Microcomputer Archives and Records Management Systems: Guidelines for Future Development[1]

RICHARD M. KESNER

THE F. W. FAXON COMPANY is a high-technology organization that provides sophisticated, automated serials subscription services to nearly 20,000 library customers internationally. As such, Faxon is a heavy user of computers and is, in fact, the largest single IBM customer in the state of Massachusetts. Like many corporations dependent upon the computer for the maintenance of their records and management systems, the F. W. Faxon Company is now looking toward small computers and distributed processing to serve its information needs.[2] By integrating word processing, electronic mail, computer output microfilm (COM), and on-line interactive information systems, the company plans to move into a paperless office environment by the middle of the 1980s. In this regard, Faxon is at the leading edge of

[1]This essay draws upon material previously presented in sessions before the membership of the Society of American Archivists and the Congrès International Informatique et Sciences Humaines (Berkeley, California, 3 September 1981 and Liège, Belgium, 25 November 1981, respectively). I would like to acknowledge the generous support of the Research Programs Division of the National Endowment for the Humanities, East Tennessee State University, and the F.W. Faxon Company, Inc., in providing me with both the means and the time to pursue this research project. I take full responsibility for any errors in fact or judgement in what follows.

[2]Distributed processing refers to the arrangement whereby units within a larger organization maintain their own EDP (electronic data processing) facilities rather than relying upon a centralized, large (so-called "main frame") computer. The advent of mini- and microcomputer technology has made distributed processing both possible and highly desirable. See, for example, Judson Bresling and C. Bradley Tashenberg, *Distributed Processing Systems: End of the Main Frame Era?* (New York: AMACOM, 1978); P.J. Down and F.E. Taylor, *Why Distributed Computer* (Manchester, Eng.: The National Computing Centre, Ltd., 1976); and Philip H. Enslow, Jr., "What is a 'Distributed' Data Processing System," *Computer* 11, 1 (1978).

The author is manager of Office Systems and Services for the F.W. Faxon Company, Inc., Westwood, Massachusetts. He is also the compiler and editor of Automation, Machine-Readable Records, and Archival Administration: A Select Bibliography *(Society of American Archivists, 1980).*

what has become a major movement within the business world.[3] Needless to say, these developments have significant implications for those of us concerned with the management of records centers and archives within and outside of the business community.

It was the opportunity to assist in the creation of a paperless information system that attracted me away from a more traditional archives position. The work requires someone with archival/records management training who also enjoys a certain familiarity with distributed processing and small computer technology. Faxon was interested in me because of my work in the area of microcomputer applications in archives. The purpose of this essay is to share the findings of my earlier research and that of the project team with the professional archives community. Just as I plan to build upon my previous work to establish and manage a paperless information environment at Faxon, it is hoped that others will benefit from the recommendations and suggestions presented in this essay.

On 1 July 1980, the Archives of Appalachia launched an investigation of the possible applications of a microcomputer in an archives and records management environment. Through the assistance of the National Endowment for the Humanities,[4] the principal participants in this project, Don Hurst and Richard M. Kesner, set out three major objectives for their research: to consider the feasibility of employing microcomputers in an archival setting; to develop prototype automated systems for an archival environment; and to share the findings of this research with as large a professional audience as possible. In a series of earlier publications, the project staff has already outlined its original thinking and accomplishments.[5] Staff members have supplemented efforts with a number of conference presentations and workshops.[6] Now that the grant period has passed, the project staff would like to take this opportunity to review its activities and to provide its colleagues with a concise set of recommendations pertaining to the introduction of microcomputers into archives and records centers.

The project staff has not devised a single automated system or model that we recommend to all. Such an approach would fail to recognize the rapidly changing nature of microcomputer

[3]For a discussion of the impact of distributed processing in the business world and its implications for the use of small computers, see Robert W. Shirey, "Management and Distributed Computing, Parts 1-4," *Computerworld* 14, 41 (1980): *In Depth* 14,41 (1980): 1-16; *In Depth* 14,43 (1980): 108; and *In Depth* 14,44 (1980): 1-20; Dan M. Bowers, "Intelligent Terminals and Distributed Processing," *The Office* 84,3 (1976): 86-94; and Bowers, "New Directions for Distributed Processing, *The Office* 88,3 (1978): 23-24. See also Shirley Daniels, *All You Need to Know About Microcomputers: The Small-Business Manager Advisory* (Oakland, Calif.: Third Party Publishing Co., 1979).

[4]Awarded by the National Endowment for the Humanities through the Research Collections Program, the Division of Research Programs on 1 July 1980. Grant No. RC-10018-80-1376.

[5]See Richard M. Kesner and Don Hurst, "MARS: A Development Report," *Automatic Data Processing in Archives (ADPA)* 3,2 (1980): 11-20; and idem., "Microcomputer Applications in Archives: A Study in Progress," *Archivaria* 12 (1981): 3-20.

[6]Aspects of our MARS project activities and results have been presented before various professional groups, including papers before the Society of American Archivists (1980 and 1981), the Mid-Atlantic Archives and Records Conference (1980), the Society of Georgia Archivists (1980), the American Society for Information Science (1981), and the Organization of American Historians (1982). In addition, we have run the following workshops before professional groups: Public Archives of Canada (March 1980), the Society of American Archivists (October 1980 and September 1981), the American Society for Information Science (March 1981), the University of Missouri School of Library Science (August 1981), and the American Society of Information Sciences (May 1981). A number of these papers and workshops have been presented as articles in professional journals or as parts of conference proceedings.

technology and would prove too inflexible to implement successfully. Instead, we have prepared a series of guidelines for the selection of microcomputer equipment and programming packages (hereafter referred to as "hardware" and "software," respectively). We have also devised a simple model for the deployment of a microcomputer system in an archives and records management setting. From our point of view, recent and anticipated developments in both hardware and software will allow archivists and records managers the flexibility to exercise a wide range of options while at the same time ensuring that the final product of their efforts will meet, and indeed, exceed, the minimum basic standards set by the profession.

A number of individuals, institutions, and working groups within the archival community are at present engaged in the consideration of various automated indexing and retrieval systems designed specifically to serve the information needs of archives. They are also concerned with the establishment of a national data base for archives and manuscript collections. It was our task during the course of the project to explore the possible role of the microcomputer in such a system. The results are not all in, but it is safe to say that there is a place for these remarkable machines in the plans of the National Information Systems Task Force.[7] In addition to this general objective, the project staff has examined the potential for use of microcomputers in a variety of information management operations with the long-term goal of rendering these operations more economical and responsive to institutional needs.

Before addressing some of these larger issues, it is perhaps best to review the evolution of the project staff's thinking concerning the uses of microcomputers in archives and the guidelines established as a result of our investigations. The concluding section will attempt to address both the state of the art and the future role of microcomputers as they relate to archival administration and a national or international archival information data base.

Project Activities

During the course of our study, project activities fell into three general areas: background study, prototype development, and dissemination of research results. Our background research included a number of bibliographic data base searches and a thorough survey of the literature pertaining to microcomputers and information management. To keep abreast of developments, the project staff also reviewed relevant computer-related publications, including: *Datamation, Computerworld, Mini-Micro Systems, Creative Computing, Personal Computing, Byte,* and *Interface Age.* We recommend that any user subscribe in addition to the journal that specializes in his or her particular hardware configuration. In the case of the Apple microcomputer, for example, *Softalk* is quite informative. Radio Shack, Atari, and other manufacturer/user groups publish comparable

[7]The National Information Systems Task Force includes many of the most talented people in the areas of archival administration, automated indexing, and information retrieval to be found in the profession today. The ultimate goal of the task force is to develop standards, procedures, and formats for the establishment of an archival information data base. This data base will include repository and collection descriptions from institutions throughout the United States and Canada. The task force has recently presented a series of discussion documents to the Council of the Society of American Archivists pertaining to the standardization of collection description. The National Endowment for the Humanities has awarded the task force a grant to continue its work. A section of that grant calls for the creation of a microcomputer software package for data entry into the proposed data base.

publications.

The project staff supplemented its extensive readings in the literature with a series of discussions involving microcomputer engineers and distributors, and microcomputer hardware and software specialists. Whenever possible, we also sought hands-on experience with various hardware and software configurations, including the Wang and IBM series minicomputers, the Xerox and IBM word processing systems, the complete line of Radio Shack TRS-80 computers, and the Apple II and III. This broadly based research provided us with a reasonable overview of microcomputer technology. It has also allowed us to project into the future and anticipate either hardware or software innovations that may directly influence the direction of our study.

At the heart of our development efforts stood the objective of developing a prototype microcomputer archives and records management system. As our project proceeded, however, we found ourselves taking a number of unexpected detours. Through our survey of the literature and our own hands-on experimentation, we learned that considerable amounts of research and development monies are required during the creation of a state-of-the-art software package along the lines envisioned in our project proposal. For example, one major microcomputer manufacturer recently developed a satisfactory data base management system at a cost of $800,000. While this manufacturer will recover his investment through sales, it was clear to us that we had neither the resources nor the time to develop a prototype. Furthermore, in the year since we undertook the development of a microcomputer archives and records management systems (MARS) prototype with NEH support, a number of microcomputer software firms have begun to market highly sophisticated, general purpose packages designed to do approximately what we had hoped to accomplish with MARS.

These products, including such packages as PROFILE, SCRIPTSIT, EASY WRITER, DB MASTER, and VISICALC,[8] are both capable and economical, ranging in price from $100 to $300. CP/M and MP/M, two microcomputer operating systems that will be discussed in more detail later in this report, have also become more readily available, providing greater software portability between various brands of microcomputers and allowing multiprocessor configurations at a reasonable cost.

In view of these developments, as well as our own limitations and the time frame of the project, we decided to redirect our efforts away from the development of a unique stand-alone archives records management software package and toward a system or set of systems that utilize commercially available software products. According to this second plan we would adapt existing commercial software and develop a "driver program" that would bring the various commercial components together. The driver program was to include menu selections of archival operations, such as "accessioning" and "researcher registration," as well as operating instructions for archives users

[8]PROFILE is a data base management system marketed by Radio Shack. SCRIPTSIT is a word processor package marketed by the same company. EASY WRITER is a word processing system built for the Apple microcomputer and marketed by Information Unlimited Software, Inc. DB MASTER is a data base management system built for the Apple and marketed by Stoneware Microcomputer Products. VISICALC is an accounting package produced by Personal Software with versions for most popular microcomputers.

and staff.[9]

This strategy, unfortunately, met with problems of its own. In the first place, our approach was based on the assumption that we could break into commercial software packages and alter the code to meet our specific objectives. Because computer companies invest considerable amounts of money to develop these packages, they take great pains to secure them from copyright infringement and unwarranted duplication. Often, the algorithms are so deeply embedded in the programming that efforts to crack the code prove fruitless. More importantly, even if successful, our efforts would have yielded a specialized set of programs with only limited applications and without the portability and flexibility that we want in any MARS package.[10] Thus, adaptive programming appeared as unrewarding as original programming. First, it would prove costly and extremely time consuming. Second, the final product would not be highly portable, hence eliminating or at least seriously limiting its usefulness in a network situation. Finally, the documentation and system updates associated with commercially available packages would not apply once the software was adjusted for use as part of MARS. In fact, any alteration of the original software would undoubtedly void the manufacturer's warranty. Furthermore, the menu-structured "driver" and the user instructions envisioned as part of the system depended upon the type of hardware and software selected by the end user. To set MARS in a particular mold only served to limit the choices of our colleagues, and this was certainly never our intention.

At this point in the project's evolution, we returned to our initial objectives and after further analysis realized that commercially available microcomputer software might indeed satisfy all of our needs. It should be noted that both hardware and software advances have kept well ahead of our ability to even read and digest reports of these accomplishments. The resources, as far as archivists are concerned, are currently available. But how does the archivist take advantage of these developments? As our NEH research project draws to a close, we are in a position to provide some answers and guidance. While not a prototype in the strict sense of the word, our final development scenario does set out the components and general operating principles for a microcomputer system that will both serve the specific needs of archivists and link their respective institutions with those of their colleagues and with a national or international data base as well.

Essentially, our system model is composed of three elements or information sets. The first of these includes the minimal satisfactory hardware configuration for a microcomputer archival information processing system. The second element pertains to the minimal, commercially available software

[9]Portability and flexibility are both important concepts in the context of microcomputer applications in archives. Archival microcomputer software must be portable (i.e., useable on different hardware configurations) if different archival organizations are to benefit from information and resource sharing without the burden of obtaining identical hardware. In addition, the rapid changes taking place in microcomputer technology require that software be easily upgradeable to exploit the potential of the new hardware. Good commercial packages are regularly upgraded by their manufacturers. But specialized, in-house systems would not benefit from these developments. Similarly, archival software needs to be flexible so that different archives with varying procedures and records formats may benefit from the potential of the same system. Software portability and flexibility will allow each institution to operate independently while allowing each to share information with related organizations.

[10]For a detailed discussion of this approach, see Kesner and Hurst, "Microcomputer Applications," pp. 11–18.

packages required to run the hardware sufficiently and economically, and to fully exploit its information and word processing potential. The final component of this package is a conceptual framework within which this hardware and software operate. This latter aspect of our "system" model ties specific archival operations to particular software packages. Through CP/M and MP/M, it also considers portability, multiprocessor configurations, and networking.

Before proceeding to a more detailed consideration of these model elements, it is necessary that we stress, as we have in other publications,[11] the importance of systems standardization. Neither a microcomputer nor a larger main-frame computer system will enhance the efficiency and economy of archival operations unless a degree of standardization exists prior to conversion to a machine-readable form. Accessioning, researcher registration, collection description, and information indexing and retrieval all require a modicum of format control if these records are to be entered into and manipulated by the computer. We of course cannot and need not dictate the exact form these procedures should follow. It is essential, however, that they follow some systematic format before automation is introduced. When the time comes to build a national data base, these structured—though different—formats can in turn be manipulated to establish a common body of information.

Model Elements[12]

Element I: Characteristics of the minimal satisfactory microcomputer configuration.

The minimal satisfactory microcomputer configuration should:

—cost less than $5000 (but the price may rise to as much as $7000 pending upon the cost of the printer and the mass storage device)

—have a display unit, either a television monitor or a television with an adapter

—have a keyboard, preferably with attached number pad

—be equipped with 48K RAM (random access memory) user-addressable memory, or perhaps 64K with CP/M or MP/M operating systems

—be equipped with resident ROM (read only memory) for programming language interpreter, preferably BASIC, though versions with PASCAL, PL-1 and even FORTRAN are also available

—be capable of mass storage by either a floppy disc drive system or a winchester type hard disk system, with a capacity of from 100K to 10 or 20 megabytes

—be equipped with a quality impact printer capable of handling a variety of forms, preferably with changeable type fonts

—be capable of direct connect modem for communication with other systems, or to patch into an information network.

[11]See note no. 5. See also Richard M. Kesner, "Computers, Archival Administration, and the Challenges of the 1980s", *Georgia Archive* IX, 2 (1981): 1-18; and A. Arad and Lionel Bell, "Archival Description—A General System," *ADPA* 2,3 (1978): 2-3.

[12]No effort has been made in this article to define specific computer terms. To a certain extent, earlier MARS articles (see note no. 3) have done this. For more general information about microcomputers and microcomputer technology, consult Charles J. Sippl, *Microcomputer Handbook* (New York City: Petrocelli, 1977); Donald D. Spencer, *Microcomputers at a Glance* (Ormond Beach, Fla.: Camelot Publishing Co., 1977); and Michael Hordeski, *Illustrated Dictionary of Microcomputer Technology* (Blue Ridge Summit, Pa.: Tab Books, 1978).

In choosing the central processing unit (i.e., the computer), minimal microprocessor requirements depend upon the intended uses of the system. The requirements may include:

—sound or color graphics. The 6502 microprocessor (found, for example, in Apple computers) supports these functions

—sophisticated file manipulation and data management facilities, as are necessary to carry out most archival functions. The Intel 8080 or the Zilog Z-80 microprocessor supports these functions, but available software makes a 6502-based system equally attractive at this time.

It is important to remember that the market is changing rapidly with respect to microcomputer technology. As the impact of the introduction of 16-bit and 32-bit microprocessors is felt in the market place, they will supersede the Z-80, the 6502 and other 8-bit microprocessors providing us with machines possessing considerably greater processing power. Even among 8-bit microprocessors, it is essential to compare the instruction sets in order to determine which chip is best suited for string manipulation, or at least to ensure that the desired software will run on that machine.

The following is an outline of the essential requirements for the disk operating system and for the instruction set of the ROM interpreter. A satisfactory disk operating system (DOS) must offer:

—system utilities that ease the processing of file manipulation (i.e., sorting, merging, deleting, appending, backup creation, and file recovery)

—warm restart procedure so that work in ROM is not lost due to system freeze-up

—ease of using DOS commands even though a program is resident in RAM

—dual directory maintenance so that if one directory malfunctions the system defaults to reading the back-up directory

—support of sequential, direct, and ISAM (index sequential access methods).

A satisfactory ROM Interpreter instruction set requires:

—language should approximate ANSI standards as closely as possible; this is essential for communication with other units and networks

—language should promote portability between microcomputer vendors

—language should contain instruction sets that make it easy to do string manipulations; this is essential for text manipulation and information indexing and retrieval

—language should contain capabilities to pass parameters to DOS and then return to the operating program

—language should contain programming conventions that promote structured programming.

Though the typical archivist or records manager may not understand the importance of each of the components of Element I, these components may nevertheless prove useful as a measuring stick with which information managers may evaluate computer equipment prior to acquisition by their organizations. As a simple rule of thumb, it is best to work through an official microcomputer dealer who knows his or her products and can provide services and advice. We would discourage resorting to wholesale distributors and catalog purchases, even of equipment bearing well-known brand names, because such purchases rarely include

the support and maintenance necessary to keep a system running properly. Microcomputer magazines, such as *Creative Computing* and *Personal Computing,* regularly publish equipment reviews that are helpful, and they also provide promotional material on individual products through reader service cards. The effort spent in the selection of a system is well worthwhile. A high-quality hardware configuration will serve as a solid base upon which to build an automated administrative system.

Element II: Characteristics of the minimal commercially available software required by an archivist or records manager to exploit the potential of his or her hardware configuration to the fullest extent.

Operating System (OS): The operating system includes that portion of the system software that manages the rest. In a sense, it talks to other system software and allows these other packages to talk among themselves. For example, let us assume that an archives has established a mailing list of those persons and organizations who are likely to contribute to an endowment fund. This list would be established and maintained using the computer's data base management system. Having established the list, the archives decides to contact these potential contributors by mail through personalized letters. The archives uses its word processor to develop the necessary letter. The staff then turns to the operating system to merge the address files with the letter so that each person receives his or her own personalized letter. Similarly, the clock and date functions on an OS can be employed by some systems to place the correct date on correspondence and memoranda. This characteristic is particularly useful when one seeks to retrieve information from the system when only the approximate date of document creation is known. All microcomputers come with some type of operating system when purchased. However, there are a few OS's on the market, especially CP/M and MP/M from Digital Research, that are quite powerful and are rapidly becoming standard throughout the industry. CP/M and MP/M are discussed more fully below.

ROM Interpreter: All microcomputers include a ROM Interpreter, usually for programming in BASIC. The ROM Interpreter allows the user to prepare specialized programs and to modify commercially produced software packages to meet specific archival needs. Some ROM Interpreters are better than others (see Element I for a listing of essential ROM Interpreter characteristics), and the archivist must therefore be careful in his or her selection.

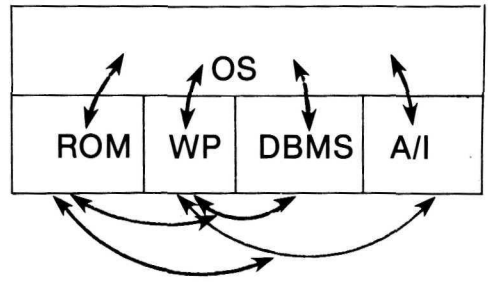
Word Processor (WP): The word processor software package allows for the entry and editing of text. The text may be in the form of a letter, an article, or even a book; it may also be a form, a mailing label, or a brochure. With a good word processor, editing documents is a simple task. As a result, efficiency and productivity—not to mention quality—improve dramatically through the use of WP. Word processors vary widely both in terms of quality and price. As in the case of the OS and the ROM Interpreter, it pays to shop around. Again, trade journals and EDP rating services, such as DataPro, will provide practical advice in this regard.[13]

[13]*DataPro Reports* prepared by DataPro Research Corporation, a McGraw-Hill Company, provide a looseleaf service dealing with most aspects of the computer industry, office automation, word processing, and small computers. At times their information is dated, but it will nevertheless provide novices with an excellent introduction to various options so that they can raise important issues when discussing hardware and software with dealers and sales representatives.

Data Base Management System (DBMS): A DBMS serves the computer user in a variety of ways. One may, for example, establish records for various archives operations, such as accessioning and researcher registration, through the use of a DBMS. Once the information format is established for the record in question, clerical personnel may then enter the information with minimal supervision, thus freeing the professional archivist for more creative duties. The archives can also employ the DBMS to retrieve information from each created data base. One may, for instance, wish to call up a specific accession record. By using a DBMS this could be accomplished through a search by accession number, donor name, collection name, date of receipt, or shelf location. The DBMS would also serve as the information indexing and retrieval system for accessing collection descriptions where search terms are entered and the computer responds with collection names and disk locations. The user could then call up specific collection guides prepared previously on the word processor and stored on other diskettes.

Accounting/Inventory Module (A/I): The A/I Module provides the microcomputer with the software to manipulate tables of figures and to manage statistical information. There are many packages on the market that do this; the best and most popular remains VISICALC, which is available for use with most microcomputers. The A/I Module would be used in an archival setting to manage budgets, grants, personnel, and supply inventories.

A complete list of the basic software required for a stand-alone microcomputer system would therefore include: an operating system, a ROM interpreter, a word processor, a data management system, and an accounting/inventory module. Schematically, these pieces fit together as follows:



All of the software packages interact with the operating system. The operating system and the ROM interpreter can work together to add those enhancements to the remaining commercially-obtained software required for use in archives. It must be noted, however, that such enhancements require the breaking of the software codes for these packages, which is a time-consuming and highly specialized (thus expensive) task. In the view of the MARS project staff, it is better to select general purpose software carefully and to use it to the fullest extent. This may require some compromise on the part of the archivist, but in terms of time savings, efficiency, and better services, this small sacrifice is well worthwhile.

During the course of our research project, we worked with the standard Radio Shack (TRS-80) I, II, and III and Apple II Plus operating systems as well as CP/M. CP/M was found to be far superior to the rest for our needs. Of the ROM interpreters, the Z-80 is more useful for string manipulations and therefore more useful in an archival setting than the Apple 6502. We worked with the following word processor packages: APPLE WRITER, MAGIC WINDOW, EASY WRITER, and SCRIPSIT. The latter two packages are quite good and met our requirements in terms of finding aid and publication generation. Both DB Master (Apple) and Profile (Radio Shack) worked well as data base management systems. Finally, we relied upon VISICALC for

our accounting/inventory operations. We saw no need to seek alternatives to this excellent software package.

Element III: Microcomputer Archives and Records Management Systems (MARS):

Having experimented with a variety of hardware configurations and software packages, we are now in a position to make some general observations concerning the employment of these components in an archival setting. We do not have an overall program that will drive the rest. Instead, we have provided a series of guidelines from which the reader may choose in developing a MARS. Individual applications will vary according to the financial resources of the host institution, the degree to which the archivist has standardized office procedures, and the creativity and conscientiousness of archives personnel. Our observations fall into two general categories: those pertaining to a stand-alone system, and those pertaining to a multi-terminal in-house or inter-institutional system.

The stand-alone application assumes that all automated operations within the archives will take place at a single location. The activities envisioned include: collection accessioning; collection description; researcher registration; financial management and budget planning; supply inventory control; personnel management; grants administration; correspondence and forms management; mailing list maintenance; finding aid generation; information indexing and retrieval; special publications generation (e.g., the creation of bibliographies, pamphlets, and brochures); and user/staff services (e.g., training, instructional, and orientation packages designed to address specific educational needs). According to our scenario, the archives obtains the necessary computing power through Elements I and II. The following model indicates which aspect of the system can handle a given archival function:

—OS: manages the overall operation of the system and therefore allows the computer packages to perform their prescribed tasks.

—ROM: provides for the specialized enhancement or alteration of commercially obtained software packages in conjunction with the OS and also for the creation of specially tailored archival software. All of this will prove expensive and difficult. ROM, however, can be employed with great success and without considerable effort in the area of computer assisted instruction (CAI). In this instance, the archives prepares instruction modules for both users and staff dealing with such topics as "the resources of the archives," "research techniques," "document conservation," "collection processing," "security procedures," and "operating the reference desk." This application will prove extremely economical in large archival institutions. CAI has demonstrated itself to be an excellent tool in this regard.

—WP: capable of collection description (text preparation), correspondence and forms management (text and forms preparation), grants administration (preparation of applications and reports), finding aid preparation (text preparation), general administration (preparation of reports and memoranda as well as more routine correspondence), reference services (correspondence and report generation), and special publications (text preparation and layout work).

—DBMS: capable of collection accessioning (creation and retrieval of records), research registration (creation and retrieval of records), collection and reference services use (statistics and record keeping), mailing list maintenance (creation and retrieval of

records), general administration (statistics and record keeping), and information indexing and retrieval (creation and retrieval of records).

—A/I: capable of financial management (on-line ledger; daily cash flow), budget planning (report generation and projections), supply inventory control (on-line accounting; automatic ordering; report generation), and grants administration (on-line ledger; daily cash flow; report generation).

The multi-unit system assumes that the information environment requires more than one work station in-house. This would be true of archival institutions where collection processing, accessioning, and reference services all take place in different and distant locations. Any large archives would certainly fall into this category but even small archives that experience heavy use may require more than one microcomputer work station. Otherwise, users and reference staff will keep the unit so busy that word processing, accounting, and other administrative operations may begin to pile up. Furthermore, the National Historical Publications and Records Commission (NHPRC) in the United States and the National Information Systems Task Force (NISTF) are currently at work on elements of what may become an international data base for archival holdings in the United States and Canada. During the course of our research, we have always kept the activities and objectives of the NHPRC and the NISTF in mind. We do not foresee any problem in combining microcomputers with this centralized system, and indeed, we view the microcomputer as the essential element in the creation of economical, machine-readable collection descriptions for input into the system.

—For in-house or inter-institutional networking, a microcomputer requires a multiplexer and a modum communication device with a RS-232C computer circuit board. The multiplexer allows a number of microcomputers to talk to one another. The modum and board serve as the communication device. For example, in a large archives, one could join as many as eighty Radio Shack TRS-80 IIIs to a host TRS-80 II through the use of a multiplexer. If the correct operating system is used these networks need not employ the same hardware configurations or software packages to communicate.

—This brings us to CP/M and MP/M (i.e., Control Program for Microcomputers, and Multiprogramming Monitor for Microcomputers – both Digital Research trademarks). CP/M is a powerful single-user operating system built for the 8080 and the Z-80 microprocessor. MP/M is the multi-user or multi-terminal equivalent of CP/M. Since their introduction, these two operating systems have gained rapid and continuing popularity in the small computer field and have in fact become de facto industry-wide standards in what is otherwise a highly diversified field. Thousands of programs in a dozen or more languages have been developed for systems running CP/M, and the system operator can choose from a range of languages not found in most larger computer configurations. Because of the standardization that CP/M has brought to microcomputer systems, it is possible to obtain commercial software to run on a system with no modifications even though the package may have originally served another machine.

—The implications of CP/M standardization are profound. In the first place, CP/M transforms a given microcomputer into a more powerful and more flexible device. Second, it

eliminates the concerns over portability and networking that are so central to any discussion concerning the creation of a national data base for archival information. Third, it dramatically strengthens the case for the employment of microcomputers in archives for both intra- and inter-institutional information management. Thus, archivists will be free to obtain the hardware and software that most closely reflect their particular needs and budgetary limitations, while ensuring the compatibility with the greater national system.

Conclusions

The three-element scenario presented in this report affords a number of options to the archivist concerned with the introduction of a microcomputer system into his or her institution. We have taken the liberty of making a few specific recommendations related to our concern that the hardware and software obtained for the purposes of automated archival administration meet certain minimum standards. The cost of such an acquisition remains quite reasonable, no more than $5000 to $7000 depending upon the printer and the mass storage device chosen. An additional $1000 will be required to obtain the various software packages. But for this small investment, one will acquire a system that will significantly improve both the quality and quantity of work generated by the archives staff. The universal move in the private sector toward use of word processing and electronic mailing testifies to the practical nature of this move alone. When one also considers the numerous applications for the accounting and data base management systems, and when one realizes how much of this is done manually at greater expense and perhaps ineffectively, one may make a strong case indeed for the introduction of microcomputers to archives at the earliest possible date.

That trend has in fact already begun. Major archival institutions in the United States, Canada, and Western Europe are currently studying the microcomputer for use in their programs.[14] Furthermore, the National Information Systems Task Force has included the development of a microcomputer-based data entry system as part of its larger plans. The proposal calls for the design of a user-friendly software package that will employ the standardized descriptive format currently under consideration by the Task Force. Finally, the introduction of 16-bit and 32-bit microprocessors will influence future trends in microcomputer design and development. In all likelihood, five years from now we will witness the advent of extremely powerful and yet affordable microcomputers. Mass storage devices are also becoming affordable. Indeed, the diskette may be on the way out except as a back-up storage device to be replaced by inexpensive hard disk devices.

Technology is moving very quickly. In response, some of the finest minds in the field of microcomputer software are working overtime. At long last, the developers and producers of microcomputers are discussing standardization that will in turn facilitate communication between archives, records centers, and other information vendors. Even as this article goes to press, the trade journals are announcing breakthroughs in programming and impressive new prod-

[14]During the course of our project, we have exchanged information with colleagues at the Public Archives of Canada (Ottawa), the Jewish Federation of Canada (Montreal), Massachusetts Institute of Technology (Cambridge), the Smithsonian Institution (Washington, D.C.), the University of Washington (Pullman), the Catholic Documentation Center (Nijmegen, The Netherlands), and the University of Western Ontario (London).

ucts. Furthermore, the climate of opinion among archivists towards automation has so brightened in recent years that many professionals are now seeking ways to introduce the computer into their own shops.

All of this activity may prove intimidating. Many have asked, "Why should I buy a microcomputer now when next year an even better one will be available?" Microcomputer manufacturers are sensitive to this point and are therefore building "upgradability" into their machines. The IBM personal computer with 16-bit technology is an excellent example of this practice. In the final analysis, however, a microcomputer system must meet the needs of the particular institution. The fact that it may not be the latest "model" is hardly relevant. If carefully planned, the shift to microcomputers offers the greatest potential for economically and constructively addressing the future administrative and information needs of archives.