LIBRARY SYSTEMS DEVELOPMENT

FOR THE

TRIANGLE UNIVERSITIES

Consulting Report

by

Ritvars Bregzis and John F. Knapp

January 1979
# CONTENTS

<table>
<thead>
<tr>
<th>I</th>
<th>INTRODUCTION</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>The Consultants' Task</td>
<td>1</td>
</tr>
<tr>
<td>B.</td>
<td>Study Objective</td>
<td>1</td>
</tr>
<tr>
<td>C.</td>
<td>Procedure</td>
<td>1</td>
</tr>
<tr>
<td>D.</td>
<td>Methodology</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>SUMMARY AND RECOMMENDATIONS</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>TRENDS IN INFORMATION TECHNOLOGY</td>
<td>7</td>
</tr>
<tr>
<td>IV</td>
<td>THE REQUIREMENT FOR BIBLIOGRAPHIC ACCESS AT THE TRIANGLE UNIVERSITIES</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>A. Learning and Research Resources</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>B. Re-adjustment of the Direction</td>
<td>14</td>
</tr>
<tr>
<td>V</td>
<td>GUIDELINES FOR DEVELOPMENT OF BIBLIOGRAPHIC ACCESS</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>A. Alternatives for Bibliographic Access</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>B. System Criteria</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>C. Recommended Approach</td>
<td>24</td>
</tr>
<tr>
<td>VI</td>
<td>GENERAL DESCRIPTION OF THE BIBLIOGRAPHIC ACCESS SYSTEM</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>A. Basic Configuration</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>B. Principal Components</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>C. Implementation Phases</td>
<td>33</td>
</tr>
</tbody>
</table>

| VII| APPENDICES                           |
|    | I Depth of the Bibliographic Record  |
|    | II COM Catalogue Development         |
|    | III Acquisitions Systems Development |
|    | IV Circulation Systems Development   |
|    | V Authority Control                  |
|    | VI Project Management                |
I  INTRODUCTION

A. The Consultants' Task

The consultants were asked to investigate relevant conditions in the Triangle university libraries, to outline reasonable options possible within the scope of the current technology, and to recommend an approach for joint development of a system that could provide bibliographic access to the collections of the three libraries and serve the union catalogue function for their collections (Letter, J. Hewitt to R. Bregzis, July 18, 1978, p.2)

The consultants were asked to take into account the obligation of the Triangle university libraries to serve not only their affiliated constituents, and the non-affiliated constituents in the Research Triangle Park area, but also the other fourteen campuses of the University of North Carolina system, as well as the citizens of North Carolina.

The consultants were also asked to evaluate the systems presently in operation and under development in the three university libraries and their suitability for networking and resource sharing; to evaluate alternatives in establishing such systems; to recommend a system for joint development; to recommend developmental priorities; and to indicate in general terms the required hardware configuration and resource commitment.

B. Study Objective

The objective of this study was to identify the service goals, needs, and priorities specific to each of the three libraries and common to all three, to interpret these components as an integral part of a larger over-all information service goal, and to define specific objectives and steps required towards reaching this goal.

C. Procedure

The study consisted of a one week period devoted to on-site visits to the three university libraries. These visits encompassed exploration
of the service objectives of these libraries, their available staff and budget resources, the service environment and conditions, as well as a review of the automated systems in operation and under development.

Due to the time constraint, the study had to be limited to an overall assessment of the principal target components of this study, mainly through discussions with administrators of the three libraries, the department heads, some key staff members and some task oriented advisory groups. In addition, relevant existing documents were made available to the consultants.

The quick pace of the on-site visits confronted the members of the three libraries with a highly demanding task to react spontaneously to the consultants' exploratory inquiries and questions. The consultants appreciate the unreserved and collegiate openness of the staff in the three universities, and are thankful for the competent, synoptic, and cogent answers received. Any misinterpretations which may have arisen in the assimilation of these communications the consultants acknowledge as their own.

D. **Methodology**

The methodology used in this consulting review encompasses the following approaches:

- discourse and observation through interviews and discussions with individuals and task oriented groups, and through inquiry in on-going library operations.

- assessment of the observed situations at the Triangle Universities against the consultants' perception of corresponding activities, performance, and techniques currently prevailing in the field.

- identification of strengths and capabilities with emphasis on common needs and interests of the three libraries.

- development of solutions which the consultants judge to be useful, affordable, and expandable in the North Carolina context.
II SUMMARY AND RECOMMENDATIONS

Availability of library resources depends on three primary factors: existence of library resources, accessibility of information (bibliographic) about these resources, and deliverability of these resources.

In the Triangle Universities and in the immediate vicinity there is an exceptional wealth of library collections owing to the long standing practice of planned, cooperative, and detailed acquisition policies and arrangements. There is also an effective library resource delivery mechanism in operation, including extensive inter-institutional lending and delivery arrangements. The weakest link in the library resources availability chain is the accessibility of bibliographic information, in particular outside of the individual library. This is a difficulty common to our contemporary libraries which with their riches and variety of resources have outgrown the capabilities of the traditional catalogue. Nor do the current efforts in computerized library cataloguing and union catalogue systems address the problem of user access to bibliographic information directly and fully.

The proposed solution to this problem entails concentration on user access to bibliographic information as the primary objective, eventually using local mini-computers and data bases along with corresponding telecommunications facilities to bridge the distance between the user and the information about library resources. Such facilities would provide access to this information using a wider range of access capabilities than are possible through the traditional library catalogue.

In a proposed phased development of the bibliographic information access capability, it is recommended that a COM catalogue be established as the stepping stone toward and back-up for the direct access system and also as a distributable bibliographic information resource in its own right.
Recommendations:

1. Establish a computer and telecommunications based bibliographic access system in each of the Triangle University libraries as the core of a bibliographic access network.

2. Continue the creation and derivation of MARC records through SOLINET/OCLC in the NCS Library and the UNC-CH Library and proceed with the installation of these facilities at the Duke University Library. Immediately establish a mechanism for possession of OCLC archival tape records either through facilities which may be offered by SOLINET or directly from OCLC.

3. Acquire a MARC record Accumulation/Update/Translate/Format capability
   . for the development and maintenance of the Bibliographic Access data base
   . for COM catalogue generation

   (cf. Appendix II)

4. Accept a brief-catalogue concept as basis of bibliographic access in COM and on-line forms, at least as an intermediate tool

   (cf. Appendix I)

5. Develop a machine readable Bibliographic Access data base.

6. Establish COM brief-catalogue production, supported either by a locally installed computer software facility which can be used by the three libraries for the generation of the COM fiche, or by a vendor under contract for COM production services.

   (cf. Appendix II)
7. Initiate planning for eventual installation of mini-computer systems with telecommunications capability in the Triangle university libraries, using identical operating systems, telecommunications software, and fully compatible applications software.

8. Implement phased development of the on-line Bibliographic Access System
   a) to access a library's own data base
   
   b) to expand it to mutual access among the Triangle Universities
   
   c) to be followed by further expansion of access from other North Carolina institutions
   
   d) allowing for possible addition of other cooperating institutions with compatible facilities
   
   e) with the view to connect presently existing and still to be developed local bibliographic management systems or services to the Bibliographic Access System

9. Follow the development of LC and OCLC/SOLINET facilities for Authority record service and account for these in the general systems design.
   (cf. Appendix III)

10. Continue operation of the existing Duke University Library acquisitions system and begin an investigation of the applicability of this system as a base for a joint development of a Triangle Universities acquisitions system.
    (cf. Appendix III)

11. Continue operation of UNC-CH circulation system, and complete the development of the NCS UL circulation control system, with a view to its eventual interfacing with the bibliographic access system.
12. Establish a working group under the auspices of TULCC to begin the development of standards related to circulation control.

(cf. Appendix IV)
III TRENDS IN INFORMATION TECHNOLOGY

The recommendations in this report are anchored in a number of theoretical, technological, operational, and economic factors which presently prevail, are presently emerging, or can be reasonably expected to have a significant role in the near future.

- Emphasis on automation for user services

The most significant impact of automation on library service can be expected to occur in the area of direct user services, an area which has not received sufficient attention in the past. The provision of access to the required bibliographic information has the advantage of visibility of service effectiveness, efficiency for the end user, analogy to automated services in other areas, and possible cost benefits. The current and immediate past development in library automation, in particular in the accumulation of bibliographic records, has laid an extensive and solid foundation for automated support of library user service.

- COM technology

COM technology constitutes a bridge between the static, traditional card catalogue as a bibliographic access mechanism and the dynamic, interactive mechanism of conversational on-line computer technology. COM technology is semi-dynamic because it can be re-configured with greater ease, it can be available simultaneously in many places, and it has great flexibility in grouping and presenting its access and information elements.

- Distributed data bases

Current experience indicates that maintaining full integrity of the formalisms and definitions of the complete MARC record
in a very large, universal data base is a task that eludes complete control, fully flexible serviceability to the participants, and operational economy of the data base for specific end uses. The difficulty exists both in the single common denominator of data definitions, as well as in the disparate functional approaches by the user institutions that have to be satisfied by the universal systems mechanism which services the universal data base.

The alternative strategy of distributed data bases can, through the use of dynamic linking mechanisms, substitute for the single, universal mandatory standard. This leaves greater flexibility in the accommodation of local requirements from the local data base, while at the same time maintaining a minimum common standard of essentials without requiring complete uniformity. The added cost of storage, because of data redundancy, is not as significant a factor as it was a few years ago.

Distributed multi-processors

Distributed data bases permit local processing that meets local requirements and at the same time sustain a required set of common service functions. This frees the local processing system from having to be fully functionally compatible with the larger system environment at the applications level. Compatibility is required at the common level of data definition and in the important operating and communications systems functions.

Local processing that can be tied across other processing environments has become feasible and economical with the mini-computer, through its progressively more standardized interfaces and emulation techniques, its processing power, and its storage capacity.

Network communications

Present communications technology and recent introduction of new data communication services have already made interactive data
communication less sensitive to long distance costs. The trend toward distance independent tariffs and the rapidly expanding use of data communication service in a wide variety of business situations indicates that data communication is emerging as an essential and economically feasible service. In conjunction with the availability of distributed multi-processing capabilities and local data bases, data communication facilities are becoming the catalyst for a transition from centralized information processing configurations to decentralized, distributed configurations which can be readily drawn upon to perform a greater variety of individualized tasks.

Gradual evolution

Development of functional capabilities requires planning. The main task of planning is to arrange available resources, tools, and required actions in a manner that ensure attainment of the chosen objectives consistent with the chosen criteria, schedule, and cost. In the process of development, the specific character of resources and tools may change, necessitating adaptation of the plan and change in the required actions. This requires dividing the main goal into semi-independent objectives and the definition of these objectives into corresponding levels of attainment.

Such an approach suggests the need to establish operational components which are free standing, largely self contained and self sufficient, and which function as independent services while at the same time forming the cornerstones for a larger functional structure. The gradual implementation of these functional cornerstones lends capability for dynamic adaptation to the total evolution toward a complex goal, which seldom can be fully defined in detail at the outset and which becomes affected by the ongoing change in the components of its construction.

Reduced MARC record

Bibliographic access systems tend to use mainly selected elements of the MARC record for bibliographic access services. Existing
successful applications (on-line and COM) depend on a limited bibliographic description with emphasis on the versatility and quantity of access elements. A less than complete MARC record can be very service effective in an initial operating base for bibliographic access, covering a wide range of library resources.

Common acceptability

Common acceptability of the first level of system components and services can secure useful results early in the cooperative enterprise. The success of cooperative systems development depends largely on the ability to accommodate a limited number of key requirements of the cooperating parties. By limiting the initial development to requirements that are common and to services and obligations that can be shared readily by all, the successful attainment of this limited objective can then become a commonly acceptable point of departure for the next level of service development. Such an approach permits building on solid results while at the same time allowing for the required flexibility.

Building system services from available functional capabilities

The current trend in library automation follows an approach which concentrates on building of bibliographic records and record handling systems, before planning and evolving automated bibliographic service functions for the public. By contrast, the approach recommended in this report aims first at providing user service based on readily available system resources, leaving the in-depth enhancements to the system for further development, guided by feedback from the initial service attainment.
IV  BIBLIOGRAPHIC ACCESS REQUIREMENTS OF THE TRIANGLE UNIVERSITIES

A.  The Learning and Research Resources

The Triangle Universities are located in the geographical center of one of the most highly concentrated areas of learning and research activity in the United States. The activity of these universities spans virtually the entire spectrum of academic disciplines.

The specialized research facilities of the Triangle Universities are extensive and some of them are of nation-wide and unique significance, as the Duke University's renowned research in para-psychology. These concentrated research facilities have recently been complemented by the establishment of the National Humanities Center in the Research Triangle Park adding emphasis to the balance of research in both the sciences and humanities. With this step, the Research Triangle area becomes the emerging national coordinating center for research in the humanities. The research activity of the Triangle Universities is further complemented by the specialized industrial research facilities of an impressive number of major industries in the Research Triangle Park.

The learning activity so heavily concentrated in the Triangle Universities area (with the combined full time enrollment of about 49,000 students and with over 4,800 faculty) extends further within the University of North Carolina System, encompassing another 14 universities across the State of North Carolina (with nearly 70,000 students and 4,000 teaching staff.) In addition, there are three other private universities (with combined 10,000 students and 400 full time staff), 45 mainly private and denominational liberal arts colleges (with almost 40,000 students and 2,000 staff), 20 community colleges (with about 35,000 students and 1,300 staff) and 35 technical institutes (with about 40,000 students and 3,000 teaching staff.)*

The Triangle Universities possess an impressive accumulation of recorded information resources. The three Triangle university libraries' collections total nearly 6 million volumes and close to 50,000 periodical titles. (The largest university book collection is in the Harvard University containing 9.5 million volumes, and the third largest at the University of Illinois has 5.8 million volumes. In addition to the 6 million volumes in the Triangle area, within a 50 mile radius there are 2 million additional volumes in college and university libraries and within 100 miles almost another 2 million.

The industrial research facilities in the Research Triangle Park possess a significant number of unique and specialized materials. The library resources at the University of North Carolina system (with more than 3.5 million items exclusive of UNC-CH and NCS) and another million of private university holdings, other than those of the Duke University, form a strong basis for the educational function throughout the State.

In this concentrated and intensive learning and research situation, readily available access to library materials is essential. With the vast amount of information resources existing in the university and specialized research environment, ready accessibility to these resources at present is not possible due to unavailability of information about them. However, the Triangle Universities have effective, working arrangements for inter-university lending and delivery of library materials, and cooperative lending agreement exist also between the various university libraries of the University of North Carolina System. There are also inter-library loan arrangements between the specialized industrial research establishments and the Triangle Universities. The effectiveness of these delivery systems, however, is largely dependent on the availability of bibliographic information about materials in all of these libraries; these materials are only as useful as the availability of knowledge about their existence and location renders them accessible to the potential user. And herein lies the fundamental problem.

At present the knowledge of available library materials is largely confined to the local institution - the individual university of research center.
Although there exists some "union" lists of specialized materials, and some lists of holdings that are exchanged between these institutions, as well as the North Carolina Union Catalogue on cards in one location, there is no systematic and thorough mechanism for finding out whether a given item exists anywhere within the total Triangle learning and research system, or which institution holds a given item, or what resources exist in a specific field of knowledge within the Triangle area, the University of North Carolina system or the State of North Carolina. This situation adversely affects not only the user public of these libraries, but it also makes it more difficult for the libraries themselves to pursue their cooperative service activity and collection building with the required and potentially possible effectiveness.

The consultants find that

- at the present time this unavailability of systematic and comprehensive knowledge of the existence and location of library and research resources is the central problem that the Triangle libraries and the surrounding educational and research institutions face

- this bibliographic access problem exists elsewhere in North America

- the Triangle university setting, the resource strength, their national role in research, and their currently existing high level of cooperation in library resource building and usage argue strongly for the establishing of an effective solution to the bibliographic access problem as a high priority requirement. The existing wealth of resources and the resource delivery mechanism constitute an almost ideal situation for developing a solution to the bibliographic access problem, while the methodology of development could be of assistance in similar situations elsewhere

- The building of bibliographic access can and should be approached gradually, beginning with the coverage of the core resource accumulation in the Triangle Universities,
next expanding to encompass the research establishments in the Triangle Research Park area and the other components of the University of North Carolina system, and later enlarging this access to the State of North Carolina as well as interfacing it with other cooperative access arrangements.

the solution of the inter-institutional bibliographic access problem entails establishing machine readable record files and data bases in the individual institutions and computer terminal access (including telecommunications) to selected principal elements of the machine readable records in these files.

B. Re-adjustment of the Direction

Currently the Triangle University libraries are engaged in a number of projects aimed at cooperative expansion and use of their resources.

The Duke - UNC-CH agreement of collection development is long standing (1930's) and continues to be effective in the acquisitions of specialized materials. The existing practice of joint purchases of major and important items has added to the strength of their combined collections, as well as to the economy of achieving it.

In the area of reader services, agreements exist to facilitate inter-institutional availability of library materials and obtaining of photocopy. Daily courier service exists between the three university campuses.

In specific areas of bibliographic management, successful automated operations (acquisitions and circulation control) have been installed and others are under development. All this effort is supported by competent staff and coordinated by the management staff of these libraries and various task groups which are actively engaged on planning extensions of the presently operating systems as well as new lines of development. A good deal has already been achieved by the Triangle Universities in introducing automated
processes in their library operations, particularly in the traditionally labour intensive areas, and these operations have brought not only budgetary gains but, even more important, useful management information which in turn has helped to provide better service.

These achievements in bibliographic management can be contrasted negatively with the lack of effective bibliographic access for the user public. Therefore, the most important requirement now is to create a corresponding effective bibliographic access service for the users, which can put to better use both the existing resources and the existing delivery mechanisms. This requirement points to a needed re-orientation of the major thrust in the development of the Triangle university library automation effort at this time. The present level in the development of computer and communications technology can support this task of building a bibliographic access system for the users.

It is therefore recommended that the Triangle university libraries establish a computer and telecommunications based bibliographic access system, functioning separately and individually in each of the Triangle university libraries. This system is to be

- self contained and self sufficient in each of the three libraries
- capable of communicating bibliographic access information within and between these and other libraries
- capable of providing necessary tools derived from its data bases in form of lists, COM catalogues and the like
- designed to use effectively bibliographic records obtained through existing bibliographic utilities and other services
- eventually capable to connect functionally with the existing (and meanwhile improved where appropriate) bibliographic management systems in the individual libraries
This proposed systems approach is based on a strategy which accepts as its focal objective the establishment of a relatively modest but immediately useful and gradually expanding bibliographic access service at an early stage of development; such service to be built outward both in its scope and depth, to provide at an early state a COM catalogue as its interim and supplementary service, and to connect at a later time with presently existing and eventually emerging automated acquisitions, circulation, serials and cataloguing services. Rather than attempting to connect various internally and externally available bibliographic systems services into an integrated universal bibliographic on-line system, this strategy takes the alternate route and builds outward from more readily available components a more readily obtainable and useful service. The eventual connection of the existing and still to be developed internal and external automated bibliographic systems services with the proposed bibliographic access system represents closing of the circle through a spiral that has started from the hub, rather than attempting to span this circle around the periphery given its presently incongruous components, and the otherwise necessary requirement to find for it a very high order common denominator.
V GUIDELINES FOR DEVELOPMENT OF BIBLIOGRAPHIC ACCESS

A. Alternatives and Options

Three general types of automated bibliographic system application can be considered for the support of bibliographic access needs of the Triangle Universities. These are: externally available bibliographic utility services, centralized common facility, and linked individual facilities.

External bibliographic utilities, such as OCLC, BALLOTS, or others offer functioning and proven services. The available functions are known; also known are their operational capabilities, cost, and reliability. Bibliographic utilities also provide access to large accumulations of bibliographic records, generally in standardized form. By definition, use of such system services constitutes participation in a large network organization with the advantages of shared development costs, well-developed technical support, and a wide concentration of bibliographic expertise and labor.

The major limitations to the user of externally based bibliographic utilities are inherent in the operation of multi-user utilities. One of these major limitations is the standardization dilemma. On the one hand, whatever the actual standardization level and specific orientation, it is bound to be too rigorous or too lax for any particular user. On the other hand, even if this level is relatively fluid, often it still cannot accommodate the specific requirements of the individual user in a thoroughly acceptable manner.

In practice the maintenance of a standard for a wide user base tends to be quite difficult, and individualistic real life requirements tend to be either accommodated or not accommodated through compromise and majority choice. Such results seldom are thoroughly satisfactory, and tend to lead to multiple standards, thus obtaining a measure of the required flexibility and maintaining still the pretense of a standard.
Another important limitation of present bibliographic utilities is the lack of services oriented to the needs of library patrons. Currently active bibliographic utilities are oriented toward building and maintaining data bases of bibliographic records. Those user oriented service extensions which these utilities support, tend to be secondary to the bibliographic record orientation. Presently, bibliographic utilities appear to be patterned after the traditional library catalogue, and concentrate on the construction of the machine-readable counterpart of the card catalogue. In the card catalogue the public service function is inherent in the form of the records and in the sequential arrangement of the catalogue which in turn is anchored in the format of this medium. In the automated bibliographic data base, the public service function is not inherent in the form of the record; it has to be specially built, taking into account the service objectives, the character of the bibliographic records, and the machine oriented medium. To date relatively little attention has been devoted to this aspect of library systems development.

Also important is the restriction of bibliographic utility services to common denominators which may not be the best choice for the individual user institution. These restrictions may apply to certain categories of bibliographic data, to output products, and even more to interactive uses of such data.

Taken together these and other less fundamental limitations support a general assessment that bibliographic utilities as currently operated are an effective means and source for the generation of bibliographic records and for support of some library technical services functions, but for direct service to library patrons they have not yet proved a comparable effectiveness.

External bibliographic utility services can be provided with local extensions to mitigate the limiting aspects of such services and to provide desirable enhancements. A number of regional network organizations are practicing this approach. The resulting improvements, as in the case of SOLINET, are welcome and helpful; however, due to the sizable membership of such organizations, sufficient specialization and operational freedom for the individual institution so far has not been accommodated.
Another way of using the services of an external bibliographic utility could be based on special, locally developed system extensions to suit the individual user institution. The major inhibition to this alternative is the high cost of development and operation of local systems, since such extensions have to operate at a level of complexity defined by the internal logic of the utility. This alternative also assumes that appropriate formal arrangements with the utility can be obtained on acceptable terms. Such an approach would also involve considerable hardware problems and this, combined with the cost of development, will require a good dose of compromise.

On the whole, an externally available bibliographic utility service does not appear to be suitable for the public bibliographic access requirements of the Triangle university libraries. The situation is reminiscent of the problem which presents itself to the user of a major computer manufacturer's products. The advantages to these products are many; however, if the user's specific requirements do not match the standard configuration of a particular product, trying to extend or modify its capabilities is usually a costly and thorny road, unless someone else has already cut the path in the expectation of others to follows.

A common centralized systems facility to serve the bibliographic objectives of the Triangle university libraries can be considered as a possible alternative to the use of external bibliographic utility service. Advantages of such an approach would be an orientation to the Triangle Universities' specific requirements, independence in the structural logic and operational conditions, and focus and flexibility for subsequent expansion to the Research Triangle Park and the state university system. However, the choice of this alternative would be predicated on the centralized system service philosophy, and would constitute the establishment of yet another bibliographic utility.

Major disadvantages would be the high development cost, length of the time required for this development, and little intermediate service potential during the initial phases of implementation. A further factor to consider is that the design and technical implementation would be a major effort and, although not without precedent, nonetheless unavoidably costly. Even though such a
system could be imported, considerable effort would be needed to adapt it to local requirements. An unpredictable schedule for delivery of services would be inevitable and commensurate with the magnitude of the effort.

Two basic variants of local centralized system approach could be considered. In its purer form, one of these alternatives would entail setting up a dedicated, cooperatively governed computer facility to meet the bibliographic service needs of the Triangle Universities and the anticipated extensions within the state. The expectation would be to service both technical service functions and bibliographic access requirements. The building of such a facility would be a very large scale development project and would carry a cost which could be justified only if the centralized bibliographic system service facility were the most cost-effective means of achieving automated bibliographic control and access capabilities, and if a centralized system for a large service area such as the State of North Carolina and beyond were the goal.

Another less ambitious variant of the centralized bibliographic system would be to use one of the existing, large computer facilities in the Triangle Universities for the operation of a centralized bibliographic system. This variant should require less investment in equipment but will require at least the same level of development effort as installation on a dedicated machine and feature the same unpredictable schedule for delivery of services. Even worse, this approach has proved time and time again to be wrought with operational problems. On a relatively small scale this is evidenced locally by the current use of the TUCC facility for the Duke University Library acquisitions system support. The end result would have all the benefits and disadvantages of centralized services and the considerable disadvantage of dependence on a facility over which the libraries have little management control.

Individual compatible bibliographic access systems for each of the Triangle university libraries is the third alternative to consider. Success of this alternative depends on effective communications between one individual system and the data base of another system. In using this approach it is assumed that each institution has its own data base managed by its local system. Effectiveness of communication between the systems is predicated on compatibility between
the computer systems, the software, and the definitions of the bibliographic record or the core record in the individual installations.

The advantages of this approach are that it constitutes a flexibly functional network organization, it permits maximal institutional individuality in specific data definition and operational functionality, its developmental costs can be shared, its operating costs are relatively moderate, and it can be implemented more readily with a higher degree of predictability. By its nature such an approach provides multiple functional redundancy, and therefore, dependability.

The individual access system will have limitations in its power to manipulate the total data base, and for this reason the system may have to be supplemented by a larger, general purpose computer to perform periodic maintenance functions.

Two basic application modes of this approach may be considered for the Triangle Universities. Their individual compatible bibliographic systems may be operated either in full record or in partial record bibliographic data level compatibility. Of particular interest for our current exploration is the partially compatible mode, where variation of the bibliographic record data level within acceptable norms permits flexibility of development and use of such a system.

Among the foregoing alternatives two notable observations emerge. The external bibliographic facility constitutes the most suitable source for accumulation of machine-readable records, and the individual, compatible local system is the most flexible, affordable, and directly user-oriented system. A combination of both would provide the best means of attaining the Triangle Universities' bibliographic access objectives.

It is assumed that the full MARC record is a general, all-purpose data structure which serves as a common denominator for most of the interests of the individual library as well as national bibliographic information requirements. It is also accepted that the generation and acquisition of bibliographic
records is most economically and effectively obtained through a large bibliographic utility which can offer as large a pool as possible of machine-readable records for use by the individual institution.

It is also desirable that the bibliographic utility provides features for dynamic adjustment of the individual library's bibliographic records to reflect the current status of its resource accumulation. However, not all bibliographic utilities provide such individualized service, and this is currently the case with SOLINET/OCLC. None of the presently operating bibliographic utilities offer service functions oriented to the individual library's specific bibliographic requirements and its individual record base.

In the existing situation the most suitable solution appears to be a combination of the three elements:

1. acquisitions of full MARC records through the SOLINET/OCLC utility service
2. accumulation and maintenance of these full MARC records as a supporting operation for the Triangle university libraries locally
3. and the establishment of compatible individual bibliographic access systems that are attuned to the patron requirements of the three individual institutions.

B. System Criteria

The review of the existing bibliographic environment nationally, regionally, and locally, and the examination of the more prominent requirements in the Triangle university libraries indicated a number of criteria which should govern the application of the new technology to the management of bibliographic information in the three libraries and access to library resources in these libraries and beyond.
. Commonalty among the three libraries is essential in
  . coordination of resource strength, with the aim to retain
    the existing lines of strength, and to accommodate and
    complement growth in resource specialization
  . supporting the chosen endeavours through agreement
    motivated by institutional self-interest as well as cooperative
    advantage
  . cost effectiveness for both the individual institutions and
    for the common endeavours

. User service orientation is paramount. It is essential that
  technological innovations be aimed as directly as possible at
  the service objectives of the individual libraries and the
  community of cooperating libraries, and that the benefits
  from technological innovation do not stop with the supporting
  operations.

. The inter-institutional "union catalogue" function is a vital
  precondition for further development of inter-institutional
  cooperation.

. A number of strategic criteria are important, if the technological
  innovation is to be practical, acceptable, and effective:

  . Available external sources and services should be accepted
    as points of departure and strength for the architectural
    structure of the automated bibliographic information system

  . Early useful results should be attainable at reasonably
    moderate effort and cost. Two years should be the maximum
    period for the emergence of the initial service capabilities
The development of such services should proceed gradually, and by evolving enhancements both outward and in-depth from the initial core functions.

The development should be planned in distinct phases, aiming at an accumulation of short-term benefits which build toward longer term goals. Operationally these phases should constitute distinct and independent service capabilities. A five year time frame is a reasonable perspective for planning.

Backup service capabilities should be planned so that they can also function as intermediate services.

Among important technical criteria are:

- Operational compatibility with external bibliographic resource services and with internal systems and specialized task operations;

- Common standards in specifically defined important areas, but not necessarily operational uniformity on a general scale;

- Distributed network approach to take advantage of increasing communications orientation and to avoid the need for centralized data accumulation and large scale local processing facilities;

- Operationally it is important to avoid heavy, central administration and complicated governing structures.

C. **Recommended Approach**

In the future, if not already, the machine-readable record will be the primary source for making available bibliographic information to readers. Among the principal reasons for the increasing application of computer based
techniques to bibliography are the growing difficulties experienced with the customary ways of providing bibliographic access. At the same time, computer based information storage and retrieval is becoming more cost effective, and there is a gradual but steady growth and consolidation of knowledge and skills in the techniques of applying computer and communication technology to information problems.

The traditional card catalogue is expected to come under increasing pressure for improved usability as the number of machine-readable records grows and the public becomes even more aware of effective alternative means for access to information in related situations. A large library can no longer leave out bibliographic data automation from its planning, and in most instances this has become an urgent necessity for retaining its relative institutional effectiveness.

This assessment applies to the Triangle Universities individually and as a cooperating group. Their very successful, and in some ways exceptional, record in cooperation cannot be further developed without substantially enhancing the effectiveness of bibliographic communication between them and with the research community around them.

The cooperation in planned collection building between the libraries of the Triangle Universities is exceptional in its past accomplishment and continuing commitment. The maintenance of this cooperative endeavour depends now more than ever on the effective bibliographic communication between these libraries. This communication is also becoming a key factor in facing the economic stringencies imposed on most libraries. Building up a bibliographic information communication base is, therefore, emerging as one of the highest priorities of the Triangle university libraries. It is becoming increasingly important as the bridge between the library resources and the readers in these universities.

This report recommends that the three university libraries begin to plan and implement this bibliographic information communication base and its operating facilities.
The implementation of such bibliographic access systems would entail:

1. retaining the present method of MARC record acquisition

2. continued operation of the existing and developing bibliographic management systems, keeping free the option to connect these to the bibliographic access systems.

3. establishing one common free-standing MARC record accumulation/update/translation facility in one of the Triangle University administrative computing facilities, or arranging to have these services provided by a vendor, keeping free the option to transfer these, or some of these functions later to one of the bibliographic access systems. The tasks of this facility are:

   . to accumulate for each of the three institutions their MARC records

   . to update their accumulated MARC records

   . to translate the updated accumulated MARC records for

      . COM Brief-Catalogue production

      . addition to the data bases of the bibliographic access systems

(See Appendix II)

4. setting up arrangement for the production of COM catalogues

5. establishment of bibliographic access systems in each of the three libraries, consisting of

   . flexible level MARC data base
. a single manufacturer's mini computer and storage equipment

. identical communications oriented bibliographic access software.

The recommended approach is based on the following observations:

. There is an acutely felt need in all three libraries for a means to discover whether any of the libraries holds a given book. Associated with this need are various qualifying factors related to the context of this book within the particular library's holdings.

. Each of the three libraries is already engaged in some aspect of automation for a specialized management purpose. These existing and developing automated operations are necessary and well aimed. They also are individualized, and they cannot readily be used mutually and commonly through replication, adaptation, or merging (See Appendix III on the Duke acquisitions system).

. All three university libraries (including the Duke University library, beginning at the end of 1978) are engaged in the creation of MARC records for their holdings through the SOLINET/OCLC bibliographic utility. Thus the building of a solid machine-readable data base has already begun in all three libraries, although the extent of the resource coverage varies widely.

. Development and plans for services offered by SOLINET and OCLC (or any other large bibliographic utility) do not indicate that individual libraries can expect in the near future that the services offered by these sources will meet their local needs in the crucial area of reader services and inter-institutional bibliographic access with the needed specificity and economy.
The current trend in cooperative (or rather contributory) library automation development is concentrating on the creation of MARC records and on planning of national networks for the communication of these records. There is very little evidence that a shift in this orientation will take place within the next few years toward developing facilities which will provide a finding tool for the public (and the librarian alike) at the library service level.

For the Triangle university libraries the option (consistent with the present trend of MARC record cumulation) to develop centralized, on-line facilities for the handling of MARC records is not recommended for a variety of reasons as discussed above. This approach would compete with some aspects of SOLINET development, it would be very costly, the price would be too high for the few really first priority services obtained, it would be a major development effort involving a lengthy period of time, and little service utility could be expected on short term basis. Moreover, the structure of such an approach involves a high level of biblio-technical complexity, as it would have to accommodate a number of disparate functions within one logical mechanism.

Separation of the bibliographic access functions (local) from the externally oriented record building (SOLINET/OCLC) and the bibliographic managment functions (circulation, acquisitions, serials control) affords economy, flexibility, and more precisely focused effectiveness. A variety of options remain available for interfacing a free-standing bibliographic access system with the external record building and with local bibliographic management systems, as well as for eventual tie-in with bibliographic network access services when such become available.
VI  GENERAL DESCRIPTION OF THE BIBLIOGRAPHIC ACCESS SYSTEM

A.  Basic Configuration

The Bibliographic Access System is envisaged as the fundamental component of the bibliographic system in each of the Triangle university libraries. It is based on the concept of bibliographic communication between individual bibliographic environments without requiring these environments to be identical in all of the formal characteristics.

The Bibliographic Access System accommodates individual data bases in each of the participating institutions, without requiring their records to be identical and complete. The proposed access system requires common standard identification of record access data and an adequate measure of descriptive data with their complement of functional designators, but not necessarily the full extent of data as defined by the full MARC record. The ability to handle records of varying degrees of record fullness lends to this system a large degree of flexibility, but inhibits the resulting service only by what is absent. Thus the service taken as a whole is not necessarily subjected to the customary lowest common denominator in effectiveness.

The ability of the Bibliographic Access System to handle varying depth of record definitions within its local environment lends it the power to communicate also with other similar bibliographic environments, permitting access to other cooperating data bases in a way that is not different from access to the local data base. The lack of occasional correspondence between the bibliographic records in the three data bases could be compensated by application of such logical combinatory techniques as Boolean logic and key word access in the mechanisms of the system, and direct record linkage where required.

In this arrangement each of the Triangle Universities would have its own bibliographic access file, its own computer facility of a common manufacturer, interconnected by identical communications software, and using an identical operating system and fully compatible applications programs. This would not only facilitate the operation of these systems as a network but could also add a significant level of reliability through functional redundancy and backup.
Within the present capabilities of the mini-computer and communications technology, inter-institutional access between the Triangle Universities could be made virtually transparent to the user by establishing a common index to all three data bases, which could be operated in one of the institutions. This latter approach may be rendered unnecessary by developments in communications software capabilities within the coming few years.

The Bibliographic Access data bases would be derived and maintained from the presently accumulated and continually created MARC records obtained from the SOLINET/OCLC utility by the three libraries and from the Duke University Library acquisitions records for brief retrospective records. The functions of accumulation, update, and translation of these records into the Bibliographic Access data base internal format (common to all three library Bibliographic Access data bases) constitute an operation which initially might be performed on one of the Triangle Universities administrative facilities or by a vendor, with a view to being transferred later to the Bibliographic Access System facilities.

The formatting of bibliographic records for COM catalogue generation could also be added to the maintenance operation or performed by a vendor. In the longer run, this formatting function could be transferred to the Bibliographic Access facilities with the rest of the maintenance functions.

The development of the Triangle Universities' bibliographic systems would be rounded out with the developing of connective interfaces for the individual acquisitions and circulation systems, and also for serials and cataloguing systems, if it is desired to connect them to the Bibliographic Access Systems.

This outlined approach for the development of functional components of the cooperating Bibliographic Access System facilities through a gradually phased implementation permits some of the required work to begin early, while further planning is continuing, bringing some useful services into operation within the first two years. This approach allows options in record definition and fullness, in the gradual expansion of the on-line access facilities, and in gradually absorbing the new access service as part of regular library service
both within the individual libraries and among them. It also permits flexibility in using parts of the system already in operation or under development. And also, this approach permits the communication of bibliographic information in a truly cooperative and unrestricted way.

B. Principal Components

The principal components that constitute the recommended Triangle Universities library bibliographic access system include bibliographic resources, the physical and functional facilities, and some contracted services.

The **bibliographic resources** include:

- MARC records created or derived through SOLINET/OCLC

- the integrated (and currently updated) file of these records for each of the three libraries:

- source records from existing automated systems

- the translated Bibliographic Access data base which may have briefer records than the full MARC file

- the COM catalogue file which can be based either on the accumulated MARC record file or on the Bibliographic Access data base

The **physical facilities** include:

- on-line access facilities to the SOLINET and OCLC bibliographic utilities

- interim computer facility to perform the accumulation and updating of MARC records obtained through SOLINET/OCLC and other bibliographic records derived from internal sources, and to perform the
translation of these records into the format of the Bibliographic Access data base, unless the option is chosen to purchase these services from a vendor.

- dedicated Bibliographic Access mini-computer facility in each of the Triangle university libraries

- bibliographic resource management facilities in the three libraries (circulation control, acquisitions, etc.) with a measured degree of independence based on further analysis

- option of a common and separate bibliographic index facility

The functional facilities required to operate the bibliographic access system include:

- software for the accumulation, updating, and maintenance of MARC and other source records and their translation into the Bibliographic Access data base record format, to be established locally or contracted from vendor

- software for the generation of the base file for COM brief-catalogue production, either from the accumulated source records (an initial phase option) or from the brief-catalogue data base. It is assumed that this system function be maintained only on one facility for the support of the files of all three libraries, or performed by a vendor

- software for the maintenance of Bibliographic Access data base on the local mini-computer facilities. This function should absorb gradually most of the MARC source record accumulation and transformation functions

- identical software for all three libraries to support on-line mini-computer access to the Bibliographic Access data bases, first locally, later between the three libraries
software to extend the Triangle university library bibliographic access to other parties first through direct connection to the three mini-systems, later by connecting additional partners in the Bibliographic Access network

software to interface local bibliographic management systems with the Bibliographic Access systems.

In addition to the foregoing physical facilities and functional system facilities, contracted services will be needed for

- generation and productin of COM catalogues and lists
- possible data management services in lieu of maintaining such facilities on a local computer.

c. **Implementation Phases**

The fundamental component of the proposed bibliographic access system is the Bibliographic Access data base in a variable level MARC format, identically defined for all three libraries, but permitting a specified latitude in variation of the actual level of individual records. The implementation of this data base is, therefore, the target in the development of the Triangle Universities bibliographic access system.

The operational goal of the proposed system is readily available access to the bibliographic resources in the Triangle university libraries from locations within any of the three universities. There can be a choice of the specific paths that can be taken to accomplish this goal, and there are a number of levels that can be set for this target. It is therefore possible, and also desirable, to develop the bibliographic access system so that the wider objective is achieved gradually, opening up service potential in phases of the overall system.
Taking into account the principal objectives of the Triangle university libraries, the available resources, the present technical feasibility and the expected library service requirements, it is accepted that the gradual development of bibliographic access to the bibliographic information in the three libraries should be implemented beginning with the immediately available bibliographic data and with simple access techniques, but leading to a broader bibliographic coverage and more responsive techniques.

Within this context the first operational target would be an updatable consolidation of the available bibliographic records, in identical format for all three libraries, so that this consolidation can be used as the base for the initial COM catalogues and later can be transformed into the Bibliographic Access data base. This first phase would thus build the foundation blocks for the bibliographic access system, as it would also produce a look-up tool: the initial version would be the COM catalogue - available outside the individual library.

The second and third phases would concentrate on the development of the Bibliographic Access data base from the accumulated records and on the functional programs for the public access service.

The aim of the second phase would be to transform the accumulated full MARC and abbreviated record into on-line data bases for the mini-computer systems and to develop, test, and stabilize the current updating of the on-line data bases. Along with this development of the dynamic maintenance of the Bibliographic Access data bases the establishment of the mini-computer systems facilities would also commence. In addition, if desirable, preparation for the transfer of COM catalogue generation to the mini-computer environment could be initiated at this time.

In the third phase, the main attention would be devoted to the development of the functional capabilities of the mini-computer systems for using the on-line Bibliographic Access data bases so that direct public service could be provided for the users in the Triangle university libraries and other institutions.
It is important that in the development of the Bibliographic Access systems, operational stability of the dynamic maintenance of the on-line data bases be achieved before engaging in the implementation of the retrieval aspects of the operation.

Development of authority record integration could also proceed with the aim to interconnect related bibliographic records through authority records as they become available.

Further development in the fourth phase would aim to extend the Triangle university library Bibliographic Access system to other libraries in the Research Triangle and to the other libraries of the North Carolina State University System. Later it would also aim to develop direct access to the SOLINET facility and other facilities as needed, and would build the connecting links between the local bibliographic management systems and the Bibliographic Access system.
### Relative Phasing Scheme for the Triangle Universities Library Systems Development

<table>
<thead>
<tr>
<th>TASKS</th>
<th>1st YEAR</th>
<th>2nd YEAR</th>
<th>3rd YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
<td></td>
</tr>
<tr>
<td>1. General Planning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Outline &amp; Strategy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Select Task Groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. a. Data Base Design</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Machine Rec. Definition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Object Operations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Outputs/Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Software</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Rec. Generation via OCLC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Base File Maintenance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Retro. Record Acquisition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. A. Equipment Selection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Installation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Software Development A B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. COM Catalogue Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. On-line Public Access System</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. On-line Acquisitions System</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Authorities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. On-line Circulation System</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I

DEPTH OF BIBLIOGRAPHIC RECORD

The MARC record has become the standard for machine oriented bibliographic record communication and for machine-readable bibliographic record definition. Because this definition is intended to be an all-purpose standard, it is a compromise with weaknesses in both directions: it is not sufficiently specific or inclusive enough for record processing in certain elaborate systems environment and it tends to be overly complex in many practical operational situations. It is a norm, and as such it seldom is implemented in pure form. Also, the acceptance of a norm does not rule out controlled deviation. The two major considerations which enter in this assessment of practicality are the availability and cost of machine-readable records and the cost and efficiency of handling the full MARC record.

Limited availability of machine-readable bibliographic records is a major drawback in the development of many automated bibliographic systems. There are only few library system functions which can offer meaningful benefits without a large if not complete base of bibliographic records. Accumulation of the record base, however, is a time consuming as well as costly effort. In particular, this is the case if the full MARC record definition is the objective of this effort. Even availability of such records through an external facility, although very effective and relatively economical, still takes considerable time, if the required accumulation is of large scale.

The cost associated with machine-readable record acquisitions is usually a major factor. Not only is the computer systems support service costly, unless some arrangements are available that reimburse the system cost for the value of the bibliographic contribution, but also costly is the staff time required to perform the task. The selection and identification of the required records, the adaptation necessary to provide the local specifics,
the provision of the required coding and keyboard in operations amount to even more than the machine systems support cost. And a full record is more costly than some abbreviated form which, given the the acceptability of the abbreviation, can serve the local purposes to an acceptable degree.

The level of the bibliographic record fullness therefore becomes a focal factor in the planning of a bibliographic system. Granted the usefulness of the full MARC record, and granted the requirement to contribute full MARC records to cooperative services of regional and national importance; even so not all local operations have to tie in directly with regional and national systems nor do they always require or benefit from a full MARC record. It is, therefore, important to assess in detail the level of actual requirements. In particular it is important and strategically wise to examine the anticipated use of the record and to identify stages in an implementation which will require varying levels of record completeness.

Planned upgrading of machine-readable records is a potential task that should be considered. Although it may be argued that complete one-time record creation is less costly than a gradual evolution to the full record, this is not always so in practice. One of the principal reasons is that at the systems planning stage it is not possible to anticipate all of the intricate functions that will have to be accommodated and all of the data required to support them. In most operational bibliographic systems record upgrading has been a continuous activity. An initial operational data base at a limited level of record fullness is, therefore, not only possible, but also may even be strategically advantageous.

Record "fullness" consists of three groups of data in the machine-readable bibliographic record: the bibliographic contents of the record; the data that define and control the relationships of the bibliographic content (the MARC tags, subfield codes, etc.); and the data that are needed for the systems technical management of records. This division leaves out much data that function in library management processes, such as circulation control or acquisition systems. The MARC record contains the bibliographic contents data and a considerable amount of content control data. It contains little of systems
control data, since these are largely dependent on the specific characteristics of the environment in which the MARC records function.

In the distinction between various levels of record fullness, three types of data are to be considered within the bibliographic content: the bibliographical description (such as title page description, notes, etc.), access data (various entries and access numbers), and bibliographic inventory data (copy, collection location data). Likewise bibliographic content control data are of several categories. The principal ones are: the designations of the character of bibliographic data (record type, type of publication, form of contents, media code), functional indicators (e.g. access data fields vs descriptive data fields), and relationship indicators (source file indicator, ancestor record linking number). Systems control data similarly cover several types of systems control components, such as dates of last processing, transfer to printout file, and so on.

In the planning of record levels for the chosen systems functions, all these categories require careful analysis, weighing, and selection. The objective of selecting more than one operating level of record is to define the data in terms of its functional purpose and its most economical use of systems resources.

Different levels of bibliographic record are required for a rare book data base, for a general cataloguing data base, and for a general bibliographic access system. Whereas the rare book data base requires extensive descriptive contents and corresponding control elements, the cataloguing base will be able to function with less descriptive detail and the general access system will require more emphasis on access data elements but even less descriptive detail. Similarly the selection of systems control elements will vary between a data base which has to support COM catalogue production and one which is used for on-line access.

It should be noted that such data definitions should be flexible so they define the amplitude of the record fullness at a given level but at the same time also provide for controlled exceptions. A given intermediate level should define the list of data elements that constitute the intermediate record level, but it also should provide for those specific data elements which may remain absent, partially filled in, or filled above the norm. In practice such a
flexible approach to machine-readable records involves distinction between mandatory and optional data elements. In this provision it is essential to define appropriate control elements which will permit the system to recognize the exceptional situations and to deal with them appropriately in one of its predefined alternative modes of operation.

In the operation of multiple level data bases (which is a feasible concept) definition of the "core" record for a given application is of paramount importance. What is needed here is program logic which can use data facilities which are available in a given record. The system which requires a "full" level record should be designed to exclude records from its operations which are at a low level of contents and are not logically admissible, but to include such records when the abbreviated content does not adversely affect its operation. Thus, for example, a lower level record lacking subject access fields will be excluded from the subject indexes, but it will be included in all other indexes of the system. Such an operation of controlled varying levels of record content can provide maximum effect and cost benefit from a wide variety of data sources without being restricted to the effect of lowest common denominator.
CURRENT TRIANGLE UNIVERSITIES

BIBLIOGRAPHIC DATA BASE DEVELOPMENT

Record Depth

DUKE
Records

UNC-CH
Records

NCS
Records

A

O C L C

O C L C

O C L C

Brief-Cat.
B

LC/MARC
C

Special
Extensions

Level A - Common minimum

Level B - Full LC/MARC record

Level C - Individual special/Specialized format extensions

on-going full record creation

retro-spective full record conversion

minimum level records
APPENDIX II

COM CATALOGUE DEVELOPMENT

The computer generated micro-catalogue represents half way in the transition from the traditional catalogue to the dynamic on-line version of its machine-readable counterpart. In its graphically fixed form the micro-catalogue is a relative of the traditional catalogue in card or book form. In its flexibility to be re-configured in its internal structural relationships, it possesses one of the powerful characteristics of the on-line catalogue: adaptability in presentation and display.

This characteristic is responsible for one of the great advantages of micro-catalogue. It can be structured with a large degree of flexibility to suit particular user requirements. To the provider of bibliographic information service its appeal lies in the amenability to change. It always leaves the option of a second chance to do better in its composition, construction, and presentation. The character of its medium and technical implementation not only allows its regeneration; it requires periodic regeneration to account for changes in its bibliographic content. The computer generated micro-catalogue represents a methodology that spans the traditional and the new in bibliographic access techniques.

The micro-catalogue has been successful in libraries where it has been introduced; it seems to be an obvious extension of visual display technologies which are so familiar in our contemporary environment. It is remarkable to note that in situations where the micro-catalogue exists side-by-side with the traditional catalogue, the former is the one where most readers converge.

The COM-Based Public Access Catalogue

Initial attempts at library cooperation need to undertake projects which show early results in order to give the cooperative enterprise a sense of identity and to provide an impetus for continuing program growth. Pro-
jects selected for first efforts should produce a product or service relatively quickly, be based on proven technology, and not require excessive coordination of policy among the institutions involved. The recommended COM-based public access catalogue meets these criteria: accumulation of machine-readable records from the OCLC archive tape service and the regular production of a COM union catalogue is certainly technically feasible because it has been accomplished by other libraries, the accumulation and editing of the records and the production of the first COM catalogue could be accomplished in less than one year and not more than two years, and the effort would take little coordination because of the bibliographic commonalties which already exist among the institutions. It is a project with high potential for success which will give the Triangle Universities research community a new and useful device for resource sharing.

As a technological base for bibliographic display, the COM catalog has an admittedly short life. Within three to five years it will be made obsolescent by "mini and micro" computer technology which will eventually make economically feasible an on-line Triangle Universities union catalogue. However, we recommend that the Triangle Universities not wait, but initiate activities now that provide an interim solution to the problem of public access and prepares the libraries for using the new technology effectively when it becomes available. What must not be overlooked in this proposed project is the importance of the development of a coherent Triangle Universities cataloguing data base which is under the control and management of the individual libraries. The longer this event is put off the more difficult the data base will be to establish as the number of cataloguing records grows. Also, the accumulation of the machine-readable file will begin the process of gaining independence from the card catalogue with its many problems: large physical size, deteriorating physical condition, labor intensiveness, bibliographic inconsistencies, and resistance to proper maintenance. After some experience with the mangement of machine-readable files and experimentation with the COM medium, individual units within the Triangle Universities may want to seriously consider this technology as an alternative to the card catalogue and begin planning for closing the local card catalogue.
The need to adopt a new technology for the provision of public catalogues is, of course, being made more pronounced by the activities of the Library of Congress, which is in the process of applying computer technology to its own catalogues. Libraries which are heavily dependent on the Library of Congress for the maintenance of their own catalogues (and the Triangle university libraries are no exception) are going to find during the 1980's that the rate of change introduced into the cataloguing of the Library of Congress increasing dramatically because LC will be freed from the constraints which in the past have been imposed by its enormous card catalogues.

Development Approach

The assessment that production of a COM-based public access tool is technically feasible is based on the judgment that computer software has been developed and is being used for production of catalogues exactly like the one proposed for the Triangle Universities. The Triangle Universities can choose one of two possible courses of action. First, they could survey the field and identify software which is available for transplant and adaptation to the North Carolina setting. Such software might be available from other libraries or from a private vendor. The second possibility would be to engage the services of a vendor to take over responsibility of all data base maintenance and COM production. The offerings of such vendors may be explored by soliciting proposals in response to written specifications provided by the TULC committee. Whatever approach is chosen, the consortium should proceed under the assumption that only a modicum of effort should be required for computer software development. The three libraries will have to maintain a certain flexibility about what they perceive as requirements for the catalogue in contrast to that which may be available from either the adopted software system or the vendor. Pursuit of perfection in the early days of this cooperative effort will result in delays and disillusionment, and it is better to settle for a product which is less than perfect, but available, and introduce improvements as various problems are identified.
Software Capabilities

Software requirements for the production of public access catalogue include:

1. The ability to handle any form of MARC structured records and the full Roman alphabet character set.

2. The ability to accept OCLC archive records, to adjust the internal character set to operating requirements of the production software, and to detect duplication of records.

3. The ability to maintain the archive file by introducing changes to the records at both record and field levels.

4. The ability to "unionize" records from more than one library source. In order to produce the public access catalogue, duplicate titles from the three libraries need to be pulled into a single record with multiple locations, each associated with a call number.

5. Some technique for editing headings so that the file will at least be consistent unto itself with respect to the form headings.

6. The ability to explode a record into its various entries (personal names, corporate names, titles and series), create sort keys for each of these entries which will force an arrangement of the entries somewhat close to acceptable library filing order, sort on the basis of these sort keys, and format the entries for display on COM fiche or film. In addition, the software should have the ability to print portions of the file on paper. Display capabilities for the full Roman alphabet character set must be evaluated.

7. Facilities for providing regular supplementation to the catalogue.
Hardware Requirements

Hardware becomes an issue only if the Triangle Universities choose to mount their own processing facility in North Carolina. One can expect that most of the software that would be available and readily acceptable to the North Carolina setting will be based on IBM 360/370 equipment. A hardware configuration for this software is relatively easy to find in most universities or urban communities. Any medium sized facility in the range of the IBM 370 model 148 to 158 can easily support the software described above. Such facilities will usually have sufficient disk space to allow for the efficient sorting of large files but is an issue which must be addressed. Record storage for the system would be on magnetic tape and will cause no special problem. For computer line printing, the Triangle Universities would probably want to purchase the so-called ALA print train from IBM which provides for printing of the full Roman alphabet character set. In our survey, we found computing facilities at North Carolina State and Triangle Universities Computer Center which could operate the system, assuming that they have the capacity to take on the work and provide a reliable production schedule. This last point appears to be problematical at TUCC. There is also planning at Duke University for IBM based computer facilities which might also be available.

Editing the Data Base

Full consistency of entry forms for all records common to three libraries in a traditional union catalogue is a goal practically too costly to be accepted. Even if resources would permit the accomplishment of this goal initially, on-going maintenance of such consistency would turn out to be cumbersome and very costly. The main reason for this difficulty is the requirement for each individual library to account for and to continue its own precedents of entry form which from time to time have to be established in the absence of an available LC entry. The cumulative effect of this situation is considerable, and it grows at an exponential rate.
In view of this problem, the Triangle university libraries have two basic routes to choose for the attainment of the COM union catalogue objective. One is to accept individual COM brief catalogues separate for each of the three institutions. The mutual exchange and use of these catalogues would provide the three libraries with a considerable degree of "union" visibility of their aggregate holdings.

The other practical alternative would be to plan a consolidated COM union catalogue, with the clear understanding that full consistency of entry forms will not be attained. The strategy in this case should aim at maximal consolidation of variant forms of entry by means of computer programs accepting the remainder of variations unresolved, or undertaking a special editorial effort to identify and link particularly sensitive and troublesome variations in the COM base file. The scope of this editing could range from minimal to extensive, depending on the resources available for such task, and depending on the practical value placed on the extent of form consistency of the COM union catalogue.

**Com Catalogue Production**

The production of the micro-catalogue involves three distinct phases: the generation of the computer tape representing the selection, configuration and layout of the data to be included in the micro-catalogue; the photo-composition of the master film from the computer tapes; and the production of the master microform product, and copies from it as required. The production of micro-copies is an inexpensive process, the COM photocomposition and production of the micro master can also be done at a very reasonable cost, particularly in high volume operations. The most expensive part in the COM catalogue generation is the preparation of the computer tape that feeds the COM generator.

The generation of the COM computer tape is a complex process employing a sequence of computer programs which select the required records;
imbed in them the required codes that convey the desired format, data arrangement and display functions; generate the required access entries and data attached to them; and compose all of this data structure in the desired layout in paragraphs, columns, and fiche or film pages.

In the planning of the informational structure of the micro catalogue, it is important to avoid biasing it by the traditional card catalogue information arrangement and display conventions. The page layout of the micro catalogue offers some advantages over the catalogue card, such as avoiding unnecessary repetition of some information units, some extra flexibility in layout, more effective scannability of access points, and economics (both look-up and cost) arising from juxtapositioning related elements. These advantages are powerful, and it is worth spending time and effort to determine the most suitable data arrangement for the specific purposes of the COM catalogue.

Very important also is the functional arrangement of the micro catalogue: categorization and organization of its access points, and merging or distribution of these into separate access sequences; also the extent of data presented in the various sequences is an important consideration. For example, there may be one arrangement sequence containing fuller information than the supporting access sequences, e.g., a full form record sequence by accession number, and a number of access indexes with less descriptive detail. This arrangement as well as the updating and issuing pattern affect not only the serviceability of the micro catalogue, but also its production cost, which in turn represents a trade-off against its user service cost.

The updating pattern and production cycling can be planned in a great variety of combinations, most of which will entail differences in production cost. Thus, a register type of accumulation of the full record may require less frequent reproduction, while in the case of the full record display under one of the customary access categories - author, title - would require periodic re-accumulation and resequencing of the entire catalogue.
The production costs of the COM catalogue are centered mainly around
the computer processing of the COM tape, and more than half of the
computer processing cost is incurred for the generation of the access
keys and the 'derived' records attached to them from the initial full record.
In this most cost-sensitive phase of the micro-catalogue creation, it is
important that in the production of large volume re-accumulations, the
process of access key generation and 'secondary' or 'index record'
composition does not need to be repeated for the entire file; but only for
those records which have actually changed their contents.

Com Catalogue Quantitative Relationships

Some relationships of micro-catalogue vital statistics observed in a
large micro-catalogue environment may be helpful as points of departure.

1. The ratio of access points to bibliographic records:

<table>
<thead>
<tr>
<th>Record</th>
<th>Authors</th>
<th>Titles</th>
<th>Subjects (incl. names)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>1.37</td>
<td>1.35</td>
<td>1.30</td>
</tr>
</tbody>
</table>

2. Ratios of display space: full record entry vs other brief record
entries (expressed as a percentage of the total page columns)

<table>
<thead>
<tr>
<th></th>
<th>Brief Record Entries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Record</td>
<td>Author</td>
</tr>
<tr>
<td>35</td>
<td>22</td>
</tr>
</tbody>
</table>

3. Distribution of computer processing cost (for 1.25 million records,
expressed as a percentage of the total cost)

<table>
<thead>
<tr>
<th>Selection</th>
<th>Record Processing</th>
<th>Key Generation</th>
<th>Page Column Gen.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.3</td>
<td>11.5</td>
<td>68.5</td>
<td>10.7</td>
</tr>
</tbody>
</table>
Resource Requirements

The micro catalogue is not inexpensive; it is cost effective because its costs can be distributed over a much wider base than the conventional catalogue. The wider distribution of the micro-catalogue creates an acceptable basis for cost sharing because micro-catalogue copies tend to be in demand for sale to users of library resources beyond the primary constituency of the organization.

If Triangle Universities plan to use a private vendor for the full production of its public access tool, then obviously the only resource requirements are the funds to do the job. If the Triangle Universities issues a Request for Proposal for this work, it is likely that the bids will come back in with something like $3,000-$10,000 front end charge for setting up the system, editing charges ranging from 10¢ to 25¢ per title edited, and COM production charges ranging from 2¢ to 6¢ per title displayed. Obviously, the Triangle Universities would need to appoint a knowledgeable staff member to work with the vendor and coordinate between the three libraries. This could be a full time job. If the Triangle Universities intends to mount its own computer software facility and perform its own editing, they should plan on a skilled programmer/analyst to install and maintain the software component, and initially at least two non-professional bibliographic editors to create the necessary file consistencies. These editors would have to be under the direction of a professional librarian and would need to be based in one of the libraries in order to have access to its bibliographic facilities. The initial file could require from six to nine months to edit, and it is difficult to define the computing costs for this activity because it varies so much depending on the financial arrangements by which computing is performed at a university.
APPENDIX III

ACQUISITIONS SYSTEMS DEVELOPMENT

Introduction

Previous sections of this report have identified systems development activities which will provide enhanced access to materials acquired and catalogued by the Triangle University libraries. A first extension of this initial work should include the collection development and acquisition activities which occur before an item is catalogued. These activities rely on essentially the same brief bibliographic record described earlier in this report and identified as possessing already a high degree of commonality between the institutions. Cooperative systems development in collection development and acquisitions offers the Triangle Universities opportunities for fulfilling at a detailed, item by item level, long standing collection development agreements by providing shared access to each institutions' selection decisions and items on-order and in-process. Such a facility will not only permit a "finer tuning" of current collection development agreements, but also provide a major enhancement to public service.

Joint acquisition files based on manual technology (3x5 unit record files) have been attempted in the past by library consortia (the Boston Theological Union Institute is an example), but such systems have not been judged effective because they are costly and unresponsive. The individual library acquisition file is duplicated and integrated with other libraries' files at a central site, and the selection and ordering process is delayed while local orders are cleared through the central file.

Batch computer technology does not offer much improvement over the shortcomings of the manual technology. Although it could eliminate the necessity for the duplication of files and allow the dissemination of the consortium's acquisition information beyond the central site, a batch system is either costly or unresponsive because of the requirement for frequent display of a very large and dynamic file using print or COM devices.
On-line computer technology can overcome the limitations of the other alternatives by providing immediate access to the acquisitions information of other libraries in the consortium and achieving the benefits of shared data files (e.g., the vendor file) where appropriate. Although not too many years ago the cost of on-line technology would have prohibited the development of a joint file based system, current offerings using 'micro and mini' processors show promise of economic feasibility.

Duke University has an operational on-line acquisitions system, and we were specifically charged to investigate and evaluate the potential for extending the facilities of this system to the other two universities. Our conclusion is that this would not be advisable for several technical reasons explained below. However, we do recommend that a common on-line acquisitions system be included in the overall system development plan for the Triangle University libraries and be given second priority after the public access system. Second priority does not mean that work on the acquisitions system must wait until development is complete; rather work on both systems could proceed in parallel consistent with the system development approach described earlier in this report and subject to the availability of development funds.

Design Approach

From the perspective of the individual library an acquisitions system must meet the obvious goals of making the acquisitions process less labor intensive and of providing better management control over a complex library activity. In the context of the consortium there are additional goals which need to be emphasized:

1. Provide positive identification of bibliographic items which have been previously entered into the system by any library participating in the consortium and provide status information for that item, such as desideration, on-order, in-process, etc.
2. Provide the ability to share data in the common files as well as the individual files where possible. Once a bibliographic description has been entered into the system, that data should not have to be rekeyed when used by another library.

3. Provide the ability to enter bibliographic descriptions from sources external to the system such as the OCLC data base.

4. Provide data security to the individual library such that only the individual library can access its own acquisitions files, unless other specific arrangements have been agreed upon.

These goals can be met if the system is file oriented and if a clear distinction is drawn in the system design between what is strictly local information and what information can be shared. Such distinction can be maintained if the following suggested data structure is implemented. Note that this data structure operates independently from any particular hardware/software implementation; i.e., it could be implemented on a single computer facility which all three universities share simultaneously or it could be implemented on distributed multi-processors interconnected by communications links. As made clear earlier in this report, we favor the latter approach.
ACQUISITIONS SYSTEM
DESIGN

Index Level

Author/Title/Access Number data with link to Bibliographic Descriptions

Vendor Data

Bibliographic Descriptions from an external source

Bibliographic Descriptions

Acquisitions Management Data

Fund Accounts

Accounts Payable

Institutional Interface

Local Level

Bibliographic Descriptions

Acquisitions Management Data

Fund Accounts

Accounts Payable

Institutional Interface

A

B

C

Institutional Interface

Institutional Interface

Institutional Interface
This diagram suggests that each library maintains a separate acquisition file consisting of records which contain a bibliographic description (author, title, edition, imprint, etc.) and acquisitions management data (number of copies, volumes, purchase order number and date, fund code, etc.). The bibliographic descriptions for all libraries using the system are indexed on a common access file on which searches by author, title, series, LC card number, and ISBN can be performed. A successful search on this index results in one or more pointers to the relevant records in the individual library files and immediately alerts a user to possible duplication in the system. Any bibliographic description and selected status information can be displayed for any user of the system but file updates may be made only to the local level file by users associated with that individual library. The index level file cannot be directly updated by a user; it is only updated as a result of changes made to the local level file.

The book fund file is shown in a separate box to suggest that this data is only of local relevance and would not be accessible or displayable by users outside the local library. Likewise the diagram suggests that each library will have to have a special segment of application program logic where the library book fund financial management interfaces with the systems of the parent institutions, often necessary to initiate actual payment to a vendor. The vendor file itself, consisting mainly of names and addresses and other descriptive codes of one sort or another, should be able to be shared among the users of the system.

This concept can be summarized as follows:

<table>
<thead>
<tr>
<th></th>
<th>Shared</th>
<th>Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access data</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Bibliographic descriptions</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Acquisitions maintenance data</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Book fund accounting data</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Accounts payable data</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Vendor data</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
The Duke University Acquisitions System

During our investigation we spent several hours examining the Duke acquisitions system which we judged to be a well conceived and well executed system. It was determined that with a modest amount of investment in systems development, it would be possible to structure the system for more than one library along the lines described above. At the same time several other enhancements would need to be added:

- use of upper/lower case terminals which would produce data displays more compatible with the public service function envisioned by this report

- development of a data capture interface between an OCLC terminal and the acquisitions system (UNC-CH reports finding bibliographic descriptions for 75% of the items at pre-acquisitions searching)

- development of several additional management reports

Unfortunately, we came to the conclusion that we could not recommend this line of action because of not easily solved problems of system unreliability. The system is mounted at the Triangle Universities Computer Center which is giving very unreliable service for a production system. The system failed several times while we were watching it demonstrated, and staff report whole days when the system is unavailable. This kind of performance is typical of an academic computer center which must handle the needs of hundreds of users in a research and development environment.

The TUCC system configuration is very unstable with frequent introductions of new hardware components and perpetual modifications to operating system software. This situation is not likely to change (academic and administrative computing are fundamentally incompatible), and the obvious thought is to mount the acquisitions system on another, more stable system. This transfer is not easily accomplished because of the particular software environment on which the system is based.
Given the difficulty for adaptation to a new environment and given our general view that future library systems should look toward stand-alone dedicated equipment, we recommend that an acquisition system be jointly developed to operate in a totally different hardware/software environment than the Duke system. The functional design of the Duke system could be followed very closely which might foreshorten the development effort significantly.
APPENDIX IV

CIRCULATION SYSTEMS DEVELOPMENT

Consistent with our theme that cooperative action between the Triangle university libraries should begin where there already exists a high degree of commonality, we believe that systems development in support of library circulation is not the best choice for launching a cooperative enterprise. There is little prospect for early implementation of identical components among the libraries because, unlike bibliographic information which has been relatively standardized in libraries for many years, there are no agreed upon data formats to control the content of circulation files either for patrons or library materials. Circulation systems embody a large number of policies and procedures which are specific to each library, and represent an implementation of a library's relationship to its parent institution. For example, the apparently simple matter of a common borrower's identification card which could be honored by each of the Triangle Universities and uses as input to a circulation system is made exceedingly complex by the possible requirement that these cards also interface with other computer based applications in the parent institution, such as parking privileges, athletic events, hospital identification, etc.

If the Triangle Universities wish to pursue development of a common circulation system (such as is currently under development at North Carolina State University), it is recommended that the TULCC form a working group which would begin the development of standards related to circulation. This effort should focus on two major areas:

   
   a. Information related to the identification and description of patrons (e.g., the device to be used for borrower's identification, name and address files)

   b. Information related to identification and description of items of library material to be circulated (e.g., the device to be used for item identification (bar codes, OCR, etc.), the minimum bibliographic information needed to support circulation files)
c. Identification of information required to support various circulation transactions (e.g., charges, discharges, holds, recalls, transfers to reserve, etc.)

2. Circulation policy standards

a. Classification of borrowers (e.g., faculty, graduate students, undergraduates)

b. Description of loan privileges by class of borrower

c. Number and type of loan privileges

d. Procedures for handling reserve books (e.g., placement on reserve, the physical handling, removal from reserve)

e. Description of policies related to the suspension and termination of borrowing privileges

f. Policies and procedures related to library materials which are overdue

g. Procedures related to missing library materials

From this study, the working group should consolidate the material, noting areas of substantial similarity and difference. They should then be able to recommend policy standards which can be adopted by the Triangle universities libraries and also to identify areas where policies are substantially different and standards would not appear to be feasible. The work of this committee and the agreements which may materialize are a prerequisite to any discussion on the development of a common circulation system design. The commonalities must be established prior to any successful joint effort and should require considerable time because the work described above will require detailed investigation of each institution's circulation policy and procedures at every site where materials are circulated.
APPENDIX V

AUTHORITY CONTROL

1. Assumed: Authority system is a correlation method which uses normalized form as collocation medium for correlation of related bibliographic records; other correlation methods are conceivable and possible.

2. Objectives:
   a. Referral for the user
   b. Swapping device for AACR2 change
   c. Correlation control mechanism for cataloguers

3. Expected impact

   Accumulation of sizeable authority files in the next few years is expected. The methods of their application for the support of bibliographic access services, however, cannot be clearly anticipated at this time.

4. Use

   a. Extract required references periodically and incorporate in or use in conjunction with user record files

   b. AACR2 swapping success would depend on consistency of past interpretation and following of AACRL/LC. The result is difficult to anticipate. Success of this application should be evaluated before assimilation of this application is planned.

   c. As mechanism for cataloguing correlation the available authorities should be of meaningfully complete scope, perhaps for 75% of the entries used currently. Also they should be
supported by system functions which automatically correlate the authorized form with the form in the user record files and the records currently being handled. This implies a complex system, the cost effectiveness of which cannot be sufficiently accurately estimated at this time.

The patterns of use and extent of usefulness of machine-readable authority records in the bibliographic information service process of the individual library will be determined by characteristics and volume of authority records and their service provided during the next few years by the Library of Congress, and by the bibliographic utilities assisting the integration of authority records with the bibliographic records of their clients.

From the point of view of the individual user library, an authority record service when offered by OCLC could be relatively easy to use for the purpose of extracting required authority records or only the required references for use with its own bibliographic system or products. The building of a user's own integrated authority files through the OCLC bibliographic utility service at this time also appears to be difficult to expect, unless OCLC orientation to user record specificity is substantially heightened.

In view of this prevailing vagueness of the methods and techniques by which the distribution of authority records will occur, it is difficult at this time to plan for a specific way to absorb authority records in an economically and operationally effective manner into the individual bibliographic system.

At present it can be expected that within about a year the pattern and character of the machine-readable authority record production and distribution by the Library of Congress will have been somewhat established, and within another year the bibliographic utilities can be expected to settle on the character and extent of their authority record service.

For these reasons the Triangle university libraries should at this time allow for the introduction of authority records as a general design requirement in their bibliographic system, but should not commit the system at this stage to a specific method and technique of acquisition and integration of the authority records.
PROJECT MANAGEMENT

In bibliographic systems development competent and effective project management is one of the most crucial considerations. It involves full knowledge of the main lines of this development and active control of its progress. Thus, the matter requires comprehensive, precise and explicit, yet concise documentation, and it requires leadership that controls and sets the pace of the development. These are particularly important factors in the development of bibliographic systems, since experience-tested and established patterns and guideposts for this endeavour do not abound, and in practical situations the combination of specific factors and constraints differ widely.

At the risk of stating the obvious and well known, some important control features should be established, monitored, and enforced.

- **Plan**
  
  Explicit plan of implementation tied to realistic critical path schedule of the components, steps, sequence and dates is a must.

- **Budget**
  
  Resource allocation should be based on observed realistic precedents and allowance made for appropriate contingencies.

- **Specifications**
  
  Technical plans should have corresponding precise synopses that can be used for decision making by general management.

- **Commitment and Contract**
  
  The nature of the responsibilities of all parties should be outlined explicity. Expected measures of attainment, responsibilities, and
commitments should be clearly defined, and consequences and penalties indicated where appropriate. Most failures of project attainment are largely attributable to lack of clearly defined expectations, commitments, and consequences.

Documentation

It is critically important to generate basic documentation at the time of planning and implementation, and not after. This documentation should be sufficient to convey to all important implications of the components, functions, resources, implementation schedule, commitments, responsibilities and costs. Many developmental projects have floundered due to their dependence on exclusive individuals' knowledge of project specifications and unilateral change of these specifications.

Reporting and Interim Review

Clear channels of communication and a competent and sufficiently representative management mechanism should provide a continuous review of development progress. Factual and complete reporting to this mechanism is essential. Active assessment, and reorientation where necessary, should be visibly exercised by management.

Acceptance

Acceptance conditions and procedures should be defined in advance, and they should not only spell out all criteria and conditions to be met, but also include obligations, commitment, and remedial and compensatory measures. The importance of this factor cannot be overstressed. Most interminable delays in project implementation are caused by vague and ambiguous statement of requirements, responsibilities and commitments in the acceptance process of functional system components.
Project Guidance by Management

The Library management has to provide active guidance to project management and has to assume responsibility for establishing the basic project structure, tasks and responsibilities. The framework and effectiveness of the mechanisms that interface with the project and the project tasks is the responsibility of Library management, as are budgetary conditions and expectations.

The success of project management depends on the practical ability to measure attainment against defined objectives. Specification of these objectives, of the components and of the attainment in an exact and where applicable quantifiable way is essential. This specification cannot be done without precise (not necessarily lengthy) documentation which in turn has to tie in with the objectives, resources and the technical execution, so that at all implementation stages the result can be tangibly measured against the initially defined requirements and objectives.