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ABSTRACT

The final report on the Council on Library Resources (CLR) Grant #443 for the New England Library Information Network (NELINET) is divided into three parts. Section one is a general commentary on the NELINET project, which was conceived to test the viability of creating a centralized, regional capability to use electronic data processing techniques for technical processes and other service requirements of a network of libraries. The philosophy of the total project and of the system design planned to achieve project objectives is discussed. The NELINET system design and its transferability is reviewed in section two. Section three is a technical report on the hardware, software and system design of the project. (SJ)

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NEW ENGLAND LIBRARY INFORMATION NETWORK

FINAL REPORT

CLR GRANT 443

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FINAL REPORT, CLR-443

PART I

COMMENTARY by NEBHE

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Inasmuch as the work done under the terms of CLR-443 was part and parcel of earlier efforts made under a series of Council grants, it seems worthwhile to comment briefly on the philosophy of the total project and of the system design planned to achieve project objectives.

The project, which has come to be known as "the NELINET project", was conceived to test the viability of creating a centralized, regional capability to use electronic data processing techniques in support of the technical processing and other service requirements of a network of libraries. It was hoped that, if this capability could be demonstrated as being possible from an engineering view and economic from a management view, and if a working network of libraries could be created, the two things combined would serve to provide both a better way to perform traditional library tasks and as a vehicle for enabling libraries to render new kinds and dimensions of user services.

The earlier grants had supported planning plus initial computer programming and library evaluation. As planning moved to the stage of research and development and as actual experimental production of technical processing services became a reality, several guiding principles evolved. As a group, they could be viewed as the framework within which discrete elements of project work have been carried out.

One of the decisions made was that a grand system design involving years of planning should not be undertaken, and that systems work should be more practical than theoretical. An early statement specified that, "In order to minimize development costs, the approach to installation of regional processing should develop a task at a time. These tasks can be planned in such a way that the participating libraries will receive useful service while the long-range objectives...are being accomplished." Thus, it was decided to concentrate a great part of the project efforts toward the production of immediately useful technical processing services. The production of catalog materials--cards and labels--was agreed upon as the first task to be undertaken. At the same time, however, the project's larger objective in this was seen as being the creation of a regional data file useful for many additional services beyond the production of catalog materials. It was decided, furthermore, to tie this catalog materials and data file creation work to the Library of Congress Machine Readable Catalog (MARC). That data record was not seen as the sole source of information, but as the currently most usable record and as a superior model for long-range development.

Early on, of course, it was decided that all project developments would be undertaken with the objective of keeping costs at a minimum. Not only were management and financial resources very limited for the complicated and expensive project planned, but maximum efficiency was mandatory from the practical view of ultimately selling services to libraries at acceptable charges.

Even though the need for a grand systems design was rejected, there were certain guiding overall principles agreed upon for the projected automated system. One was that the detailed work done for any discrete task should be so designed as to possess a high degree of transferability--both from one working environment to another within the project, and from the New England regional network to other regional networks. Thus, all computer programming has been planned and executed in this framework. This involved, at the beginning of CLR-443, making a decision as to the specific computer capability desirable and to the pros-and-cons of the language to be used in program writing. So important was this decision that the Board felt an outside professional opinion was called for. It persuaded Mrs. Henriette D. Avram of the Library of Congress, and a person familiar with project development, to make the necessary assessment. Her evaluation constitutes Part II of this report.

A further decision related both to costs and transferability was to seek a machine environment in which the manufacturer's own operating system provided much of the programming necessary, thus permitting project efforts to concentrate on applications programming, i.e. on library-oriented requirements. Additionally, it was decided to use as many manufacturer's utility programs as possible.

Finally, the project's developers, as far as the actual services production system was concerned, saw it as essential that planned growth be a constant consideration. It was seen as mandatory that possible equipment obsolescence be avoided and that machine configuration have maximum capacity and flexibility. As a corollary, it was agreed that the optimal system needed to achieve the goals involved would have to be a random access, time shared system using a disc type memory store rather than magnetic tape.

Within this framework of broad decisions, the series of Council grants has resulted in an automated system for producing catalog materials for a network of libraries. The existing system is only a simulation of the one believed to be optimal, but the programming is wholly capable of transference to that optimal system if and when financial resources make that possible. And even the simulated production system can produce useful and marketable technical services to a network of libraries for a limited time. It can do this with a major reduction in service delivery time, in the MARC (II) format for catalog cards, and at a cost which, while relatively high because of first-time experimental nature of the capability, is within reason. Much experience is needed to discover both limitations and additional uses of the system, but a sound base has been created from which to move forward to new specific tasks related to the whole.

CLR-443 COMPUTER PROGRAMMING The immediate objectives of work under this grant were to continue, complete, and augment the planning and programming initiated under previous grants, and to test the effectiveness of this work by a series of pilot demonstrations of catalog materials production.

As had been the case under previous CLR grants, the Board contracted with the firm Inforonics, Inc. of Maynard, Massachusetts, for the necessary computer programming and systems development. The research and development staff of Inforonics, Inc. also provided the management needed to arrange and conduct the pilot demonstrations. The Board exercised an element of supervision over the broad technical developments and project management. Details of the technical work done by Inforonics, Inc. and of the results of the pilot demonstrations are contained in Part III of this report.

It is to be noted that completion of the CARD AND LABEL PRODUCTION, the CARD FORMATTER, and the SMERGE programs specified in the grant proposal was a continuation of the work started under the previous CLR grant--425. Also, since the entire effort to produce catalog materials was based upon the Library of Congress' Machine Readable Catalog (MARC) record and format of cataloging data, a large portion of the work under this grant was involved with the rewriting of computer programs written earlier for the MARC I format so that use could be made of the new MARC II format.

The computer program work done deviated from grant proposal specifications in three respects: (1) one program specified in the proposal was not written, (2) two programs not specified in the proposal were written, and (3) two programs specified in the proposal were not sufficiently debugged for demonstration use, while two others needed minor debugging at the time of grant termination.

The LINE PRINTER program specified in the proposal was not written, since experience showed it to be unnecessary in the light of the IBM utility software available and usable.

The two programs, MAKTEN and PAPER, were not specified in the proposal, but were found essential in the light of the machine configuration being used and for the purpose of getting a clear identification of operating errors. Their respective functions are described in Pages 29-31 of Part III of this report. Both programs were written for the PDP-10/50 computer and with orientation for disc storage of data.

Even though not specified in the grant proposal, the time and effort involved in writing these programs was clearly dictated by the requirements of (a) meshing the LC MARC II TO NELINET MARC II program, written for a PDP-9 computer, with the capacities of the larger PDP-10, and (b) of identifying clearly the keying and transmission errors found in the demonstration runs. These requirements might have been foreseen in the grant proposal, but the later determination to write the new programs is considered a not unusual development in the sort of system work involved. In this connection, it should be noted that use of a PDP-9 computer was not provided for in the original plan of work. The use of this machine for handling the LC MARC II TO NELINET MARC II program was decided upon by Inforonics, Inc. as being useful and convenient, since it was located in house and also because it provided a capability to check the MARC II tapes as they were received.

Two programs, POCKET LABEL FORMATTER, and SELIN LABEL FORMATTER, while coded, were not debugged sufficiently during the grant period to be capable of use during the pilot demonstration part. This deficiency was, of course, a major disappointment and can be ascribed indirectly to the failure in machinery and utility software experienced at the first service bureau facility used for data processing. This failure is discussed below.

Two programs, CARD AND LABEL PRODUCTION and CARD FORMATTER, while adequately written for use during the pilot demonstrations, did require further debugging work at the time of grant termination. No change in program design would be involved in this work and the bugs were considered by Inforonics, Inc. as minor in character.

The computer programming completed was, in the Board's view, of high quality. This was substantiated, in part, when it became necessary to abandon the first service bureau and move to a second. The programs were found substantially usable in the second machine environment, a fact which not only verified their basic validity, but also indicated that their transferability factor was high; the latter a consideration of major importance from the view of the entire project serving as a prototype for library network development.

SYSTEM TESTING AND CATALOG MATERIALS PRODUCTION

The grant proposal called for a six-month testing, demonstration, and pilot operation period. The former phase was to include limited operation for testing and debugging during the course of ten production runs, while the latter was planned to involve twenty-six full-scale production runs.

As capabilities developed, neither of these objectives could be met. Both phases had to be severely restricted by constraints of time and money. Testing was reduced, therefore, to one full production run, plus a brief period of "practice" runs using a low volume of requests for service, while full-scale production was limited to a five-week period during which only five regular production runs were completed. This latter phase was actually augmented somewhat by the processing within that time period of some 500 special requests by the University of Connecticut.

These major deviations from the proposed work plan were due to several unexpected developments. A major part of the problem is touched upon in Part III of this report on Pages 11-13, and was related to hardware and software problems arising from machine and software deficiencies at the Applied Logic Service Bureau in Princeton. It is to be noted that some $7,000 of computer time registered at ALS was declined for payment from grant funds.

Two further problems developed which had not been anticipated. The Inforonics staff encountered many more difficulties with the computer programming than they had counted on, and they found additionally that they had under-estimated the complexities of writing the programs for a time-sharing system. The net result of these findings was that much more time had to be devoted to the first experience with the PDP-10 and the Bryant 4000-2A disc and to the writing of computer programs than had been planned. Although the costs of machine usage were not affected, the use of the Inforonics staff had to be re-allocated as to function. While this resulted in only a modest increase in personnel costs in dollars, it meant a major loss of staff time available for testing and production.

The Board recognizes that this kind of problem is not uncommon in experimental development work of the kind here involved. A machine breakdown cannot be anticipated, nor can all of the complexities involved in breaking new ground in an automated communications system. Nevertheless, this particular aspect of CLR-443 pointed to a serious communications deficiency between Inforonics, Inc. and the Board. While the Board is satisfied that good engineering judgment was used--there was, in fact, no alternative to the course taken, it would have been more satisfactory to all concerned had the extent and implications of these problems been known by the Board, the Council and the participating libraries, as they were occurring.

A review and tabulation of the demonstration results is given on Pages 62-105 in Part III of this report.

Several operational conclusions can be drawn from the demonstration experience:

1. The LC MARC II tapes provide a usable record from which serviceable customized catalog cards can be produced

in a network context, i.e. functioning as a central machine file of data electronically accessible to a number of libraries located at remote distances;

2. the turn-around times between request for cards and their delivery is appreciably less than usually experienced in commerce between libraries and the Library of Congress;

3. the maximum effectiveness in the production of catalog cards using MARC II data lies in the favorable meshing of the extent and speed with which the Library of Congress generates such records and the point in the cataloging process at which the library requests cards;

4. the cost of producing catalog cards from the MARC II tapes by the system so far developed, while somewhat higher than projected in the final report on CLR-425, is still within the purchase range of the participating libraries;

5. the use of a magnetic tape data storage base will very rapidly become inefficient for catalog card production processing as that file grows in size;

6. several months of further experience with a fully producing system are necessary to provide both users and operators with maximum competence to make optimal use of the system.

Even though abbreviated, the demonstration phase has provided, in the Board's opinion, information which supports the NELINET concept for catalog materials production based on the MARC II records, and has indicated the probability of a viable cost for producing this service in the NELINET context.

The Board and the participating libraries believe that an effective operational simulation of an eventual regional technical processing center has been developed as the result of Council support through the series of grants culminating in CLR-443. In spite of the set-backs and deficiencies experienced during this latter grant period, the Board and the libraries are satisfied that solid progress was made. A first system now exists which, when refined through additional technical development and operational experience, can serve to provide other and extensive services to libraries.

NETWORK DEVELOPMENT

Obviously, one of the essential ingredients to a successful project is a network of cooperating and coordinated libraries. While the grant proposal carried no specific stipulations concerning work in this area, the support of a capacity at the Board to monitor the project may be seen as implying such a responsibility.

The group of the six New England state university libraries which made up the project's network when work began remain the core group today. During the course of CLR-443, an additional university library, the Boston campus at the University of Massachusetts, committed itself to participation and has been invited to join the network.

Support from the core network members has always been good. Many meetings and many hours of effort have been expended by the chief librarians and their staffs on behalf of the project over the past three and one-half years. During the course of CLR-443 and the previous grant, CLR-425, the tempo and extent of library participation in the project was accelerated and expanded. During the latter grant period, for example, library staff members were given instruction and practice in system operation, while five of the libraries committed themselves to the purchase of technical processing services as these became available from the system.

During CLR-443, while experience with system operation was minimal, there was a good measure of additional staff involvement and a major increase in participation by the chief librarians. At a series of meetings called by the Board, these men were briefed in project development and asked to render judgments as to priority tasks for research and development. This latter effort was taken very seriously, since it was recognized as an essential element in writing a detailed Master Plan for the project; this plan is now ready for final preparation.

From those meetings has come agreement, furthermore, to undertake the appointment at each library of a staff member who, after adequate indoctrination, could serve as the focal point for project technical liaison. It is not envisaged that this would be a full-time responsibility at this juncture, but does serve as evidence of the sustained interest in the project's concept and potential value on the part of network members. The Board has asked, furthermore, that the participating libraries create a regional committee of staff representatives who can give regular advice to the Board and project developers. The libraries have agreed to do this. One reason for such a request is the Board's belief that very close association with project work will be increasingly necessary from this point forward.

It is worth noting, in this general context of network development, that the project's Advisory Committee now includes one of the leading State Librarians from the region, as well as the director of an organized library network from outside New England. Both appointments serve as evidence of the Board's interest in broadening the network's scope. Additionally, it is pertinent to record the increased tempo of interest by other libraries in the region in learning of the project. As of this writing, the Board has been requested to present four major briefings to major libraries and groups of libraries in the region. Some of this undoubtedly arises from the increased publicity about project development provided by the publication of the newsletter, NELINET NEWS, by the Board.

The Board has not actively solicited new network members. Such action is considered premature at this juncture. Nevertheless, it is abundantly evident that an expanded network will be essential if the economics of the project are to be favorable. The Board has considerable evidence that response to the project's services will be favorable once a viable system is in operation. The prognosis for success in this is positive enough to warrant a belief that a large and supportive network can be forged in the interest of the project. It is equally clear that a major augmentation of the Board's capacities to provide supervisory and administrative support for such a network is essential.

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FINAL REPORT, CLR-443

PART II

REPORT by MRS. HENRIETTE D. AVRAM

on SYSTEM DESIGN

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TRANSFERABILITY AND THE NELINET PROJECT

Henriette D. Avram

The New England Library Information Network (NELINET) Project is concerned with the creation of a machine-readable file of bibliographic data and a computer-oriented technical processing center to provide service to the libraries of New England. The economic and functional viability of the projected NELINET Center rests on the assumption that it will operate in a fully dedicated, time-shared, random access oriented computer environment. The work in progress in the area of catalog card and label production, involving basic research and development, will test the technical feasibility of that assumption, and will be considered as operating in a simulated NELINET Center environment. The main difference between the simulated and projected environments is that the former, although it will utilize a magnetic disc in selected computer processing operations, e.g., the formatting of catalog card images, will rely primarily on magnetic tape for the storage and searching of bibliographic records; in the projected environment, a random access device will be utilized throughout as the storage medium.

Since mid-1966, the New England Board of Higher Education, the interstate agency sponsoring the NELINET Project, has entered into a series of contractual agreements with the firm of Inforonics, Inc., of Maynard, Massachusetts, whereby the latter would provide the necessary systems design and software to implement the projected NELINET Center. Because the funding for the developmental work culminating in the creation of this Center will be secured primarily from granting agencies and/or from the network libraries, it is most important to the New England Board of Higher Education that two basic requirements be met:

1. The application program modules designed for the simulated environment should work with a minimum of modification for the projected environment.
2. The final product, i.e., the hardware, systems design, the procedures and the software that comprise the NELINET Center, should be useful to the entire American library community.

I was asked by the New England Board of Higher Education in January, 1969 to evaluate the work completed by Inforonics to that date to determine if the two requirements stated above were being fulfilled. An analysis of this type involves the concept of transferability. In the first instance, the transferability is internal to the developmental stages of the NELINET Project itself; in the second case, it relates to the extent to which all or some of the NELINET system can be used by the constituent libraries of the network, or by other library networks, for all or some of the same purposes as it was designed for the New England Board of Higher Education.

The planning for both phases of the NELINET Project includes on-line access. In the simulated environment, the libraries that are part of the network will transmit their requests via a teletype for bibliographic data and/or file updating to Inforonics, Inc., and the latter will re-transmit these requests on-line via Dataphone to a service bureau containing the hardware/ software configuration specified for the system. As more experience is gained in the Project, i.e., as technical and cost factors are evaluated more carefully, the libraries themselves may eventually be hooked directly on-line to the service bureau.

When the NELINET Center is established, the network libraries will be connected directly to the Center in an on-line time-shared basis. Because the primary function of the NELINET bibliographic data bank will be to serve as a machine-form catalog that can be searched on-line by the network libraries in support of cataloging and acquisitions, this time-sharing aspect becomes critical. In the simulated environment, a service bureau will have to be used; this will not be the case for the final projected Center. Accordingly, Inforonics, Inc. has specified that a particular computer, the Digital Equipment Corporation PDP-10, be used in both phases of the NELINET Project. Although this decision was based on a number of factors, four of the pivotal ones were that: (1) the PDP-10 was capable of time-sharing in the sense that multiple unrelated program jobs could be run relatively concurrently, utilizing a time-slicing algorithm to allot portions of operating time to each job; (2) the manufacturer had written the software to provide this kind of time-sharing; (3) the equipment was available in a service bureau operation using this software at the onset of the project, i.e., in the simulated environment; and (4) the configuration, i.e., hardware and software was capable of expansion to the estimated number of users in the projected environment.

The simulated NELINET environment has itself been divided into two distinct phases. The first of these was a pilot operation, based entirely on magnetic tape storage of Library of Congress MARC I records, in which a Digital Equipment Corporation PDP-1 was utilized for the computer processing required to produce catalog cards and labels, and in which the computer programs were coded in PDP-1 machine language; the second phase is the one that has been described above, that is, a pilot operation based on Library of Congress MARC II records, in which a PDP-10 will be utilized for the computer processing required to produce catalog cards and labels, and in which the computer programs will be coded in PDP-10 machine language. It was originally intended to experiment with MARC II records on the PDP-1, utilizing the programs written for MARC I records modified to incorporate the fundamental differences between the two types of records. The reasons why this original intention was abandoned are fully recounted in the final report on CLR-425, and will not be repeated here.

The decision having been made, has the first requirement of the New England Board of Higher Education been satisfied with respect to the eventual transition of application program modules from the simulated environment to the projected environment using the PDP-10? The design specifications of the program modules that are to be used in both phases, e.g., catalog card production, book pocket label production, book spine label production, etc., were analyzed and considered to be designed to work equally well for the tape system and for the random access system. The programs used to search magnetic tapes by Library of Congress card number in the simulated environment will not, and, in fact, should not, be used in the random access system of the projected environment, where searching will be by author/title as well as by LC card number. File organization in a magnetic tape system is inherently serial, and the techniques for a random access system should be entirely different and far more sophisticated. If the random access device were used to perform as a tape, i.e., in a sequential mode, without the utilization of random access capabilities and directory techniques, the system would be inefficient and badly designed. Therefore, it can be stated that all effort is being expended by Inforonics, Inc. to design modular programs to transfer as many as possible from the simulated to the projected environment.

The second requirement of the New England Board of Higher Education was to insure that the final product would be useful to the library community.

Insofar as systems of the kind represented by NELINET are concerned, transferability may have a variety of meanings, i.e., it may refer to the ability to transfer the entire system, both hardware and software; the ability to transfer the system specifications; the ability to transfer the logical flow diagrams of the software configuration; the ability to transfer the software itself; or the ability to transfer the knowledge gained from the operational experience. Two factors that will significantly affect the character of the transferability that is possible for the NELINET system center around the computer selected and the programming language used.

The hardware, i.e., the PDP-10 was chosen because it was available in a service bureau operation and had the capabilities required for the projected environment. The question most frequently asked will be "Would not a more popular piece of equipment have been the better choice because of the likelihood that more libraries will have access to the equipment?" The majority of the computer market is held by a manufacturer whose equipment at that time did not have the existing capability of being run in a time-shared mode (as defined earlier in this report) and could not be readily found in a service bureau. The manufacturer initially intended to provide a time-shared system but this was withdrawn some time prior to the Inforonics decision. Therefore, the equipment of the major manufacturer was not in reality a choice that met the immediate needs of the NELINET Project.

Even if the major manufacturer's equipment had satisfied the NELINET needs, there is perhaps something to be said in favor of designing a library system for a different hardware configuration. In the case of the NELINET Project, the experience that will be gained on a computer configuration with certain characteristics will provide a partial answer to the question often asked, "What is an ideal hardware configuration for NELINET-type networks?" The knowledge gained from this experience and made available to the library community exemplifies one of the m ings of transferability, i.e., the transfer of knowledge.

The main significance of the choice of equipment for the NELINET Project lies less in the particular manufacturer whose equipment is used than in the fact that the entire NELINET system, i.e., the procedures and the software, can only be transferred to a library network with the same equipment configuration. Since the New England Board of Higher Education is committed to making all of its findings available to the library community, including the procedures and software of the NELINET Project, such availability would represent complete transferability to any library network possessing the same hardware configuration, or willing to acquire it.

It should also be noted that the system specifications, i.e., the logic and the flow, are independent of hardware and can be transferred independently of hardware specifications. System design is time consuming and costly in terms of the manpower required, and such information would be extremely useful for other systems planning a NELINET-type operation. Similarly, the program specifications and logical flow diagrams, although not completely independent of hardware, include design aspects, e.g., search strategy, etc., that would be useful for other network designers. Again, this activity is expensive in terms of manpower, and any assistance that could be secured would substantially reduce costs for others. In both cases (system and/or programming specifications) the New England Board of Higher Education will make this information available to the library community.

The decision of Inforonics, Inc. to program in PDP-10 machine language rather than in a higher level language, however, is more complicated vis-a-vis the assessment of its consequences on the transferability of NELINET experience, since software can not be transferred from one manufacturer's computer configuration to another[1] if it is not written in a higher level language, and even this does not guarantee transferability.

Timing is of prime importance in time-shared systems, even for those programs operating in a background mode. Although programs can be written faster in terms of elapsed programming time in such higher level languages as COBOL and FORTRAN, a good programmer will write more efficient code in machine language. The NELINET system, to be a useful system in terms of service and cost for the New England libraries, should be written as efficiently as possible; this effort is not a "one-shot" job, but a system that will be operating for a long time.

Thus, the decision to program in PDP-10 language for the applications that will be processed in a time-shared environment seems warranted in terms of the functional technical requirements of the NELINET Center. Even if it had been decided to program in a higher level language (both COBOL and FORTRAN are implemented on the PDP-10), the complete transferability without modification of the resulting software is open to some question.

Granted that modification of software is simpler, (again

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[1]Some manufacturers claim compatability in the use of machine language code or supply translators for one machine language to the other. To the best of my knowledge, neither been claimed by a manufacturer for PDP-10 machine code.

open to some question and dependent on what was written, who wrote it originally and who is modifying it) than a complete rewrite, there is still another factor to be considered. If the application programs were written in COBOL, the potential user of the programs for another system would have to base his system on NELINET design, that is, use the NELINET type peripheral equipment, formats, etc. On the other hand, if the NELINET programs were designed for the lowest common denominator (design for the least sophisticated configuration to which the programs might be transferred), in an attempt to insure transferability, then NELINET would be adversely affected.

This is not a utopian world. The computer community and the library community are making progress towards standardization. Both have a long way to go. In the interim there are problems in transferring computer systems from one computer to another (even when the same manufacturer's equipment is being upgraded) within an organization; these are complicated many times over when the concern is across organizations. The use of higher level languages must be evaluated in the context of each system being designed and the capabilities and requirements of potential users of the entire system or components of the system. Blanket statements concerning the transferability of programs written in higher level languages are fraught with danger.

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FINAL REPORT, CLR-443

PART III

TECHNICAL REPORT by INFORONICS, INC.

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NELINET - THE NEW ENGLAND LIBRARY INFORMATION NETWORK

COMPUTER PROGRAMMING AND PILOT OPERATION OF MARC II CATALOGING SUPPORT SERVICES

PREPARED BY

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SUBMITTED TO

THE NEW ENGLAND BOARD OF HIGHER EDUCATION

FINAL REPORT

CONTRACT NO. CLR-443

DECEMBER 31, 1969

ACKNOWLEDGEMENTS

There were technical contributors to the NELINET MARC II system besides the authors of this report:

James Agenbroad assisted in writing the specifications. Douglas Campbell, Anthony DeStefano, Kurt Lanza, and Richard Mackler designed and wrote the programs. Peggy Greene, Liam Kelly, and Ruth Tighe assisted in running the demonstration of services. Finally, the contribution of the librarians in the state universities of Connecticut, Massachusetts, New Hampshire, Rhode Island, and Vermont should be acknowledged. Without their participation, the project could not have taken the long and difficult step from design to implementation.

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FIGURES

TABLES

1. INTRODUCTION AND SUMMARY

1.1 HISTORY

NELINET, since its inception in 1966, has been sponsored by the New England Board of Higher Education. The work done under the present grant is a continuation of work done under four previous grants from the Council on Library Resources, which can be summarized as follows:

1. CLR-354: Initial Systems Study, determined the initial specifications for a computer-based New England library technical processing center and its services;

2. CLR-374: Catalog Data File Creation, resulted in the development of the initial computer programs based upon the Library of Congress MARC I Format;

3. CLR-385: Systems Design and MARC I Pilot Operation, resulted in the initial studies of library acquisitions processes and random-access file organization and searching, as well as in the demonstration of catalog card and Selin label production services, using the computer programs developed under CLR-374;

4. CLR-425: MARC I Pilot Operation and Conversion to a MARC II System, an extension of the work of CLR-385, provided for the continuation of the MARC I-based pilot operation through the end of July, 1968, and for the beginning of the systems design and programming required for catalog data file creation and for catalog card and label production based upon the new Library of Congress MARC II Format.

1.2 WORK PERFORMED

Under the present grant, which began on February 15, 1969 and ended on November 15, 1969, the systems design and program specifications begun under CLR-425 were completed, and a set of programs were written to generate catalog cards and labels from Library of Congress MARC II tapes.

A demonstration of services was conducted with the five participating libraries over a five week period, beginning October 8, 1969. The libraries transmitted requests once a week, the MARC records were searched, and catalog card sets were produced for the items found. The label formatting programs were not sufficiently debugged to provide labels during this demonstration.

1.3 ACCOMPLISHMENTS

With the completion of the work done under this contract, NELINET now has a system for generating cataloging products on which its future services can be based. There are two significant features of this system. First, its design has been based on the MARC II format with the definition and identification of the bibliographic data elements kept completely intact. Second, the system has been designed for a large scale computer, Digital Equipment Corporation's PDP-10, so that it has a large capacity for growth.

This report describes this system, the programs involved, and the demonstration that took place. In addition, complete program documentation has been submitted to the New England Board of Higher Education.

Assuming that the Library of Congress continues to distribute MARC tapes, and that the remaining bugs are removed from the programs, the system can be used to produce catalog cards ready for filing and labels ready to be applied to books within a very short turn-around-time. Increasing the volume of output from the system by increasing the number of requests submitted can be accomplished with comparative ease.

Using the results of the present experiment, these services are estimated to cost $1.56 per title processed, with a projection that these costs will be lower in the future.

These accomplishments lead naturally to a number of short range and long range objectives. The system may be used to begin the creation of a machine readable file of the holdings in the participating libraries. Today great emphasis is placed on libraries sharing resources and the government has directed monies toward this end. But effective and efficient sharing of holdings depends on (1) quickly locating the material, and (2) getting the material from where it is located to where it is needed. Machine readable files of holdings provide the means of quickly locating materials, either by printed lists or machine form catalogs. With the additional capability for creating machine readable records for items not on the MARC II file, this service can be greatly expanded. In this way, sharing processing facilities increases the ability of the participating libraries to share resources.

2. SYSTEM DESCRIPTION

The NELINET MARC II system in current pilot operation has been designed to be the logical precursor to a fully dedicated technical processing center that will serve the New England library community. Such a center would require data processing equipment costing many hundreds of thousands of dollars. The present system has been designed to provide an operational simulation of the dedicated center without requiring the capital commitment. The objectives and methods of the system, and the machines, communications, programs, and operating procedures that comprise the operating network are discussed below.

2.1 OBJECTIVES

The goal of operational simulation without capital expense has required that the system be developed and operated in a service bureau environment. Within this context, we have had the dual objectives of creating a body of programs and procedures that would be easily transferable from the service bureau to a dedicated center, and, simultaneously, providing useful services and products to the participating libraries. For reasons discussed at length in earlier reports, initial system services were chosen to be technical processing services in support of cataloging, using the Library of Congress MARC II magnetic tapes as the primary data base. A main objective of the present contract has been to complete the conversion of the earlier MARC I NELINET system (CLR-425) to the MARC II format and to move from a batch processing system on Inforonics' computers to an on-line processing system on a service bureau machine identical to that planned for the fully-dedicated technical processing center.

These objectives have been met in good measure and during the course of this contract we have additionally shown evidence of the transferability of the programs. This latter point was demonstrated when we were forced to switch service bureaus when the one we used initially had an extended period of disc and software problems.

2.2 THE MARC II DATA BASE

In simplest terms, the system as designed accumulates MARC II records as they are received from the Library of Congress, searches this data base when requests for cataloging services are received, and processes those records which are located so as to produce catalog cards, Selin labels, and book pocket labels.

The MARC II data base is central to the system, is very large, and is growing rapidly. As of November 5, 1969, we had accumulated approximately 28,000 records, averaging 500 characters each. This base is growing at the rate of about 1,000 records per week.

2.2.1 Data Base Storage

The particular economics of the service bureau environment have required that our MARC II data base be kept on magnetic tape rather than disc, despite the fact that the fully-dedicated system planned would use disc or other random-access mass storage.

A large disc file, such as would be used in the eventual fully-dedicated system, would cost in the neighborhood of $250,000 and have a capacity of 500,000,000 characters, or about 1,000,000 MARC II records, less directories or other information. This cost is in the order of 50¢ per 1,000 characters, or about 6.25¢ per 1,000 characters per year, assuming an eight-year service life.

Using an identical disc file at a service bureau, the same 1,000 character storage would cost about $4.50 per year, on a one-year storage contract. (One "Mass Storage Unit" (MSU), of 1,024 characters, typically leases for 37.5¢ per month on a one year contract.) Short-term lease is even more expensive, typically twice the long-term rate - 75¢ per month, or 2.5¢ per day per 1,024 characters. In addition the file loading charges make short-term use of such a large storage file at a service bureau even more costly.

From the time-shared service bureau point of view, random-access storage is a fixed resource that represents one of the limits on the number of time-shared users that can be accommodated. Hence, it is not unreasonable that its policies and pricing discourage the use of extremely large data bases. One bureau limits the maximum storage contract to 10,000 MSU. Considering that it may service 100 users and 10,000 MSU is about 1/8 of the total disc, this is not an overcautious limit, but at the same time, it is barely sufficient to hold three months' collection of MARC II records, without directories. Furthermore, the service bureau charge for a tape unit is $2.50 minimum per half hour or less. This is a modest charge, though data transfers are expensive. Current charging schedules are 1¢ per 1,024 words of core per second. The second is broken up into 60 "ticks" but even short transfers are charged a minimum of 3 "ticks" (or 50,000 microseconds; a long time by processing standards). These figures are cited to show that allocation of costs in a service bureau environment is quite different from that which would hold true in a fully-dedicated center.

Hence, for the demonstration of the present project, magnetic tape storage has been used for the data base.

Because tape searching time increases extremely rapidly as the data base grows larger, tape usage is only feasible as an interim solution, since it offers economies only under the simultaneous conditions of a moderate size data base and a scheduled batch processing system.

2.3 COMPUTERS USED

A Digital Equipment Corporation (DEC) PDP 10/50 has been used as the basic systems computer. In a fully-dedicated system, this machine would be capable of performing all technical processing now contemplated. During the present demonstration however, this machine, located at a service bureau, was used for only a part of the technical processing. A Digital Equipment Corporation's computer PDP-9 was used at Inforonics for the initial conversion of the LC MARC II tapes to tapes in NELINET MARC II, an internal format that, while fully convertible back to LC MARC II, is more convenient for internal processing. Use of an in-house computer permits verification of the MARC tape before sending it to the service bureau.

An IBM 360/40 computer is used at another service bureau (Information Services, Inc., Wellesley, Massachusetts) because it drives an IBM 1403 line printer with the required upper and lower case print train. The choice here was dictated by both the particular hardware and the quality of the service bureau. The usual service bureau line printer, if used for nothing more than information-only page printout, frequently suffers from poor alignment and other ills that would disqualify it for the creation of crisply printed catalog cards. This particular installation specializes in the creation of computer produced charity solicitation letters with a "hand-typed" personalized appearance. Their printer consequently is extremely well-maintained.

2.3.1 Disc Files

Though the current system holds the data base on magnetic tape, its processing programs have been written to make use of disc files, where appropriate. Many PDP-10 service bureaus have one or more large discs. The large Bryant disc (4000-2A) was initially a widely popular choice. Some service bureaus are now planning, however, to use Memorex discs; and some are installing IBM 2314 discs. So far, our programming has been disc independent, since most service bureaus have been using the standard DEC Monitor (operating system), in which disc storage is treated as an extension of core, from the applications program point of view. Storage is parcelled out in fixed length segments by the monitor so that the monitor, not the applications program, has control over the precise physical disc location that holds a particular piece of information. By this means, the applications programs have been kept independent of particular disc geometries. For large scale retrieval operations on disc files it is frequently desirable to utilize data location on the basis of the specific disc. Some service bureaus are planning to provide the facility to bypass the monitor in such cases, as well as to provide small user-dedicated disc packs. These options have not been required on the present project.

2.3.1.1 Disc Problems

During the course of the project, it was necessary to switch service bureaus because of disc and software problems at the first service bureau. Had we waited for the problems to be solved, we would have suffered much more than the two month delay this breakdown did occasion.

The service bureau had two complete systems with a third one going into service (systems A, B, and C). The purpose of having multiple systems is to provide "graceful degradation" in case one system has problems. Thus, switching one system out of service for maintenance or testing would not terminate service, but would merely increase the waiting time for service on the systems that are operating. However, the Dataphone lines from the Boston area were multiplexed in Boston into a private line that connected only to the "A" system. Hence, when trouble developed with the disc on this system, there was no way to switch systems.

Another problem was traced to a dirty disc. It should be noted in passing that it takes only a microscopic amount of foreign matter on the disc surface, or airborne, to make it "dirty". With critical head-to-surface spacings in the 100 micro inch range, maintained by a boundary layer of air moving with the disc surface at speeds in excess of 120 miles per hour, it does not take very much dirt to cause severe problems. Air contamination is the classic enemy of disc files, since contamination is a self accellerating process wherein dust can cause scraping of the oxide on the disc surface, causing errors and more contamination, until finally head meets disc, and the disc is said to have "crashed". The results are always fatal when this occurs, in that at least one track becomes permanently damaged. Hence, air filtration is normally maintained at very high levels, typically 95% efficiency for one micron dust particles.

The problems were, in part, hardware deficiencies due to a faulty disc. During the period when "slow degradation" of the equipment was taking place, Inforonics was always the first user to be affected, since the size of our data base was considerably larger than that of the other users, and error rates that would not usually affect the accurate read-in of a short problem would invariably prevent the accurate read-in of a 10,000,000 character-plus data base.

This experience would seem to show that large data bases cannot be served on equipment that is even faintly marginal, and that duplication of equipment does not automatically guarantee "graceful degradation" during periods of trouble. While these problems constituted an extremely unfortunate occurrence for both the project and the service bureau, it did force us to prove what we had maintained: that the body of programs were completely transferable to other service bureaus and other PDP-10's.

2.4 TELECOMMUNICATIONS

The participating libraries are currently equipped with Teletype machines with dual connection to TWX lines and Dataphone lines. The TWX lines have been used for inter-library loan communications and the Dataphone lines have been used for transmitting requests to the processing center and for transmitting requests and program data from the processing center (Inforonics, Inc., Maynard, Massachusetts) to the PDP-10 at the service bureau (The Interactive Sciences Corporation, Braintree, Massachusetts) currently being used for this purpose. The Teletype keyboards in use are the single-case 33ASR models. It was planned early in the project to switch to the more flexible 37ASR models (double-case) when these became generally available. Although announced in 1966, these are just beginning to see limited service and have not been available for this project. While Dataphone lines are required to communicate with the computer, and would be required at the libraries to service double-case Teletype keyboards or more advanced display terminals, the low speed transmission of request tapes via the Model 33 Teletype could be handled by either TWX or Dataphone.

The six state university libraries in New England are between 50 and 200 miles distant from the processing center in Maynard, and between 40 and 265 miles distant from each other. The transmission cost of a 30-minute Dataphone message to the center averages about $5.28; the transmission cost of a 30 minute inter-library TWX message averages about $7.50. The transmission cost of a 30 minute Dataphone message from the center to the Service Bureau averages about $3.00. In the case of Dataphone, the 30 minute period corresponds to roughly 150 cataloging requests, for an approximate average total transmission cost of 5.5¢ per request.

2.5 PROCEDURES AND PROGRAMS

There are about fifteen principal machine operations involved in running the overall system. They are summarized here and shown on the accompanying charts. Detailed descriptions of the programs involved are contained in the next section.

1. <u>Weekly Conversion of LC MARC II Data</u>:

   Each week a tape is received from the Library of Congress containing bibliographic records in MARC II communications format. These are converted by the LC MARC II TO NELINET MARC II CONVERTER program to the NELINET internal format prior to further processing.

2. <u>Request Validation</u>:

   Teletype requests from the libraries are received as paper tape, then retransmitted to the service bureau where they are operated on by the program PAPER, which loads them onto the disc. They are then run through the program REQUEST VALIDATOR, which checks for errors and normalizes permissible variations in request format. Two files result: an error file, and a validated request file. + statistics

3. <u>Request Sort Key Generation</u>:

   The validated requests are then run through the program SORT KEY GENERATOR, which creates a sort key derived from the Library of Congress card number and the request identification number, and creates a file of requests with sort keys as headers.

4. NELINET MARC II Data Input:

The week's bibliographic records which have been converted to the NELINET internal format are then transferred from tape to disc on the PDP-10 by the program MAKTEN.

5. NELINET MARC II Data Sort Key Generation:

The program SORT KEY GENERATOR then operates on the data output from MAKTEN to create a file headed by sort keys.

6. Sorting of Requests and NELINET MARC II Data:

The program SORT accepts the new bibliographic records and the validated requests, and creates one ordered file containing both.

7. Searching and Merging:

The SEARCH/MERGE program (SMERGE) then accepts the cumulative NELINET master file containing all the bibliographic records which have been received from the Library of Congress and processed into the system, as well as the previously unmatched requests, and the file of new bibliographic records and new requests, and performs functions of searching and merging to create four new files: a new cumulative NELINET master file of bibliographic records and unfulfilled requests; a file of found bibliographic records with their associated requests; a file of the requests that were matched, which serves as holdings information; and a file of not-found messages. The new and old NELINET master files are on magnetic tape. At the end of the run, statistical and performance data of the run are printed out.

8. Sorting of Found Records:

The file of found bibliographic records and their associated requests is now sorted by the request number in the request sort key. This contains the identification of the requesting library and the library's sequence number for the request, and results in the products being returned to the libraries in their input order.

9. <u>Card and Label Processing</u>:

The program CARD AND LABEL PRODUCTION (CLPP) then operates on the sorted found records and creates four output files. These correspond to the output products wanted, and contain local information, as required, derived from the requesting libraries' stored "profiles". The separate files are cards, Selin labels, book pocket labels, and error messages. One record is created in the output files for each separate output item (e.g., one record for each entry in a card set, one Selin label for each physical volume). + stats

10. <u>Card Formatting</u>:

The program CARD FORMATTER operates on the file created by CLPP and causes card images to be formatted and output on a magnetic tape in line printer format. stats number of card images

11. <u>Selin Label Formatting</u>:

The SELIN LABEL FORMATTER program operates on the Selin label output created by CLPP and punches a paper tape to drive the label-typing typewriter.

12. Pocket Label Formatting:

The POCKET LABEL FORMATTER creates a magnetic tape containing formatted book label images in line printer format.

13. Card Printing:

The output tape from the CARD FORMATTER is then printed on continuous form card stock on a 1403 line printer, using an IBM utility program. These are then put through a card cutter.

14. Pocket Label Printing:

The output tape of the POCKET LABEL FORMATTER is printed on the same line printer; this time with continuous form label stock.

15. Selin Label Typing:

The paper tape output of the SELIN LABEL FORMATTER is then used to drive a Dura Typewriter with a Selin label attachment.

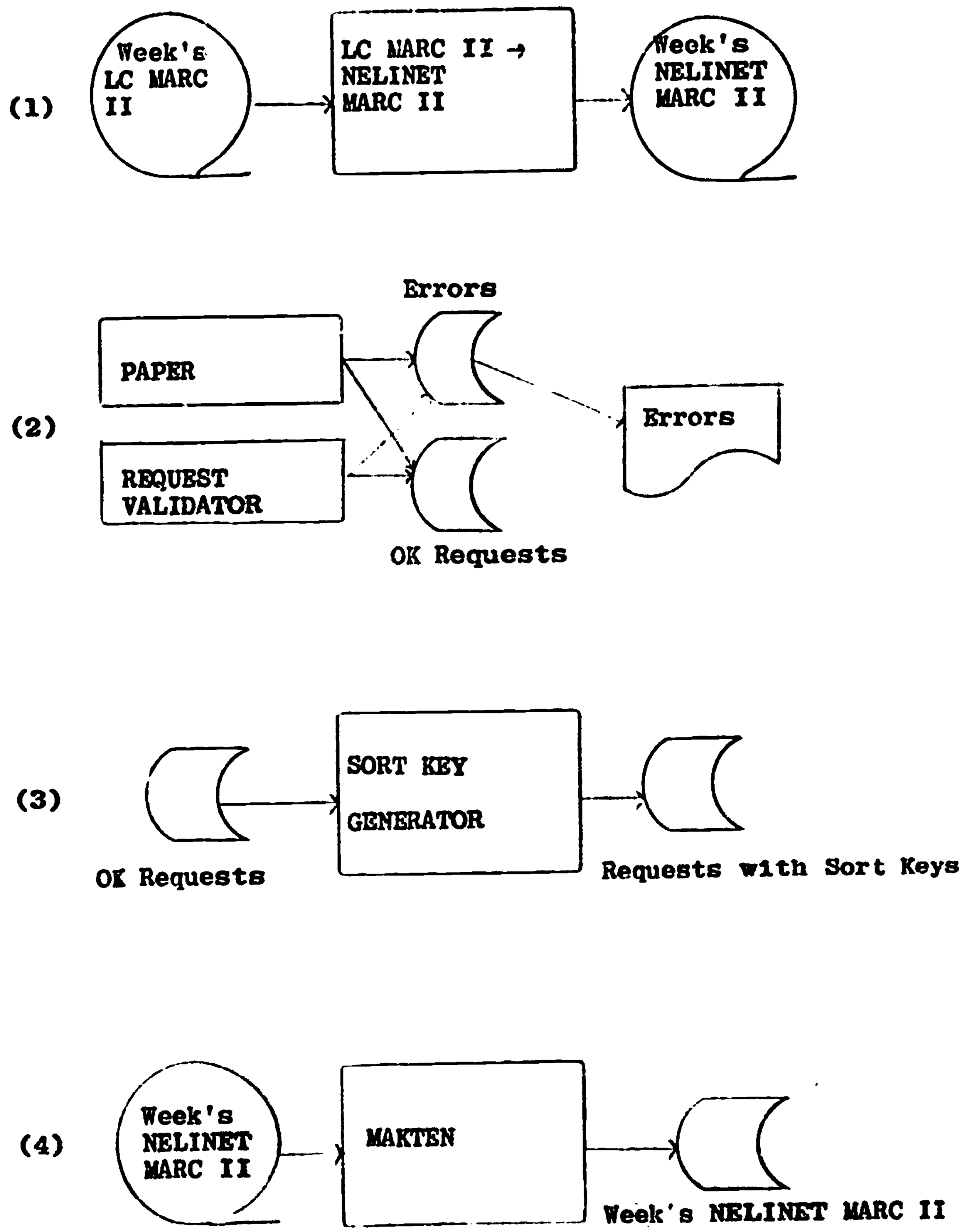

FIGURE 2-1

NELINET MARC II SYSTEM

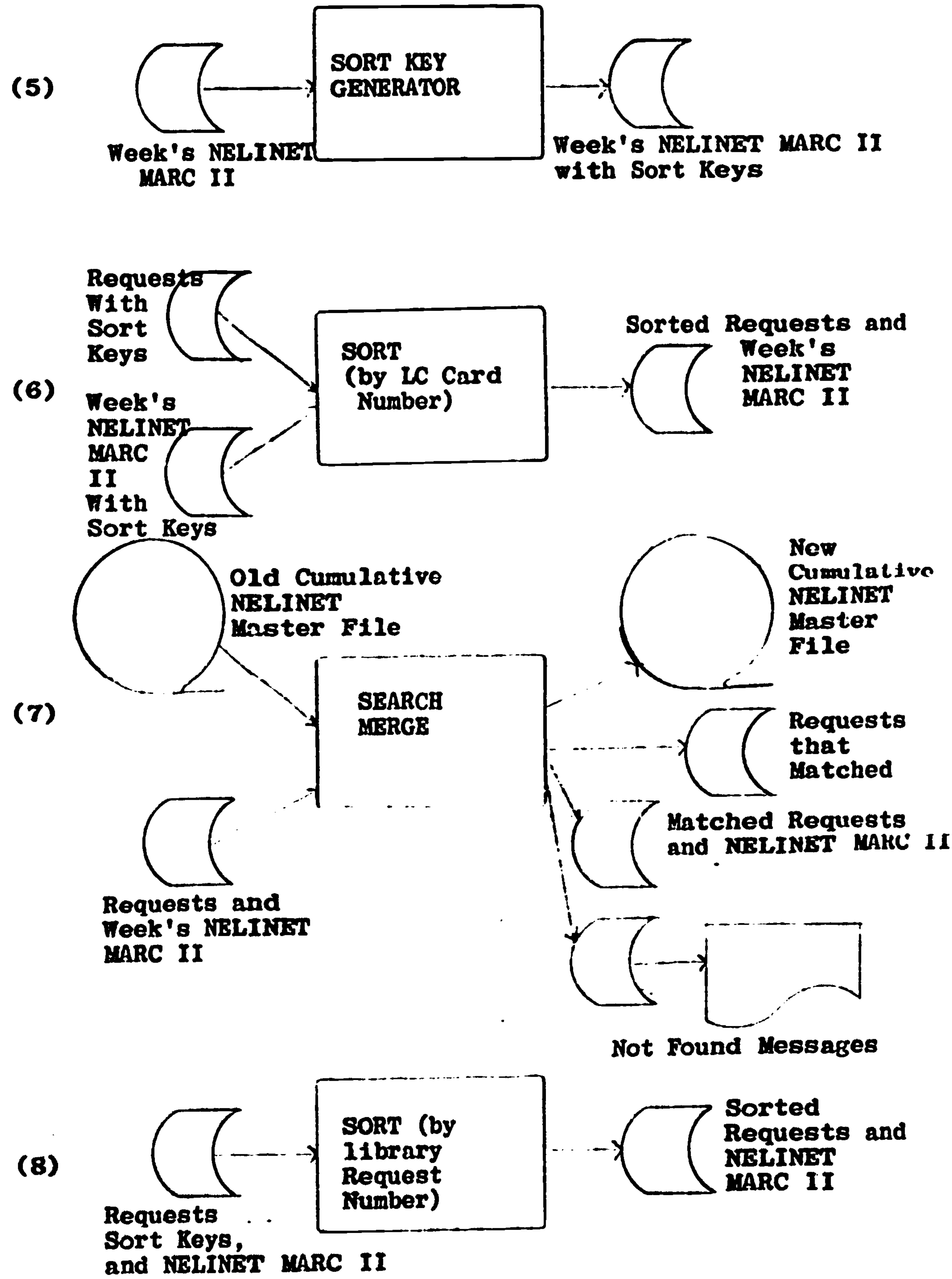

FIGURE 2-1 (Cont'd.)

NELINET MARC II SYSTEM

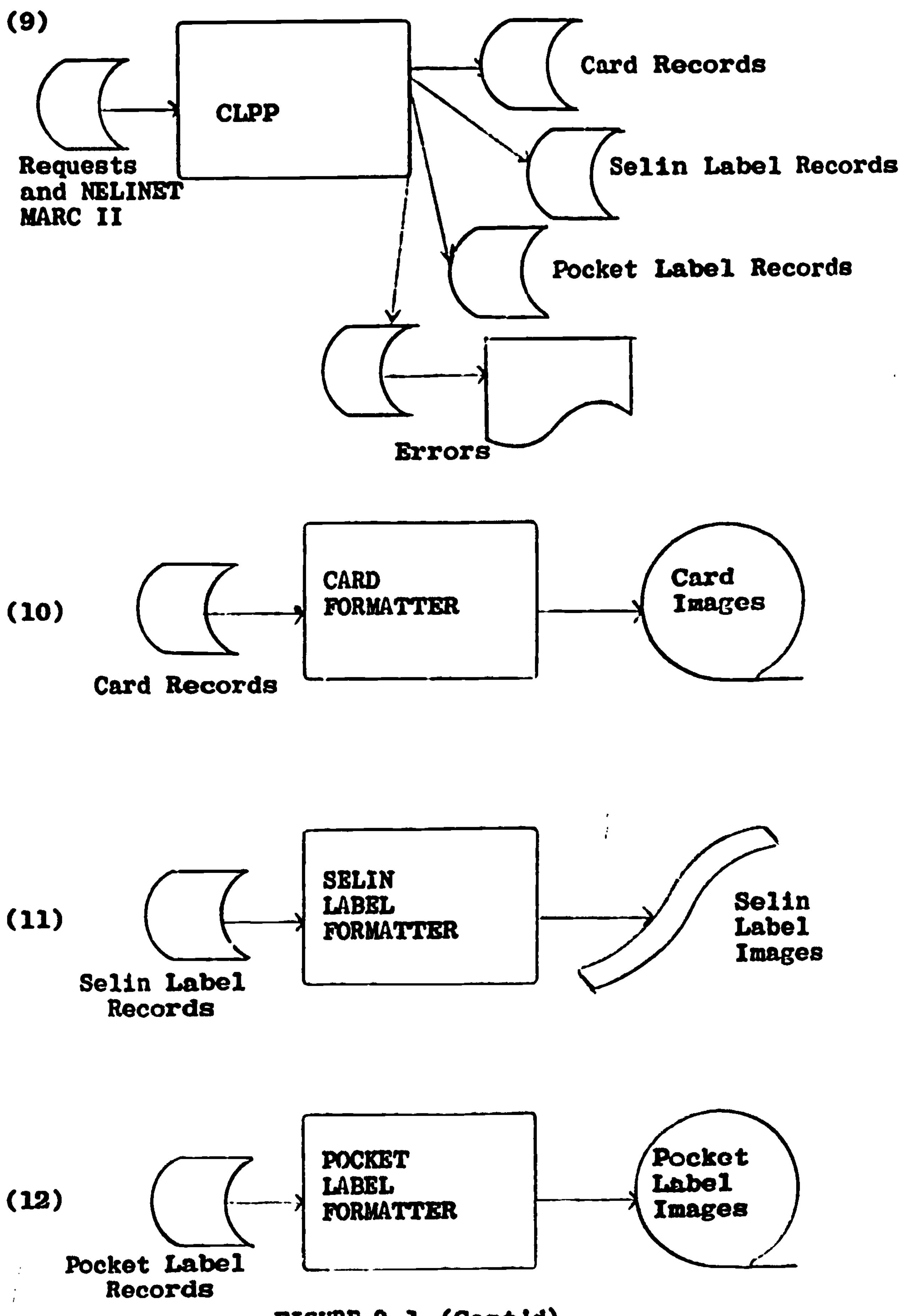

FIGURE 2-1 (Cont'd)

NELINET MARC II SYSTEM

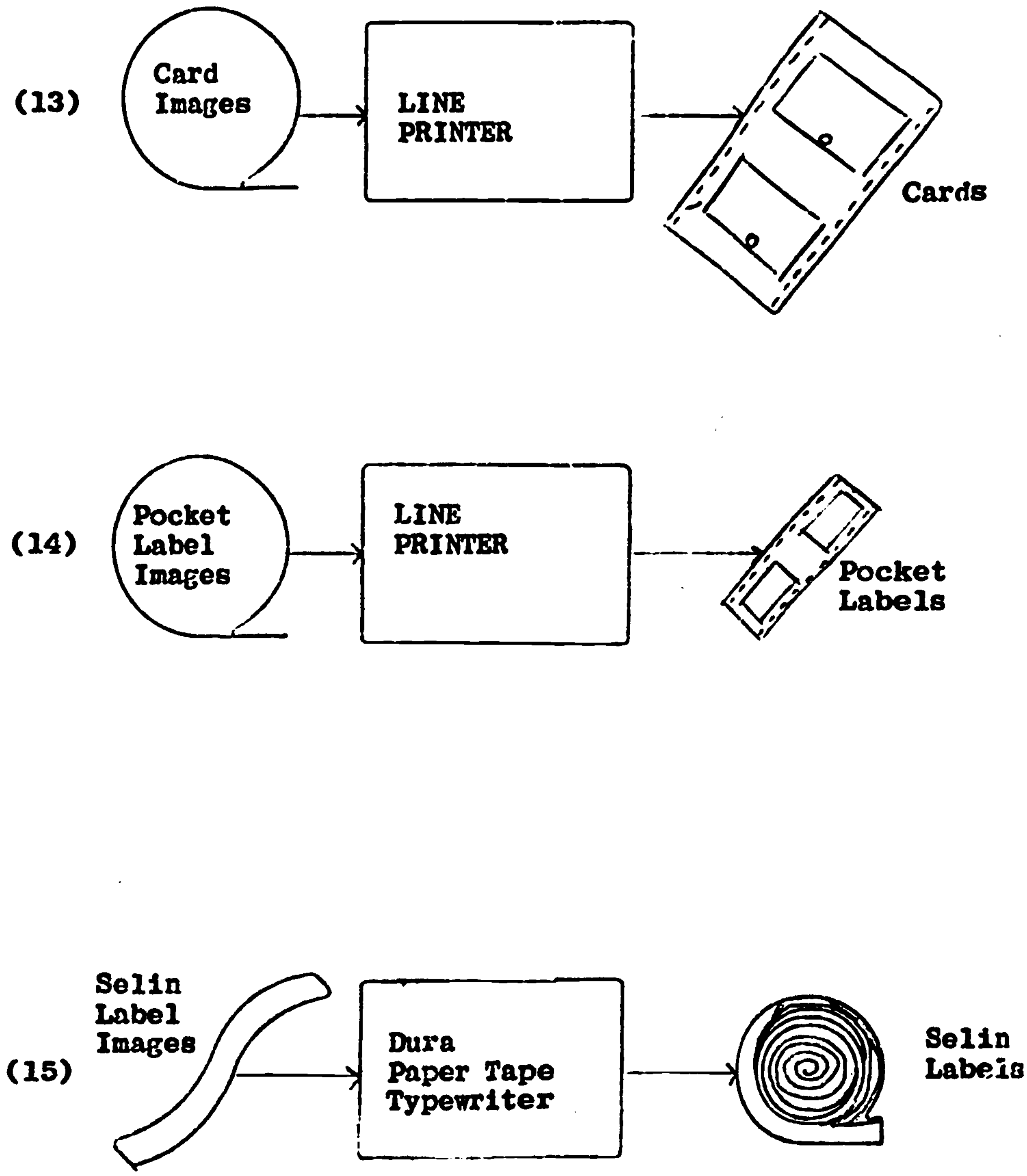

FIGURE 2-1 (Cont'd.)

NELINET MARC II SYSTEM

3. SYSTEM PROGRAMS

A total of twelve programs is involved in generating catalog cards and labels from the MARC II tapes distributed by the Library of Congress. Eleven of these were developed for this project. They are:

1. LC MARC II TO NELINET MARC II CONVERTER
2. MAKTEN
3. PAPER
4. REQUEST VALIDATOR
5. SORT KEY GENERATOR
6. SORT
7. SEARCH/MERGE (SMERGE)
8. CARD AND LABEL PRODUCTION (CLPP)
9. CARD FORMATTER
10. POCKET LABEL FORMATTER
11. SELIN LABEL FORMATTER

The twelfth program is an IBM utility program, the Information Services Print Variable Length Program, which drives a line printer. While there was some doubt during the design phase of the project that this program could be used to print catalog cards, when tested with output from the CARD FORMATTER, it was found that it could.

Most of the programs represent different functions, but the three formatting programs are exceptions to this.

They all perform the same function, but do so on different types of records.

Some of these programs operate on the bibliographic data from the Library of Congress; some operate on the request data submitted by the participating libraries; and others operate on both types of data, bibliographic and request.

All the programs used in the system, except the LC MARC II TO NELINET MARC II CONVERTER and the IBM utility program that prints the cards, have been programmed for Digital Equipment Corporation's PDP-10 computer. The former program was programmed for a Digital Equipment Corporation PDP-9 computer. The IBM utility program that prints the cards is a 360 program that drives a 1403 line printer. By using the "Batch" feature in Digital Equipment Corporation's PDP-10 monitor system, the individual PDP-10 programs may be set up so that they run as if they were one.

The NELINET MARC II system, although it presently generates only catalog cards from MARC tapes, was designed with a broad range of possible uses and additions to the system in mind, e.g., data creation for books not included in MARC II's coverage, book catalog production, etc. Since the eventual configuration is seen as random-access storage, the programs developed are disc-oriented, although the master file is on magnetic tape.

A complete package of program documentation for all programs developed has been deposited with the New England Board of Higher Education. Only a brief description is presented here.

3.1 LC MARC II TO NELINET MARC II CONVERTER

This program accepts tapes distributed by the Library of Congress in the MARC II communications format and outputs tapes that are in the NELINET internal format. The NELINET internal format uses a "mapped" record structure wherein the tags, plus the address (pointer) of the data field relative to the starting position of the first data field, are placed in a map (or directory) at the front of the record. The data fields follow this map. The map can contain a maximum of 100 entries (one entry per tag) and data fields are limited to 3,000 characters per physical record.

The Library of Congress MARC II communications format also uses a "mapped" record structure. The control information that accompanies each tag entry in their map, however, consists of the length of the data field that the tag identifies as well as the address of that data field relative to the starting position of the first data field. In the NELINET internal format, the map does not contain the length of the data field; the length can be generated when desired.

In the Library of Congress communications format, the tag identifying each field is in the map (directory). The indicators which further identify each field occupy the first two positions in the data field. The LC MARC II TO NELINET MARC II CONVERTER program converts, by algorithm, the Library of Congress tag and indicators into an 18 bit tag which identifies the data fields completely. These 18 bits appear as the tag representation in the map in the NELINET internal format. Having the indicator expressed along with the tag in the map eliminates looking at the data fields to determine if certain processing functions are to be performed. For example, certain operations are performed when the main entry is the subject of the book. This information is shown by an indicator that is in the data field in the Library of Congress record. By having this information in the map, processing is simplified.

This program also converts the ASCII character codes into the NELINET internal character codes and moves the data contained in the leader, which cannot be regenerated automatically, into the variable fixed field.

The program output is 7-level, odd parity, 200 bpi. The 200 bpi can be easily changed to 556.

Original plans called for modifying the NELINET MARC I system to accept MARC II data, convert it to its MARC I equivalent, and then process the data with the MARC I programs. For the reasons given in the final report on CLR-425, plans were changed and it was decided to design a new MARC II-based system for the PDP-10, the computer that had been selected for the NELINET processing center.

This program had already been written before this decision was made, and was programmed for the PDP-9 computer at Inforonics. It was found very convenient, during this project, to have this conversion take place at Inforonics. When trouble does arise in running this program, the Library of Congress tapes can be checked out and bad tapes can be reported more quickly than if the conversion took place at the service bureau.

At completion, the program types out the number of input and output records, and the number of parity errors and illegal characters. It also identifies the record number and data field tag that contained the erroneous or illegal data.

3.2 MAKTEN

This program performs two functions. It transfers data from magnetic tape to disc and it converts the addresses (pointers) in the data fields from word pointers to character pointers.

As explained in the preceding section, the LC MARC II TO NELINET MARC II CONVERTER was written for the PDP-9, a small 18-bit word computer. Its output format is word oriented. MAKTEN accepts this output, and converts the word pointers to character pointers since character pointers are more efficient when using the PDP-10 36-bit word computer. It then writes the records on a disc.

The output records are in the standard NELINET internal "mapped" format with the 18-bit tag occupying the first half of a PDP-10 36-bit word and the address of the starting character position of data occupying the other half of the word. A separate directory file is also output which contains the starting word address and word count for each record. All the disc files are structured in this manner for random-access.

Messages are typed on the teletype if any input/output errors occur. At termination, the program types out the number of records processed.

3.3 PAPER

PAPER is a utility program that accepts the requests transmitted via the Teletype at Inforonics and loads them onto a disc. It assumes the input to be in 7-bit ASCII code, as output by the teletypewriters. The terminating sequence to end each request must be: backslash, backslash, carriage return. The ASCII 7-bit character codes are converted to their 6-bit NELINET internal character code equivalents. The output recor' is still in the NELINET input format, i.e., a carriage return that is not followed by a tab indicates a tag, a tab separates the tag from the data, a carriage return followed by a tab indicates data continued on a new line.

Since the tab key on the 33ASR model Teletype does not physically move the carriage, the "←" character is keyed instead of the tab so that it can be proofread. PAPER converts the "←" to a tab.

PAPER contains two editing routines to allow deletion of errors discovered while keying. They are (1) delete a line; and (2) delete a record, signaled by a "\KL" (kill a line) and a "\KR" (kill a record), respectively. (See Instructions For Teletypists in Appendix C for further detail.)

Whereas the NELINET internal format allows a maximum of 3,000 characters in the data fields in a MARC bibliographic record, only 996 characters are allowed for a request record in the internal format because the amount of data in a request is small. At completion, the program types out the number of records processed.

PAPER may eventually become part of the REQUEST VALIDATOR. During the demonstration it was kept separate so that keying and transmission errors could be more easily identified.

3.4 REQUEST VALIDATOR

The REQUEST VALIDATOR accepts the output of the program PAPER, validates each record, and outputs two disc files. One contains all the correct records, the other contains the error messages. Both files are in the NELINET internal format, i.e., they are mapped records as described in Section 3.1. Again, the data fields are allowed a maximum of 996 characters per physical record as in the PAPER program.

Each record is checked to assure that all tags input are valid, that the tags that are required are not missing, and that the tags that should appear only once are not duplicated, as follows:

	Required	Unique
req (Request No.)	yes	yes
crd (LC Card No.)	yes	yes
loc (Location, Copy, Volume Data)	no	no
call (Local Call No.)	no	yes
supp (Supplement No.)	no	yes

Each field is then verified as follows:

req -- Must contain 2 alpha characters (library code), 2 digits (year), a hyphen, and a 1-6 digit sequence number. This may be followed by an "m".

crd -- May have a 1-3 character alpha prefix. Must have 2 digits, a hyphen, and a 1-6 digit sequence number. This may be followed by a suffix.

loc -- Block 1 (location symbols): Alphas, spaces, periods, and backslashes are valid.

-- Block 2 (copy number): Numerics, spaces, dollar signs, hyphens, periods, commas, and "c"s are valid.

-- Block 3 (volume numbers): Alphas, numerics, spaces, dollar signs, hyphens, commas, and periods are valid.

loc -- Blocks 4, 5, and 6 (Suppress Catalog Cards, Suppress Selin Labels, and Suppress Book Pocket Labels): The letter "x" is valid. If an upper case shift is input, it is eliminated.

-- Block 7 (extra main entries): The numbers 1-7 are valid.

call -- Alphas, numerics, spaces, slashes, hyphens, commas and periods are valid.

supp -- One numeric or one alpha is valid.

This program also normalizes the following sequences of spacing characters:

1. Drops spaces before carriage returns.
2. Drops sequential carriage returns.
3. Drops sequential tabs.
4. Drops spaces before tabs.
5. Converts carriage return tab to a space.

The error messages output on the second file contain the date, the program name, the record identification, the error description, and the data which caused the error. The identification for each record contains the library code and the request number, so that the errors can be sorted back by library. These messages and the number of good and/or rejected records are typed out for each library at completion.

The experience in using this program and the PAPER program during the demonstration is described in Section 4.2.1.

3.5 SORT KEY GENERATOR

The SORT KEY GENERATOR converts variable field data to fixed field data suitable for sorting. It generates sort keys for the bibliographic records which contain the Library of Congress card number, and for request records which contain both the Library of Congress card number and the library's request number.

The input files to the program are in NELINET internal format, and in NELINET internal character codes. The characters in the items selected for conversion to sort keys are normally converted to 6-bit ASCII character sets for ease of sorting on the PDP-10. However, the program contains six different conversion tables, any of which can be selected for any item. Escape coding is also provided for the general case; that is, all special character sequences and case data can be stripped. The output files generated from the program contain the sort key followed by the input record in the NELINET internal format. The SORT KEY GENERATOR is a completely table dependent program whose functions are derived from these tables. The number of records processed is typed out at completion.

The Sort Key is six PDP-10 words long and contains thirty-six six-bit characters. The contents of the Sort Key are shown in Figure 3-1.

3.6 SORT

The SORT program for the NELINET system employs a standard Shell Sort. The SORT sequence is specified by tables and can sort any number of keys in any order. The starting bit and the number of bits in the string are specified for each key. Normally the character codes in the keys are six-bit ASCII codes.

Core allocation for SORT is dynamic, i.e., the program requests core from the monitor as it needs it. This feature allows one to specify the maximum number of records and, therefore, the maximum amount of core which can be used. Time sharing service bureaus use a time/core algorithm in pricing jobs. The ability to change the amount of core allows one to achieve the best price per job with different service bureaus.

The program first passes the input file (any number is possible), pulling the keys and record addresses for the input records until it has exhausted the setup value for the number of records. It then sorts these and writes them out on a temporary file. When all the records have been

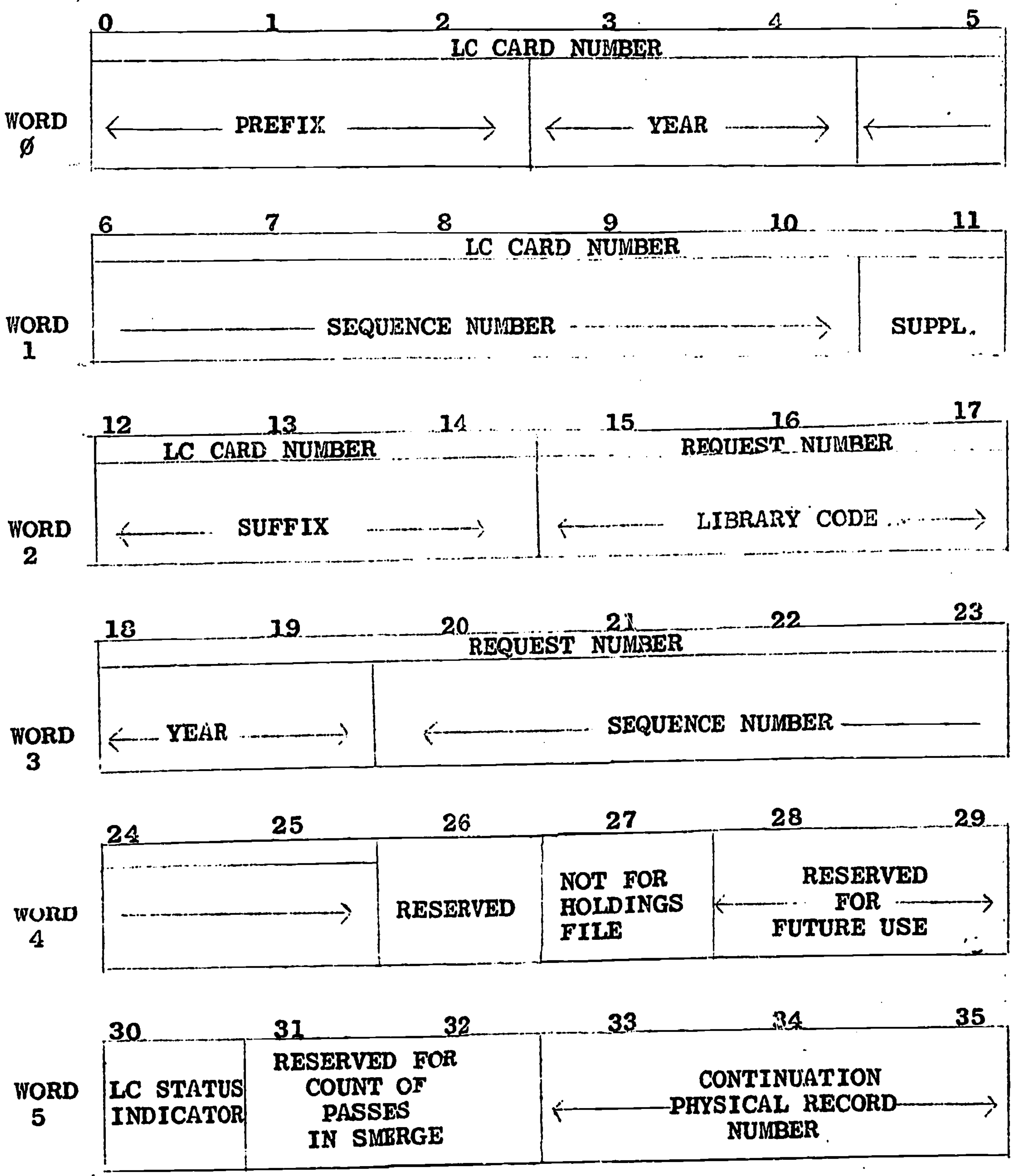

FIGURE 3-1

SORT KEY

processed, it merges the temporary files into one, and then creates a new directory file to the original input file. The output file becomes a copy of the input file but with a different directory.

The SORT program is used to sort request records and the week's bibliographic records by Library of Congress card number before searching and then again after searching to sort the matched request and bibliographic records by library request number.

3.7 SEARCH/MERGE (SMERGE)

Input to SMERGE consists of:

1. A magnetic tape, containing in one numeric sequence by Library of Congress card number: (a) the bibliographic records which have been received from the Library of Congress and processed into the NELINET system and, (b) the unfulfilled requests which were unmatched in previous runs. This is the old cumulative NELINET master file.

2. A disc file in one numeric sequence by Library of Congress card number, containing: (a) new requests from the libraries and, (b) new bibliographic records from the Library of Congress.

In the demonstration of this project, the system was run once a week and one tape was issued each week by the Library of Congress. If the system were run more frequently than once a week, input to this program would not always contain new bibliographic records. All input records are in the NELINET internal format and all contain a sort key.

SMERGE searches for bibliographic records which match the requests submitted by the libraries and creates a new cumulative master file. The program matches requests and updates the file in one pass to save the high costs of processing large files.

SMERGE outputs three disc files and one magnetic tape file:

(1) A disc file of records containing bibliographic data and request data that will be used as input to the card production program. Each record in this file contains the request record and the bibliographic record that matched it, as well as the request sort key so that it can be sorted back by library.

(2) A disc file of requests that were matched. This file contains each fulfilled request as it was input by the library. Although it is not preserved, at present, in the future it could serve as a file of holdings data.

(3) A disc file containing not found messages for the requests that were not matched. Each message contains the library's request number and the Library of Congress card number in sort key form so that they can be sorted by library if desired. The number of times that the request has been searched is also contained in the message.

(4) A new cumulative NELINET master file. This file is on magnetic tape and contains (a) all the bibliographic records that were on the old master file, (b) all the unfulfilled requests that were on the old master file that were not matched in the new weekly batch of bibliographic records, (c) the new weekly batch of bibliographic records, and (d) all the new requests that were not matched by either the bibliographic records in the old master file or the bibliographic records in the new weekly tape.

This tape becomes the input tape for the next run. Presently, its density is 800 bpi.

SMERGE is actually a three way equal to or less than match/merge program which works on two input buffers and one output buffer. It was designed for use with large random-access files but presently uses two magnetic tapes, one in and one out, plus an input disc file.

The program works entirely from the data in the sort keys and does not look internally into the map or the data fields in the record. Since the bibliographic records do not contain a request number in their sort keys, they can be distinguished from request records. They will also sort ahead of a request for the same Library of Congress card number.

A comparison is first made on the input buffers. The lower card number is moved to the output buffer. The card number in the output buffer is then compared to the card number in each input buffer. If it is unequal to both, it is output on magnetic tape and the lower of the two input buffers is moved to the output buffer and the process is repeated. If the card number in the output buffer equals the card number in either (or both) the input buffers, a check is made that the input buffer represents a request.

The appropriate data is then output to the holdings and card production input files, the input buffer that contained the matching request is refilled, and the cycle repeats.

SMERGE also keeps a count of the number of passes on each unfulfilled request which did not match. When retention periods for keeping unfulfilled requests on the file have been determined, SMERGE can purge (or otherwise handle) unfulfilled requests which have been on the file this long.

The not found messages for all unfulfilled requests written on the disc are, at present, typed out at the end of the run on the Teletype, and have been used in checking out the system. They could, if desired, be sorted back into library request number order and transmitted back to the libraries. This was not done, however, because the investigators did not feel that they knew the most efficient way of handling these messages in a full scale operational system. Should the libraries be notified of all their unfulfilled requests on the file, or only those submitted in the latest run? Should the requests be transmitted back to the libraries or printed and mailed? Finally, would not found messages be of any use to a library in a full scale operational system after retention periods for keeping requests on the file have been determined?

At termination, the program types out the total number of bibliographic records on the new master file, the number of unmatched requests remaining on the file for each library, the number of new requests that were matched for each library, and the number of old unfulfilled requests that were matched in this run for each library.

3.8 CARD AND LABEL PRODUCTION PROGRAM (CLPP)

CLPP accepts the output of SMERGE and generates for each input record, four types of records:

1. A record for each entry required for a set of cards.
2. A Selin record for each physical volume owned.
3. A pocket label record for each physical volume owned.
4. Error message records.

Each type of record is output onto a separate disc file.

The profile for each library contains information about the library's processing specifications, including:

1. Oversize determinations.
2. Oversize symbols.
3. An indicator for Selin label production.

4. An indicator for pocket label production.
5. Conventional title treatment.
6. Main entry as subject treatment indicator.
7. Library symbol to appear on catalog cards.
8. A table of valid branch, department, and special shelf locations giving the card requirements.

In processing each record, the program will examine the library's profile and perform the operations specified.[1] The profile information for each of the five participating NELINET libraries is summarized in Table 3-1.

CLPP performs a number of processing functions on the bibliographic and request data, including the following:

1. Generation of overprint headings from tracings, titles, and series statements.

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1 The variations in practice found among the participating libraries are described in "Library Networks: Cataloging and Bibliographic Aspects", by Ann T. Curran, to be published by the University of Illinois in the "Proceedings of the Seventh Annual Clinic on Library Applications of Data Processing".

		Conn.	Mass.	N.H.	R.I.	Vt.
1.	Oversize determination					
	(a)	>28	29-40	28-37	>31	28-30
	(b)		41-60	>37		31-61
	(c)		>60			>61
2.	Oversize symbol					
	(a)	f	+	ovsize	f	Q
	(b)		folio			F
	(c)		F Folio			FF
3.	Make Selin labels	yes	no	yes	yes	yes
4.	Make Pocket labels	yes	yes	yes	no	yes
5.	Conventional titles are to appear on cards:					
	(a) always					x
	(b) never					
	(c) only if they appear on LC printed cards	x	x	x	x	
6.	Subject added entries are to be made when the main entry is the subject.	no	yes	no	yes	yes
7.	Output printed symbol	CtU	MU	NhU	RU	VtU

TABLE 3-1

LIBRARY PROFILES

8a. Card requirements -- Connecticut

Location	Branch	Special Shelf	Main Entries	Subject Entries	Added Entries	Shelf List
(Main)			2	1	1	1
Acq.		X	2	1	1	1
Bibl.		X	2	1	1	1
Catl.		X	2	1	1	1
f		X	2	1	1	1
G.P.D.		X	2	1	1	1
Music	X		3	2	2	2
Pharm.	X		3	2	2	2
Ref.		X	2	1	1	1
Spec.	X		3	2	2	2

8b. Card requirements -- Massachusetts

Location	Branch	Special Shelf	Main Entries	Subject Entries	Added Entries	Shelf List
(Main)			2	1	1	2
AG EN	X		3	2	2	3
BURGO	X		3	2	2	3
BUS	X		3	2	2	3
CHEM	X		3	2	2	3
CRAN	X		3	2	2	3
EDUC	X		3	2	2	3
ENGIN	X		3	2	2	3
ENT	X		3	2	2	3
+		X	2	1	1	2
FOLIO		X	2	1	1	2
FFOLIO		X	2	1	1	2
FOOD	X		3	2	2	3
FOR	X		3	2	2	3
HOME	X		3	2	2	3
LABOR	X		3	2	2	3
LAND	X		3	2	2	3
MATH	X		3	2	2	3
MORR	X		3	2	2	3
MUSIC	X		3	2	2	3
NUR	X		2	1	1	2
PER		X	2	1	1	2
PHYS	X		3	2	2	3
PLANT	X		3	2	2	3
PSYCH	X		2	1	1	2

TABLE 3-1 (cont'd.)

LIBRARY PROFILES

8b. Card requirements -- Massachusetts (cont'd)

Location	Branch	Special Shelf	Main Entries	Subject Entries	Added Entries	Shelf List
REF		X	2	1	1	2
RES C	X		2	1	1	2
SHADE	X		3	2	2	3
SPEC	X		3	2	2	3
TECH P	X		2	1	1	2
VET	X		3	2	2	3
WALT			3	2	2	3

8c. Card requirements -- New Hampshire

Location	Branch	Special Shelf	Main Entries	Subject Entries	Added Entries	Shelf List
(Main)			4	1	1	1
Archiv		X	4	1	1	1
Biochm	X		5	3	3	3
BioSci	X		5	2	2	2
Browse		X	4	1	1	1
Call		X	4	1	1	1
Chem	X		5	2	2	2
Eng	X		5	2	2	2
Folio		X	4	1	1	1
German		X	4	1	1	1
Hj		X	4	1	1	1
j	X		5	2	2	2
LS		X	4	1	1	1
LSj		X	4	1	1	1
LSRef		X	4	1	1	1
Math	X		5	2	2	2
Mcard		X	4	1	1	1
Mfiche		X	4	1	1	1
Mfilm		X	4	1	1	1
Mprint		X	4	1	1	1
MS		X	4	1	1	1
NH		X	4	1	1	1
Nt		X	4	1	1	1
Ovsize		X	4	1	1	1
Pam		X	4	1	1	1
Per		X	4	1	1	1
Phys	X		5	2	2	2
Ref		X	4	1	1	1
RefBib		X	4	1	1	1
Spec		X	4	1	1	1
Vault		X	4	1	1	1
y		X	4	1	1	1

TABLE 3-1 (cont'd.)

LIBRARY PROFILES

8d. Card requirements -- Rhode Island

Location	Branch	Special Shelf	Main Entries	Subject Entries	Added Entries	Shelf List
(Main)			1	1	1	1
Archiv		X	1	1	1	1
Blatz		X	1	1	1	1
Ext	X		2	2	2	2
f		X	1	1	1	1
J.F.K.		X	1	1	1	1
mcard		X	1	1	1	1
mfiche		X	1	1	1	1
mfilm		X	1	1	1	1
NML	X		2	2	2	2
R.I.Cl		X	1	1	1	1
Rare		X	1	1	1	1
Ref		X	1	1	1	1

8e. Card requirements -- Vermont

Location	Branch	Special Shelf	Main Entries	Subject Entries	Added Entries	Shelf List
(Main)			3	1	1	1
F		X	3	1	1	1
FF		X	3	1	1	1
J		X	2	1	1	1
Mfilm		X	3	1	1	1
MP		X	3	1	1	1
Per		X	3	1	1	1
Q		X	3	1	1	1
R		X	3	1	1	1
R Ind		X	3	1	1	1
S	X		4	2	2	2
TR	X		4	2	2	2
W	X		4	2	2	2

TABLE 3-1 (cont'd)

LIBRARY PROFILES

2. Generation of tracings for title and series entries when the overprint headings are taken from the title and series statements.

3. Generation of the appropriate number of main entries, added entries, subject entries, and shelf list cards from the profile and tracings data.

4. Generation of the appropriate Arabic or Roman numeral to be printed before each tracing.

5. Break-up of the Library of Congress call number string into segments which can be printed in the margin of the cards and on the labels.

6. Generation of a record for each label from the summarized statement of copies and volumes.

7. Addition of the library's location symbols (including oversize when appropriate) to the call number.

CLPP is a general purpose, table driven, pre-processing program which yields disc files for input to the formatting programs.

Parameters in CLPP are set up by two types of tables: the specific library profile table (LPT) and the general entry table GENT. LPT is searched by the library identification code. This table contains all the data which is unique to a specific library, such as oversize determination. It also contains a slot for the library's statistics, such as the number of entries generated. GENT contains the parameters which are common to all libraries, such as what data fields are output and in what order, leading and trailing messages for data fields, special character conversion needed for a field, etc.

The program can modify itself using data found in the tables. For instance, GENT is set up to output all conventional titles, but LPT allows libraries to choose whether they want all conventional titles, none, or only those printed on Library of Congress cards.

The program was designed to output a separate record for each entry rather than have the next program, the CARD FORMATTER, generate the subject and added entry records from the main entry and the overprint headings. If, in the future, it is desired to perform a machine sort of the records by entry to simplify filing cards into the catalog, the sort would be made on the output of CLPP.

The program types the number of input records processed for each library and the number of all output records generated for each library at completion.

3.9 CARD FORMATTER

The CARD FORMATTER accepts as input the disc file of catalog records that has been output by CLPP, and formats the data contained in each record into a card image (or images if the record extends to more than one card) that can be printed on an IBM 360 computer using an IBM utility print program. Each card image is output as a separate record onto the magnetic tape.

The major functions of the CARD FORMATTER include:

1. Horizontal and vertical positioning of each data field.
2. Breaking lines on spaces and hyphens.
3. Right-justifying data fields when necessary.
4. Converting NELINET internal character codes into the character codes required by the output device.
5. Eliminating delimiter character sequences or converting them to spaces, carriage returns, or hyphens as appropriate for the data field.
6. Generating continuation card headers and "continued on next card" messages when necessary.

7. Truncating overprint headings when they contain more than three lines of data.

The CARD FORMATTER is a table driven program consisting of three parts - the formatter, the input-output routines, and the processing routines for each type of data field. Briefly, the input routine reads a disc input record, the formatter arranges this data into card images by using the data field processing routines, and delivers the data to the output routine, which, in turn, packs it into a suitable form for line printing and then writes the data out onto magnetic tape. This continues until all input records have been processed.

The formatter portion of the CARD FORMATTER is the heart of the program. It requests an input record from the disc and re-formats the data. The input record is a mapped record with the entries in the map in a fixed sequence. The formatter scans the map and processes each data field via the data field processing routines, placing the data in the desired output buffer. Currently two output buffers are used, each holding 17 lines of data, 46 characters per line - the size of a catalog card. The data that is common to all continuation cards is placed in the first buffer. Other data (normal bibliographic data) is placed in the second buffer.

The data in the first buffer is then "overlaid" onto each continuation card image.

The data field processing routines - one for each different type of data - are special macro commands which define the manner in which the data is to be processed. They set and alter various parameters and switches and insert spaces, carriage returns and "messages" into the output page.

The formatting routine converts all input data from NELINET internal character codes to 8-bit EBCDIC codes. The IBM print train with the TN character set is presently being used to print the catalog cards. This character set does not contain some of the characters in the MARC II data base. At the moment, these characters are just eliminated from the printed cards but special conversions have been planned to try to make up some of the special characters by combining certain characters in the TN set. (See Table 3-2.)

Output from the formatting portion of the program is sent to the output routine in two instances: when a card is full, i.e., 17 lines have been filled; or when the last data field in the input record has been processed. The output routine uses pointers to access the card images. It picks up the card information and compresses it into the format necessary for compatibility with seven channel IBM

GRAPHIC	NAME AND/OR FUNCTION	CONVERTED TO
ʾ	Alif	Apostrophe
Ł	Polish L - Upper Case	"L" and a "/" strike over
Ø	Scandinavian O with a slash	"O" and a "/" strike over
Đ	D With Cross Bar - Upper Case	"D" and a "-" strike over
Þ	Icelandic Thorn - Upper Case	"b" and a "p" strike over
Æ		"A" and an "E"
Œ		"O" and an "E"
′	Mîagkiĭ Znak	Apostrophe
•	Dot in Middle of Line	Bullet
♭	Musical Flat	"space" and "flat"
®	Subscript Patent Mark	"O" and a "r" strike over
Ơ		"O"
Ư		"U"
ʿ	Ayn	Apostrophe
ł	Polish l - lower case	"l" and a "/" strike over

TABLE 3-2

MARC II CHARACTER CONVERSIONS FOR TN CHARACTER SET

GRAPHIC	NAME AND/OR FUNCTION	CONVERTED TO
ø	Scandinavian o w/ Slash-Lower Case	"¢" and a "o" strike over
đ	D with Cross-Bar Lower Case	"d" and a superscript "-" strike over
þ	Icelandic Thorn - Lower Case	"b" and a "p" strike over
æ		"a" and an "e"
œ		"o" and an "e"
″	Tvërdyĭ Znak	Double quote
ı	Turkish ı - Lower Case	"i"
£	British Pound	"L" and a "-" strike over
ð	Eth	"d" and a superscript "-" strike over
ơ		"o"
ư		"u"
?	Pseudo Question	omit
\	Grave	omit
/	Acute	Apostrophe

TABLE 3-2 (Cont'd.)

MARC II CHARACTER CONVERSIONS FOR TN CHARACTER SET

GRAPHIC	NAME AND/OR FUNCTION	CONVERTED TO
^	Circumflex	omit
~	Tilde	omit
‾	Macron	supersctipt "-"
˘	Breve	omit
˙	Superior Dot	omit
¨	Umlaut	Double quote
ˇ	Haček	omit
°	Circle or Angstrom	Degree sign
︠	Ligature	omit
︡	Ligature	omit
ʼ	High Comma Diacritical	Apostrophe
˝	Double Acute	Double quote
̐	Candrabindu	omit
¸	Cedilla	Comma strike over
̨	Right Hook	omit
̣	Dot Below Character	omit

TABLE 3-2 (Cont'd.)

MARC II CHARACTER CONVERSIONS FOR TN CHARACTER SET

GRAPHIC	NAME AND/OR FUNCTION	CONVERTED TO
‥	Double Dot Below Character	omit
∘	Circle Below Character	omit
=	Double Underscore	omit
꜀	Left Hook	omit
̧	Right Cedilla	omit
◡	Upadhmānīya	Underscore
⌒	Double Tilde	omit
⌒	Double Tilde	omit
'	High Comma (Centered)	Apostrophe
¨	Dieresis	Double quote

TABLE 3-2 (Cont'd.)

MARC II CHARACTER CONVERSIONS FOR TN CHARACTER SET

Standard Variable Block and Record Format. The output routines have been kept separate to facilitate changing to other output devices if desired.

On termination, the program types out the number of input records and the number of cards generated.

The format of the cards generated (see Figure 4-5) intentionally resembles the format of typed cards intended for reproduction via the unit card method. In a computer based system, each card need not be an exact replica of the main entry with a fixed amount of space reserved at the top of each card for overprint headings. In the NELINET system, the familiar, but less efficient from a space standpoint, format was copied because it was felt that it would be more acceptable to librarians. More efficient formats may evolve when librarians begin to think in terms of machine based systems with new techniques for updating, coordinating, and displaying data.

One problem that is encountered in automatic formatting of data when the top margin is a fixed number of lines should be noted. The CARD FORMATTER is designed to truncate overprint headings at three lines. (The main entry begins on line four on all cards.) Long title overprint headings for title added entry cards can be truncated at three lines and pose no problem of being considered acceptable. Long corporate author added entry headings and long series headings do present problems. In a series heading that is longer than three lines, the last part which includes the number, is chopped off, making filing, etc. more difficult.

One possible solution would be to print the entire overprint heading with the main entry starting on the next line. This method could be used for all entries and would save space when the entries are short. This would, in some cases, result in continuation cards for one entry and not for the rest of the card set, and would therefore, be different from the familiar unit record concept.

To provide for more than three lines of overprint heading by always starting the main entry on line five or six would not be desirable because most added entries are less than three lines long. Perhaps the best compromise would be to refrain from starting the title part of an author-title added entry on a new line (the usual format for author title overprint headings) if the heading were long and then type, manually, any that were still unacceptably chopped. This would happen perhaps a couple of times per thousand cards of output.

3.10 POCKET LABEL FORMATTER

The input for this program is the disc file of pocket label records output by CLPP. Each record is in the NELINET internal format and contains a call number, location symbols if present, a copy number if more than one is owned, a volume number if it is a multivolume work, and abbreviated author and title data.

This program is similar to the CARD FORMATTER in design but has fewer data fields to process. Characters, both data and delimiter, are processed by a similar technique. Output again is on magnetic tape in EBCDIC character codes to be run with the same IBM utility program that prints the catalog cards. The maximum line length is 25 characters and the maximum number of lines is seven.

The output of this program is run on continuous form pressure sensitive labels which can be applied to either book pockets or book (charge) cards.

Although coding for this program was completed during CLR-443, the program was not sufficiently debugged to offer labels during the demonstration of services.

3.11 SELIN LABEL FORMATTER

The input for the SELIN LABEL FORMATTER is the disc file of Selin records output by CLPP. Each input record is in the NELINET internal format and contains a call number, location symbols if present, a copy number if more than one copy is owned, and a volume number if it is a multivolume work.

The program inserts a carriage return after each appropriate line segment, and punches a paper tape containing Dura BCD character codes which have been assigned for a Selectric Orator ball. The Orator ball prints tall slim characters, ten characters to the inch, horizontally. (The participating libraries prefer these characters to the Pica characters output in the MARC I demonstration.)

Although the record as output by CLPP could be used to generate any type of spine label, this program has been designed specifically for Selin labels. Selin labels cannot be printed on line printers, therefore requiring that the output of this program be punched paper tape so that it could be run on a DURA typewriter with a Selin label attachment.

As was the case with the POCKET LABEL FORMATTER, this program was not sufficiently debugged to offer Selin labels during the demonstration of services.

3.12 PROGRAM STATUS

With the exception of CLPP and the CARD FORMATTER, the programs were running without any detectable bugs at the end of the demonstration. CLPP and the CARD FORMATTER do contain a number of bugs which affected about 18% of the card sets generated during the demonstration. These are considered to be minor bugs in that fixing them would not involve any change in program design.

A bug is considered to be an error in a program when the program does not do what it was specified to do. In addition to the bugs that exist in these programs, there are some refinements, changes in the specifications, that would be desirable. The treatment of overprint headings longer than three lines was discussed in Section 3.9. Possible improvements in PAPER and the REQUEST VALIDATOR are described in Section 4.2.1. In addition to these refinements, the SMERGE program will have to be modified so that it can accommodate the present form of suffixes in the Library of Congress card number and delete records properly.

4. DEMONSTRATION OF SERVICES

Original plans called for beginning the demonstration in July with the University of Vermont and gradually adding the other libraries throughout the summer, with all libraries participating by early September. Difficulties were encountered, however, in getting the system running. As a result, the formal demonstration did not begin until early October, with the libraries transmitting requests once a week for five weeks - on October 8th, 15th, 22nd, 27th, and November 5th. Requests were transmitted on Wednesday mornings, with the exception of the October 27th run, which was moved up to Monday so that visitors from the Council of Library Resources might see the operation.

During the summer, the participating libraries were visited by Inforonics' staff and instructed in the use of the service. Practice worksheets were filled out, keyed, and transmitted during this visit and then again a few days later to familiarize the library staff with the procedure and the request format. These "practice" requests were searched against the file prior to the October 8th run and the unfulfilled (unmatched) requests were left on the file during the demonstration.

4.1 PROCEDURE

The procedure was very similar to that followed during the MARC I Demonstration. The libraries could submit up to 50 requests on October 8th and up to 100 requests on October 15th, 22nd, 27th, and November 5th. The University of Connecticut submitted only 50 requests on each of the regular runs because it was submitting a special set of requests for 501 items. Although these 501 items were current imprints and were expected to be in the MARC II data base, they did not represent current processing in that the actual volumes had been received by the library some time prior to the demonstration period.

All the requests submitted were for English language monographs currently being processed in the participating libraries. The point in the library's processing cycle at which the request procedure was inserted varied among the libraries and, in some cases, within the library. The manner in which each library used the system is explained in Section 4.2.2.

The procedure was as follows (the letter of each step corresponds to the letter in the flow chart in Figure 4-1):

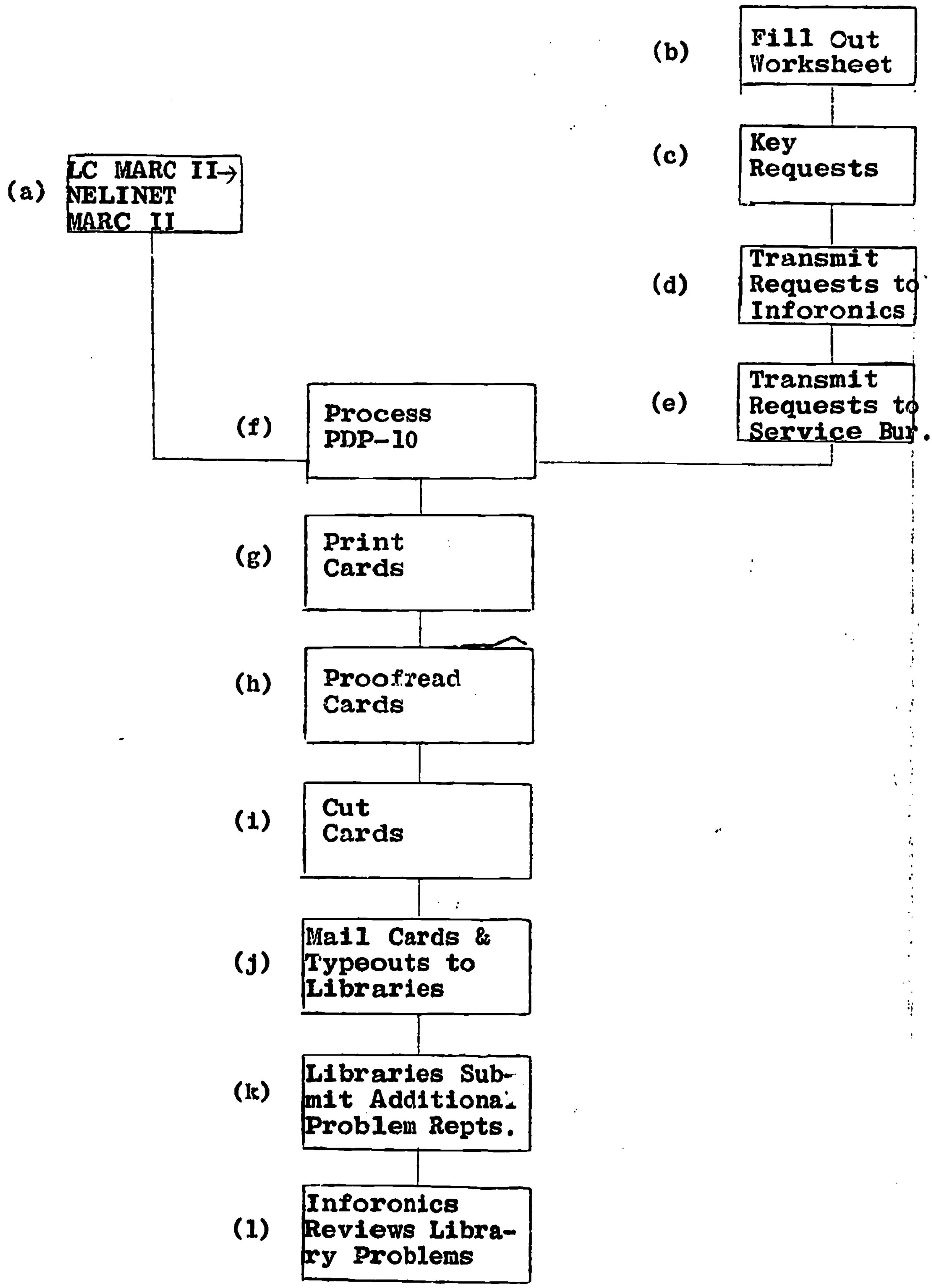

FIGURE 4-1

DEMONSTRATION FLOW CHART

(a) The weekly MARC II tape received from the Library of Congress is converted at Inforonics into the NELINET internal format. This tape is then sent by messenger to the PDP-10 service bureau (the Interactive Sciences Corporation in Braintree, Massachusetts).

(b) A cataloger (or clerk in the Catalog Department) in each library fills out a worksheet for each title according to the specified instructions. (See Appendix B.) On this worksheet is recorded the request number (a number which identifies both the library making the request and the request or transaction number), the Library of Congress card number, the location, copy, and volume information, and the local call number if the library does not desire the one established at the Library of Congress. (See Figure 4-2.) The libraries can request extra copies of the main entry or obtain only one copy of the main entry, to use as Library of Congress cataloging copy, if they wish. In the latter case, they record an "m" in the block labelled "no mf" - no master file - which indicates that the request data should not be recorded on the library's

NELINET MARC II REQUEST WORKSHEET--UNIVERSITY OF RHODE ISLAND

Filled in by Teletype Operator:

req←	ru69-	12	no mf

- -

Filled in by Cataloger:

crd ← 69-10602

	Location Symbol(s)	Copy No(s)	Vol. No(s)	No Cd	No S	No Bk	xME
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.

call← ______________________

Valid Location Symbols

Archiv	mfilm
Blatz	NML
EXT	R.I.Cl
J.F.K.	Rare
mcard	Ref
mfiche	

FIGURE 4-2

REQUEST WORKSHEET

holdings file. The request format was designed to leave as little room for error as possible by reducing to a minimum the data the libraries inputted. When the libraries want products for a single copy for the main stacks of the main library, for example, they do not record anything in the "loc" field. The recording procedures for other conditions are described in Appendix B.

(c) The Teletype operator types the information recorded on the worksheet according to the typing instructions described in Appendix C. This typing is done off-line on a model 33ASR Teletype and produces a punched paper tape and a teletypewriter listing. (See Figure 4-3.)

(d) The Teletype operator places the punched paper tape in the reader at the time specified for transmission. If the machine has the "Automatic" feature, the operator sets the switch to Automatic. Inforonics initiates the transmission by calling the library. The transmission then proceeds automatically. If the library does not have the Automatic feature on its Teletype, the operator must push the start switch after

REQ← RU69-12

CRD← 69-10602

\\

FIGURE 4-3

TELETYPE REQUEST

Inforonics calls. The operator is near by during the transmission to insure that the paper tape does not get tangled and jam in the reader. The Teletype at Inforonics produces a punched paper tape and a listing of each library's requests. In the MARC I demonstration, the libraries initiated the transmission by calling any time during the morning. Since the Teletype at Inforonics is also used by the Inforonics programmers to debug their programs, in this demonstration, Inforonics initiated the transmission so as not to tie up the Teletype any longer than necessary.

(e) Inforonics transmits the requests via its Teletype to the PDP-10 service bureau in Braintree. The libraries could transmit directly to the service bureau and may do so eventually when all the problems have been worked out and the operation is running smoothly.

(f) The requests and new bibliographic records are put through a series of programs on the PDP-10 that search the file and for those records found, (both the new requests and the requests from previous runs that are matched in the new tape) outputs a magnetic tape containing catalog card images. (These programs are described in detail in section 3.) Error and "not found" messages are also typed out. The programs necessary to produce Selin labels and pocket labels were not sufficiently debugged to offer these products during this demonstration.

(g) The output magnetic tape from step (f) is taken by messenger to the Information Services Inc. service bureau in Wellesley, Massachusetts, where it is printed onto continuous form card stock, using an IBM 1403 line printer, driven by a 360/40 computer, with an upper and lower case print train with the IBM TN character.

(h) A librarian at Inforonics proofreads the catalog cards, noting all program bugs and possible input errors in the Library of Congress data on the Teletype listing of the requests. A problem report (see Figure 4-4) is made out for each input error and new program bug. Copies of reports describing possible errors in Library of Congress data are sent to the Library of Congress. The error messages generated by the computer programs are reviewed and any errors in the

Date: Oct 8 Req. No.: CtU69-281021

From: ATC LC Card No.: 68-18234

Library: —

Description of Problem: (attach sample if possible) Believe this is an LC data error. A bracket appears in the imprint between MIT and press

```
f
TA      Dietz, Albert George Henry, 1908-
418.9     Composite engineering laminates,
C6      edited by Albert G. H. Dietz.
D48     Cambridge, MIT[press [1969]
          vii, 328 p. illus. 29 cm.
          Includes bibliographies.
          1.Composite materials--Addresses,
        essays, lectures. 2.Laminated
        materials--Addresses, essays,
        lectures. I.T.

CtU69-281021                          68-18234
TA418.9.C6D48                         620.1/1
```

Suggested Improvement:

Send To: Miss Ann T. Curran
Inforonics, Inc.
146 Main Street
Maynard, Massachusetts 01754

FIGURE 4-4
PROBLEM REPORT

requests are noted on the Teletype listing. Statistics on the number of card sets that contain bugs and other errors are recorded along with the statistics generated by the programs.

(i) The catalog cards are then mechanically cut by the NIKOR card cutter at Inforonics.

(j) The catalog cards (see Figure 4-5) are mailed to the libraries along with the annotated Teletype listings.

(k) The libraries review the cards and send back problem reports to call attention to any imperfect cards Inforonics did not catch and also to give their opinions about the format of the cards.

(l) Inforonics' staff reviews the reports sent in by the libraries, registers them, and responds to the libraries when appropriate.

4.2 RESULTS

In summary, a total of 2317 requests was submitted by the libraries for which 1349 MARC records were found. Included in these 2317 requests are the 248 requests submitted

The Goulds.

GOULD FAMILY.

GOULD, JAY, 1836-1892.

CT 275 G6 H63 1969

Hoyt, Edwin Palmer.
The Goulds; a social history, by Edwin P. Hoyt. New York, Weybright and Talley [1969]
vi, 346 p. illus., ports. 25 cm.
1.Gould, Jay, 1836-1892. 2.Gould family. I.T.

RU69-12
CT275.G6H63 1969

69-10602
929.2/0973

FIGURE 4-5a

CATALOG CARDS

```
HD       Employment and educational services in
6275       the Mobilization for Youth
N4         experience. Edited by Harold H.
E45        Weissman.  New York, Association
           Press [1969]
           224 p. 21 cm.  (The New social work,
         3)
           Bibliographical footnotes.
           1.Youth--Employment--New York (City)
         2.Occupational training--New York
         (City) 3.Education--New York (City)
```

```
HD       Employment and educational services in
6275       the Mobilization for Youth... 1969
N4                                  (card 2)
E45      4.Mobilization for Youth. I.Weissman,
         Harold H., ed. II.Mobilization for
         Youth.
```

```
CtU69-300014                      69-18845
HD6275.N4E45                      331.3/4/097
```

FIGURE 4-5b

CATALOG CARDS WITH CONTINUATION HEADER

during the practice sessions, the 1568 submitted during the official runs (October 8, 15, 22, 27, and November 5), and the 501 submitted in the University of Connecticut's special request.

Production summaries for each of the five participating libraries are presented in Tables 4-1a and 4-1b.

4.2.1 Requests Rejected

174, or 7.5% of the requests transmitted were rejected. Although the usual procedure was not to correct the requests, but just to point out the error on the Teletype listing returned to the libraries, an exception was made for the University of Connecticut's special request for 501 backlog items. The 17 requests that were rejected in this batch were rekeyed and resubmitted by Inforonics and searched in the next run. 13 of these 17 rejected requests were rejected because a "/" was keyed instead of "\" in signaling the deletion of lines and records.

About half of all rejects were caused by errors in keying or format, and half were caused by poor transmission. The errors due to poor transmission were not evenly distributed among the libraries. New Hampshire's transmissions accounted for more than half of them. There

	Connecticut	Massachusetts	New Hampshire	Rhode Island	Vermont	Total
Requests Sent	790	300	511	336	380	2317
Requests Rejected	37	8	75	11	43	174+
Requests Searched	770+	292	436	325	347	2170+
Requests Not Found	41	144	228	251	157	821
Requests Found	729	148	208	74	190	1349
Acceptable	595	109	159	67	167	1097
Unacceptable	134	39	49	7	23	252

TABLE 4-1a
PRODUCTION SUMMARIES

	Connecticut	Massachusetts	New Hampshire	Rhode Island	Vermont	Total
Requests Sent	790	300	511	336	380	2317
Requests Rejected	4.7	2.7	14.7	3.3	11.3	7.5+
Requests Searched	97.5+	97.3	85.3	96.7	91.3	93.7+
Requests Not Found*	5.3	49.3	52.3	77.2	45.2	37.8
Requests Found*	94.7	50.7	47.7	22.8	54.8	62.2
Acceptable**	81.6	73.6	76.4	90.5	87.9	81.3
Unacceptable**	18.4	26.4	23.6	09.5	12.1	18.7

+The 17 requests that were rejected in Connecticut's special request for 501 backlog items were keyed and resubmitted by Inforonics. 10 of Vt's practice rejects were also resubmitted.
*Percent of Requests Searched ** Percent of Requests Found

TABLE 4-1b
PRODUCTION SUMMARIES - PERCENT

was so much trouble in receiving the October 22 requests from New Hampshire that the tape for the next run was mailed rather than transmitted over the Teletype. The machine at New Hampshire was serviced by the telephone company and transmission improved somewhat for the November 5th run.

Busy circuits also caused trouble in getting through to the libraries. Initially the schedule was set up with Inforonics calling the library at a specified time on Wednesday morning. Inforonics found it could not keep to the schedule because it sometimes took six or more attempts to reach a library. The procedure was changed with all the libraries set up to transmit anytime from 10:00 to 12:00 on Wednesday morning. The libraries were called in alphabetical order. If there was trouble in reaching one library, the next one was tried, coming back later to the other library.

The format is simple and was quickly learned. However, errors continued to occur throughout the demonstration, suggesting that keyboarding errors are a function of keyboarder accuracy rather than length of experience with the system. Some of the errors were miskeyings -- i.e., striking the wrong key. Others were errors in format, e.g., forgetting to key the characters required to end a record before beginning the next record.

The verification routines in the REQUEST VALIDATOR (described in Section 3.4) are aimed at catching both keying and format errors. They presently catch almost all of the format errors and a good number of keying errors. They also catch most of the errors due to poor transmission. With the addition of a verification routine on local call numbers to check that not more than six characters are present within the slashes that indicate line segments, virtually all of the format errors affecting card production that were noticed in the demonstration run would be caught.

All keying errors, on the other hand, could not be caught by verification routines. The verification routines presently catch a large number of keying errors. A few more could be added that would catch others. However, a miskeying in a local call number, e.g., a 7 for a 6 somewhere in a Dewey class number, could not be caught. At present, the sequence number in a Library of Congress card number is not verified, but it could be for new card numbers by using the check digit. Errors made in assigning or keying the request number could also be caught by sequence checking the request number.

Whereas the variety of characters that can occur in bibliographic data make error detection by character verification almost impossible, character verification of the possible characters in the data elements in a request can catch most of the errors. Programmers (and programs) like to deal in terms of never and always. With bibliographic data one can never say never and less frequently can one say always. The data elements in requests, however, are mainly for control purposes and are not concerned with bibliographic description. Most of the determinations of valid and invalid characters for a data field can be made when the system is designed. Experience in running the system can indicate additional ones that would be useful and also which checks are too restrictive. For example, the verification routines for local call numbers do not consider brackets a valid character in a local call number. In the demonstration they occurred once. Since they can occasionally occur, the routine will have to be loosened to accept brackets.

Much time can be spent when designing a validating program in trying to predict the kinds of errors that might be made in inputting a new format. It takes operating experience, however, to really see what people will do to a system. The first objective is to catch the errors. The next objective is to avoid repetition of the error, if possible. If that is not possible, the objective is to second guess what the data should have been. If neither of these approaches is possible, the next objective is to let the library know what the error is.

Avoiding the error is the most desirable solution if it is possible. The input code for the University of Connecticut is CO. In one of the early transmissions, the number 0 was keyed instead of the letter O. This request was therefore rejected. Staff at the University of Connecticut suggested that their input code be changed to CT. This was a good suggestion. It would mean a change in the REQUEST VALIDATOR to accept CT as the valid code -- not a difficult change. It would, however, also have other implications. The CARD AND LABEL PRODUCTION program uses the input code to get into the library's profile specifications. The input code in this program could also be changed without much difficulty. There would, however, be unfulfilled requests with the library code CO already on the cumulative file. The program would have had to be modified to accept either code. Since the demonstration was to last only a few weeks, it was decided not to make this change during the demonstration. This example also illustrates the point that in automated systems, very little is simple.

Operating experience also showed that the character used as the control character, the backslash "\", was error prone. This character is to signal that an editing command follows and also to terminate each request. In the October 8th run, one of the libraries used the regular slash "/" to end each request. All of these requests were rejected. On another day, another library keyed "/KL" instead of "\KL" when they wanted to kill (delete) a line. These requests were rejected.

One solution is to find another character instead of the "\". Another would be to substitute a "\" for a "/" whenever the "/" is not valid. This would work for ending requests since it takes two backslashes "\\" to end a request and two regular slashes are not expected in the data. Single slashes, however, do occur in local call numbers to separate the line segments, in location statements to separate location symbols, and in Library of Congress card number suffixes. The programming required to second guess correctly about substituting "\" for "/" would not be insignificant. A better approach would be to find another control character. Presently the "↑" character on the teletypewriter indicates an upper case shift, the "←" separates tags or labels from data fields, and the "$" indicates that the copy and volume ranges that follow are to be enumerated in label production - which leaves few characters remaining to choose from.

The wide variety of errors detected by the REQUEST VALIDATOR are not presently matched by a correspondingly wide variety of error messages because the REQUEST VALIDATOR is catching errors that were not considered when the program was designed. As a result some of the error messages put out are difficult to interpret. In the demonstration, the error messages were interpreted by Inforonics' staff and then described on the annotated copies of the Teletype listings returned to the libraries. Now that there is some knowledge of the kinds of errors made, the machine output error messages can be improved so that they would be understandable to the libraries.

4.2.2 Records Found on the MARC File

As shown in Tables 4-1a and 4-1b, 1349 or 62.2% of all requests searched were found on the MARC File. There was, however, a wide range of difference among the libraries, with Connecticut finding the largest percent of searched requests (94.7%), Rhode Island finding the least (22.8%), and the other libraries achieving a hit rate of between 47% and 55%.

In addition to total production figures, additional statistics on the number of records found on the MARC file were obtained for the five official runs, i.e., October 8th, 15th, 22nd, 27th, and November 5th. These figures are shown in Tables 4-2 through 4-7. The number and percent of records that were on the file when the requests were initially submitted and those that appeared 1, 2, 3, and 4 weeks later are presented along with the totals for each institution for

Library	Connecticut	Massachusetts	New Hampshire	Rhode Island	Vermont	Total
Requests Searched	231	261	382	304	258	1436
Found When Run	198	100	127	38	186	649
Found 1 Wk. Later	11	6	7	5	0	29
Found 2 Wks. Later	4	11	15	6	1	37
Found 3 Wks. Later	0	5	14	4	0	23
Found 4 Wks. Later	0	2	3	1	0	6
Total	213	124	166	54	187	744

TABLE 4-2a
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
SUMMARIES

Library	Connecticut	Massachusetts	New Hampshire	Rhode Island	Vermont	Total
Requests Searched	231	261	382	304	258	1436
Found When Run	85.7	37.9	33.2	12.5	72.1	45.2
Found 1 Wk. Later	6.0*	2.7*	2.4*	2.0*	0*	2.8*
Found 2 Wks. Later	2.8*	5.4*	7.8*	4.5*	.8*	4.7*
Found 3 Wks. Later	0*	3.5*	11.2*	5.1*	0*	4.6*
Found 4 Wks. Later	0*	4.5*	6.8*	2.9*	0*	3.7*
Total	92.2	47.5	43.5	17.8	72.5	51.8

*See footnote on Table 4-3b

TABLE 4-2b
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
SUMMARIES - PERCENT

Date Of Transmission	October 5	October 15	October 22	October 27	November 5	Total
Requests Searched	44	48	50	41	48	231
Found When Run	34	46	47	32	39	198
Found 1 Wk. Later	6	1	0	4	-	11
Found 2 Wks. Later	4	0	0	-	-	4
Found 3 Wks. Later	0	0	-	-	-	0
Found 4 Wks. Later	0	-	-	-	-	0
Total	44	47	47	36	39	213

TABLE 4-3a
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
UNIVERSITY OF CONNECTICUT

Date of Transmission	October 3	October 15	October 22	October 27	November 5	Total
Requests Searched	44	48	50	41	48	231
Found When Run	77.3	95.8	94.0	78.0	81.3	85.7
Found 1 Wk. Later	13.6	2.1	0	9.8	-	6.0*
Found 2 Wks. Later	9.1	0	0	-	-	2.8*
Found 3 Wks. Later	0	0	-	-	-	0*
Found 4 Wks. Later	0	-	-	-	-	0*
Total	100	97.9	94.0	87.8	81.3	92.2

*Percent of total requests searched initially, whose "not found" requests were still on the active search file. Dashes indicate requests were not on the active file that week.

TABLE 4-3b
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
UNIVERSITY OF CONNECTICUT - PERCENT

Date of Transmission	October 8	October 15	October 22	October 27	November 5	Total
Requests Searched	44	100	61	18	38	261
Found When Run	10	44	24	7	15	100
Found 1 Wk. Later	2	3	1	0	-	6
Found 2 Wks. Later	4	4	3	-	-	11
Found 3 Wks. Later	1	4	-	-	-	5
Found 4 Wks. Later	2	-	-	-	-	2
Total	19	55	28	7	15	124

TABLE 4-4a
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
UNIVERSITY OF MASSACHUSETTS

Date of Transmission	October 8	October 15	October 22	October 27	November 5	Total
Requests Searched	44	100	61	18	38	261
Found When Run	22.7	44	39.3	38.9	39.5	37.9
Found 1 Wk. Later	4.5	3	1.6	0	-	2.7*
Found 2 Wks. Later	9.1	4	4.9	-	-	5.3*
Found 3 Wks. Later	2.2	4	-	-	-	3.5*
Found 4 Wks. Later	4.5	-	-	-	-	4.5*
Total	43.2	55	45.9	38.9	39.5	47.5

*Percent of total requests searched initially, whose "not found" requests were still on the active search file. Dashes indicate requests were not on the active file that week.

TABLE 4-4b
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
UNIVERSITY OF MASSACHUSETTS - PERCENT

Date of Transmission	October 8	October 15	October 22	October 27	November 5	Total
Requests Searched	44	81	68	97	92	382
Found When Run	18	23	27	40	19	127
Found 1 Wk. Later	0	3	3	1	-	7
Found 2 Wks. Later	6	4	5	-	-	15
Found 3 Wks. Later	1	13	-	-	-	14
Found 4 Wks. Later	3	-	-	-	-	3
Total	28	43	35	41	19	166

TABLE 4-5a
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
UNIVERSITY OF NEW HAMPSHIRE

Date of Transmission	October 8	October 15	October 22	October 27	November 5	Total
Requests Searched	44	81	68	97	92	382
Found When Run	40.9	28.4	39.7	41.2	20.6	33.2
Found 1 Wk. Later	0	3.7	4.4	1.0	-	2.4*
Found 2 Wks. Later	13.6	4.9	7.4	-	-	7.8*
Found 3 Wks. Later	2.2	16.0	-	-	-	11.2*
Found 4 Wks. Later	6.8	-	-	-	-	6.8*
Total	63.6	53.1	51.5	42.3	20.6	43.5

*Percent of total requests searched initially, whose "not found" requests were still on the active search file. Dashes indicate requests were not on the active file that week.

TABLE 4-5b
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
UNIVERSITY OF NEW HAMPSHIRE - PERCENT

Date of Transmission	October 8	October 15	October 22	October 27	November 5	Total
Requests Searched	35	44	54	42	129	304
Found When Run	8	9	8	2	11	38
Found 1 Wk. Later	0	1	1	3	-	5
Found 2 Wks. Later	1	2	3	-	-	6
Found 3 Wks. Later	0	4	-	-	-	4
Found 4 Wks. Later	1	-	-	-	-	1
Total	10	16	12	5	11	54

TABLE 4-6a
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
UNIVERSITY OF RHODE ISLAND

Date of Transmission	October 8	October 15	October 22	October 27	November 5	Total
Requests Searched	35	44	54	42	129	304
Found When Run	22.9	20.5	14.8	4.8	8.5	12.5
Found 1 Wk. Later	0	2.3	1.9	7.1	-	2.9*
Found 2 Wks. Later	2.9	4.5	5.6	-	-	4.5*
Found 3 Wks. Later	0	9.1	-	-	-	5.1*
Found 4 Wks. Later	2.9	-	-	-	-	2.9*
Total	28.6	36.4	22.2	11.9	8.5	17.8

*Percent of total requests searched initially, whose "not found" requests were still on the active search file. Dashes indicate requests were not on the active file that week.

TABLE 4-6b
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
UNIVERSITY OF RHODE ISLAND - PERCENT

Date of Transmission	October 8	October 15	October 22	October 27	November 5	Total
Requests Searched	31	32	56	46	93	258
Found When Run	18	26	45	36	61	186
Found 1 Wk. Later	0	0	0	0	-	0*
Found 2 Wks. Later	0	1	0	-	-	1*
Found 3 Wks. Later	0	0	-	-	-	0*
Found 4 Wks. Later	0	-	-	-	-	0*
Total	18	27	45	36	61	187

TABLE 4-7a
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
UNIVERSITY OF VERMONT

Date of Transmission	October 8	October 15	October 22	October 27	November 5	Total
Requests Searched	31	32	56	46	93	258
Found When Run	58.1	81.3	80.4	78.3	65.6	72.1
Found 1 Wk. Later	0	0	0	0	-	0*
Found 2 Wks. Later	0	3.1	0	-	-	.8*
Found 3 Wks. Later	0	0	-	-	-	0*
Found 4 Wks. Later	0	-	-	-	-	0*
Total	58.1	84.4	80.4	78.3	65.6	72.5

*Percent of total requests searched initially, whose "not found" requests were still on the active search file. Dashes indicate requests were not on the active file that week.

TABLE 4-7b
RECORDS FOUND - OFFICIAL DEMONSTRATION RUNS
UNIVERSITY OF VERMONT - PERCENT

each run. The requests submitted during the practice sessions were eliminated from this analysis because it was suspected that the libraries did not use the system in the practice sessions as they did during the five official runs. Comparison of the percent of records found in these five runs as shown in Table 4-2b with the totals for the entire demonstration presented in Table 4-1b indicates that this was true for most of the libraries. The greatest difference was exhibited by the University of Vermont. When their practice requests are included as they are in Table 4-1b, their hit ratio is only 54.8%. When the practice requests are excluded, the hit ratio rises to 72.5%. The University of Connecticut's special request for 501 backlog items was excluded because it would give a distorted picture of the number of records that might be expected to be found when initially searched and in each succeeding week's run.

The newness of the MARC service (six month's accumulation), the limited number of demonstration runs, and the high probability that the libraries were not using the system as they would in a full scale production operation (in which they would submit requests for everything that might be on the MARC file), make grand attempts at interpretation of the statistics gathered rather foolish. Therefore, the statistics are presented for each run for each library, without interpretation, but with a discussion of the factors that may have affected the hit ratio, and of the practices that were followed by each library in deciding for what to submit requests.

As Table 4-2b indicates, there is still a wide range of differences with Connecticut again having the largest percent of hits (92.2%), Rhode Island the least (17.8%), and Massachusetts, New Hampshire and Vermont finding 47.5%, 43.5%, and 72.5%, respectively, of their requests.

Since all the libraries were submitting requests for current English language monographs, one might expect that all requests submitted would be found on the file. That they did not can be attributed to four factors: (1) the "newness" of the file - it contained an accumulation of only six months processing of English language monographs printed in this country and three months accumulation of English language monographs printed elsewhere; (2) the currency of cataloging and MARC II editing at the Library of Congress; (3) the pattern of book selection and ordering at the individual libraries; and (4) the point in the processing cycle at which the libraries chose to submit their requests. This last factor may be influenced by the classification scheme used by the library. If the library does not use Library of Congress classification, it must wait until a classification number is assigned the book before requesting cards in order to receive cards that contain their call number.

The MARC distribution service began late in March, 1969, and had a six month's accumulation, some 20,000 records, on it when the demonstration began in October. At the end of the demonstration, it contained almost 28,000 records. Records for American imprints cataloged by the Library of Congress prior to March, 1969 and non-American English language imprints cataloged before July, 1969 were not on the file. Even though the scope of coverage for MARC II is well defined, records for some current English language monographs will not be found on the MARC file because the monographs were cataloged at the Library of Congress before the MARC II distribution service began. As one goes on in time, the percent of a library's current processing included in this catagory could be expected to diminish.

A library's selection and ordering practices also affect the percentage of hits. Books received on standing order plans may not yet have been cataloged by the Library of Congress when the libraries submit their requests. Faculty suggestions for purchase, on the other hand, though for new books, may not be for ones that have just been issued by the publishers, and therefore have a better chance of being found.

Added to the possible variations in libraries' selecting and ordering practices are the variations in the time chosen in the processing cycle to enter a request. A library may submit requests immediately upon receipt of the books. If this procedure is used for books received on standing order, a low hit rate is understandable.

A library may submit requests for books before, or after, searching for Library of Congress cataloging copy. If it submits requests after searching for Library of Congress copy it may choose, in a demonstration such as this one, to enter requests only for those items for which there was an indication on the Library of Congress cataloging copy that the record was on the MARC file. It might also choose to submit requests for items for which it could find no Library of Congress copy. In these cases whether or not the library receives Library of Congress proof slips would have an influence on the number of records found. If it does receive proof slips, it is submitting requests for newer books than if it were searching in the National Union Catalog only.

If a library waits to submit requests until after it has cataloged a book, one would expect to find a larger percent of the records on the file because more time has elapsed since the book was first released.

Finally, the decision of what to submit may be influenced by the amount of work in the library that can be eliminated by the system-generated products. If, for example, the library does not have Library of Congress cataloging copy, the searching operation as well as catalog card preparation is eliminated by use of the system. If it already has the cataloging copy, and if it has ample personnel for catalog card preparation, it might not request the catalog cards from the system. Likewise, if a library's searching staff is ample but the catalog card preparation staff somewhat limited, the library might choose to submit requests which it knows are on the MARC file and for which the system would therefore generate catalog card sets. When a library is submitting the maximum number of requests allowed, its decision is based on getting what will be most useful to it from the system. When a library is not submitting the maximum number of requests, its decision to use the system only for items that will save it a large amount of effort is influenced perhaps by the librarian's frugal nature which has developed from years of necessity!

Any or all of these factors may have been present in this demonstration. The libraries were instructed only on the number of requests to submit each week. With the exception of the University of Connecticut, the libraries could submit up to 50 requests in the first transmission on October 8th, and up to 100 in each of the four other transmissions. The University of Connecticut was instructed to limit transmissions to 50 requests since it was also submitting its special request for 501 non-current items. Only the University of Connecticut submitted the maximum number of requests that they were allowed in each transmission.

The University of Connecticut used the system for standing orders for which it had received Depository Cards bearing the indication that the record was on the MARC file. If a Depository Card is not found when the book is received, a copy of the order form is placed in the file to catch the Depository Card when it is received.

As indicated in Table 4-2b, Connecticut received 92% of the requests searched during the five official runs. One would have expected them to find all. This discrepancy was discussed with the Library of Congress, and it was found that it is possible to have a card with MARC indicated on it before the record is actually on the MARC file.

The University of Massachusetts had already found proof copy for some of its requests. Other requests were for titles for which they had not received proofslips. The November 5th run was almost entirely for titles for which they did not have proofslips. 39.5% of its requests in the

November 5th run and an overall average of 47.5% of its requests were found.

The University of New Hampshire used the system largely for items for which it had not found proof copy. In some cases it found that it actually had the proof copy but had not searched for it under the cataloged main entry. It found 43.5% of the requests searched during the official demonstration runs.

The University of Rhode Island used the system for items for which it could not find Library of Congress copy using the Information Dynamics Corporation microfiche service. It found only 17.8% of the requests searched during the official runs.

The University of Vermont is the only participating library that does not use Library of Congress classification. It must assign a Dewey classification number and input its call number in its requests to generate complete card sets containing the University of Vermont call number. This it did for some items. It also used the system to obtain Library of Congress cataloging copy for titles that were not yet in the National Union Catalog. It does not receive Library of Congress proof slips. With a couple of additions to the request worksheet (see Appendix B, page B-7), the system will generate one copy of the main entry instead of a complete set of cards. Vermont found 72.5% of the requests searched during the official demonstration runs.

The NELINET MARC II system was designed to retain unfulfilled requests on the file and search each new batch of records for those items. During the demonstration period, the MARC file searched was not a complete up-to-date MARC file because two of the recently received MARC tapes had to be returned as unusable and because two other of the recently received tapes were large and could not be sorted at the service bureau due to a bug in its system. The bug was fixed, usable copies of the two bad tapes were obtained, and every unfulfilled request was then searched against the complete MARC file before the demonstration terminated.

The card sets generated at this time from these previously unfulfilled requests were then checked against the lists of Library of Congress card numbers on the MARC file that came with the tapes. Determinations were then made as to whether the card set would have been generated when the request was first searched or run or whether it would have been generated 1, 2, 3, or 4 weeks later. The results are shown in Tables 4-2 through 4-7. Again, since the number of requests and runs are small, little can be interpreted from these figures.

4.2.2.1 Comparison of MARC I and MARC II Hit Ratios

Statistics were collected for the last two months of the MARC I demonstration. 53.1% of the requests searched during this period were found on the MARC I file. Since the NELINET MARC I system did not retain unfulfilled requests on the file to be searched against new records, all of these requests were found when the request was first submitted.

In the MARC II demonstration, a total of 62.2% of all requests searched were found. In the five official runs, however, only 51.8% of the requests searched were found. Included in this 51.8% are the records found 1, 2, 3, and 4 weeks later.

4.2.2.2 Conclusion

Of the records not found when searched, it would be expected that some would never appear on the file because they are not included in MARC II's coverage. It is conceivable that the libraries could mistakenly submit a request for a book that could not be on the MARC II file, but since it is easy to determine whether a book is a current English language imprint it is unlikely that this would happen very often. It is more probable that the reason for most of this type of not found is that the book was cataloged at the Library of Congress prior to the time when MARC II records were prepared for this type of material -- for American imprints if it was cataloged before the end of March, 1969, and for English language monographs printed outside this country, if it was cataloged before July, 1969. As one goes on in time with a MARC file, one would expect that a library's current processing would be affected less and less by this factor.

Of the requests that were "not found" that are not in the category of "not founds" described above, the reason for their not being found must be that they were not cataloged or MARC edited by the Library of Congress in time to be on the MARC file during this demonstration. This would suggest that if the Library of Congress processing conditions during this demonstration, i.e., the backlog in the cataloging or MARC editing, were typical of what might be expected, leaving the unfulfilled requests on the file for more than four weeks might produce a significantly larger number of hits.

However, in summary it should again be pointed out that although the statistics obtained in this demonstration may be interesting, they are not in fact meaningful indicators of the coverage of the MARC II tapes in relation to a library's current processing. To gain meaningful statistics, a library's total current processing would have to be considered, and over a longer period than five weeks. What the experience gained during CLR-425 and CLR-443 has pointed out is that the picture changes from library to library depending on the library's purchasing and processing practices.

4.2.3 Card Sets Generated

Of the 1349 records found, 81.3% of the card sets generated were considered acceptable and 18.7% were considered unacceptable when proofread by Inforonics' staff. This resulted in the libraries receiving acceptable card sets for 47.3% of the requests submitted during this demonstration. Bugs in the programs accounted for over 90% of the unacceptable card sets. Errors in the input data on the MARC tapes accounted for a small number of errors. In some cases, it was difficult to determine whether strange data in the catalog cards generated were due to a bug in a program or due to an error in the data. This pointed out the desirability of an easy and inexpensive way to look at the data in an individual MARC record. Sequentially searching for a particular record in a file as large as the MARC file is an expensive operation. Pulling off the record in question in the next run by submitting a request for it was the best solution that could be thought of during this project. Reports of all potential MARC data errors were sent to the Library of Congress.

Some of the card sets considered unacceptable by Inforonics were used by the libraries. When alternate class numbers were present in the call number field, for example, incorrect data was output in some cases because of a bug in one of the programs. When the University of Vermont requested one copy of the main entry for cataloging purposes and incorrect data appeared in the Library of Congress call number, it did not affect their use of the card but it was still counted as a bug. Slight errors in format which the libraries might nonetheless consider acceptable were also considered bugs.

A frequent comment made about computer produced catalog cards is that they take up too much space in the catalog because line printers print 10 characters to an inch horizontally and 6 lines to the inch (usually) vertically. Large libraries are especially concerned with the bulk factor. During the demonstration runs, the number of records that were contained on one card, two cards, etc. were counted for over 1,300 titles. Comparison figures were obtained from the Processing Department of the Library of Congress on their printed cards and are shown below:

	NELINET MARC II CARDS	LIBRARY OF CONGRESS PRINTED CARDS
One card	79.9%	87.8%
Two cards	16.7%	10.0%
Three cards	2.5%	1.6%
Four cards	.6%	.3%
Five cards	.1%	.2%
Six cards	.2%	.1%

Inforonics had been experimenting with various continuous form card stocks, line printers, ribbons, and print chains for another customer, the Air Force Cambridge Research Laboratory library, to achieve higher quality line printed catalog cards. During the demonstration runs, different combinations of card stock, ribbon, and print chains were used and the librarians were asked to evaluate the quality of the products. Their preferences were as follows:

- Connecticut - University Products cream stock, Courier Train, Letter quality ribbon.
- Massachusetts - Rand white stock, Courier Train, Mylar ribbon.
- New Hampshire - University Products cream stock, Courier Train, Mylar ribbon.
- Rhode Island - Rand white stock, Courier Train, Mylar ribbon.

Vermont - Rand white stock, Courier Train, Mylar ribbon.

4.2.4 Turn Around Times

Of the five official demonstration runs, catalog cards were mailed three (working) days after the libraries transmitted the requests for one run and two days after the libraries transmitted requests for three runs. All output from the last run (November 5th) was held until the replacement tapes were received and the statistics were manually derived. The last shipment, therefore, was mailed two and one half weeks after the requests were transmitted.

The usual procedure was to run at the PDP-10 service bureau the same day as the requests were received or the next morning. The output magnetic tape was then taken to the line printer and usually run the day after the requests were received. The cards were then picked up, proofread, etc. and mailed first class to the libraries.

The October 15th and 22nd runs were mailed on Friday and were received by the libraries on Monday; the October 8th run was mailed on Monday, two of the libraries received it on Tuesday and two on Wednesday; the October 27th run was mailed on Wednesday, two of the libraries received their cards on Thursday and two received them on Friday. One library did not receive cards on the October 8th run because the "/" was input instead of the "\" in all requests and one library did not receive any cards in the October 27th run because none of their new requests submitted in that run were found on the MARC tapes when initially run. It would appear that libraries could expect to receive cards one to two working days after they were mailed from Inforonics.

4.2.5 Other Problems

Some of the problems encountered have been described; a few others deserve mention. An incorrect Library of Congress card number was reported by one library. They received cards for the card number printed in the book, but the cards did not match the book.

Another problem reported was that the branch or special shelf location of a book is not always known at request time but only after the book has been cataloged. The card sets received in such cases will, of course, not bear the correct location symbols.

4.2.6 Machine Running Costs

The computer running costs for each of the machine operations are summarized in Table 4-8. These costs are the program running costs and do not include set up costs such as tape mounting and dismounting in the LC MARC II TO

OPERATION	COST/ INPUT RECORD PROCESSED	INPUT
LC MARC II TO NELINET MARC II	.006	MARC Records
MAKTEN	.003	MARC Records
PAPER	.011	Request Records
REQUEST VALIDATOR	.003	Request Records
SORT KEY GENERATOR/Requests	.002	Request Records
SORT KEY GENERATOR/MARC	.003	MARC Records
SORT (by LC Card No.)/Requests	.019	Request Records
SORT (by LC Card NO.) MARC	.008	MARC Records
SMERGE	.006	Request and MARC Records
SORT (by Library)	.013	Title Found
CARD AND LABEL PRODUCTION	.065	Title Found
CARD FORMATTER	.270	Title Found
LINE PRINTER (Cards)	.183	Title Found

TABLE 4-8

MACHINE RUNNING COSTS

NELINET MARC II CONVERTER. They are all based on the number of input records processed. Since unfulfilled requests remain on the file to be searched against new MARC records and since the coverage of MARC II data is fairly well defined -- all current English language monographs -- the costs, based on input requests, are very close to what the costs for these operations would be if figured on a titles found (or card sets generated) basis.

Estimating total costs per card set generated in an operating system is difficult because the searching costs vary directly with number of records on the file and indirectly with the number of records found. The total computer running cost, exclusive of searching, is about 60¢ a card set generated. Searching a file of about 100,000 MARC records would cost about 60¢ a title if 1,000 titles were found in the run.

5. ANALYSIS AND PROJECTIONS OF OPERATING COSTS

The demonstration production runs yielded a considerable amount of cost data from which system operating costs can be projected. The purpose of this section is to present the results of several cost analyses and projections useful for planners of computer based library technical processing systems.

5.1 SYSTEM CONFIGURATIONS

Different configurations of computer systems and operating procedures which make up a centralized technical processing service will have costs of operations peculiar to themselves. This section will consider only those configurations which have been studied under the NELINET project.

5.1.1 Random-Access System

One equipment configuration pertinent to the cost analysis is that originally contemplated for this project. The important feature of this system was that all of the bibliographic data was to be stored in a random-access memory. Random-access memory configuration is considerably more expensive than magnetic tape configurations used in the initial phases of the project. However, the eventual and major use of the machine form card catalog, for more complete technical processing services, depends on its availability in a random-access form. This latter consideration guided all project planning and whenever possible, computer programming approaches were taken in the direction of eventual use of a random-access system. This type of system is the one eventually thought to be operationally feasible, and a consideration of its costs, both development and operating, has been a topic of study during previous phases of the project. A specific analysis was made in the final report to CLR-425, namely, a projection of costs required to produce cards, Selin labels, and pocket labels via a random-access system. This projection will be examined in the light of the present project experience, and where necessary, will be updated.

5.1.2 MARC I Tape System

The second configuration pertinent to project activities was the MARC I tape system, which was developed and demonstrated under CLR grants 374, 385, and 425. This system searched a magnetic tape data base of MARC I bibliographic records to produce cards, Selin labels and pocket labels for the participating libraries. Computer cost data were collected for this system and will be compared with the computer costs measured in the MARC II tape system.

5.1.3 Current MARC II Demonstration System

A third equipment configuration to be analyzed is the MARC II system demonstrated under the current project CLR-443. This system is functionally similar to the MARC I system, the main difference being that the new programs are improved. Also, some of the programming can be used in a future random-access system. Its computer costs have been measured and will be compared to previous demonstration computer costs.

5.1.4 Proposed Magnetic Tape Operating System

Until resources can be found to cover the capitalization needed to procure a random-access system, it appears that the present demonstration system, with some modifications, can be run in production. An estimate of the cost of this production operation will be made. The cost estimates of each computer processing function were derived by using the measured costs obtained from the MARC II demonstration increased by approximately 15-20% for fee and overhead due to reruns. Labor, material, and communications costs were derived by estimating time and amounts of material required and then calculating costs.

5.2 FACTORS FOR CONSIDERATION IN COST ANALYSIS

There are several factors which should be considered in the cost analysis procedure.

5.2.1 Experimental Costs vs. Production Costs

Much of the work done for the NELINET project has been experimental, and as such, has incurred costs not applicable to a production environment. There have been labor costs required to monitor the operation, to solve problems, to collect data, etc. These costs include production labor as well as development labor, but it was impossible to distinguish between them in the course of the demonstration. Therefore, no labor costs were measured.

A second cost category is telecommunications cost. This, like labor cost, was difficult to separate into production cost and experimental cost during the demonstration and therefore was not measured.

A third major category of cost is computer cost and in the experiment, there were costs associated with bad runs and re-runs which were not applicable to production costs. These are easier to distinguish because equipment usage occurs in discrete units and these units are logged by the computer. The project personnel, in running the test-runs, could separate a run that was typical of production from a run in which there were experimental problems.

Given this problem of measurable and unmeasurable costs, the method of cost comparison and analysis is: 1) to compare original computer costs measured, eliminating labor, communications, material, and other categories not measurable; and, 2) to estimate costs of all unmeasurable processes and present a comparison of projected total production system costs.

5.2.2 Consolidation of Processing Components Into Common Cost Categories

Because we are considering different systems in our cost comparison, all components cannot be compared on a one to one basis. In order to overcome differences, processing components must be consolidated so that similar functions are compared. When this does not give a true comparison, this will be noted. The general processing functions which make up the technical processing service of card, Selin label, and pocket label production are listed as follows:

a. Request processing

b. File searching

c. Producing and delivering products

d. File updating

e. Fixed operating costs

In the production comparisons, these categories will be broken down into labor, transmission, computer, and material and miscellaneous costs.

5.3 COST COMPARISONS

Two cost comparisons will be made, the comparison of measured computer costs of the MARC I and MARC II demonstrations, and the comparison of the total estimated costs of projected operating systems.

5.3.1 Comparison of Measured Computer Costs

One set of costs to be compared is the machine costs measured during the MARC I and MARC II experiments. These experimental costs are also compared to the computer portion of random-access system costs presented in the final report to CLR-425. These comparisons are shown in Table 5-1.

The significant points found in the comparison between MARC I and MARC II computer costs are:

a. The request processing cost is significantly lower in the MARC II system, even though additional computer checking functions are provided.

b. The magnetic tape search costs are not lower in MARC II using the time-shared system. No prediction was made about this, but one would have expected costs to be lower. As the present time-shared service bureau rate

	MARC II Demonstration $	MARC I Demonstration $	Random Access $
Request Processing Cost			
PAPER	.011	(x)	(w)
REQUEST VALIDATOR	.003	.027(1)	.027(1)
SORT KEY GEN/REQ.	.002	(x)	(w)
SORT(By LC Card No.)Req.	.019	.024(1)	(w)
Total Req. Cost $/Req.	.035	.051	.027
Search Costs			
SMERGE	.60(2)	.54	.06
Total Search Cost $/Title Found	.60	.54	.06
Production of Cards, Labels, and Pockets			
SORT (by Library)	.013	(z)	.013
CARD AND LABEL PRODUCTION	.065	.072	.07
CARD FORMATTER	.270	.137	.07
LINE PRINTER	.183	.617	.10
LABEL FORMATTER	(v)	.03	.03
POCKET FORMATTER	(v)	(u)	(t)
Total Card, Label and Pocket Production Costs $/Title Found	.531	.856	.28

NOTES:

(1) Costs in CLR-425 report, recomputed on a per request basis.
(2) Assumes .006/record searched x 1,000,000 records searched ÷ 1,000 titles found.
(t) Function not estimated in random access production system.
(u) Function not part of MARC I demonstration.
(v) No data available as program was not tested.
(w) Function does not exist in random-access system in category.
(x) Combined with another program, cost included in that program.
(y) Function included in communication cost.
(z) Done manually, cost not available.

TABLE 5-1

COMPARISON OF MEASURED COMPUTER COSTS, MARC I, MARC II, AND COMPUTER COSTS OF FUTURE RANDOM ACCESS SYSTEM schedule stands, the input-output cost of the magnetic tape process is as high as an equivalent stand-alone machine. This is an area which warrants further investigation in future work.

c. Card production costs are lower in MARC II than in the MARC I system, even though the records are machine sorted back into library input order before card sets are printed, a feature not performed in the MARC I system.

d. The card formatter costs are higher in the MARC II system. Time and availability of funds did not permit an analysis of the program operation which would show why this occurred.

e. The line printer cost is lower in MARC II than in MARC I because a faster computer line printer was used. Two-up printing was not used as proposed, because we anticipated a high computer cost of outputting records for two different libraries - side by side - and because no methods for cutting the cards printed two-up were available at the time of program design.

When comparing the MARC II computer costs against the computer costs of the Random-Access System projected in the Final Report on CLR-425, the important points uncovered were:

a. The magnetic tape searching cost was high by a factor of ten over the random-access cost. This was expected.

b. The cost of sorting card sets by library appeared minimal in the demonstration. This suggests that further sorting by subject, title, and author may save manual processing costs at the libraries.

5.3.2 Comparison of Production System Operating Costs

A proposed magnetic tape service will be compared with the previous random-access projection and, where the random-access cost is unrealistic, it will be revised. This comparison adds costs of labor, material and transmission to the equipment costs to arrive at a final estimate of operating cost. In order to compare a magnetic tape system with a random-access system, a typical run of a batch of requests must be used. A batch of 2,000 requests searched against a file of 100,000 records, with an 85% match rate was assumed, the same rate as that used in the previous estimate made under CLR-425. These comparisons are shown in Table 5-2. The computer charges have been increased by from 15% to 20% to cover a computer overhead and fee cost which was not included in measured costs based on service bureau billings. Points of comparison are:

a. The labor cost for the magnetic tape system is higher than for the random-access system because of the Teletype monitoring and messenger service required to achieve a rapid response to requests. In the random-access system, the Teletypes are connected directly and a line printer would be located at the computer so that the only labor required would be the computer operation and the cutting, packaging and mailing of cards and labels.

b. The communication costs for requests are as projected in CLR-425. It should be noted that, as the Teletype load increases for a library, through other library or University facilities bearing a portion of the fixed communication costs, it will be advantageous to connect directly to the computer as the labor cost to tend a Teletype is nearly equal to the message cost.

MARC II MAGNETIC TAPE SYSTEM

	Material	Labor	Transmission	Computer	Total
I Request Processing $/Request					
Monitor Teletype Reception		.03			60.00
Monitor Running Paper		.03			60.00
Dataphone Cost			.014		28.00
Run PAPER				.013	26.00
Run REQUEST VALIDATOR				.005	10.00
Run SORT KEY GENERATOR(reqs.)				.004	8.00
Run SORT (reqs.)				.014(c)	28.00
Total Request Cost by Category		.06	.014	.036	
Total Request Cost/Request				.11	
Total Cost 2,000 Requests		120.00	28.00	72.00	220.00
II File Search					
Run SMERGE				7.00/ 1000 recs.	700.00
Total Cost/1,000 Records Searched				7.00	
Total Cost/100,000 Records Searched				700.00	700.00

(a) Random-access cost is per request.
(b) Cost is higher because transmission was from Burlington Vermont to computer, not from Maynard to computer.
(c) Best experimental sort run cost was taken as a base rather than average

TABLE 5-2
COMPARISON OF OPERATING COSTS OF MAGNETIC TAPE PRODUCTION SYSTEM WITH THOSE OF A RANDOM-ACCESS SYSTEM (ASSUME 100,000 RECORD FILE, 2,000 REQUESTS ONCE A WEEK, 85% MATCH RATE, 1,700 TITLES PROCESSED.)

RANDOM ACCESS SYSTEM CLR 425					REVISED RANDOM ACCESS SYSTEM				
Material	Labor	Transmission	Computer	Total	Material	Labor	Transmission	Computer	Total
		.04(b)		80.00			.04(b)		80.00
			.03	60.00				.04	80.00
		.04	.03				.04	.04	
			.07					.08	
		80.00	60.00	140.00			80.00	80.00	160.00
			.06/ req. (a)	120.00				.12/ req. (a)	240.00
			.06/ req. (a)					.12/ req. (a)	
			120.00	120.00				240.00	240.00

TABLE 5-2
COMPARISON OF OPERATING COSTS OF MAGNETIC TAPE PRODUCTION SYSTEM WITH THOSE OF A RANDOM-ACCESS SYSTEM (ASSUME 100,000 RECORD FILE, 2,000 REQUESTS ONCE A WEEK, 85% MATCH RATE, 1,700 TITLES PROCESSED.)

MARC II MAGNETIC TAPE SYSTEM (Cont'd.)

	Material	Labor	Transmission	Computer	Total
XII Production & Delivery - Pockets, Labels, Cards - Cost/Title Matched					
Run SORT(Matched requests per Library)				.018	30.60
Run CLPP				.069	117.30
Run PUFF				.294	499.80
Run Pockets				.070	119.00
Run Label				.030	51.00
Run Card Printer				.174	295.80
Run Pocket Printer				.017	28.90
Cut cards		.03			51.00
Print labels		.006			10.20
Postage	.04				68.00
Material & Misc. Equipment	.14				238.00
Total Production & Delivery Cost by Category	.18	.036		.672	
Total Production & Delivery Cost				.888	
Total Production & Delivery Cost/1,700 Titles Matched	306.00	61.20		1142.40	1509.60

TABLE 5-2 (Cont'd.)
COMPARISON OF OPERATING COSTS OF MAGNETIC TAPE PRODUCTION SYSTEM WITH THOSE OF A RANDOM-ACCESS SYSTEM (ASSUME 100,000 RECORD FILE, 2,000 REQUESTS ONCE A WEEK, 85% MATCH RATE, 1,700 TITLES PROCESSED.)

RANDOM-ACCESS SYSTEM CLR 425 (Cont'd.)					REVISED RANDOM-ACCESS SYSTEM (Con·				
Material	Labor	Transmission	Computer	Total	Material	Labor	Transmission	Computer	Total
								.018	30.60
			.07	119.00				.07	119.00
			.07	119.00				.14	238.00
								.07	119.00
			.03	51.00				.03	51.00
			.10	170.00				.10	170.00
								.017	28.90
	.03			51.00		.01			17.00
	.01			17.00		.006			10.70
.03				51.00	.04				68.00
.13				221.00	.14				238.00
.16	.04		.27		.18	.016		44.5	
			.47					64.1	
272.00	68.00		459.00	799.00	306.00	27.20		756.50	1089.70

TABLE 5-2 (Cont'd.)
COMPARISON OF OPERATING COSTS OF MAGNETIC TAPE PRODUCTION SYSTEM WITH THOSE OF A RANDOM-ACCESS SYSTEM (ASSUME 100,000 RECORD FILE 2,000 REQUESTS ONCE A WEEK, 85% MATCH RATE, 1,700 TITLES PROCESSED.)

MARC II MAGNETIC TAPE SYSTEM (Cont'd.)

	Material	Labor	Transmission	Computer	Total
IV Fixed Operating Costs/Run (week)					
Monitor REQUEST VALIDATOR Through PUFF		27.00			27.00
Dataphone Cost From REQUEST VALIDATOR Through PUFF			10.80		10.80
Dataphone Cost Fixed Monthly			48.00		48.00
Computer Logging Error Control				4.50	4.50
Messenger Service To Printer		23.30			23.30
Package For Mailing		9.00			9.00
Total Fixed Operating Costs by Category		59.30	58.80	4.50	122.60
V File Updating Cost/Run(week)					
LC MARC II TO NELINET MARC II				15.00	15.00
Messenger Service		52.20			52.20
Run MAKTEN (LC MARC II)				5.20	5.20
Run SORT KEY GENERATOR (LC MARC II)				6.60	6.60
Run SORT (LC MARC II)				14.40	14.40
Total File Update Cost by Category		52.20		41.20	93.40
Total Production Cost per Weekly Run	306.00	292.70	86.80	1960.10	2645.60
Total Cost per Title Matched					1.56

TABLE 5-2 (Cont'd.)
COMPARISON OF OPERATING COSTS OF MAGNETIC TAPE PRODUCTION SYSTEM WITH THOSE OF A RANDOM-ACCESS SYSTEM (ASSUME 100,000 RECORD FILE, 2,000 REQUESTS ONCE A WEEK, 85% MATCH RATE, 1,700 TITLES PROCESSED.)

RANDOM-ACCESS SYSTEM CLR 425 (Cont.d)					REVISED RANDOM ACCESS SYSTEM (Cont'd)				
Material	Labor	Transmission	Computer	Total	Material	Labor	Transmission	Computer	Total
		.05(b)		85.00		27.00			27.00
		27.00		27.00			34.00		34.00
								4.50	4.50
	.01(d)			17.00		9.00			9.00
	102.00	27.00		129.00		36.00	34.00	4.50	74.50
								15.00	15.00
								5.20	5.20
								6.60	6.60
								14.40	14.40
Not Estimated								41.20	41.20
[illegible]72.00	170.00	107.00	639.00	1188.00	306.00	63.20	114.00	1122.20	1605.40
				.70					.95

(d) Labor cost computed per title in CLR 425

TABLE 5-2 (Cont'd.)

COMPARISON OF OPERATING COSTS OF MAGNETIC TAPE PRODUCTION SYSTEM WITH THOSE OF A RANDOM-ACCESS SYSTEM (ASSUME 100,000 RECORD FILE, 2,000 REQUESTS ONCE A WEEK, 85% MATCH RATE, 1,700 TITLES PROCESSED.)

c. The cost of acceptance of a request, validating and temporarily storing it, is as projected in CLR-425. In a future plan, the estimate is raised to allow for additional checking and message printout.

d. The search cost is a large share of the computer expense and is six times that of a random-access memory projected in CLR-425. Because of the poor reliability achieved on large random-access memories during our time-shared computer experience, we estimate random-access cost to be double the previous estimate of $.06 and the new projection is revised accordingly. The cost estimate was doubled because the simplest and quickest way to achieve reliability would be to double the memory size and thus the cost, using one half for backup.

The search cost for a magnetic tape system is more or less favorable, depending on the ratio of requests to total file size. If a large number of requests can be searched, compared to the file size, then the search cost will be low.

e. Because the demonstration, as mentioned before, showed the card formatting costs to be higher than projected, we estimate that these costs in a magnetic tape production system will be higher.

f. Material and postage costs in the MARC II magnetic tape production system were slightly higher than the random-access projection made in CLR-425 so the revised projection shows this increase.

g. It is still expected that a two-up printing system can be developed in the future so that printing costs will be as previously estimated.

5.4 FUTURE COSTS OF THE PROPOSED MAGNETIC TAPE OPERATION

Four significant factors which will influence the magnetic tape operating cost in the future are described below.

5.4.1 Time-Shared Computing Costs

The present situation with time-shared computing costs is changing with respect to the NELINET type of production. The rates quoted are those for numerical calculation type of work. The net effect of these factors is that the computing costs should decrease slightly.

5.4.2 System Overhead Costs

An experiment or demonstration does not yield definite data about operational system overhead costs. These include such things as the costs of: adding new customers, responding to errors and complaints, improvements in the system, training of system personnel, planning of major improvements or new services, and accounting and administration.

Computer overhead and systems maintenance costs have not been estimated for the MARC II magnetic tape system or the revised random-access system. These costs vary and depend on the desired rate of system improvement.

The original estimates of system improvement computer overhead rates are still reasonable for any revised projection. Definite technical development plans are needed before they warrant changing.

The accounting overhead costs can be lowered somewhat because most accounting functions required are available on a time-sharing system.

5.4.3 Initial Production Costs vs. Future Production Costs

Another problem which arises in analyzing costs is distinguishing initial production cost from on-going production costs. An initial system is the result of an analytical design and such a design never can consider all of the small operations which make up the major components. These are brought to light by operating the system. The present state of the demonstration has not seen the system operational long enough to identify all of the areas for improvement. The net effect, presumably, is that the future costs will be lower as the improvements are made.

5.4.4 Significant Technical Innovation

If financing prohibits one from following the random-access approach, then there are techniques of magnetic tape file organization and searching which can be used to reduce costs. Up until now, techniques have not been pursued and are not discussed because it was expected that a random-access memory approach was eventually going to be used.

APPENDIX A

Request Worksheets

NELINET MARC II REQUEST WORKSHEET -- UNIVERSITY OF CONNECTICUT

Filled in by Teletype Operator:

		Day	No.	no mf
req ←	co69-			

Filled in by Cataloger:

crd ←

	Location Symbol(s)	Copy No(s)	Vol. No(s)	No Cd	No S	No Bk	xME
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.

call ← ______________________________

Valid Location Symbols

Acq.	Music
Bibl.	Pharm.
Catl.	Ref.
G.P.D.	Spec.

NELINET MARC II REQUEST WORKSHEET--UNIVERSITY OF MASSACHUSETTS

Filled in by Teletype Operator:

		Day	No.	no mf
req←	ma69-	| |	| |	

Filled in by Cataloger:

crd ← [ ]

	Location Symbol(s)	Copy No(s)	Vol. No(s)	No Cd	No S	No Bk	xME
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.

call ← ____________________

Valid Location Symbols

AG EN	HOME	PLANT
BURGO	LABOR	PSYCH
BUS	LAND	REF
CHEM	MATH	RES C
CRAN	MORR	SHADE
EDUC	MUSIC	SPEC
ENGIN	NUR	TECH P
ENT	PER	VET
FOOD	PHYS	WALT
FOR		

NELINET MARC II REQUEST WORKSHEET--UNIVERSITY OF NEW HAMPSHIRE

Filled in by Teletype Operator:

req←	nh69-		no mf

- -

Filled in by Cataloger:

crd←	

	Location Symbol(s)	Copy No(s)	Vol. No(s)	No Cd	No S	No Bk	xME
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.

call← ____________________

Valid Location Symbols

Archiv	LS	Nt
Biochm	LSj	Pam
BioSci	LSRef	Per
Browse	Math	Phys
Call	Mcard	Ref
Chem	Mfiche	RefBib
Eng	Mfilm	Spec
German	Mprint	Vault
Hj	MS	y
j	NH	

NELINET MARC II REQUEST WORKSHEET--UNIVERSITY OF RHODE ISLAND

Filled in by Teletype Operator:

		no mf
req ←	ru69-		

Filled in by Cataloger:

crd ← ____________________

	Location Symbol(s)	Copy No(s)	Vol No(s)	No Cd	No S	No Bk	xME
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.
loc ←	1.	2.	3.	4.	5.	6.	7.

call ← ____________________

Valid Location Symbols

Archiv	mfilm
Blatz	NML
EXT	R.I.Cl
J.F.K.	Rare
mcard	Ref
mfiche	

NELINET MARC II REQUEST WORKSHEET--UNIVERSITY OF VERMONT

Filled in by Teletype Operator:

		Day	No.	no mf
req←	vt69-			

Filled in by Cataloger:

crd← ______________________

	Location Symbol(s)	Copy No(s)	Vol. No(s)	No Cd	No S	No Bk	xME
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.

call← ______________________

Valid Location Symbols

J	RIndex
Mfilm	S
MP	TR
Per	W
R	

APPENDIX B

Catalogers' Instructions for Filling Out Request Worksheets

NELINET MARC II

Catalogers' Instructions for Filling Out Request Worksheets

(Use Red Pencil)

<u>req - Request Number</u>

The Request Number is an identification number given to each request. It must be present in each request and it must be the first piece of data transmitted. It contains the library input code, the last two digits of the year, and a 1-6 digit sequence number.

The library's input code and the year have been pre-printed on the forms. The sequence number is assigned by the requesting library. Either one of the two following schemes may be used to assign the sequence number:

(1) One sequence of numbers may be used for the entire year. If such a scheme is used, the first and last requests might appear as follows:

			no <u>mf</u>
req ←	nh69-	1	

			no <u>mf</u>
req ←	nh69-	18692	

(2) A new sequence of numbers may be used for each day's transmission. In this scheme, the first three digits represent the day of the year (the days being numbered from 1 to 365 or 366) and the last three digits represent the number of the request in the day's batch of requests. In this scheme high order zeros should fill out each of these numbers to three digits.

		Day	No.	no <u>mf</u>	
req ←	vt69-	01012	01112		1/2/69 12th request

6/30/69
1st
request

	Day	No.	no mf
req ← vt69-	1 8 1	0 1 0 1	

If the record is not to go on the library's master (holdings) file, record an "m" in "no mf". (An example of the use of this feature is shown in the call number section of these instructions.)

		no mf
req ← mh69-		m

	Day	No.	no mf
req ← vt69-	0 1 0 1 2	0 1 0 1 2	m

The matched requests will be sorted back by the library's request number. If a library desires an internal arrangement within a day's batch of requests, e.g. by main entry, they should arrange the requests (or the books) in that order and then number the requests.

crd - LC Card No.

Record the Library of Congress card number here. Include prefixes if present. Suffixes can be ignored.

crd ← 68-2672

crd ← Agr 69-123

loc - Location--Copy--Volume Data

Each "loc" data field (line) contains the information for the copies (or volumes) in a particular location. The NELINET worksheet presently provides for recording data for eight locations. This may be expanded if it is found to be insufficient. Whenever more than eight locations are to be recorded for one title, the additional ones may be recorded on another worksheet noting the first worksheet accordingly. If no "loc" data is recorded on a worksheet, main library--main stacks--copy one will be assumed.

1. Location Symbols

Record location symbols as they are to be printed. A location symbol should not contain more than six characters, including periods. If more than one symbol is required for a particular location (e.g., a special shelf location within a branch library), separate symbols with slashes. Up to three location symbols, including oversize, may appear on catalog cards. Each location symbol will be validated against the location symbol table in requesting library's profile.

Examples:

	Location Symbol(s)
loc ←	1. Ref.

	Location Symbol(s)
loc ←	1. Chem./Ref.

NOTE: The last line segment does not require a slash.

If nothing is recorded in the location symbol block, main library, main stacks will be assumed. The oversize symbol should not be recorded. It will be generated by the program.

2. Copy Numbers

"Copy" is abbreviated as small letter "c" followed by a period, "c.". Single copies may be recorded as "c.1". If nothing is recorded in the copy number block, "c.1" will be assumed.

Multiple copies consecutively numbered are recorded by preceding the range of copy numbers with a dollar sign "$", e.g. $c.1-10.

Multiple copies (in a particular location) not consecutively numbered, must be recorded individually. Each copy number (or range of consecutively numbered copies) is recorded, separated by commas, e.g., c.1, c.4; $c.1-3, c.5; or $c.1-3, $c.6-9.

NOTE: The "c." must appear before each individual copy number or each range of copies.

Examples:

Copy No.(s)
2.

copy one assumed

Copy No.(s)
2. c.3

Copy No.(s)
2. $c.1-10

Copy No.(s)
2. c.2, $c.4-6

Copy No.(s)
2. c.3, c.6

Copy No.(s)
2. $c.1-3, $c.5-8

NOTE: As stated previously, main library--main stacks--copy one is assumed if the worksheet does not contain any "loc" data. If, however, the worksheet does contain some "loc" data and copy one is located in the main stacks of the main library, this must be stated:

	Location Symbol(s)	Copy No.(s)
loc ←	1.	2. c.1
loc ←	1. Chem	2. $c.2-4

3. Volume Numbers

Volume numbers are recorded in the same fashion as copy numbers -- a dollar sign precedes consecutively numbered volumes, and commas separate nonconsecutive volume numbers (individual volume numbers or ranges).

	Location Symbol(s)	Copy No(s)	Vol. No(s)
loc ←	1. Ref.	2. c.1	3. $v.1-3

	Location Symbol(s)	Copy No(s)	Vol. No(s)
loc ←	1.	2. $c.1-2	3. $v.1-5

	Location Symbol(s)	Copy No(s)	Vol. No(s)
loc ←	1. Chem.	2. c.3	3. v.1, v.4

	Location Symbol(s)	Copy No(s)	Vol. No(s)
loc ←	1.	2. c.1, c.4	3. $v.1-3, v.6

As indicated above in the second example, multiple copies of the same range of volume numbers ($v.1-5) can be recorded in one "loc" statement. If, however, at one location the same volume numbers are not contained in each set, a different procedure should be followed. If, for example the Chem. branch (or any other location) owned three copies of volumes 1 and 2 but only one copy of volumes 3, 4, and 5, two "loc" statements would be required. As shown below, catalog cards should be suppressed in one of the "loc" statements.

	Location Symbol(s)	Copy No(s)	Vol. No(s)	No Cd.
loc ←	1. Chem.	2. \$c.1-3	3. \$v.1-2	4.

	Location Symbol(s)	Copy No(s)	Vol. No(s)	No Cd.
loc ←	1. Chem.	2. c.1	3. \$v.3-5	4. X

The example cited above could also be recorded as:

	Location Symbol(s)	Copy No(s)	Vol. No(s)	No Cd.
loc ←	1. Chem.	2. c.1	3. \$v.1-5	4.

	Location Symbol(s)	Copy No(s)	Vol. No(s)	No Cd.
loc ←	1. Chem.	2. \$c.2-3	3. \$v.1-2	4. X

When a physical volume contains more than one bibliographic volume, the range of volume numbers is recorded without any dollar sign e.g., two physical volumes, one containing bibliographic volumes 1 and 2 and the other containing bibliographic volumes 3, 4, and 5, would be recorded as:

	Location Symbol(s)	Copy No(s)	Vol. No(s)
loc ←	1.	2. c.1	3. v.1-2, v.3-5

Volume designations other than volume (v.) can be enumerated if the volume designation (or its abbreviation), and the number of the volume do not exceed six characters.

e.g., Pt.1-3 or N.1-2

A period should always follow the abbreviation when volume numbers are enumerated.

Volume designations other than the simple type noted in the paragraph above cannot be enumerated and each physical volume should be recorded individually.

e.g., 1949 or ser. 349

When a volume designation exceeds six characters, the program will look for a space, hyphen, slash, or period and break at this point. The hyphen, slash, or period will be retained.

4. <u>No Cd. - Suppress Catalog Cards</u>

If catalog cards are to be suppressed for this request, record an "x" in this block.

5. <u>No S - Suppress Selin Labels</u>

If Selin Labels are to be suppressed for this request, record an "x" in this block.

6. <u>No Bk - Suppress Selin Labels</u>

If book pocket labels are to be suppressed for this request, record an "x" in this block.

7. <u>x ME - Extra Main Entries</u>

If extra main entries are desired, record the number wanted in this block. Up to seven may be requested.

<u>call - Local Call Numbers</u>

Whenever a call number other than the one established at the Library of Congress is to be used, record it here, separating the segments that are to appear on each line with slashes. No more than six characters may be included in one line segment. Location Symbols are not recorded as part of the call number - they are recorded in the "loc" statement.

call ← 660.1/B62

call ← HG/276/D725

NOTE: (1) The last line segment does not require a slash.

(2) A period does not precede the Cutter Number.

If nothing is recorded here, the call number established at the Library of Congress will automatically be placed in the left margin of the catalog cards and on the labels. It will be broken as follows:

DS
2416
R8
H764
1966
Vol.
2467

Libraries may use the system to obtain LC cataloging copy. To do so, record an "m" in the "no mf" block of the request number, suppress catalog cards, SeTin labels and book labels, request one extra main entry, and leave the "call" line blank as in the following example:

NELINET MARC II REQUEST WORKSHEET-UNIVERSITY OF RHODE ISLAND

Filled in by Teletype Operator:

			no mf
req←	ru69-	263	m

Filled in by Cataloger:

crd← 69-2768

	Location Symbol(s)	Copy No(s)	Vol. No(s)	No Cd	No S	No Bk	xME
loc←	1.	2.	3.	4. X	5. X	6. X	7. /
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.
loc←	1.	2.	3.	4.	5.	6.	7.

call← ______________________

Valid Location Symbols

Archiv	mfilm
Blatz	NML
EXT	R.I.Cl
J.F.K.	Rare
mcard	Ref
mfiche	

APPENDIX C

Instructions For Teletypists

NELINET MARC II - INSTRUCTIONS FOR TELETYPISTS

(In the following instructions, the characters to be typed have been enclosed in quotation marks for clarity. Do not type the quotation marks.)

A. GENERAL INFORMATION

1. For easy reading, double space between lines.

2. A carriage return is not complete until the line feed key is typed.

3. The ASR-33 teletype does not have upper and lower case characters. To distinguish upper case characters from lower case characters, the up arrow "↑" (shift "n") will precede each upper case character.

   e.g., ↑H↑S/162.4/↑C146

4. The tab key on the ASR-33 does not physically move the carriage. Tabs normally would be used to separate tags (labels) from data fields:

   e.g., tag — crd; data field — 69-123

   and to separate subfields within a data field:

   loc — Data Field: Subfield — 1.Chem.; Subfield — 2.$c.3-4

   The character "←" (shift "O") will be used instead of the tab in these instances. A space or a number of spaces may be typed after this character to format the data.

   e.g., loc ← 1.Chem.← 2.$c.3-4

5. Error correcting commands

   (a) To delete a single line, type "\KL" at the end of the line to be deleted and follow by a "carriage return-line feed". The correct line can now be typed. (The "\" is the shift "L" key.)

   (b) To delete an entire request, type "\KR carriage return-line feed" and begin request over again.

B. KEYING REQUESTS

1. Press local ("LCL").

2. Press punch on.

3. Generate a couple inches of rub outs by pressing simultaneously, the rub out key and the repeat key (REPT).

4. req - Request Number

   This must be present in each record and will appear on each worksheet as:

			no mf
req ←	nh69-	126	

			no mf
req ←	nh69-	29	m

		Day	No.	no mf
req ←	vt69-	001	012	

		Day	No.	no mf
req ←	vt69-	180	001	m

and should be keyed as:

req ← NH69-126
req ← NH69-29M
req ← VT69-001012
req ← VT69-180001M

The operator may type as many spaces after the "←" as she thinks will format the page nicely.

5. crd - LC Card Number

This must be present in each record and will appear on each record as:

crd← 69-123

crd← Agr 72-61

and should be keyed as:

crd← 69-123
crd← ↑AGR72-61

6. loc - Location--Copy--Volume Data

This may or may not be present in a record. Type only the blocks (subfields) that have been filled in by the cataloger. The "←" and one or more spaces are used to separate the subfields as well as to separate the tag (loc) from the data. The following location statements:

	Location Symbols	Copy No(s)	Vol. No(s)	No Cds	No S	No Bk	xME
loc ←	1.	2.$c.1-2	3.$v.1-3	4.	5.	6.	7.
loc ←	1.	2.	3.	4. x	5. x	6. x	7. 1
loc ←	1. S	2.	3.	4.	5.	6.	7.
loc ←	1. R	2.$c.1-3	3.	4.	5.	6.	7.

should be keyed as:

loc← 2.$c.1-2← 3.$v.1-3
loc← 4.x← 5.x← 6.x← 7.1
loc← 1.↑S
loc← 1.↑R← 2.$c.1-3

7. call - Local Call Number

This may or may not be present. It will appear on the work-sheet as:

call← 621.1/B62

and should be keyed as:

call← 621.1/↑B62

8. To end each request, type "\\carriage return-line feed". The "\\" should appear alone on a line.

9. The "\\ carriage return line feed" following the last record is sufficient to end the transmission. Follow this with a couple of inches of rub outs. This will separate the last request from any dialogue that takes place when you transmit.

NOTE: (1) A CARRIAGE RETURN-LINE FEED MUST FOLLOW THE "\\" THAT ENDS THE LAST RECORD.

(2) DO NOT TYPE ANOTHER "\\".

C. TRANSMITTING REQUESTS

1. Set everything to the "off" condition.

2. Make sure that the machine is on the Dataphone line, not the TWX line.

3. Put the punched request tape in the paper tape reader, making sure it is smooth and that there are no wrinkles in it.

4.a All libraries except the University of Connecticut:

Set the switch in the lefthand corner of the machine to "Automatic". Inforonics will initiate the request by calling the library. The transmission will then proceed automatically without further intervention from the library staff. It is desirable, however, to have someone present while the transmission is taking place to insure that the tape does not get tangled.

4.b University of Connecticut

Someone must be present when Inforonics calls to push the switch in the lefthand corner of the machine to the "Start" position. The transmission will then proceed automatically.