circulation period and it is this that the system retrieves and stores for subsequent use.

Upon reading the barcode on the item to be circulated, the system first checks to see whether or not the item is allowed to circulate. Reference materials do not normally circulate. If the item is not allowed to circulate then the system blocks the check-out process. Next, a check is made to insure that the item is not already charged to another patron. It would certainly be undesirable to have the records show that a given item is checked out to more than one patron. Thus, an item has to be checked in before it can be checked out. The system also retrieves the normal circulation period of the item. The return date for the item is determined by using the smaller of the patron circulation period and the item circulation period. A prestamped return slip is placed in the book, thus completing the check-out for that

particular item.

The check-in process is essentially similar except that the patron ID-card is not necessary for check-in. At the time of check-in, if the book was overdue then the system automatically computes the fine. If the patron is able to pay the fine, this is recorded and the transaction completed. If the patron is not able to pay the fine then a fine record is automatically created for the patron and the patron is considered delinquent.

The hold/recall operation is closely associated with the check-in process. Holds may be placed either at the call number level or at the item level. (Simplistically speaking, a call number hold means that a patron is willing to take any copy of a given book and an item number hold means that a patron wishes to have a specific edition, copy, or volume). In order to place a hold the patron gives the information to the operator and also fills out his address on a notification card. The notification cards are numbered serially and this serial number (or hold number) is also identified to the system. During check-in the system checks to see if a hold was placed on the book being checked in. If a hold was placed the operator is alerted and the hold number is displayed on the terminal. Using this hold number the operator pulls out the right notification card which is then mailed to the patron, informing him that his book is now available. The book itself is placed on the hold shelf.

When the patron comes to check out the book that was being held, the system, during the check-out process, insures that the book is indeed being checked out to the patron that placed a hold

on it. This acts as a double check and insures that the patron who requested the book first gets it first. There are many situations in which such an operating procedure can be unduly restrictive. Therefore, the system allows the operator to override any of the built-in checks if the circumstances so dictate.

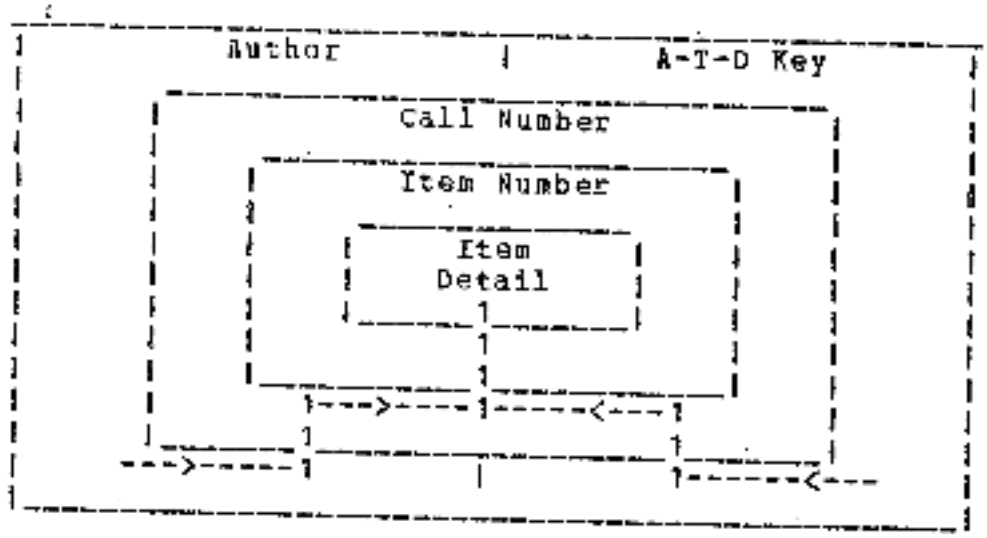
Procedurally, with one exception, the recalls are processed exactly in the same manner as the holds. In the case of the hold, the patron requesting the item waits until it is returned. However, in the case of the recall, a notice is sent to the patron informing him that the item is needed by another patron. Barring this one distinction, the two procedures are identical.

The system is designed to automatically generate overdue notices. Unlike all of the procedures described thus far, which are controlled by the use of a terminal, the overdue notices are produced by a batch program. As needed a batch program is initiated to generate overdue notices. A notice is sent to each patron having items that are overdue. The information on the notice includes the call number, title of the book, and its due date. An overdue book also makes a patron delinquent.

The bindery control function produces the necessary reports needed to determine what items have been sent to the bindery and when those items are expected to be returned from the bindery. Inter-library loans are processed as if the requesting library were a patron, with each library being assigned a unique barcode number. Thus, items are checked out as in the normal checkout process described above.

The searching and finding capabilities include an author search, a call number search, an item number search, and an author-title-date key search. Also, there are ways in which the circulation file may be searched to determine the status of an item or what items a patron may have checked out. At data entry time the system automatically generates an author-title-date key. The author-title-date key is 14 characters long and consists of three parts. The author data is used for the first part and consists of 6 characters. Five characters come from the author's last name and the sixth character is the first initial. In case of corporate authors, the first six non-blank characters are used. (In many cases a list of standard abbreviations is used). Eight characters are taken from the title. The first four characters of the first word plus two characters each from the next two words are used. The key does not need to be composed of the parts given above. It may be formulated in any fashion as long as it is fourteen characters in length. In addition, the publication date, if known, can be used to further limit the number of items displayed. In searching with the key use of partial information is permissable. Thus, if the author's initials are unknown then a '?' may be used instead. It would be perfectly acceptable to use S?,? as an author name and initial, implying thereby that the author's last name begins with S and no further information is available.

In all cases, the search is hierarchic. The following diagram explains the hierarchy.



The author search or the ATD-key search both lead to call number information. The call number search leads to item information and the item search gives the detail information concerning the item. Starting at any level of the search it is possible to go on to lower levels without rekeying any information displayed on the screen. Each request produces a response of no more than 16 lines. If a greater number of entries meet the search criteria then one screen is filled up and the word "more . . ." is displayed in the bottom right hand corner to indicate that there is more to come.

The 80/20 rule of inventory control states that approximately 80% of inventory carrying costs are due to approximately 20% of the items in inventory. A similar rule is surely true of library circulations. A rather small percentage of the total collection accounts for a large percentage of total circulation. In order to get the system running it seemed reasonable therefore to first capture all the data associated with items that circulated. Accordingly, the following data

entry and circulation procedure was established to support initial entry of high usage data:

a. Barcoded item labels were ordered in pairs.

b. For items that did not have a barcode on them the patron, at circulation time, wrote out only the call number on a slip of paper.

c. One barcoded label was placed on the item and its duplicate on the slip.

d. Circulation was now completed for the barcoded item and the slip with the item number and call number sent to data entry.

e. The data entry personnel could then enter the necessary data for the item in circulation without delaying the patron at the circulation desk.

The placing of the barcode on the book required some consideration. Perhaps the best location for it would be on the spine. However, the spine already had the call number on it and in many cases the spine was too thin to hold the label. The best alternative, therefore, was to place the barcoded label on the top left hand side of the front cover. This would be the most visible and accessible location. In case of physical inventory the label could be exposed and read by merely tilting the book on the shelf without completely removing it. The barcoded labels are coated with a protective coating to give them greater shelf life.

Two formats are available for data entry. The short format includes only the minimum data necessary for operations. This

data consists of item number, call number, LC card number, location, and circulation period. The LC card number is included because it acts as an access point to the MARC records. This will permit, at some future date, the extraction of full bibliographic records from MARC files. The long format consists of the data shown in Appendix A. Data may be entered on-line or by a combination of batch and on-line processing. Both formattable and non-formattable screens are available for data entry.

A three pronged approach is being tried for data entry. First, the circulation data is being captured as the books circulate. Initially only the short form is used for these items. Next, complete data is being entered for newly acquired items and for items processed during a shelf by shelf conversion. The third approach calls for capturing the complete data by extracting it from the MARC record using the LC card number. This last approach has yet to be implemented.

Since many of the operations for this system are on-line, it was imperative that proper backup and recovery procedures be included as an integral part of the system. In order to have the most reliable recovery procedure it was decided to log every update transaction on a system log. Further it was decided to put the log on a tape drive rather than a disc drive. Whereas tape logging is slower than disc logging it is significantly more reliable. If logging were done on disc then a disc crash would lose both the data and the transaction log causing an "unrecoverable" problem. Since no hard copy is kept on many of

the Library transactions this situation would be unacceptable.

Also in order to maintain the integrity of the data base contents various reports listing the contents of the data base are available. These reports include author list, galley proof list, and holdings list.

Summary

To summarize, the Library Circulation and Finding System provides for the following capabilities:

1. Creates a new record or modifies an existing record for each item in the library.
2. Creates a new record or modifies an existing record for a patron.
3. Provides a check-out facility which performs the following checks:
   a. identifies delinquent patrons
   b. identifies items that may not circulate
   c. automatically determines loan period
   d. allows for loan period other than normal.
4. Provides a check-in facility which performs the following:
   a. automatically clears patron record
   b. identifies items on hold or on recall
   c. keeps track of fines.
5. Provides a procedure for holds and recalls.
6. On a periodic basic prints overdue and recall notices.

7. Provides access into data using the following:

    a. Patron number

    b. Item number

    c. Call number

    d. Author

    e. Author-Title-Date key.

8. Provides for backup and recovery.

9. Collects statistics and does housekeeping chores.