ASPECTS OF AUTOMATION VIEWED FROM THE
LIBRARY OF CONGRESS

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Introduction

The Library of Congress automation program is directed by the Coordinator of the Information Systems Office (ISO) who is assisted by a staff of some thirty librarians, computer systems analysts, programmers, and clerical assistants. This staff conducts investigations, manages projects, monitors contract efforts in systems analysis and computer programming, defines areas for investigation, and does long-range planning. For specific tasks, the ISO staff is usually augmented by other Library of Congress staff members who have special technical or language skills, by consultants from outside libraries, or by contract manpower.

Communication within the Office, within the Library, and within the library community about these projects and plans is vital to the automation effort. Staff members of ISO hold meetings almost daily with LC staff members and visiting librarians. Within the Library, the ISO projects are reviewed by an Automation Steering Committee whose members are drawn from the Processing, Reference, and Administrative Departments of the Library. This Committee evaluates programs and makes recommendations to the Librarian of Congress. The Librarian, and this Committee, have set a very liberal policy on reporting widely on LC’s automation program; they believe that other libraries should profit by both our mistakes and our successes, and that constant involvement with the activities and plans of other automation groups is essential to orderly progress.

ISO staff members belong to such groups as the ALA Information Science and Automation Division, the United States Standards Association, the Association of Research Libraries, the American Documentation Institute, and the Federal Library Committee. 

addition, staff members serve on a number of panels and task forces appropriate to library automation programs.

The Library's automation program has been written about rather extensively and a bibliography of publications relating to this program is available upon request from the Information Systems Office. We hope that librarians throughout the country will accept the responsibility for keeping abreast with developments in this program and will offer comments and advice whenever they approve or disapprove of the Library's program. Obviously not all suggestions can be acted upon, but they serve in any case to provide additional insight for the system designer. Such feedback has already caused modifications in certain ISO projects.

The ISO staff is also vitally concerned with automation projects in other libraries. A LOCATE (Library of Congress Automation Techniques Exchange) staff has been organized within ISO to gather, organize, and disseminate information about such projects. ISO staff review this material before embarking on projects in order to avoid duplication of effort and to gain information about progress made in other institutions. All librarians are encouraged to send information (including published and unpublished reports, input forms, codes, flowcharts, proposals, etc.) to LOCATE.

There are two main thrusts to the LC automation program. One effort, the systems development program, is concerned with determining methods by which the internal bibliographic operations of the Library can be performed more efficiently with computer assistance. The second area of intensive effort is the development of a standard format for the interlibrary transmission of bibliographic data in machine-processable form. These two activities will be discussed in detail.

Automation of the Central Bibliographic System

For those unfamiliar with the background of the Library's automation program, a few comments may be in order. In the early 1960's the Library launched a feasibility study to "consider the practicability and advisability of applying mechanization to the total bibliographical system of a large research library."¹ The work was conducted by a team of technical experts which included: Gilbert W. King (Chairman), Don R. Swanson, Merrill M. Flood, Manfred Kochen, Harold P. Edmundson, Alexander Wylly, and Richard L. Libby. The team's report, Automation and the Library of Congress, states their unanimous conviction summarized below that:

(1) The services and products of the Library could be improved through automated techniques.
(2) Automation of bibliographic processing, catalog searching, and document retrieval would be feasible in large research libraries, but

(3) Retrieval of the intellectual content of books would not be.
(4) Automation at LC would facilitate the development of a national library system.2

The team further recommended that the Librarian of Congress (1) develop an internal staff to plan and administer the automation program (the Information Systems Office has accepted this responsibility), (2) request funds to secure the specifications for an automated system (such funds were requested and obtained in fiscal 1966 and 1967 and will be requested in 1968), and (3) upon completion of system specifications request funds for implementation. The third recommendation cannot be carried out at this time, since work is now under way on the system specifications, but there is every reason to believe that such a request will be made at the proper time.

The survey team indicated what needed to be done; they, of course, did not specify in detail exactly how such a large automated system was to be achieved. The Information Systems Office developed a plan of action which would permit the orderly accomplishment of the automation of the central bibliographic system. According to this plan of action, the system would be developed in a series of phases each of which was to be concerned with specific tasks. At the end of each phase there was to be some tangible product, such as flow charts, reports, or computer programs. The phases are briefly defined in Table 1.

It was the intention of the Library to develop a system with the use of contract assistance where desirable. Accordingly, contract help was sought for the accomplishment of parts of Phases I to III. (A large portion of the Phase I effort, especially that involving flow-charting of current Library operations, had already been completed by ISO staff members.) A Request for Proposal* was sent to more

*In government usage a Request for Proposal (RFP) refers to a document which outlines a particular problem area for which contractor assistance is required. A prospective contractor responds by submitting a proposal which provides a detailed explanation of how he proposes to attack and solve the problem. In addition, he provides other required information such as descriptions of related work experience, manpower data, biographical information about his proposed project team, etc. A Request for Quotes (RFQ) asks for specific cost bids for the accomplishment of a project or the procurement of equipment. Those companies which responded to the Library's RFP with an acceptable technical proposal were asked to respond to a Request for Quotes.
than seventy prospective contractors in December of 1965, proposals
were received and evaluated in the spring of 1966, and in June 1966
a contract was awarded to the United Aircraft Corporate Systems
Center of Farmington, Connecticut. A full discussion of the work to
be done in Phases I through III, including a detailed description of the
information needed for an analysis of Library files, was presented in
the Request for Proposal. This document was reprinted, essentially
in its entirety, in the July 1966 issue of Library Quarterly. 3

The neat schedule depicted in Table 1 is, of course, an idealized
plan of action. In real life the cut-off between Phases may not be as
neat and final as they appear on paper. However, such a plan does
provide a framework for assignment of tasks and a set of goals against
which achievement can be measured.

It may seem to some that an inordinate amount of time is allotted
for Phases I and II. It is our firm belief that the future system will
not be successful unless it is based on a thorough understanding of the
functional and operational characteristics of the present system. By
this we do not mean to imply that the systems will be alike, but rather
that the new system must perform practical bibliographic operations
which aid in the daily operation of the Library. This may seem ob-
vious, but there is always the danger that systems will be designed
to perform operations which fit some system designer's idealized
concept of what should be done.

The foregoing statements imply that the Library of Congress
puts a high premium on the involvement of librarians in system de-
velopment. This is true. Much of the work cannot be delegated to
contractors or to non-librarians. Librarians must identify essential
functions clearly, state how they are to be performed, determine
essential data, and evaluate alternatives presented by the systems
staff. We endeavor to instill in our ISO staff, and in our contractors,
a respect for the complexity of library data, an understanding of and
a respect for the bibliographical skills of the Library staff, and an
empathy toward the librarian and his problems. We also aim to in-
still a respect for and an understanding of the traditions of librarian-
ship, while allowing absolutely free rein in questioning any of them.

At this point it is too early to predict what the future system
might be like, but some concepts can be reported. We believe that,
in general, the library community cannot expect to have companies
put money into research and development for equipment to meet spe-
cial library needs. In the computer field, for example, libraries for
years to come will simply be too small a market. Minor modifica-
tions, such as special keyboards and character sets are, of course,
possible if manufacturers are assured that the librarians are suffi-
ciently in agreement. Our system development is posited, therefore,
on the assumption that the equipment complex for the central biblio-
graphic system will be assembled from that available on the market
<table>
<thead>
<tr>
<th>Phase</th>
<th>Definition of Phase</th>
<th>Expected Product</th>
<th>Estimated Calendar Time and Man-years</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Survey of present System</td>
<td>To describe and analyze the present operation</td>
<td>Detailed description of present system: flowcharts, statistical studies, analysis of file use, identification of needed changes and improvements</td>
<td>Feb. 65-Dec. 66 (completed) 9 man-years</td>
</tr>
<tr>
<td>II. System requirements analysis</td>
<td>To identify the objectives of the Library's bibliographic functions and to identify specific operational requirements</td>
<td>Detailed description of major functional requirements, projections of requirements into 1970's, and interfaces with other libraries; functional flowchart of system, showing magnitude of operations, identification of data elements needed in over-all system operation</td>
<td>Oct. 66-Apr. 67 (completed) 5 man-years</td>
</tr>
<tr>
<td>III. Functional description of new System</td>
<td>Development of a sound conceptual model for system development; development of one or more alternative systems meeting requirements developed in Phase II and encompassing various degrees of automation</td>
<td>Description of recommended automated systems indicating operations to be performed, personnel requirements, files to be converted, and new or eliminated functions</td>
<td>Apr. 67-Jan. 68 6-10 man-years</td>
</tr>
<tr>
<td>IV. System specifications*</td>
<td>Specification of types and capabilities of equipment needed to fulfill functional requirements; specification of operating and computer program requirements</td>
<td>Detailed report of specifications suitable for submission to equipment manufacturers; general report for non-technical use; cost estimated</td>
<td>Spring 68-</td>
</tr>
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<td>-------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>V. System design</td>
<td>Determination of specific equipment, operating procedures, computer programs, documentation, etc., required to implement new system</td>
<td>Equipment design; detailed presentation of conversion methods, plan for phasing in new system modules, development of training programs; specification of required building modification</td>
<td>---</td>
</tr>
<tr>
<td>VI. Implementation</td>
<td>To bring the &quot;paper&quot; system to reality</td>
<td>Equipment will be manufactured, programs written; equipment procured and installed; debugged computer programs; files converted; staff trained</td>
<td>---</td>
</tr>
<tr>
<td>VII. Operation of new System</td>
<td>LC staff to operate new system</td>
<td>Completely operational system (may be implemented in modules)</td>
<td>---</td>
</tr>
</tbody>
</table>

*Until further details about the new system are available, projections of time schedule and manpower for Phases IV-VII are lacking.
in the period 1970-1975. It would be easier, but far more dangerous, to design a system which was dependent on major breakthroughs in the technology—such as low cost, associative memory devices and a universal character reader.

The extent to which the new system would be based on the complete or partial conversion of either the National Union Catalog or the Official Catalog is unknown. It could turn out that a system might be developed in which only authority files would be converted to machine-readable form. Such a system would aid in the creation of new bibliographic entries and in file searching, but for full bibliographical details a manual card file of retrospective records would have to be consulted. Such a hybrid system might be developed as an interim system, because, even if full conversion were expected at a future time, it seems entirely probable that complete conversion of a four or five million item file would take several years. For example, if fifty workers each did an average of one hundred entries (including editing, tagging, punching, verification, and correction) a day for two hundred and fifty days a year, it would take four years to convert five million entries.

During the next year, the ISO staff and the systems contractor will be engaged in developing a number of alternative automated central bibliographic systems. The alternatives will arise in the variety of equipment used—that is, a system with minimal use of computers in a batch-processing mode of operation might represent one extreme in design, and a highly sophisticated system with a complex of consoles and large, high-speed memories permitting on-line access might represent another extreme. As mentioned previously, alternatives will also arise in the data base. The minimum data base in machine-readable form could be limited to current catalog output only; a maximum data base might be the full National Union Catalog, the Serial Record, and all authority files in machine-readable form.

As the study progresses, reports of general interest to the library community will be made available. In his final report, the contractor has been requested to recommend one of the alternative systems and to support this recommendation with cost figures, personnel requirements, and a description of the procedures by which functions would be performed. It is planned that a report on this system will be made available to the public. All librarians should study it carefully. The kind of system developed in the Library of Congress will obviously influence the characteristics of the national library system or network.

Although many aspects of the new system are conjectual at this point, some of its features can be predicted. The system will have as one of its end products the LC printed catalog card. It would be unthinkable to do away with a service upon which so much of the U. S. library economy depends. It seems entirely probable that this
cataloging data will also be distributed in machine-readable form. Therefore, these end products can be isolated from the systems study and looked at in detail in parallel with the initial stages of the system development study.

Looking at the machine-readable catalog record readily permits us to:

1. review carefully the bibliographical features of the catalog card;
2. determine how the data elements on the catalog card could be handled in machine-readable form;
3. discuss the machine-readable record with librarians who represent a number of special interest groups, e.g., school libraries, special libraries, and research libraries;
4. experiment with methods of converting catalog records;
5. experiment with methods of distributing catalog records to other libraries; and
6. receive and evaluate comments on the utility of such records in actual library situations.

This careful analysis is extremely important because the constraints of computer processing require the librarian to be much more precise in defining and describing data elements than is required in manual systems. Furthermore, the cost of converting records to machine-readable form locally is fairly high and it would be advantageous to the library community if a record acceptable as a standard could be agreed upon.

In order to allow time for these discussions and to permit the results of them to be obtained in time for analysis by the system design team, a project in the production of machine-readable cataloging was launched. The next section of this paper will be devoted to a discussion of this project and what we expect to learn from it.

Project MARC (Machine-readable cataloging)

Early in 1965 three LC staff members were assigned to study in detail the requirements for handling, in machine-readable form, the information presently found on catalog cards. The results of this study were described in a report in which these requirements are discussed and a preliminary standard format for conversion of catalog records proposed. This report served as the basis for a number of informal meetings with library specialists and was the raison d'être for two conferences at which representatives of various library interest groups discussed their needs and commented on the usefulness of the proposed standard to their group. The results of these
meetings indicated that there was a consensus among librarians that at least a minimum acceptable standard was possible and that one should be adopted before too many libraries began to convert their files. There was also a universal feeling that the library community was ready to experiment with centrally produced machine-readable data and a number of libraries volunteered to cooperate in such a venture. In this spirit of cooperation, Project MARC was launched.

The goal behind the project was rather simple; the project itself required the solution of a number of complex problems. The Library of Congress would convert records for selected current catalog entries into machine-readable form and transmit them, via magnetic tape reels, on a regular basis for at least six months to participating libraries. The participants would use these records as input for local processing and for experiments and would report on their experiences. At issue were both the suitability of the data included in the records and the machine format in which the records were transmitted. To bring the project about, hundreds of consultations were held, more than forty computer programs involving some 33,000 machine instructions were written, manuals were prepared, staff trained, and equipment modified to meet Library of Congress requirements. The system planning was begun in February 1966, test data tapes were mailed in October and the first of the weekly tapes were sent out in November 1966. A brief review of the project is reported here; interested readers may secure project reports and related materials.5,6

MARC catalog records contain two different types of data: that contained in variable fields and that contained in fixed fields. Variable field data are comparable to the statements found on LC printed catalog cards and are entered on the worksheet and into the computer in natural language form—that is, written as English statements. Examples of variable fields are listed below (the numbers are tags to tell the computer what the field is; e.g., tag "10" equals main entry).

<table>
<thead>
<tr>
<th>Field Type</th>
<th>Tag</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main entry</td>
<td>10</td>
<td>Cottrell, Leonard.</td>
</tr>
<tr>
<td>Dewey class number</td>
<td>92</td>
<td>913.386</td>
</tr>
<tr>
<td>Subject tracing</td>
<td>70</td>
<td>Embryology.</td>
</tr>
</tbody>
</table>

The record also contains fields for which there are no equivalents on the present catalog card, although they are implied by statements on the card in most cases. These are fixed data fields and data are entered in them in a coded form. These fields have been chosen for addition to the record because it was the consensus of the librarians consulted that they represent categories by which librarians and users
would want to search machine-readable records. (These fields provide the computer with the capability of "comparing" records just as a human being might, by noting language, type of entry, etc.) Examples of fixed fields include:

<table>
<thead>
<tr>
<th>Type of entry</th>
<th>A</th>
<th>(A equals personal author)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form of work</td>
<td>M</td>
<td>(M equals monograph)</td>
</tr>
<tr>
<td>Place of publication</td>
<td>ENLO</td>
<td>(ENLO equals London, England)</td>
</tr>
<tr>
<td>Language of work</td>
<td>GER</td>
<td>(GER equals German)</td>
</tr>
</tbody>
</table>

Thus, the machine record includes all the data with which the cataloger and reference librarian have long been familiar as well as certain new data elements which should provide for more complex searching of the catalog. The reader should note that the use of variable fields does away with the need to restrict the size of any part of the catalog record, e.g., a title could be twenty characters long or two hundred. Fixed fields, as the name implies, are the same length in every record (that is, the code for place is always a four-character code and language is always a three-character code) but they represent non-bibliographical fields.

In Project MARC the completed LC catalog card is photocopied onto a worksheet* and forwarded to project editors who tag the variable fields (that is, insert "10" before main entries, "70" before each subject heading, etc.) and add the fixed field codes (see Figure 1). These worksheets are then sent to typists who transcribe the data on punched-paper tape typewriters and the resulting punched-paper tape is read into the computer. The computer prints out each catalog record in a worksheet format with the fixed fields across the top of the page and the variable fields aligned vertically down the side. This format provides for ease in proofreading and editing. As the entries are proofed and verified, they are removed from the magnetic tape which contains the temporary records and added to a MARC Master Tape which contains verified records. Thus, only verified entries are distributed to other libraries.

At present, four separate files are included on the final tape mailed to MARC participants (see Figure 2). These include (1) the master catalog card record in LC card number sequence, (2) a brief author/title list with card number (this file is automatically generated by the computer from the master record), (3) a descriptive cross-reference tracing record (which includes information necessary for

*The card is copied just before it is forwarded to the Library Branch of the Government Printing Office. At present it is impossible to determine whether records distributed on the tape might get data to the user sooner than the printed card.
utilization of name entries, such as cross-references, notice to cancel certain headings, etc.), and (4) a subject cross-reference tracing record (essentially the kind of data found in an entry in the LC List of Subject Headings). It may be noted that with files 3 and 4 the librarian in the field would be provided for the first time with the necessary information about the syntetic structure of the LC catalog as well as the catalog record provided in file 1.* File 2 is useful as a searching tool for those items for which the LC card number is not available at the local library.

Each participant receives a magnetic tape each week on which files 1 and 2 are cumulative (that is on the twelfth week all records entered into the system from the first week are interfiled) and on which files 3 and 4 are provided on a two-week basis only (that is on the twelfth week information about headings distributed on weeks 1 to 10 would no longer be available). It is expected that the local user would utilize files 3 and 4 to create his own cumulative master file of cross reference records. By June, 1967, some 14,000 master records are expected to be on tape. At present, only records for titles in English are in Project MARC because this was felt to comprise a set of most general use, but the system has the capability to handle most roman languages. Of course, many records for English language titles include headings and notes which require the use of diacritical marks.

In order that results from the MARC users be reported in time to be of use to the system designers, it was decided that the Library of Congress would supply a set of computer programs to each participant. These programs are primarily printing programs, that is, they allow the MARC user library to print out records from each of the four files described above. Libraries can print (1) a worksheet for local use in the same format as the MARC editor's proofsheet described above, (2) a full set of catalog cards with overprinted headings (the program will handle titles requiring up to two continuation cards), and (3) cross-reference tracing records for both name and subject entries. Figures 3 to 6 show examples of the printed output. (Librarians who are averse to upper-case computer printout will be pleased to know that these programs will print records in either upper-case or upper-and-lower case depending upon the equipment available in the local library. The Library of Congress computer print train has 120 characters including upper and lower case and the diacriticals for most European languages; bibliographical entries

*During the summer of 1967, distribution of files 3 and 4 was terminated. The files had been included in the experiment in order to test the validity of such a service and, due to the favorable response, an improved system for distributing cross-reference information in machine form is now being designed.
prepared on such a print train are perhaps superior to typed entries in legibility since the computer printer does not vary the impact from letter to letter as human typists often do.)

The user library receives a weekly tape and two printed packing lists: one is a list of the LC card numbers for the records on the tape and the other is a brief author/title-to-card number index of the tape. This allows the user library to search the printed products manually if access to a computer is not immediate and set aside those items for which machine-readable copy is available (see Figures 5 and 7).

The MARC system includes (1) manuals of procedures for editing, tagging, and punching catalog data, (2) code books for the fixed fields such as language, publisher, and place, (3) computer programs for generating the MARC records at LC, and (4) computer programs for production of printed products at the participating institutions. MARC users are responsible for producing additional programs for machine searching of bibliographic records, for production of special tools and indexes, and for other local uses. These programs will be made available to LC for analysis and distribution, as desired, to other participants.

There are sixteen MARC libraries: Argonne National Laboratory, University of California, University of Chicago, University of Florida, Georgia Institute of Technology, Harvard University, Indiana University, University of Missouri, Montgomery County (Md.) School system, Nassau County (N.Y.), National Agricultural Library, Redstone Arsenal (Huntsville, Ala.), Rice University, University of Toronto, Washington State Library (Olympia), and Yale University. Many of these libraries have accepted responsibility for duplicating tapes and programs for subsequent distribution to secondary users (distribution from LC is still restricted to the sixteen libraries listed above) in order to widen both the type of library involved in the program and the geographic area covered. Comments from both primary and secondary participants will be studied by LC in evaluating the project.

The participants are using the MARC tapes for a variety of products. Many are, of course, producing catalog cards. The catalog cards so produced can vary greatly depending upon local equipment used and local modifications made to the MARC computer programs for printing cards. Two examples of such local products are provided in Figure 8. At the University of Toronto Library the MARC tape is searched by LC card number for American imprints received in the Library. When the proper entry is located, the computer prints the Library worksheet, shown in Figure 9. This worksheet is perforated into sections to provide a cataloger’s worksheet (the right portion of the sheet) which is forwarded for key punching of local information added by the cataloger, and a processing slip which remains in the book as a control device.
The MARC project experience will be analyzed to determine the kind of service which the Library of Congress should provide for distribution of machine-readable records on a permanent basis. Experience with the project will lead to evaluation of both the internal LC operation and the external use of the record by the participants. It is too early to summarize the results although perhaps two conclusions are already evident. At the Library of Congress it would be desirable to create the record by use of an "on-line" console tied directly to the computer, and it would be useful if at least some of the tagging were done by the catalogers instead of by project editors. There is already a feeling that it is time to agree upon a standard machine-readable record so that libraries can begin to develop programs and procedures with confidence that formats will not change drastically over the next few years. Such a standard will probably be developed by 1968.

Related Projects

There are a number of projects under way or in the initial planning stages which are related to the larger efforts described above. The previously mentioned Library of Congress Automation Techniques Exchange (LOCATE) is an agency within the Information Systems Office which seeks to identify every library in the U.S. or abroad which has an on-going automation project, and to gather documentation (reports, formats, informal descriptions, etc.) about each project. This file is a working tool for the ISO staff and will be the basis of a number of reports and bibliographies as the collection and service are developed. (The first bibliography produced with the aid of LOCATE staff and based to some extent on the LOCATE collection appears in the June, 1967, ALA Bulletin.)* Librarians are urged to report their automation projects to LOCATE.

The Processing Department at the Library is working jointly with ISO staff on two projects of great importance to further automation efforts. One project is the analysis of the subject headings used by the Library from the point of view of their suitability for computer processing. This analysis will be aided by having a data base in machine form for experimentation (the LC subject headings have been converted to machine-readable form and the seventh edition of the List of Subject Headings was produced by photocomposition from magnetic tapes). The second project is the analysis of filing rules to determine changes which might be needed either in the rules or the structure of the headings, or both, for computer manipulation of catalog records. Programming of the LC filing rules is a prerequisite for computer manipulation of entries and will be of great importance
for sophisticated use of the computer in production of bibliographies, catalogs, and other printed listings. Reports on these projects, which are just now getting under way, will be made available as progress warrants.

Summary

From the developments noted in this article, it is clear that the library field is taking automation seriously. Experiments are under way, the results of which may influence each and every one of us as working librarians. If Project MARC proves that there is a market for machine-readable data (and many librarians already believe that to be an inescapable conclusion) it may be possible for any library in the country to have access to such data within the next decade. A catalog record in machine-form is not simply equivalent to the catalog card. There is nothing one can do with a catalog card beyond copying it and filing it. The information on the card is static and to use it in other ways requires a great deal of labor. Machine-readable data can be processed to provide many products—acquisition lists, catalog cards, book catalogs, labels, bibliographies—as well as utilized to perform searches, compile indexes, and so on. Bibliographic information is thus freed from the constraints of the printed card, but to use such data well librarians are forced to do a lot of hard thinking about their own libraries as systems and of their need for information within the system. Many of the developments which may result from the LC systems study may be transferable to other libraries—file organization, computer programming techniques, and converted data files would be available to those who could use them. Many smaller libraries will find these too sophisticated or too costly to duplicate; these libraries may have to develop their own systems, use service bureaus, or join regional groups. The experiences within the Library and in the field should contribute to an increased understanding of the role which automation will play during the next two decades—the experiences should complement one another, for the national libraries and the libraries in the nation should advance on compatible time schedules if an orderly network is to develop.

It has become increasingly clear that the library field will in the future need more, rather than fewer, people who understand thoroughly the fundamental theoretical concepts underlying our bibliographical practices. In addition to the theoreticians, we also need the advice of those with long years of practical experience to experiment with and to test new procedures and techniques. This is not a time for those ill-prepared for, and ill-acquainted with, the library profession.
Considering these problems, how can we at the Library of Congress improve the chances of developing a successful Library system? One way is to utilize the best librarians in the country both as formal and informal consultants. Another way is for each librarian to accept responsibility for keeping abreast of developments and offering comments and advice when they approve or disapprove of proposed features of the new Library of Congress system. Many improvements in the MARC Project resulted from unsolicited as well as solicited comments, and we encourage librarians in the field to view LC automation projects as something about which they have a right and duty to comment. Again, comments from the field may not be assimilated directly into the new system, but often an outsider’s view will provide needed new insights and cause the systems analyst to rechannel his thinking.

John Donne’s statement that “No man is an island, entire of itself” is equally applicable to libraries. Even the largest library in the world is not self-sufficient—it has neither all the materials, the financial resources, nor the human talent required to solve the important problems of our time. This lack of self-sufficiency among libraries will become more and more apparent as we try to provide enriched service to an increasingly educated and sophisticated clientele. The need for monetary and human resources will be ever more evident as librarians acquire and use the complex machinery such as computers, on-line consoles, and photo-composers and as they begin to convert huge data files. Cooperation among libraries in both the planning and execution of automation programs is mandatory. The Library of Congress is pursuing its own program in this light; progress may be slower, but the benefits will be surer.

One of the critical problems which almost all practicing librarians face today is that they were not trained to deal with machine systems, nor indeed even to view libraries as systems at all. One has only to examine the literature of five years ago to conclude that we have come a long way; one has only to read current literature to conclude that we have a long way to go. It is a problem to those of us working at the national level, just as it is to those at state and local levels, to find out what is going on, to evaluate trends, and to determine from the literature how much of what is reported is operational and how much is conjectural.

Notwithstanding the tremendous technical problems which we face in designing an automated central bibliographic system for the Library, nor the problems in developing Project MARC into a full-blown distribution service, nor the problems which we face individually as librarians trying to deal with a new technology—I believe I am right in saying that, viewed from the Library of Congress, the future of library automation looks optimistic.
The entry of a number of “outsiders” into the library field in the 1950’s and the early 1960’s taught librarians a new self-respect for their own field, and it brought an increasing awareness of the complexity of the process of creating, storing, and using bibliographical files. This new view has in many ways revitalized the field.

With the next decade we will reach a new milestone in library history. The year 1976 will mark the hundredth anniversary of the American Library Association and, in some respects, of the American library movement. Succeeding generations will view our pioneering efforts toward automation as we regard those efforts a century ago to develop and apply the basic techniques of bibliographic control.
Figure 1
MARC Pilot Project Input Worksheet.
File 1. MASTER RECORDS in LC card number order. (Cumulative)

File 2. ABBREVIATED AUTHOR/TITLE LIST (Cumulative)

File 3. SUBJECT HEADING CROSS REFERENCE TRACING RECORDS (Non-cumulative)

File 4. DESCRIPTIVE CROSS REFERENCE TRACING RECORDS (name authorities) (Non-cumulative)

PRINT PROGRAM A

PRINT PROGRAM B

PRINT PROGRAM C

PRINT PROGRAM D

Figure 2
MARC Participant Programs and Products
(System as of April 1966)
<table>
<thead>
<tr>
<th>TYPE OF ENTRY</th>
<th>FORM OF WORK</th>
<th>DIBLIO</th>
<th>SUPPLEMENT</th>
<th>CONFERENCE</th>
<th>JUVENILE</th>
<th>RECORD</th>
<th>LANGUAGE DATA</th>
<th>PUBLICATION DATA</th>
<th>NEW THIS WK</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERSONAL AUTHOR</td>
<td>MONOGRAPH</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>CLASS (10)</td>
<td>KEY (13)</td>
<td>SINGLE</td>
</tr>
<tr>
<td>SINGLE</td>
<td>LANG 1(11)</td>
<td>LANG 2(12)</td>
<td>1966</td>
<td>NEUT</td>
<td>SINGLE</td>
<td>SBSTY</td>
<td>24 CM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**THE MARC PROJECT RECORD**

**MARK DIAGNOSTIC LISTING**

**RECORD**

**NO**

**67-093571**

**BATCH NO.**

**NM04114**

**TYPE OF SECONDARY ENTRY**

**--GS**

**SERIES-YES**

**LENGTH OF RECORD**

**0641**

**L.C. CALL NUMBER**

**90**

**P29.43 1966**

**DEWEY CLASS. NUMBER**

**92**

**410/.3**

**MAIN ENTRY**

**10**

**Hamp, Eric P.**

**TITLE STATEMENT**

**20**

**A glossary of American technical linguistic usage, 1925-1950,** by Eric P. Hamp.

**EDITION STATEMENT**

**25**

[3rd ed.]

**IMPRINT STATEMENT**

**30**

Utrecht, Antwerp, Het Spectrum, 1966. fl 9.50

**COLLATION STATEMENT**

**40**

72 p. 24 cm.

**SERIES NOTE**

**51**

Permanent International Committee of Linguists. Publication of the Committee for Terminology

**SUBJECT TRACING**

**70**

Language and languages--Dictionaries.

**SUBJECT TRACING**

**70**

Grammar, Comparative and general--Terminology.

**TITLE TRACING**

**74**

T

**SERIES TRACING**

**75**

Permanent International Committee of Linguists. Committee for Linguistic Terminology. Publication

**NATL. BIBLIO. NUMBER**

**830**

(Ne66-19)

---

**Figure 3**

The MARC Bibliographic Listing. (Computer produced.)

On label mounted on t.p.: Distributed by Regional Pub. Co., Baltimore, Md.

Reprint of the 1911-25 ed.

Contents.—v. 1. General history.—v. 2. Town annals.—v. 3. Family genealogies.

MARC (Cont. on next card) 66-008987

Banks, Charles Edward, 1854-1931. The history of Martha's Vine... 1966 (Card 2) 1641-1800.


MARC 66-008987

F72.M5B22 974.494

Main entry card & extension

Figure 4
Sample of Full Set of MARC Catalog Cards. (Computer produced.)
Martha's Vineyard, Mass.--Hist.

3 v. illus., facsims., maps, ports. 25 cm.
On label mounted on t.p.: Distributed by Regional Pub. Co., Baltimore, Md.
Reprint of the 1911-25 ed.
Contents.--v. 1. General history.--v. 2. Town annals.--v. 3. Family genealogies,
MARC (Cont. on next card) 66-008987

Subject Heading No. 1 & extension

Figure 4 (cont.)
Martha's Vineyard, Mass.--Geneal.


On label mounted on t.p.: Distributed by Regional Pub. Co., Baltimore, Md.

Reprint of the 1911-25 ed.

Contents.--v. 1. General history.--v. 2. Town annals.--v. 3. Family genealogies,

MARC

66-008987

Subject Heading No. 2 & extension

Figure 4 (cont.)
<table>
<thead>
<tr>
<th>Dukes Co., Mass.--Hist.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Dukes Co., Mass.--Hist.</th>
</tr>
</thead>
</table>

| MARC |
| P72.M5B22 974.494 |

Subject Heading No. 3 & extension

Figure 4 (cont.)
The history of Martha's Vineyard,

Banks, Charles Edward, 1854-1931.
3 v. illus., facsim., maps, ports. 25 cm.
On label mounted on t.p.: Distributed by Regional Pub. Co., Baltimore, Md.
Reprint of the 1911-25 ed.
Contents.—v. 1. General history.—v. 2. Town annals.—v. 3. Family genealogies,
MARC (Cont. on next card)
66-008987

The history of Martha's Vineyard,

Banks, Charles Edward, 1854-1931. The history of Martha's Vin... 1966 (Card 2) 1641-1800.

MARC
F72.M5B22 974.494
66-008987

Title card & extension
(Note that computer has been programmed to pick up the actual title for the tracing "II. TITLE.")

Figure 4 (cont.)
<table>
<thead>
<tr>
<th>Abbreviated Author/Title List</th>
<th>MARC Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>67-247</td>
<td>O'Broin, Leon, 1902</td>
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<tr>
<td>66-28533</td>
<td>Ozbudun, Ergun</td>
</tr>
<tr>
<td>66-16515</td>
<td>Sorm, Frantisek</td>
</tr>
<tr>
<td>66-77116</td>
<td>A Little Pretty Pocket-Book</td>
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<td>A Short History of the Parish of St. John the Baptist, Rundmore, Portsmouth</td>
</tr>
<tr>
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<td>A Visit to Texas</td>
</tr>
<tr>
<td>66-24622</td>
<td>Aaron, Thomas J</td>
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<tr>
<td>67-11008</td>
<td>Abbey, Merrill R</td>
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<tr>
<td>66-28817</td>
<td>Abbott, Charles Cortez, 1904</td>
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<td>67-849</td>
<td>Abbott, John Cave, 1919</td>
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<td>66-24781</td>
<td>Abdullah, Syed</td>
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<td>66-78257</td>
<td>Abel, Elie</td>
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<td>66-24906</td>
<td>Abell, Walter</td>
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<tr>
<td>66-77185</td>
<td>Aberconway, Christabel Mary Melville (Macnaughton) McLaren, Baroness, 1890</td>
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<tr>
<td>67-72172</td>
<td>Abercrombie, Michael</td>
</tr>
<tr>
<td>67-12602</td>
<td>Abersold, John Russell, 1902</td>
</tr>
</tbody>
</table>

Figure 5
Abbreviated Author/Title List. (Computer produced.)
Electronic data processing--Credit management. NEW
  x  Credit management--Electronic data processing

Chloroplasts. NEW
  sa Chromatophores.
  x  Chloroplasts
  xx Chromatophores

NEW means new heading
CAN means cancel

Note: These are not authority cards in that the tools used at LC to establish entries are not listed - only the headings to be used in the catalog are provided.

International Association of Technological University Libraries. NEW
  x  IATUL; Association internationale des bibliothèques d'universités polytechniques; Asociación Internacional de Bibliotecas de Universidades Técnicas; Vereinigung der Bibliotheken Technischer Hochschulen

Kaneko, Hiroshi, 1933--ADD
  x  Hiroshi, Kaneko

John G. Johnson art collection, Philadelphia. CAN

NEW means new heading
ADD means add new cross reference

Figure 6
MARC Cross-reference Tracing Records.
<table>
<thead>
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<th>L.C. CARD NUMBERS FOR ALL RECORDS IN MASTER</th>
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</table>

**Figure 7**
The MARC Master Tape List. (Computer produced.)
Read, Margaret. 


Bibliography: p. 127-132. see next card

3 u1 67070653

Read, Margaret. 

Culture, health and ... 1966 card 2

Hygiene 1. Hygiene, Public. 2. Social medicine. I. Title

3 u1 67070653 (866-16886)

A: Upper-and-Lower-Case Card Produced by Yale University Library

Figure 8
Examples of Catalog Cards produced from MARC Tapes by Participants.
GUIDE TO PERSONAL FINANCE. [1ST ED.]
NEW YORK, HARPER & ROW [1967] XI, 240 P.
22 CM.
BASED ON THE AUTHOR'S ARTICLES IN THE NEW YORK TIMES.

1. FINANCE, PERSONAL.
NEW YORK TIMES.
TITLF.

05/67 G HSW:JPK□ ENG 65-21019
STI

B: Upper-Case Card Produced by the Georgia Institute of Technology Library

Figure 8 (cont.)
**Searching Report**

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<th>MSC</th>
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<th>LOC</th>
<th>LOC</th>
<th>LOC</th>
<th>LOC</th>
<th>LOC</th>
<th>LOC</th>
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</thead>
<tbody>
<tr>
<td>PS</td>
<td>Uenger, Antoine</td>
<td>Vatican II.</td>
<td>Translated by Robert J. Olsen</td>
<td>BX830.1962.W413</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Comments:**

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<th>MSC</th>
<th>ULS</th>
<th>NR</th>
<th>CENSUS</th>
<th>CATALOG</th>
<th>FACTORY</th>
<th>ADDED ENTRY</th>
<th>ADDED ENTRY</th>
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<td></td>
</tr>
</tbody>
</table>

Figure 9

Library Processing Worksheet produced from MARC Tapes by the University of Toronto Library
CALL: BX830.1962.W413

MAIN: Wenger, Antoine.

FILE: Vatican II. Eng.

TITL: Vatican II. Translated by Robert J. Olsen.

IMPR: Westminster, Md., Newman Press, 1966-

COLL: v. 24 cm.

NOTE: Includes bibliographical references.

NOTE: Contents--v. 1. The first session.

SUB:S: Vatican Council, 2d.

ADT:T:

hum[s][l]

---

**Figure 9 (cont.)**
REFERENCES


2. Ibid., p. 2.


