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Microcomputers and Local Government: A Handbook -- Instructors' Manual

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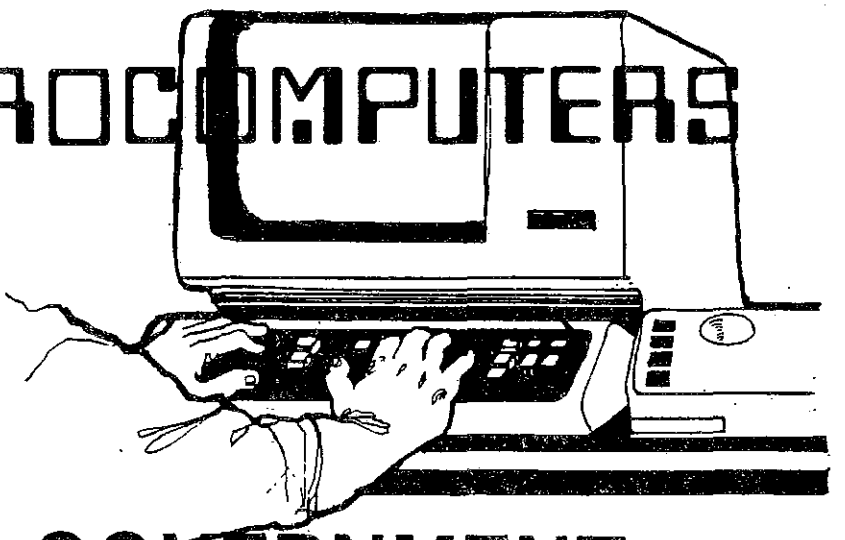

AND LOCAL GOVERNMENT:

A HANDBOOK

INSTRUCTOR'S

MANUAL

By Donald F. Norris

Development of this handbook was supported by a grant from the W. K. Kellogg Foundation.

NOTES TO INSTRUCTORS

This handbook, and its accompanying instructor's manual, was written to be used with a one- or two-day workshop on microcomputers and local governments. The handbook was designed for the local government official with little or no familiarity with microcomputers and their applications to the world of government.

The instructor's manual differs from the participants' handbook in three respects. First, the instructor's manual contains "Notes to Instructors" and brief introductions preceding each chapter outlining the contents and providing a few suggestions about ways to teach the material.

Second, throughout the instructor's manual, circled numbers appear in the margins of the text. These refer to the overhead transparencies that accompany the manual. The number is a signal to the instructor to use the appropriately numbered overhead at that point.

Third, a complete set of printed versions of the overheads is included. These may be made into transparent slides for use in the workshop.

Otherwise, the participants' handbook is identical to the instructor's manual.

A 16 mm. color film entitled "The Personal Touch: Microcomputers and Local Government" has been produced to accompany the workshop. This film may be purchased or rented from the Center for Applied Urban Research at the University of Nebraska at Omaha. The film (or its videotape version) is recommended for use as an introduction to the workshop as it closely parallels the handbook and provides a brief but clear introduction to micros and local governments. The film should help students to grasp more readily the concepts that are taught in the workshop.

In conducting the workshop, instructors should encourage participants to ask questions AT ANY TIME DURING THE PROGRAM. Instructors should be especially sensitive to participants' possible fear of asking questions that might appear to indicate their ignorance of microcomputers.

Instructors should not use technical computer jargon. As limiting as this might be, the excessive use of jargon is guaranteed to lose participants or worse, to turn them off or make them hostile. When the use of jargon is necessary, carefully define terms employed and relate them to everyday words that ordinary persons can understand.

Instructors should use examples, lots of examples, concrete examples, especially examples from governmental organizations.

This workshop is for governmental managers and administrators who need to know a little about the technology and a lot about how to acquire it safely and use it intelligently. Instructors should be especially careful about getting too technical.

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PREFACE

This handbook has its origins in a conversation between the author and Dr. Theodore Maher in the spring of 1981. The conversation centered on the role that we believed soon would be played by microcomputers in local governments and the concomitant need for training and technical assistance in the acquisition and use of microcomputers.

Data on local government microcomputer ownership, some of which are reported in this handbook, have sustained our intuitive feeling of three years ago that these marvelous devices would quickly be acquired by cities and counties throughout the country. Current projections suggest that microcomputer acquisition by governmental organizations will continue unabated for some time.

Following up on the conversation with Ted Maher proved at once easier and more frustrating than imagined. Development of a concept paper for a project to develop training and technical assistance materials and programs on microcomputers and local government was a fairly straightforward enterprise. Securing funding to carry it out, however, proved more difficult. Happily, the W.K. Kellogg Foundation saw merit in the project and in July, 1982 awarded the University of Nebraska's Center for Applied Urban Research a two-year grant for it. This handbook is one of several components of that project.

The handbook was written to be used as part of a one- or two-day workshop on microcomputers in local government for persons with little or no familiarity with the subject. It was also designed so that it could be used as a stand-alone document for persons who are more well-versed in the technology. The standard documents in the Appendix were developed from demonstration projects in the acquisition of microcomputer systems by small local governments. They are provided for use by governmental organizations in determining their computing needs and in acquiring microcomputer systems.

An instructor's version of the handbook, for use by persons who intend to conduct workshops, is available. It contains suggestions for presenting the materials and includes all of the visual aids (overhead transparencies) used in the workshop.

A 20-minute color film (and videotape), entitled "The Personal Touch: Microcomputers and Local Government," is also available. The film closely parallels the handbook and can be used as part of the workshop for governmental officials or as an introduction to microcomputers for local governmental officials, school organizations, and civic groups.

Donald F. Norris
Omaha, Nebraska
June, 1984

ACKNOWLEDGEMENTS

Development of this handbook involved several persons whose efforts the author wishes to acknowledge. David R. DiMartino played a major role in developing the standard documents for acquisition of microcomputer systems found in the Appendix, either authoring or co-authoring all of them. Robert Hober compiled the list of software vendors and called all vendors to confirm their offerings. Richard E. Yeager and Herbert A. Allaire of American Fundware, Inc., consented to the use of a modified version of their standard software agreement, and Michael Carpenter, MIS director of the city of Omaha, agreed to the use of a modified version of his specifications for purchase of a microcomputer.

B. J. Reed, associate professor of public administration at UNO, and Vincent J. Webb, director of the Center for Applied Urban Research, David R. DiMartino, Michael Carpenter, and members of the project advisory committee reviewed the draft manuscript and provided many helpful comments that have been incorporated in the final version of the handbook.

Marian Meier edited the author's prose and, as always, improved its readability. Mrs. Meier also supervised production of the handbook and developed the index. She was assisted by Tammy Wiles, Denita Walker, Theresa LaHood, and Patricia DeLancey.

Joyce Carson did the typesetting for the entire text and the Appendices. Initial drafts were prepared by Loni Saunders. Artwork was provided by Bruce McCorkindale, UNO undergraduate student.

Finally, special thanks are due to Dr. Gary W. King, project director, W. K. Kellogg Foundation, for his faith in and support for this project.

PROJECT ADVISORY COMMITTEE

The persons listed below deserve separate acknowledgement because of the role they played as reviewers and advisors. Their assistance began with informal discussions with the author and included numerous telephone conversations, group meetings, and review of the manuscript for the handbook. Along the way, they provided sound advice that helped to shape not only this handbook but also the larger project of which it is a part.

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NOTES TO INSTRUCTORS

Chapter I. Introduction

The introductory chapter is general in nature and designed to open the subject of micros in a non-threatening manner. It provides clues to the popularity of micros in government, data from recent surveys of microcomputer use, and findings from demonstration projects in microcomputer adoption and use in local governments.

The purposes and limitations of the handbook (and, implicitly, the workshop, also) are stated. These bear emphasis by the instructor. The purposes are:

1) to provide an overview of computers and data processing—especially for the local official with limited (or no) prior exposure to this complex subject;

2) to provide an introduction to microcomputers and their uses and limitations in governmental organizations; and

3) to provide a set of tested guidelines and procurement documents for governmental officials to use in acquiring microcomputer systems.

Workshop participants should be reminded that the workshop is at the introductory level and that persons with a fair amount of knowledge about computers may be disappointed, that the handbook and workshop are not technical in nature but instead are aimed at the needs of governmental managers and administrators, and that no one will walk away from the workshop as an instant expert in the subject of micros and government.

I. Introduction

A. THE MICRO REVOLUTION

In 1976, two young Californians named Steve Jobs and Steve Wozniak started a revolution. It was a quiet revolution. . . no shots were fired. . . no demonstrations occurred. . . there were no casualties, but it was a revolution nevertheless. . . a revolution that will have long-lasting results. That year these two young men developed the Apple, the first commercially successful microcomputer.[1]

(1)

> Between the development of the world's first computer in 1946 and the introduction of the Apple, about 500,000 computers of all kinds were installed. Between 1976 and 1984 over 10 million microcomputers were sold, 20 times the number of larger computers that had sold in the first 30 years of electronic computing.[2]

Microcomputers, also known as personal computers, are affecting the way organizations do their work in a number of ways. Most importantly, they have brought computing or data processing to a "personal" level. That is, for a few hundred to a few thousand dollars, persons who are not programmers, systems analysts, or technicians can acquire computer systems that can be easily used to perform a wide range of tasks more rapidly, more accurately, and more efficiently than with any other available technology.

Micros offer potentially numerous benefits to their users. However, sales are far ahead of society's knowledge of these machines and how to acquire and use them effectively. This is especially true among America's local governments. Yet, data from recent studies indicate that large numbers of local governments will purchase micros in the next few years.[3]

B. MICROCOMPUTERS AND LOCAL GOVERNMENTS

A great deal of information exists on microcomputers. Much of it is sales literature aimed at persuading people to buy them. Other material is written by vendors, consultants, and reporters for the popular media.

Information from these sources tends to contain four common themes: *1) micros are inexpensive*—almost anyone can afford one, *2) micro sales are growing rapidly*—almost everybody has one, *3) micros are easy to use*—almost anybody can use one, and *4) micros have tremendous capabilities*—almost anybody can do almost anything with one. (2)

Escaping this literature is difficult. Whether watching television, waiting in a dentist's office, riding in an airplane, or just reading the daily newspaper, people are bombarded with information about micros.

One unfortunate aspect of this material is that very little of it is based on hard research into the acquisition and use of microcomputers. Instead, it is based on opinion, speculation, and superficial observation. Happily, a body of research-based information on the acquisition and use of microcomputers in local governments is beginning to appear. The following paragraphs present some of the more salient findings of that research.

First, according to two recent studies, relatively few local governments own and use micros. A 1982 study for the International City Management Association found that 13 percent of city govern- (3)

ments had them. In 1983 the University of Nebraska at Omaha's Center for Applied Urban Research determined that 7 percent of cities under 50,000 and counties under 100,000 in the plains and mountain states had micros.[4]

1982 STUDY – 13 percent of city governments had micros.
1983 STUDY – 7 percent of cities under 50,000 and counties under 100,000 had micros.

This relatively meager use of microcomputers by local governments is not surprising. Micros have been on the market only a few years, and local government use of new technology generally lags behind that of other sectors of society. However, by another measure, local government use of micros fares relatively well. According to the president of Apple Computer, John Sculley, only about 7 percent of Americans used micros in their homes or in their jobs in 1983.[5]

Second, according to the ICMA study three brands constituted the majority of micros used by local governments. These were Apple, IBM, and Radio Shack.[6] These three companies have the largest share of the nationwide microcomputer market so their presence in large numbers in local governments should not be surprising.

Third, micros were used primarily for word processing and financial management.[7] Although many other functions were reported, few local governments used their systems extensively. Two of the reasons for this are that micros are typically single user, single function systems, and that most of the currently available programming is for word processing or related to financial management.

Fourth, the University of Nebraska at Omaha survey found that 11 percent of small cities and counties planned to buy microcomputers in the next two years while the ICMA survey set the figure at 35 percent of city governments.[8] (4)

This means that a substantial market potential exists among local governments. It also means that as many as three times the number of current local government microcomputer users will actively be seeking such systems.

Demonstration projects in microcomputer acquisition and use in small local governments in Nebraska have also produced findings of interest and value.

First, and perhaps most important, a new class of microcomputer sales organizations has begun to appear in the local government marketplace. These organizations, patterned after the OEM's for minicomputers, offer "turnkey" systems and "packaged" application software designed specifically for local government activities.

OEM – original equipment manufacturer
Turnkey vendor – sells a complete system
Packaged software – programming written for a specific function (5)

OEM stands for original equipment manufacturer, but in the world of computers it is often a misnomer. A computer OEM usually is an organization that develops programming for particular brands of hardware and then adds this programming to the hardware and sells the hardware and software together. OEM's are also *turnkey vendors.* That is, they sell a complete system, install it, provide user and operator training, and turn the

IBM

Radio Shack®

apple computer inc.

system over to its owner, providing continuing support as required. *Packaged software* is programming that is written and sold as a package to perform a specific function, such as fund accounting or payroll, but with sufficient flexibility to be used by organizations that have differing computing requirements. The next few years can expect to see an increase in the number of microcomputer OEM's, turnkey firms, and developers of packaged programming designed for the local government market.

A second finding of the Nebraska demonstrations is that microcomputers are not appropriate solutions to the computing needs of all classes and sizes of local government or for all governmental functions.

For some governments and some governmental activities, mainframes or minicomputers are required. While no magic formula exists to determine whether to use a micro, mini, or mainframe, the size of the organization, the size of the data base, and the number and complexity of the activities to be performed are important indicators. The larger the organization, the larger the data base, and the more numerous and complex the activities, the more likely a larger computer will be required.

Finally, the Nebraska projects have shown that with adequate outside technical assistance or in-house expertise, small local governments can use the procurement method discussed later in this handbook to determine their computing requirements and acquire and implement microcomputer systems.

C. PURPOSES OF THIS HANDBOOK

(6)

The history of local government use of computer technology is filled with examples of both successes and failures. The successes show that computers can be used effectively and efficiently, provide valuable information for management purposes, and do the work of scores of people. Indeed, many local governments would find doing without their computers impossible and would find the cost of replacing computer performed functions with personnel to be prohibitive. The failures of computer systems in local government include examples of systems that were too costly, systems that failed to perform up to reasonable expectations, hardware inadequacies, software failures, and worse.

The question confronting local governments today is how to ensure that the acquisition and use of microcomputers can be successful. This handbook and its accompanying training program are dedicated to this question.

The purposes of this handbook are:

1) **to provide an overview of computers and data processing,**
2) **to introduce readers and workshop participants to microcomputers, their potential uses in governmental organizations, and their limitations, and**
3) **to provide a set of procurement guidelines for local governments that plan to acquire microcomputer systems.**

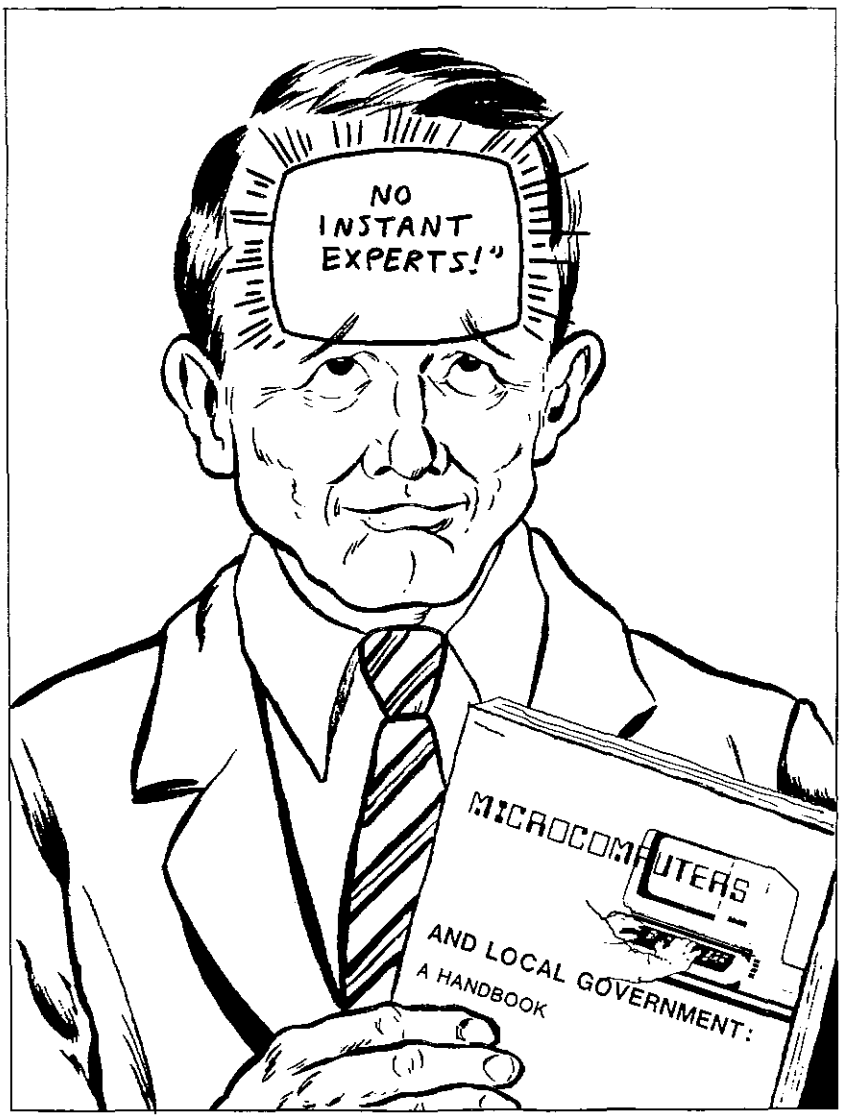
The handbook will delve into the functions of computers, look at recent research findings on computer use in local governments, examine the technology of the microcomputer, describe different types of hardware and software, and review some of the more important issues concerning microcomputer use in local government. The appendices contain sections covering different types of microcomputer hardware and provide standard documents for the acquisition of microcomputer systems.

This handbook is designed to accompany a one- or two-day workshop for governmental officials. It has also been written to be read independently of a workshop by the governmental official who has a modicum of knowledge about data processing and microcomputers.

Several things should be borne in mind about this handbook. It is written at the *introductory level* and presumes that the reader has little knowledge of micros and their use. It is *not a technical book*, so persons with technical backgrounds and extensive experience in computers and data processing may be disappointed. It does not address such issues as chip technology, internal system architecture, programming, data communication, and other essentially technical issues. Instead,

its principal focus is one of simplifying an otherwise complex and often incomprehensible subject so that potential users who are not technical experts will become more knowledgeable about how to acquire and use microcomputers.

This handbook *will not make the reader an instant expert.* It will provide useful information about a difficult subject, provide a key to the jargon or specialized language associated with computer technology, and it will address a number of management issues involved in computer use in government. More than this should not be expected. In fact, the interested reader should seek information about microcomputers from several sources. These include books and periodicals on micros, calls and visits to other governments that use them, and visits to microcomputer sales outlets. The potential user is urged to ask questions, examine systems, and actually sit down at the terminals of various microcomputers and try out programs that are offered on them.



NOTES TO INSTRUCTORS

Chapter II. Computers and Data Processing: A Primer

This chapter deals with four major topics: data processing and information management, the uses of information in organizations, the evolution of computer technology, and the principal functions of computers.

The major theme that the instructor should emphasize is that COMPUTERS EXIST TO PROVIDE INFORMATION FOR MANAGEMENT PURPOSES in organizations. Therefore, users need to know what data processing is, what information is, what information management consists of, and how information is or can be or should be used in organizations.

The section on the evolution of the technology is provided to give participants some sense of the history of this rapidly changing technology and also to inform them of the differences between earlier, larger, more forbidding computers and today's small, easy-to-use micros. In this section, the instructor should not emphasize the technical elements of that evolution but rather the differences in function and capability that each new generation of computers has made available.

The discussion of the functions of a computer, although brief, is very important. Instructors will note that the cartoon on page 10 (also an overhead transparency) is closely related to the text and should be so used. For each of the technical functions of the computer a corresponding function exists in the "everyday" system that most people are familiar with. Use of this cartoon provides an easy and comfortable way to break the technical ice by using a graphic example easily understood by most persons to describe the computer's function.

II. Computers and Data Processing: A Primer

A. DATA PROCESSING AND INFORMATION MANAGEMENT

ALL LOCAL GOVERNMENT personnel, especially those in management positions, are regularly involved in data processing whether or not they know it. This is true for users of manual systems as well as those who have computers.

Data processing means the collection, compilation, and manipulation of diverse facts available to an organization in order to produce information. (8)

Information is a coherent, organized body of data that provides its user with knowledge about an event, activity, or phenomenon. (9)

What does this really mean? Whenever data and information are discussed, an old comedy routine about partial sports scores comes to mind.[9] A partial score might read as follows: Lions 17. Partial scores are data. That is, they are diverse facts lacking coherence and organization.

Information, on the other hand, would be the complete score: Lions 17—Packers 14. Information is made up of data, but it is complete, coherent, and organized in an understandable and usable manner.

Information is a valuable resource. Complete, accurate information will enable governmental officials and personnel to make sound decisions regarding the organization and its activities.

The purpose of data processing, especially automated data processing, should be to provide complete, accurate, and reliable information for management purposes.

Organizations use data processing systems for other reasons as well. These include cutting costs, improving efficiency, reducing or holding down the number of personnel, recognizing that automation is the only feasible means of getting a particular job done, and peer pressure.

The purpose of data processing—to provide complete, accurate, and reliable information for management purposes. (10)

For routine data processing activities such as processing payroll checks or water bills, the first goal of management is often to improve methods of performing repetitive tasks on voluminous data. Only secondarily does management consider producing information for decision-making purposes. Yet, even in these routine areas, data processing produces valuable information.

An automated payroll system should give information about total payroll costs and payroll by department, function, project, and class of employee, and more. An automated water billing system should furnish information on volumes of water used by class of customer, increases or decreases in total water use, seasonal use variations, and percent of customers with overdue bills. These are just a few examples of information that should be made available to local government from two relatively routine data processing activities. What is true of these activities, of course, is also true of others—*data processing should provide useful information for management purposes.*

Data processing should provide useful information for management purposes.

What is meant by *management purposes*? The definition used here is *anything that a local government's decision-makers and managers decide they need to know in order to do their jobs.* Returning to the example of payroll processing, payroll information by project enables managers to undertake project cost accounting to ensure that a specific task, like a street resurfacing, is completed within the budget. This is information for management purposes.

Management purposes—anything that a local government's decision-makers and managers decide they need to know in order to do their jobs. (11)

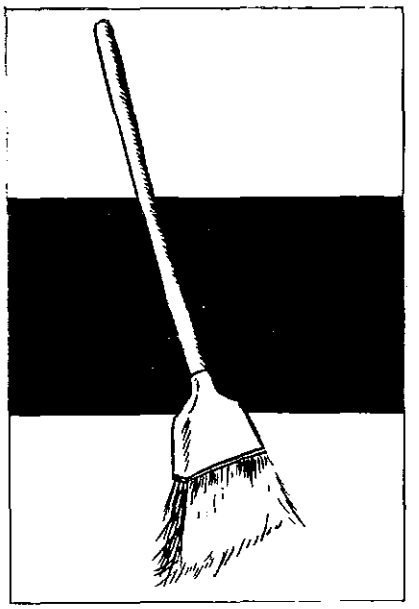
B. USES OF INFORMATION IN ORGANIZATIONS

Information can be used in many different ways and for many different purposes. The nature and purposes of the information vary with the type of organization. A sales organization will be interested in such things as inventory control, sales figures, gross receipts, net profit, and so on. A physician's office will want to have accurate patient records and also be able to calculate patient bills. A school system will want to maintain student records and do class scheduling, and on and on.

Two fundamental types of information management, regardless of organization, are *housekeeping activities* and *decision-making activities*.

Housekeeping activities include a variety of mundane, everyday functions that nearly all organizations perform.

HOUSEKEEPING ACTIVITIES (12)
- budgetary accounting
- general ledger accounting
- accounts payable
- cash management and accounts receivable
- payroll
- personnel management
- utility billing and accounting
- tax billing and collection
- departmental record keeping
- word processing.



With the exceptions of word processing and certain aspects of departmental record keeping and personnel management, housekeeping activities are mainly concerned with financial management or preparing for and controlling the flow of funds to, within, and from a governmental organization.

Small governments and smaller sub-units within larger governments may perform these functions without computerization, but almost all larger governments use computers.

Decision-making activities are significantly different from housekeeping activities. The former may use much of the same information as the latter but their purpose is different. The purpose of budgetary accounting, a routine housekeeping activity, is to produce information about actual revenue and expenditures in relation to their budgeted (or projected) occurrence and in relation to the previous year's actual occurrence.

DECISION-MAKING ACTIVITIES (13)
- spreadsheet programs
- data base management
- decision support

Budget preparation, on the other hand, is a decision-making activity. Persons involved in the budgetary process will use data from the budgetary accounting system but will not stop there. Their

principal objective is to project future budgetary conditions. To do so, these persons will ask "what if" questions about future revenue and expenditures. Where the purpose of budgetary accounting is essentially to keep track of existing financial conditions, budget preparation attempts to provide information so that policy-makers can decide what to do in planning for the next budget cycle.

In the world of microcomputers, *spreadsheet* programs (such as VisiCalc, Multiplan and others) enable local government personnel to prepare their budgets by asking questions like: "What if all personnel receive a 5 percent raise?" "What if the cost of fringe benefits increases by 10 percent?" "What if tax revenues decline by 1 percent?" Spreadsheet programs allow managers to receive immediate answers to the effects of these "what if" conditions. Armed with this information, policy-makers can plan more knowledgeably for the coming year's budget.

Another example of decision-making using microcomputers is data base management. Two examples of data base management programs are dBASE II and DBMaster. They enable local governmental personnel to use standard English-like commands to create their own files, sort through files on a system, produce unique reports, combine data from separate files, and perform many other functions.

Reflect, for a moment, on the difficulty of manually sorting through personnel records to complete federally required Equal Employment Opportunity reports. In one medium size city, these reports were prepared each year by a personnel technician who physically reviewed each of more than 2,500 personnel files to extract required information. A data base management program can change this from a major task to a relatively short and simple exercise.

Data base management programs can also simplify other activities by providing information quickly and in a form desired by management. Like spreadsheet programs, they provide information for decision-making purposes. However, housekeeping activities far outweigh decision-making activities in current local governmental use of computers. Yet, the highest and most sophisticated use of microcomputers may well be to aid in decision-making.

C. EVOLUTION OF COMPUTER TECHNOLOGY

The world's first electronic computer, which became operational in 1946, was called ENIAC, standing for *e*lectronic *n*umerical *i*ntegrator *a*nd *c*alculator. It was a huge machine, containing thousands of vacuum tubes. It weighed 30 tons, was hard-wired for up to 6,000 individual switches, and was kept in a large, environmentally controlled

room. It operated at a speed in the millisecond range (1/1000th of a second) which, while slow by today's standards, was considerably faster than most people can balance their checkbooks.[10]

In the span of a single generation, computer technology has gone through four distinct developmental stages or technological generations. *First generation vacuum tubes* were replaced in the late 1950's by *second generation transistors.* The *third generation* was born in the mid-1960's when solid logic technology reduced the electronic innards of the computer to silicon chips, and *integrated circuits* replaced transistors.

The *fourth generation* of computer technology followed rapidly on the heels of the third and is based on what is called *VLSI* or *v*ery *l*arge *s*cale *i*ntegration. Using sophisticated photo-etching techniques, circuits containing the equivalent of tens of thousands of transistors can be placed on a silicon wafer the size of a fingernail. This has also made possible the latest revolution in computer technology—the microprocessor or computer on a chip.

With each new generation, computers have become faster, smaller, less expensive, more reliable, and easier to use. Hence, computer technology is one of the few areas of the economy where price has actually declined in relation to capability in the past three decades. This has led, in part, to the increasing adoption and use of computers.

The state-of-the-art in commercially available computers is equipment or hardware based on VLSI. These can be either mainframes, minicomputers, or microcomputers. Their internal speed is currently in the nano- or pico-second range (one-billionth or one-trillionth of a second), and they can be accessed by an operator through a standard cathode ray tube (CRT) or computer terminal. Prices for state-of-the-art equipment range from a few hundred dollars for microcomputers to several millions for super computers.

D. FUNCTIONS OF A COMPUTER

COMPUTER FUNCTIONS
- **Input**
- **Processing**
- **Storage**
- **Output**

A computer is an electronic device capable of performing four basic functions:

- input—placing data into the system
- processing—manipulation of data
- storage—maintenance of data
- output—retrieval of data and information.

These functions are performed using electronic media or devices (computer terminals, disk drives, printers, and others). The use of electronic devices often gives rise to confusion and apprehension. However, information management on a computer is conceptually no different from using a pencil and paper, a calculator, and a file cabinet.

On page 10 is an example of information management using the basic technology available to most organizations in their daily activities without the use of a computer. The data *input* function is analogous to the "in" basket sitting on the desk. This is where data, in the form of diverse facts and figures, arrive for consideration and action.

Processing occurs using a pencil and paper, a calculator, and a human brain. In this function the data are converted to information. An example might be a clerk or manager receiving overtime reports from various departments. These reports contain data. Manipulation or processing of these data will produce documents reporting on overtime use by department, project, and program, and will allow analysis of overtime against the current year's budget and in comparison to last year's budget. This type of information is something that many organizations would find valuable since it can be used to maximize operational efficiency. Data processing, whether manual or automated, is required to produce information from raw data.

Data and information *storage* in this system is handled in manila file folders that are kept in the vertical filing cabinet.

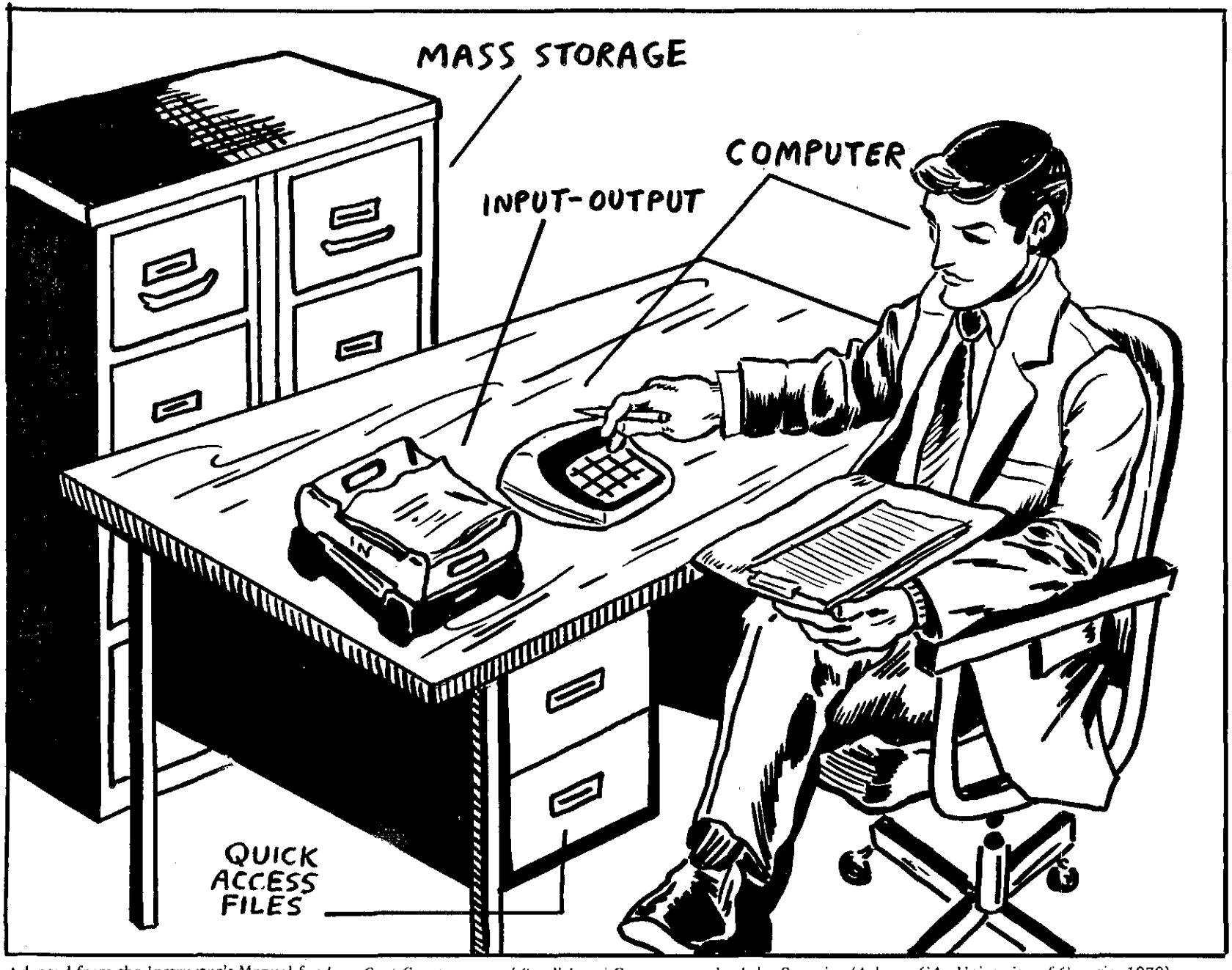
Output is the placing of a printed or typed report in the "out" basket. The report is delivered to other persons in the organization and used by them.

The major differences between information management using the basic technology shown on page 10 and using an electronic computer are:

- Speed—computers are thousands of times faster than manual systems.
- Accuracy—computers calculate with a high degree of precision and are extremely retentive. That is, they do not forget unless they are told to do so. This also means that they will act on bad programming and data just as well as good.
- Efficiency—computers can perform the work of several people—even tens or hundreds.
- Equipment—instead of in and out baskets, vertical files, and calculators, data processing on a computer uses CRT's, CPU's, disk drives, and printers. (These and other computer devices will be discussed in greater detail in Chapter III.)
- Complexity—owing primarily to the technology itself, even simple computer systems are far more complex than manual systems. Among other things, this means that good backup and restoration procedures are essential in case the system fails.

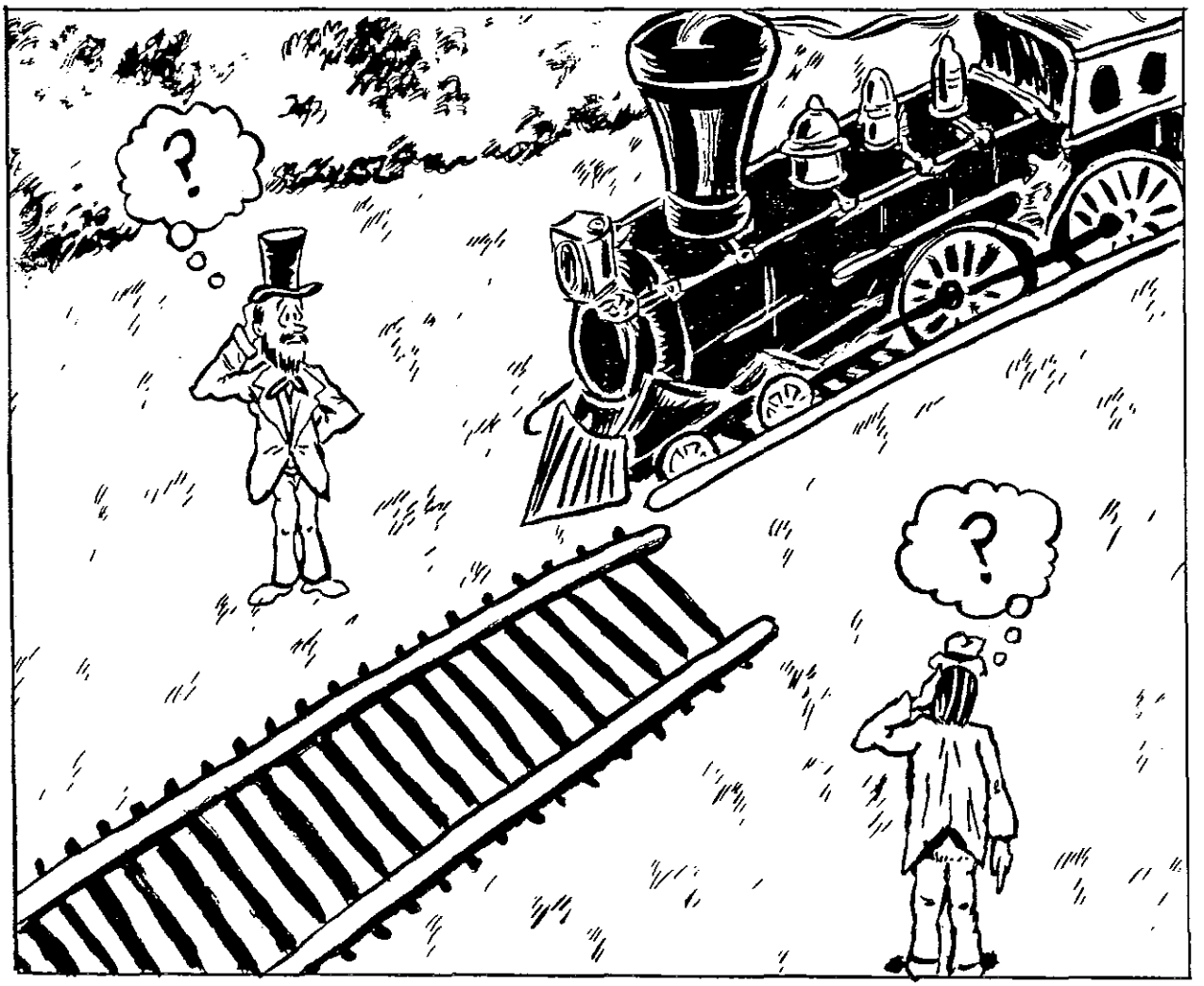
Knowing what computers are not is also important. They are not panaceas for the ills of local governmental management. Computerization is no substitute for good management. In fact, using a computer to circumvent bad management practices can make the results of those practices even worse because the computer will act on bad data and programs quickly and accurately, thereby complicating the problem.

Computers can provide extremely fast, accurate, and reliable processing, storage, and retrieval of data. They are especially good for work that is repetitive and involves large amounts of data. However, computers cannot make decisions. All they can do is provide organized information to persons who then must make the decisions. The information that computers can provide is limited by the data and software that are on the system.



Adapted from the Instructor's Manual for *Low Cost Computers and Small Local Governments* by John Scoggins (Athens, GA: University of Georgia, 1979).

Having a computer, even one that provides good information, does not guarantee that management decisions will be good ones. Human beings, no matter who they are or where they are employed, have the ability to take perfectly good information and make perfectly awful decisions. (21)



NOTES TO INSTRUCTORS

Chapter III. Microcomputer Hardware

This is the only TECHNICAL chapter in the handbook. Even so, it is fairly short and the attempt was made to write it in such a way as to avoid intimidating the uninitiated reader.

Explain to workshop participants why they need to learn about the technology of microcomputers. Reasons include that computer sales persons love the technology and the jargon that goes with it. Therefore, local officials should be armed with enough information about the technology to detect when they are not receiving completely accurate and correct answers (whether intentional or unintentional) from whatever sources.

Second, local officials should know the differences among various components of the technology (types of printers or disk drives, for example) in order to make intelligent choices about which component fits an organization's requirements.

Third, various elements of the technology (such as the difference in bit architecture) greatly affect the usability of microcomputers. Hence, the local government official should be acquainted at least at a casual level with the technology in order again to choose among different types of systems.

However, because many reference sources (including this handbook) are available, and because the most important part of the workshop involves the acquisition and use of micros, the instructor should not spend an excessive amount of time discussing technology related issues.

Nevertheless, here are a few items that the instructor may wish to emphasize:

- Bits, bytes, K, memory, RAM, and ROM are important terms to learn because they deal with the internal size of the computer, the amount of work it can do, and the speed at which it works.
- Bit architecture is important as it limits or allows multi-user capability and also affects system capacity and speed.
- Peripheral devices (screens, keyboards, mice, floppy and hard disks, printers, modems, etc.) should be discussed in relation to their functions and capabilities and their uses in an organization, recognizing that the marketplace is rapidly changing in terms of available devices and their costs.
- Although no such thing as a "typical" system exists, a local government will probably not want to go below a minimum configuration of 128K, dual floppy disk drives, a monochrome monitor, and a matrix printer.
- Finally, when presenting this technical chapter, refer to the cartoon on page 10 (and its accompanying overhead) and use it when explaining the function of a particular device. The instructor should endeavor to make the conceptual and unfamiliar concrete by using terms and examples known to the audience.

III. Microcomputer Hardware

A. INTRODUCTION

THIS AND THE following chapter are *technical* in nature. However, they have been written in order to simplify and demystify computer technology and terminology for local government personnel and, at the same time, present the principal technical concepts and components required for a basic understanding of a computer system.

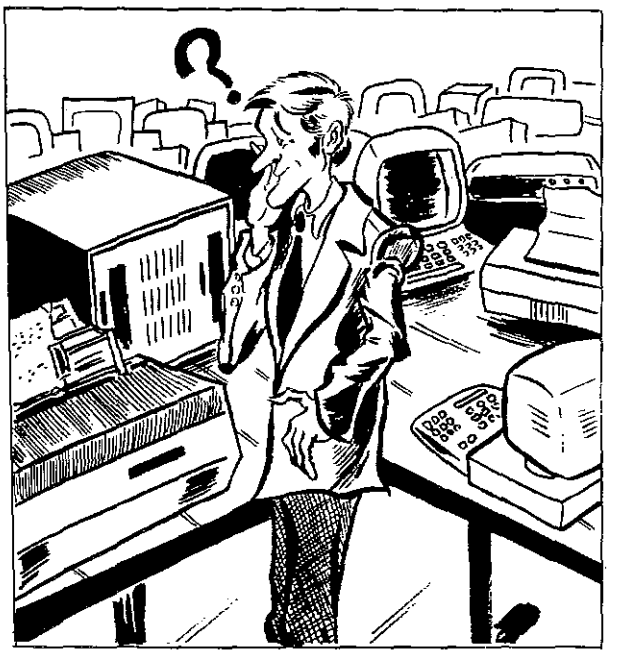
The reader will not be able to design or build a computer or write programming after reading these chapters, but he or she should come away with a sound grasp of the main elements of a computer system and how it works. Such an understanding is essential for personnel in the local government that intends to acquire and use a microcomputer.

B. THE COMPUTER SYSTEM

One of the first questions typically asked when (22) an organization decides to acquire a microcomputer is, *"Which micro should we buy?"*

Ask a computer vendor or salesperson, and the answer will very likely be a machine from his or her company. Ask a software vendor and learn that the answer is a computer that the vendor's programming runs on. The answer provided here is quite different. By and large, the brand of microcomputer matters very little. What matters is that the *system* performs the functions that require automation and that it does so at a predetermined level of effectiveness.

The term *computer system* means *the hardware, software, and all other equipment and programming necessary for the computer to perform*



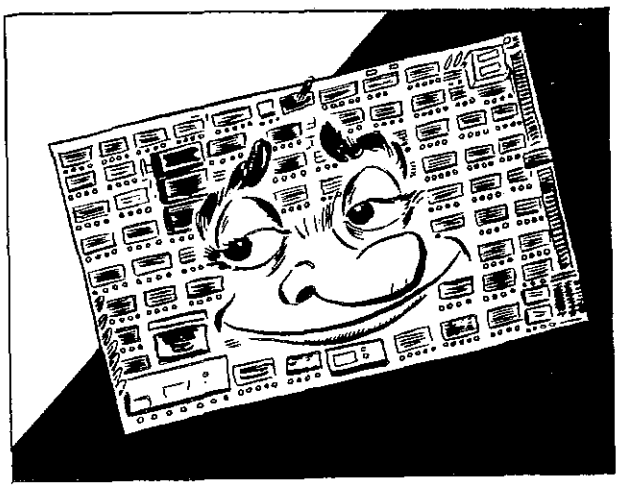
required tasks. This means that everything is present that will enable local governmental personnel to make a payroll, do budgetary accounting, print utility bills, or perform other functions.

A microcomputer system consists of two basic (23) elements. These are *hardware* including a central processing unit (or CPU), mass storage devices (usually magnetic disk or tape), terminals (usually cathode ray tubes or CRT's), printers and possibly other peripheral devices; and *software* or *programming* including operating systems and application programs.

C. MICROCOMPUTER HARDWARE

1. Computer on a Chip. The microcomputer (24) gets its name from its principal hardware component: the *microprocessor.* The first micro-

processor was developed in 1971 by Dr. Ted Hoff at the Intel Corporation in California. (Intel remains a major supplier of microprocessors.) Five years later, owing to dramatic increases in microprocessor capacity, the microcomputer industry was born.



A microprocessor is a large scale integrated circuit containing the basic components of a computer. These have been miniaturized and photo-etched onto a wafer of silicon about the size of a thumbnail. This wafer or chip contains tens of thousands of miniature electrical switches or gates that enable it to hold, read, and process data.

2. Bytes and Bits. Data are represented in a microcomputer as bits. The word *bit* stands for *bi*nary digi*t* and symbolizes what enables a computer to function: the binary property of electricity—it is either on or off. Computers read bits of data in terms of their electrical character, whether current is off or on at a switch or gate. (25)

Eight bits are combined in computers to form a *byte*. A byte (a combination of eight bits in on-or-off positions) is used to represent a letter, number, or symbol. Hence, a byte is a *character*. Characters are determined according to the arrangement of bits in a byte. For example, the number one (1) is represented in one common eight bit coding scheme as:

ON
ON
ON
ON
OFF
OFF
OFF
ON.

The number two (2) looks like this:

ON
ON
ON
ON
OFF
OFF
ON
OFF.

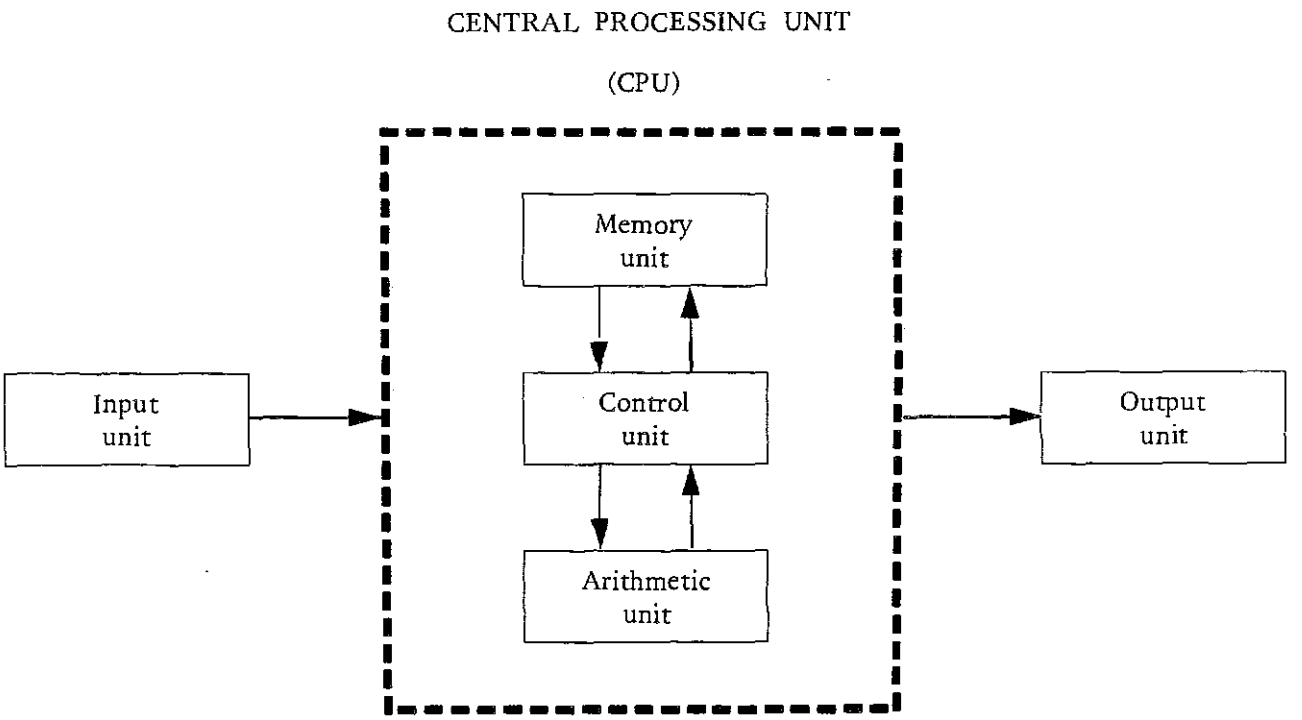
Remember: a *byte* is a *character*—number, letter, or symbol; a byte commonly contains *eight bits;* a *bit* is a *binary digit* representing one of the fundamental properties of electricity.

3. CPU and Memory. The computer's central processing unit or CPU is where the work of the system occurs. The CPU is made up of three principal parts. (26)

The first is the *arithmetical and logical unit* that performs functions like addition, subtraction, multiplication, and division, and logical functions like comparing numbers with one another to determine lesser or greater than or equal to.

The second major CPU element is the *memory.* This is often referred to as volatile or erasable memory. Its principal characteristic is that data are stored there temporarily while being manipulated. Like the old fashioned chalk board, data are placed in memory, arithmetical or logical functions are performed, and the data are removed or erased.

Memory in the computer is usually discussed in terms of *K* or thousands of bytes (1K, however, actually equals 1,024 bytes, but when the industry speaks of K, it usually rounds downward to the nearest thousand units). Finally, memory exists in multiples of 2K—4, 8, 16, 32 and so on. Typically, the larger the number of K in a computer's memory, the more work it can do.



Usable memory in a computer is known as *RAM* for *random access memory*. RAM means that the computer's CPU can place data at any location in memory and by knowing the location or "address" can also retrieve the data. Both CPU and disk storage memory are based on RAM. (27)

Another term to know is *ROM*. This stands for *read only memory*. ROM is memory in the CPU that cannot be used to store information. Typically, ROM holds machine instructions, such as the operating system, that must be present in memory in order for the computer to function.

In most of the major systems now on the market the ROM required for machine instructions is provided over and above the advertised system memory. However, not all systems are configured in this way, so the potential buyer should determine how much, if any, of the advertised memory is in ROM. Since ROM is not usable memory, the amount of ROM should be deducted from the advertised amount of memory in order to determine how much usable memory or RAM remains.

Similarly, the buyer should learn how much memory is required for the operating system, to operate peripheral devices, and to run application programs. In this way, an organization can determine the amount of CPU memory required for its microcomputer. For example, in a 64K machine, 8K may be required for the operating system and 8K for an applications program, leaving 48K for storage and processing of data.

The third part of the CPU is the *control unit*. The control unit, or controller, tells the computer what to do and how to do it—for example, to get data, to perform certain functions on the data, to return data to mass storage, or to place data on the CRT. The controller is the traffic cop of the system.

4. 8- and 16-Bit Micros. At least three different types of computers are found in today's marketplace: micros, minis, and mainframes. Although each was distinctly different at its inception, continuing technological development makes differentiation among them increasingly difficult. Nevertheless, differences among types of machines (28)

are important to organizations planning to acquire new or to upgrade existing systems.

Micros began as single user, single function computers. Current 8-bit micros remain so, but the commercial marketplace now sports 16- and 32-bit micros that more and more resemble larger systems like minicomputers and mainframes. Indeed, some, although not all, of these larger micros are multi-programming, multi-user systems, and almost all of them have ample capacity to meet the requirements of small governmental organizations.

The difference between 8-bit and 16-bit and larger computers is that the computer CPU acts on data in groups of bits. An 8-bit system addresses eight bits at a time, a 16-bit twice that, a 32-bit twice that, and so on. This internal dimension of a CPU, among other things, gives it speed in accessing and processing data, provides or limits multiprogramming capability, and determines maximum CPU memory. The larger the bit size, the faster the system, the greater its processing ability, and the larger the CPU memory.

At this writing, 8-bit micros are limited to 128K while 16-bit systems will configure to 740K of CPU memory. Larger CPU memory means that the computer is faster, can execute larger programs, and can handle more data at one time. Many programs of interest to local governments require 128K or more of memory to operate, and they will operate more efficiently on a system with a 256K or larger CPU. For these programs, a 16-bit or larger microcomputer is a better choice than an 8-bit system.

Minicomputers are typically 16-bit systems, but many manufacturers have developed 32-bit or super minis, and micros based on 32-bit technology, such as Apple's Macintosh, have entered the marketplace. Mainframes are 32-bit and larger systems. The larger the system, other things being equal, the more processing capacity, the greater the speed of processing, and, often though not always, the more costly it is.

Although this handbook is about microcomputers, the reader should bear in mind that computer size and type are important in relation to an organization's computing and information management requirements. For some, single user, 8-bit systems will be sufficient. Others will require 16-bit or larger micros, and still others will need minicomputers or mainframes. The type and size of computer for an organization depends on the types and amounts of data to be stored and work to be performed on it, and the availability of software that will run on it.

5. Peripheral Devices. The CPU cannot work alone. Three vital functions are missing—input, output, and mass storage. Various devices are used to perform these functions. Perhaps the most common input device on a microcomputer is the *terminal*, often called a CRT (cathode ray tube) or video display monitor. This is a device that looks like a small TV screen with a keyboard attachment. Commands and data are entered via the keyboard. Additional input devices include optical character readers, magnetic tape units, magnetic disk units, card readers, and even voice recognition units.

Screens for microcomputer video monitors are available in a variety of colors, principally black and white, green, and amber. Also, full color monitors are available. Decisions on screen color and whether to use a color monitor should be based on such considerations as eye comfort and the functions to which the system will be put. For example, if color graphics will not be used, a color monitor may not be required. Potential users should review various types and colors of screens before purchasing.

Microcomputers are sold with several different types of *keyboards*. A local government planning to buy a micro should specify a typewriter-style keyboard, preferably one with a ten key pad attached for numerical entries. Potential users should test different styles of keyboards to ensure that the one selected can be used easily and efficiently. Keyboards and the user's comfort are very important since the keyboard is where the user will do most of his or her work on the system.

At least one micro manufacturer, Apple, has invested a considerable sum of money to develop and market an alternative to the keyboard. This device is known as the *mouse*. The mouse is a small box attached by a wire to the computer. By moving the mouse, the user moves a cursor

on the video monitor screen. A button on the mouse enables the user to command the system by selecting appropriate choices of actions that appear on the screen. Even with the mouse, however, data and text must be entered into the system using the keyboard.

Mass storage on a microcomputer system can be likened to the vertical filing cabinets found in most offices. A mass storage unit is where the data base of the organization, all of its records and files, is kept. Memory in the CPU, on the other hand, is like the single file drawer in an executive's desk where only the files being used for current projects are kept.

In microcomputer systems, *magnetic disk* is the most common data storage medium. *Magnetic tape* is also frequently used. The major difference between these storage media is that with disk, data are stored under what is known as the random access method or RAM. Data stored on tape are stored sequentially. Hence, access time for disk is much faster. That and steadily decreasing prices for disk storage have made it the preferred method for data that must be available for instant retrieval. Archival and infrequently used files can be stored on tape efficiently, and tape is also useful to system backup purposes.

Two common types of disk storage devices are the *floppy disk* and the *hard disk*. Floppy disks (or diskettes) look like 45 rpm records and are somewhat flexible, hence the name floppy disk. Floppies come in various sizes, but 3½-inch, 5¼-inch, and 8-inch sizes are the most common. They can be inserted and removed from their *disk drives* as needed by the system user. Floppy disks typically hold from about 150K to over half a million bytes of data with some double sided, double density diskettes holding over one million bytes. Floppies with the ability to store even more data can be expected on the market in the near future.

Hard disks differ from floppies in three principal ways. First, they are rigid, not flexible. Second, they hold far more data, 5, 10, and 20MB being common sizes with hard disk drives of up to 40MB now on the market. (MB stands for megabyte and means millions of bytes.) Third, the disks are contained in sealed units or disk drives from which they cannot be removed.

Data are magnetically encoded onto disk or tape for storage purposes. Unlike the volatile memory of the CPU in which data are held electronically, data placed magnetically on disk or tape will remain there until erased by the computer user. Loss of power or fluctuations in power will not cause data losses on disk.

However, accidents do happen. Tapes can break, coffee can be spilled on a disk, and mechanical failures can occur. These and other problems can destroy all data on a disk in an instant. Hence, making copies of all data stored on disks and tapes is essential. These copies are called *backups.*

For both floppy and hard disk systems, backup is an important consideration. Floppy disks can serve as backups to other floppies. Similarly, floppies can be used to back up hard disks, but a large number of floppies and a fair amount of time may be necessary (ten 500K floppies for 5MB of hard disk). Hence, magnetic tape is often used for backup on micros that have large disk storage systems.

Printers are the most common output devices for hard copy materials (or information printed on paper) on microcomputers. Local governments need to be concerned with two basic types of printers. These are the *dot matrix printer* and the *letter quality printer.*

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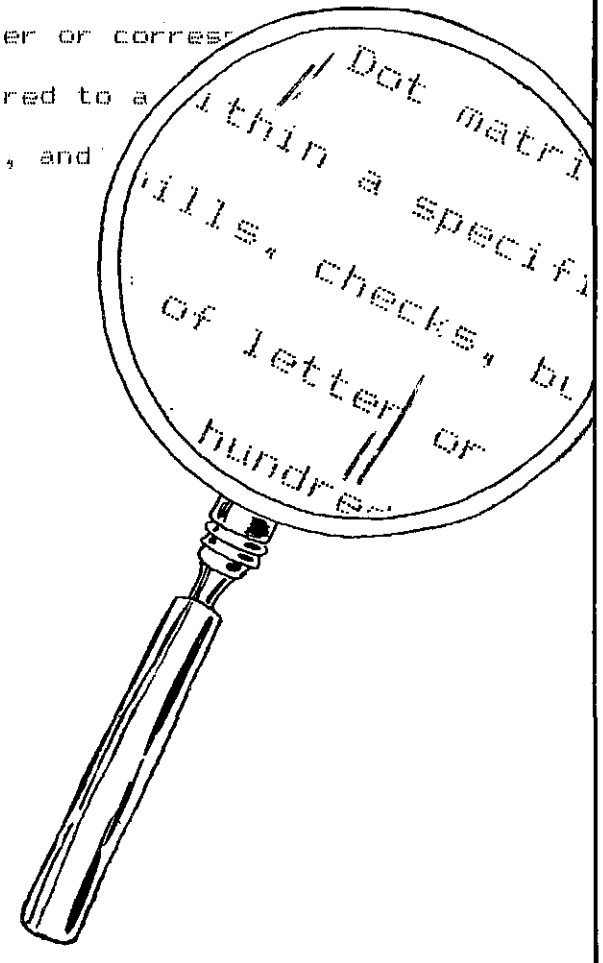
Dot matrix printers form characters by printing a series of dots within a specified matrix as shown on page 17. These printers are suitable for printing bills, checks, budget reports, and other documents that do not need to be of letter or correspondence quality. Some dot matrix printers now on the market, however, can also offer print that closely resembles that of a letter quality printer. Dot matrix printers cost from a few hundred to a few thousand dollars, depending upon speed, durability, and capacity.

Letter quality printers get their name from printing that looks as if it came from a typewriter. They are especially good for correspondence, narrative reports, manuscripts, and the like. Although letter quality printers costing a few hundred dollars are now on the market, to get the

Dot matrix printers form characters within a specified matrix. These printer bills, checks, budget reports, and other be of letter or corres a few hundred to a durability, and



Letter quality printers get their looks as if it came from a typewriter. for correspondence, narrative reports, Although letter qualit are now on the mar needed for most thousand dollar

speed, durability, and capacity needed for most local government work, a cost from two to four thousand dollars is more typical.

All micros of any consequence to local governments are equipped with things called *ports* or *interfaces.* A port is a physical connection to the computer that allows peripheral devices to be connected to the CPU and data to be transmitted between them and the CPU.

A *serial port* on a computer allows data to be transmitted one bit at a time or in series. A *parallel port* allows data to be sent in groups of bits, typically a byte at a time, or in parallel.

The difference between serial and parallel data communication is important primarily in relation to printers. Most micros on the market come with parallel interface to their printers. However, this is one industry where very few things are standard, and some systems are equipped with serial ports for their printers.

A printer built for parallel communication will not work with a micro that has only serial ports (and vice versa) unless special attachments to convert parallel transmission to serial are added.

Another important peripheral device for a microcomputer system is the *modem.* Modem stands for *mo*dulator/*dem*odulator. It is a device that enables computers to communicate with one another. Essentially a modem takes electronic impulses from a computer and changes them into a form that can be transmitted on ordinary telephone lines. The modem also receives signals by telephone and translates these into bits that can be read by the computer.

An organization needs a modem if it wants its microcomputer to be able to communicate with other micros, with mainframes or minicomputers, or to be able to interact with numerous computerized networks and data bases around the country.

6. Configuring a System. The amount of CPU memory and disk storage and the number and types of peripheral devices that a local government needs (known as system configuration) are directly related to the number and types of functions that will be performed on the system, the number of users, the size of the data base, and the volumes and frequencies of activity in each function that will be automated. Generally speaking, no two systems will be identical because the organizations in which they operate will be different. However, few local governments will be able to make much use of a microcomputer that has less than 64K of CPU memory, a single floppy disk drive, a monitor, and a dot matrix printer. On today's market such a system can be expected to cost from $1,500 to $2,500, exclusive of software. For many organizations, especially those that plan to use a micro extensively, this minimum configuration will not be adequate. Additional memory, usually a second floppy disk drive or a hard disk, and a faster, sturdier printer will be required.

A guide showing the typical conversion of typed material to bits and bytes in computer memory is reproduced in the box. This guide may be helpful in determining the amount of memory and storage for a given activity.

BITS, BYTES, AND STORAGE

One byte (eight bits) of disk space or main memory is necessary to store one letter or symbol.

A typewritten page holds approximately 250 words (1,500 characters and spaces). Thus, 1,500 bytes (12,000 bits) of computer space are necessary to store a page of text. Therefore:

- 1.5K of computer space is needed to hold one typewritten page (in main memory or on a disk)
- 30K of computer space is needed to hold 20 typewritten pages
- 150K of computer space is needed to hold 100 typewritten pages.

Source: adapted from *Guide to Personal Computing,* Digital Equipment Corporation, 1983, p. 44.

NOTES TO INSTRUCTORS

Chapter IV. Microcomputer Software

If one message should come through loud and clear from this chapter it is that SOFTWARE IS THE KEY TO THE MICROCOMPUTER SYSTEM. This chapter discusses the principal types of software of concern to local governments (operating systems and application programs), the principal languages in which programming is written for microcomputers, and also looks at the typical types of applications that are automated on microcomputers in local governments. Finally, a brief discussion is presented of the major processing modes, and definitions are provided for terms frequently encountered when discussing processing on microcomputers (e.g., on-line, interactive, user friendly, and others).

In presenting this chapter, the instructor should make clear to participants that, to paraphrase Peter McWilliams,* "Having a micro means that you never have to write a computer program." Although organizations clearly CAN write their own programming, they rarely will need to do so. The reason is that a wide range of "off-the-shelf" programming is available at very reasonable prices ($100 to $600 range), and that programming for the local government market is now being written increasingly by software houses and OEM's. This is the so-called "packaged software."

Programming or software may be more difficult for participants to comprehend than hardware. At least they can see and touch hardware. All they can sense about software is the software disk and instruction manual. The instructor should explain that although the stuff called software cannot be sensed in a tactile manner, and although it exists only in the form of a set of instructions called a programming language (that is somewhat like a foreign language), well-written programming is remarkably easy to use.

Finally, to be able to use computer programming (or hardware for that matter) a person DOES NOT need to know a programming language, how to write programs, or even to understand the electronics behind the operation of the computer. If a person can read, he or she can use a microcomputer.

*Peter McWilliams, *The Personal Computer Book* (Los Angeles, CA: Prelude Press, 1983).

IV. Microcomputer Software

A. SOFTWARE

HARDWARE is only incidental to a microcomputer system. In fact, some experts contend (30) that most commercially available microcomputer hardware will work reliably and effectively for most organizations. What most often makes a microcomputer system work or fail to work, and what causes persons implementing microcomputers in local governments to become either heroes or villains, is something called *software.*

Software is called that because it is not hardware, but it really is not soft either. In fact, it cannot be sensed at all in a tactile manner. It is called software only because of the earlier evolution of the term hardware for machinery. If machinery is hard, then programming must be soft.

> **Software, or programming, is even more difficult for many persons to comprehend than hardware. Yet, software is by far the most important part of a computer system. Without software, the computer is an expensive, dumb hunk of metal, plastic, wires, and silicon. It does nothing but take up space.**

Microcomputers can perform only one action at a time. Their incredible speed is what enables them to perform tasks so quickly and so efficiently. To do so, micros must be given precise instructions covering each single step of an activity. These sets of instructions are called programs or software.

Several kinds of programs exist. For governmental purposes, however, the two most important categories of software are *operating systems* and *application programs.*

Operating systems reside on the computer's (31) memory and control the activities of the rest of the system, including the application software and the functions of the peripheral devices. For example, the operating system communicates with the CRT to receive and execute commands, assigns print jobs to printers and establishes printing priorities, and decides when to write data on or read data from disk storage and what actions to take on these data. Operating systems are either provided by computer manufacturers or are written especially for certain classes of machines.

Several operating systems are available for microcomputers. As is true for many other aspects of computer technology, most are incompatible with one another and will run only on specific brands and types of micros. Among other things, this means that *application programs written to run on one operating system probably will not run on another.*

For 8-bit micros, somewhat of a standard (32) operating system has emerged. It is called *CP/M* for *c*ontrol *p*rogram for *m*icrocomputers. A few of the micros that use CP/M as their principal operating system are the Kaypro II, NEC 8800, and Epson QX-10.

However, several other operating systems for 8-bit systems also exist. These include TRSDOS (*DOS* stands for *d*isk *o*perating *s*ystem) for Radio Shack's 8-bit micros, AppleDOS for Apple micros, and others. Increasingly, these and many other 8-bit micros can be modified to use CP/M by adding a special hardware card or board to the CPU.

For 16-bit micros, there are three major competing operating systems. PC-DOS and its sister MS-DOS are operating systems for the IBM PC and its compatibles. At this writing, MS-DOS appears to be setting a de facto standard for 16-bit micros. However, a 16-bit version of CP/M, known

as CP/M-86 is available, and many experts feel that AT&T's UNIX operating system will gain in popularity following the breakup of the Bell System and AT&T's entry into the data processing marketplace.

For most local governments, *application programs* are the single most important parts of the system. They perform the work of the organization. Application software commonly performs such functions as accounting, budgeting, billing, inventory control, payroll, personnel management, equipment management, and many others in local governments. (33)

Each program, whether an application program or an operating system, is really made up of numerous sub-program elements. A payroll program, for example, should not only order payroll checks printed. It should also verify the amount of each check, make and record all deductions, update the general ledger and all subsidiary ledgers, prepare payroll reports and reports for all deductions, and perform many more functions. Each function requires a separate program element.

The more complicated the task, the more complex will be the program. After all, a program is a step-by-step reconstruction of all procedures that must be performed manually to complete a task.

Application programming to perform data base management and decision-making functions is also available. Included here are such things as inquiry and report generating programs, data management and data base management systems, and spreadsheet programs. These allow computer users to create unique files, make unique inquiries into a data base, generate one-time reports, sort through all files on a system for related data, and play "what if" games with data from selected files.

No discussion of application software would be complete without mention of highly specialized programming that has burst upon the computer scene and spread rapidly over the past few years. This class is known as *office automation software* and includes word processing, electronic mail, and data communication programs. Some of these programs operate on standard computers and CRT's, others on specialized boxes called word processors or other sophisticated limited function machines. The impact of this class of software, especially word processing, has been and promises to be enormous, especially as such programming becomes linked to other computer systems and as the specialized boxes gain capabilities to perform additional data processing functions.

Prices for microcomputer software vary widely. Some generic or *off-the-shelf programming* for such functions as word processing and spreadsheet analyses can be purchased for as little as $100 per package. More complex programming for such things as inventory, payroll, or accounting can cost from $300 to $500 per package. OEM developed software for such activities as fund accounting may cost from $1,000 to $2,500 per package or more. Custom written programs may be even more expensive.

Off-the-shelf software is produced for a mass market and is the least costly of the current generation of microcomputer programming. Software written especially for the smaller local government market is more expensive, and one-time or custom written software will cost even more. By almost all accounts, however, microcomputer software is considerably less expensive than programming for minicomputers and mainframes.

B. LANGUAGES (34)

Computer software is written in special codes known as programming languages. Best estimates suggest that a couple of hundred languages have been developed since the first computer was built. For general business and local government computer use, however, only three are of importance. These are *COBOL, BASIC,* and *FORTRAN.*

COBOL, standing for *co*mmon *b*usiness *o*riented *l*anguage, is probably the most widely used language for business-type functions in minicomputers and mainframes. This should not be surprising since it was created exclusively for this purpose. To date, however, COBOL is not the primary programming language for micros, although its use is increasing.

BASIC, or *b*eginner's *a*ll-purpose *s*ymbolic *i*nstructional *c*ode, is probably the most widely

used language on microcomputers. Both COBOL and BASIC are known as high-level languages. This means that programs written in these languages contain English-like statements. Oh, not florid prose. . . but understandable words and phrases.

Inquiry, report generating, and data management type programs are even more English-like. Ordinary computer users armed only with a simple book of commands and instructions can operate these programs using standard English commands. No programming skills are required.

FORTRAN, for *for*mula *tran*slation, is essentially a scientific and engineering language and does a good job with mathematical equations and expressions. Hence, it is in wide use where these functions are required, such as in engineering and public works applications.

Other languages, although not as common as BASIC, FORTRAN, and COBOL, are being seen with increasing frequency on micros. Two that deserve mention are Pascal and Logo. For the local government official, however, the name of the programming language is less important than whether adequate application software is available to run on the micro.

Generally speaking, the more sophisticated the microcomputer, the greater its language capabilities. While 8-bit systems typically are limited to one language and that is usually some version of BASIC, 16-bit and larger systems may support several languages.

Language capability is important for two reasons. First, if a local government plans to do any of its own programming, it will want a system that either has a language that staff members already know or a language like BASIC that is relatively easy to learn. Second, a system's language capability must be known in order to acquire software written in the correct language. A system that supports only one language such as BASIC will not run programs written in COBOL and vice versa.

C. LOCAL GOVERNMENTAL APPLICATIONS

A recent book entitled *Microcomputers in Local Government* listed a large number of local governmental functions that can be performed on microcomputers. These are shown in the chart on page 22.

Surveys of actual microcomputer use conducted by the International City Management Association and the Center for Applied Urban Research at the University of Nebraska at Omaha have found, however, that micros in local governments are used primarily for word processing or for applications involving financial management. These studies also found a sizable local government demand for microcomputers.[11] This suggests that an increasing number and variety of applications can be expected to be found on micros in local governments in coming years.

As one expert in the field has said about computer use in local government, "*The only limits to the use of computer technology are the pocketbook and the imagination.*"[12] In other words, if a local government wants to use a micro for a particular function and can afford to do so, it will probably be able to find or develop the system.

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LOCAL GOVERNMENTAL MICROCOMPUTER APPLICATIONS

Office and Administration
- Word processing
- File management
- Document locating
- Council minutes index
- Ordinances/resolutions
- Calendar and scheduling
- Financial modeling studies
- Specifications
- Department performance data
- Miscellaneous data/notes
- Risk management
- Statistical comparisons
- Strategic planning
- Management by objectives

Finance
- Accounting
- Budgeting
- Purchasing
- Payroll
- Financial forecasting
- Bond payments and redemptions
- Property assessment
- Tax billing
- Business licenses
- Inventory management
- Utility billing
- Accounts receivable
- Investment management

Personnel
- Recruiting and placement
- Personnel records
- Employee skills inventory
- Training records

Public Safety
- Crime reporting
- Police incident analysis
- Computer-aided dispatch
- Stolen/recovered property
- Officer activity
- Payroll scheduling
- Traffic violation processing
- Accident reports
- Court schedules
- Fire incident analysis
- Fire prevention inspection

Public Works
- Vehicle maintenance
- Utility billing analysis
- Meter inventory
- Street maintenance planning
- Street condition inventory
- Street lights/traffic signals
- Work orders

Community Development
- Building permits
- Inspection scheduling
- Land use data
- Capital expenditure projection

Parks and Recreation
- Park facilities inventory
- Parkland maintenance
- Recreation registration/scheduling
- Forestry statistics

Library
- Library circulation
- Library inventory
- On-line card catalog

Source: James R. Griesemer, *Microcomputers in Local Government* (Washington: International City Management Association, 1983), p. 26.

D. PROCESSING MODES

When compared to the state-of-the-art in commercially available microcomputers, earlier generations of computer technology appear surprisingly primitive. Earlier generation systems typically were *batch-oriented*. That is, a user would execute a series of coded forms, a keypunch operator would turn these into a deck of punched cards, and then the cards would be delivered to the computer center where they would be processed. Sometime later a printed report would be forthcoming. On larger computers, several batch activities could occur simultaneously, but on smaller systems only a single application could be performed at a time.

While the batch processing of activities like billing or payroll is not uncommon in current systems, modern technology encourages a different kind of system use. This can be defined as on-line, real time, interactive, and multiprogramming. Modern systems are also referred to as user-friendly. (36)

On-line means that the computer's peripheral devices such as CRT's, printers, and tape or disk drives are physically connected to the computer. *Off-line*, then, means a device that is not physically linked to the computer.

Real time means that processing is accomplished immediately upon command by a user. This contrasts with earlier batch machines where a user would deliver code sheets or punch cards to the central data processing location and wait several hours or even days before seeing any results.

Interactive means that a computer user, sitting at a CRT and using the system's keyboard, mouse, or other input device, can enter, revise, or delete data and generally command the system while communicating directly with the computer. This is man-machine interaction.

Multiprogramming means that, due to its incredible speed, the CPU appears to be performing several functions simultaneously. For example, one user might enter billing data via a CRT, another might update accounts receivable records, a third might inquire into the status of a budgetary acocunt, all the while the printer is running a detailed report on equipment maintenance. In this case, several different programs are in operation on the system by several users. Multiprogramming is synonymous with the term *multi-user*.

A major difference among types of microcomputers exists in the area of multiprogramming. Multiprogramming capability is lacking in 8-bit microcomputers. They are essentially single user, single function systems. Some, although not all, 16- and 32-bit micros, have multiprogramming capabilities. That is, several persons can use the system to perform several functions, all at the same time.

Multiprogramming should not be confused with *multiprocessing*. Multiprocessing is where two or more CPU's are connected together.

A *user-friendly* system is one that can be used by persons who have little or no background or training in computer technology or programming. In this case, a payroll clerk might enter all necessary data and all commands necessary to the computer to ensure that a payroll is made and all accounting therefore is properly recorded.

User friendliness is not a property of computer hardware; it is a software function. User-friendly software instructs users, provides them with choices of actions to take (often in the form of sequenced lists or multilayer menus), ensures that illegal actions cannot be taken, and forgives mistakes. (37)

For example, a payroll clerk might see a *menu* (or list of choices) on the CRT. The menu provides several choices, asking for instance whether to 1) *create a record*, 2) *update a record*, or 3) *delete a record*. If the clerk answers (1), a second menu providing choices of actions for record creation will appear and so on until actual data entry to create the record begins. Furthermore, only "legal" entries are allowed. Hence an address cannot be entered for a Social Security number, and if a mistake is made, the software tells the user and allows for instant corrections.

NOTES TO INSTRUCTORS

Chapter V. Procurement Guidelines

This chapter presents a tried and tested method for the procurement of microcomputer systems by local governments (or other organizations, for that matter). This method consists of "SEVEN SIMPLE STEPS."

The steps are:

1. **determine computing and information management requirements**
2. **establish technical, economic, and political feasibility for a microcomputer system**
3. **develop and release a request for bid or proposal describing the organization's requirements**
4. **receive and evaluate bids or proposals**
5. **select a system**
6. **negotiate a contract with the selected vendor**
7. **implement the system and monitor its performance.**

Among the many issues considered in this chapter, the following deserve particular emphasis:

1) Political feasibility is often the most difficult question to resolve in a procurement effort.

2) Cost/benefit analysis is important in determining if a microcomputer system is feasible and warranted, but cost/effectiveness may be difficult to establish.

3) Communication among the principal actors in the procurement effort (management, staff, consultants, elected officials, others) is often critical to a successful procurement and system installation.

4) Software to do the work of the local government is the KEY to the success of the system—software should be the first, last, and most important thing considered in the procurement process.

5) If at all possible the standard vendor written contract should not be signed—instead an instrument that adequately protects the interests and rights of the local government should be written.

6) A careful and deliberate system installation should be undertaken in order to ensure that the system works as promised.

V. Procurement Guidelines

A. INTRODUCTION

EACH DAY local governmental personnel are bombarded with information about microcomputers. They are told that computers can do almost anything and can do it faster, smarter, and cheaper.

They are assaulted as well as insulted by sales pitches to buy micros. They are told implicitly that something must be wrong with those who do not have them. More explicitly they are told that their kids will flunk out of school or grow up stupid if they do not have these marvels.

Much of this information is produced in order to sell equipment or is written in order to sell interesting articles to the popular media. Very little is based on objective research into the actual uses of microcomputers and their effects on society. Many sales pitches are nonsense, lacking a valid basis and blatantly appealing to emotion. They have been very effective, however, as they have helped to create a gigantic market for microcomputers in a very short time.

Information of this sort, however, provides scant help to the person or organization considering a microcomputer. A decision to acquire a microcomputer system requires a well-considered, systematic approach that must be followed carefully and completely.

The method recommended in this handbook for microcomputer system procurement is not very different from the method that should be used in the acquisition of any goods or services by a governmental organization. This method has been used successfully in the acquisition of larger computer systems by local governments around the nation, and its use in microcomputer procurement has been tested successfully in demonstration projects in small Nebraska local governments.[13]

B. PROCUREMENT STEPS

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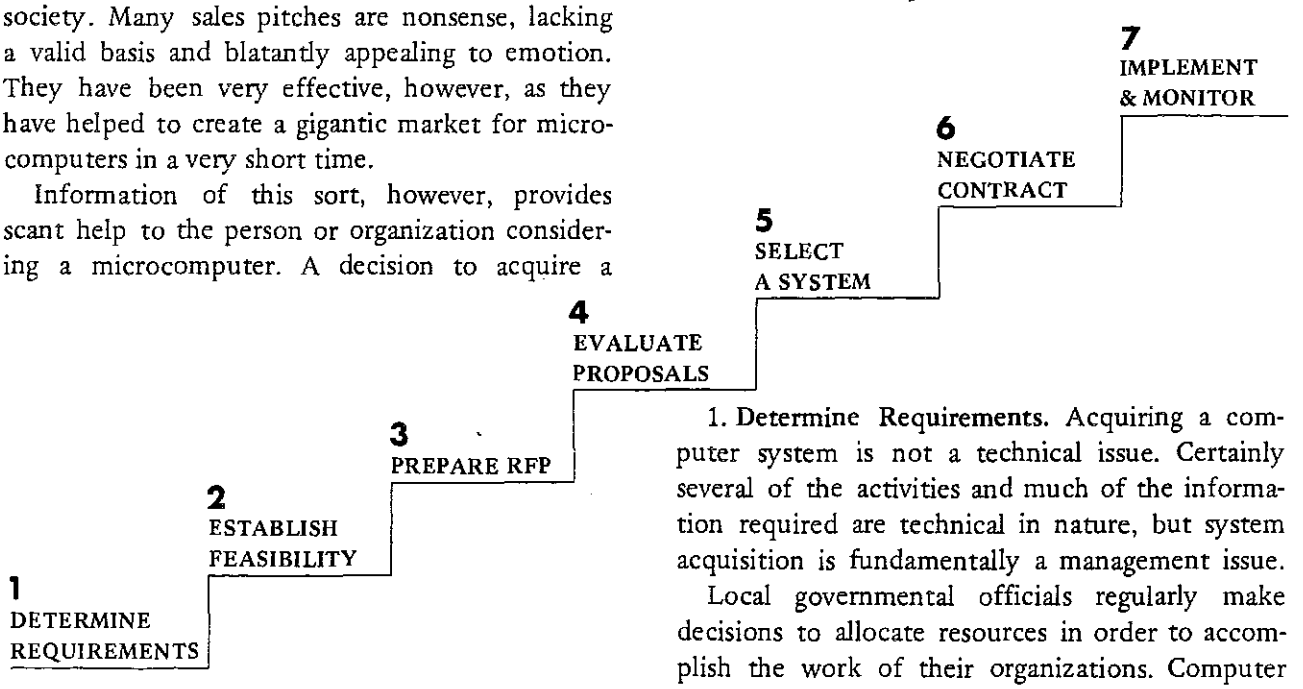
The procurement method recommended here consists of seven steps:



1. Determine Requirements. Acquiring a computer system is not a technical issue. Certainly several of the activities and much of the information required are technical in nature, but system acquisition is fundamentally a management issue.

Local governmental officials regularly make decisions to allocate resources in order to accomplish the work of their organizations. Computer

INFORMATION MANAGEMENT REQUIREMENTS FOR AN EQUIPMENT MANAGEMENT SYSTEM

Equipment

- detailed description of all vehicles and equipment
- equipment status and condition reports
- depreciation schedule
- equipment assignment (location/staff)
- equipment specifications

Maintenance

- records of all repairs (preventative, maintenance, emergency, vendor, waranty)
- 12-month history (on-line)
- equipment life history (on tape)
- equipment life history (on tape)
- billing to departments
- preventative maintenance scheduling

Parts Inventory and Control

- detailed parts inventory
- integration of inventory with purchasing system
- critical reorder parameters
- parts control (receipt, issuance, charging, transfer, return)
- handling of both used and new parts

Work Orders

- labor and parts
- updating of equipment, maintenance, parts, and performance evaluation files

Fuel Inventory and Control

- inventory status for all fuel dispensing stations
- fuel dispensing records
- fuel use by vehicle
- integration of fuel inventory with purchasing system
- critical reorder parameters

Productivity/Performance Auditing

- performance standards
- performance reports (actual vs. performance standards, by type of activity, by repair facility, by employee)

system acquisition is just another set of resource allocation decisions. The same principles associated with resource allocation and problem solving in other activities apply.

The first question to ask when considering a microcomputer is: *Does the governmental organization really need a micro?* In order to answer this question, a government must determine its *computing and management information requirements.* A requirements analysis will at once help establish the basis of need for a computer system and will allow decisions to be made regarding computer type and size.

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Management information requirements are not created out of thin air. Where do they come from? The place they do not come from is computer system vendors. Never ask a vendor to define the management information needs of a local government. Vendor representatives know computer sales and the capabilities of their particular brands of hardware or software. They do not know the computing and information requirements of a particular organization. Vendor defined information requirements will almost always resemble systems available from the vendor.

Management requirements are defined as the result of detailed analysis. Local government managers can either perform the analysis using local staff resources, or they can request consulting assistance. Either way, careful analysis is required, and its result should be a clear statement of the organization's information needs. Even if a government ultimately decides not to acquire a microcomputer system, it will at least have gone through a valuable exercise and will have developed a set of information requirements against which to revise manual systems and make them more efficient.

The statement of the organization's information needs should identify as specifically as possible what information the local government needs to be provided in order to do its job properly. The Appendix contains a copy of a requirements analysis for a small local government.

What follows here is a statement of management information requirements that was developed by an interdepartmental task force of a midwestern city for the purpose of vehicle and equipment management. These are the information items that management felt it needed in order to do its job. They are stated functionally so that computer system vendors will be able to decide how their hardware and software will best meet those needs and so that management will know what it is getting.

These probably do not represent the functional requirements for equipment management for all communities as the requirements of one city or county will certainly vary from those of another. However, this outline should provide at least a basic understanding of the management information requirements for one major functional area in local government.

2. Establish Feasibility. The second step in the process of acquiring a microcomputer is to determine whether a micro is feasible technically, financially, and politically. Computerization is technically feasible in local government for a wide range of functions.

Technical questions arise during several aspects of a microcomputer procurement. Examples include memory size, amount and type of mass storage, number and types of peripheral devices, centralized or distributed processing, 8- or a 16-bit system, type of communication capability needed, and many others.

These technical questions are directly related to the agency's management information requirements and to the volumes and frequencies of its activities.

Volumes and frequencies are important to the sizing of the system. In the example of the equipment management system, they include the number and type of vehicles and other equipment, length of the inventory records, the frequency of the transactions that create and maintain records on the system, and the frequency of inquiry and reporting, and others. Volume and frequency data must be gathered during the information management requirements analysis. It must also be provided to prospective vendors as part of the request for bid or proposal so that they can respond with an appropriately configured system.

In many communities, financial and political feasibility are more significant than technical issues. Financial and political feasibility touch on whether a local government can afford a computer system and whether local officials and staff will support automation.

Some form of cost/benefit analysis should be used so that decision-makers will know how much the system is likely to cost. Naturally, an objective analysis is required. Total system costs should be identified both for initial installation and for continued operation. These data are essential in any system acquisition.

Total system costs involve at least the following:

- **All hardware for the initial system configuration (e.g., CPU, monitors, disk drives, printers, modems, cables, and any other equipment needed to make the system function at an acceptable level)**
- **Operating system**
- **Application programs, whether off-the-shelf or packaged, or the cost of program development, and including any required modifications**
- **Hardware maintenance**
- **Software support**
- **Supplies (e.g., paper, ribbons, disks)**
- **Electrical (e.g., power supply) or room modifications**
- **Additional furniture (e.g., desks, tables, etc., to hold the equipment)**
- **Conversion of data from existing systems and methods to the microcomputer.**

These costs should be totalled and projected for one- and five-year periods in order to provide a clear picture of both initial and system life costs. In governments that own antiquated computer systems such as bookkeeping machines and early model minicomputers, the system life costs of a microcomputer system will compare very favorably, and the new system will provide substantially enhanced capabilities. In cases where the government will be a first-time purchaser of computer technology or will acquire a micro as an additional piece of equipment, out-of-pocket costs can be expected to be greater than with existing methods. However, the functional benefits and capabilities of the micro may more than outweigh these dollar costs. Making such a determination may be the most difficult part of the procurement effort.

Cost/benefit analysis alone, however, is often insufficient to establish system feasibility. In one example, analysis showed that a system could have been financed using cost savings over a five-year period. Yet, after lengthy consideration, city decision-makers scaled the system down considerably because in their view the initial expenditure was "politically" unjustifiable, especially in an election year. In another community, a city council voted unanimously against acquisition, even after a positive cost/benefit analysis. The reason was lack of communication with council members, and the opposition of one key city official managed to delay system procurement for years and made the final procurement effort far more difficult than necessary.

No guaranteed method exists to ensure the political feasibility of a computer system procurement, but several measures can be taken to facilitate it. They include a sound requirements study, objective cost/benefit analysis, and open, honest communication with key staff persons and elected officials.

Communication is critical throughout the process because it promotes understanding of the need, costs, and impacts of automation. Understanding, of course, does not necessarily result in support, but at the minimum it provides all participants with a common framework and promotes educated decision-making.

This is why in many communities a committee of elected officials and key staff persons is established to participate throughout the procurement process. These persons will be part of the

determination of management information requirements and will, at the minimum, review all elements of the process. This helps committee members to understand the procurement process and to appreciate the need (if there is one) for the system. This knowledge can then be communicated to the government's governing board when the time comes to decide whether to acquire a microcomputer system.

In smaller communities, use of such a committee may make more sense than in larger ones. In smaller communities a $15,000 or $20,000 microcomputer system may be seen as a large purchase where in larger governments purchases of this size are routine. In larger communities, however, other issues are important, including compatibility of systems, proliferation of micros, and competition with the mainframe. Here, a clear organizational policy on micros may be helpful. Chapter VI discusses such a policy.

Once a local government initiates a microcomputer system procurement process, it must decide how to acquire the needed software. *Software is the key to a computer system,* for without it the box just sits there and does nothing.

Local governments have the following microcomputer software options: 1) buy off-the-shelf software, 2) buy "packaged" software designed for local government functions, 3) buy software from another organization and modify it to meet local requirements, 4) hire an outside organization to create software especially for the organization, or 5) write the software in-house. A study by the University of Nebraska at Omaha's Center for Applied Urban Research found that over 60 percent of small local governments acquired their programming from computer hardware or software organizations.[14]

(42)

The first two options, off-the-shelf and packaged programming, have distinct advantages. First, the most costly methods of acquiring software are in-house development and unique development by outsiders. The least expensive methods are the purchase of packaged or off-the-shelf software. Second, for an increasing range of governmental functions, vendors are beginning to supply either full turnkey microcomputer systems (hardware, software, and support services) or software packages that have been developed specifically for local governmental organizations.

Third, hardware is increasingly cheap and software is increasingly expensive. This is because continuing technological advances have resulted in significant hardware price reductions relative to value. The creation and support of computer software, on the other hand, involves the work of people, instead of technology, and people time is expensive. This is one reason why a government's software decision is more important than its decision on hardware.

Fourth, programming is a highly specialized discipline requiring persons with equally specialized skills. These skills often are not related to the functional requirements of local government. That is, relatively few programmers know much about government and governmental requirements. Recent data continue to show that programmers are in relatively short supply nationally and command relatively high salaries. The 1983 entry level salary, for example, for programmers

averaged over $20,000.[15] Experienced programmers earn even more. Hence, in-house programming can become highly costly, especially for small governments.

3. **Prepare Request for Bid or Proposal.** When a local government's desire for a computer system becomes known, numerous marketing calls and unsolicited proposals from vendors often result. A community that proceeds with a system acquisition on the basis of unsolicited "solutions" is asking for trouble.

> **A well-written RFP (request for proposal or request for bid), on the other hand, will help to ensure an effective and efficient system procurement. An RFP should contain the organization's computing and management information requirements, present the volumes and frequencies of its activities, and establish substantive and procedural ground rules for the procurement.**

An RFP should be based on the requirements analysis and should tell prospective bidders exactly what the local government requires in a computer system, both technically and otherwise. It should provide the vendor with a clear idea of the rules that will be applied in evaluating proposals and should provide a schedule to be followed during the procurement. Any unique legal or other requirements should also be addressed. (A sample RFP is found in the Appendix.)

The development and submittal of an RFP may not be desirable or even practical in all cases. In some governmental organizations, policy decisions exist regarding the types of micros that can be purchased. In others, the amount of money to be spent on a micro will not justify use of an elaborate RFP procedure. In these instances, however, the organization's computing and information management requirements should be determined before proceeding, and requirements should be matched carefully with the hardware and software capabilities of the systems under investigation. (The Appendix also contains a sample set of microcomputer hardware specifications for the organization that does not need to use the RFP procedure.)

4. Evaluate Responses. Once the submittal deadline arrives, no further proposals should be received, and the formal evaluation process should begin. Knowledge of computer technology is essential during the evaluation to determine whether proposed systems are technically adequate and to ensure that proposals are comparable.

Once bids have arrived, they should be subjected to careful, objective evaluation. Several elements of the proposals should be scrutinized. These include:

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1) *RFP requirements*—Did a proposal meet all RFP requirements? For example, were all required application programs bid? Were the specified operating system and language capabilities bid? Many other questions will arise.

   If all requirements were not met, can the proposal be accepted anyway? Did the RFP allow the local government to waive technicalities and informalities and accept what it deems to be the best proposal?

2) *Hardware*—Were all hardware elements proposed? According to unbiased technical reports, is the hardware reliable? Is the hardware configuration adequate for the organization's computing requirements, especially CPU memory and disk storage?

3) *System expandability*—Can the hardware be expanded to meet the organization's growth requirements by adding additional increments of memory, disk storage, and peripherals? Will it accept additional operating systems and programming languages?

4) *Hardware maintenance*—What type of hardware maintenance is available (e.g., on-site, drive-in, mail-in, other)? Are replacement devices available for use when a particular hardware element needs repair? What type and length of hardware warranty is offered for each piece of hardware?

5) *Software support*—What type, if any, of support for the application software is proposed (e.g., on-site, via telephone, or other) and for how long? Is software support needed for any or all software packages? What type and length of software warranty is provided?

6) *Vendor organization*—What is known about

the vendor organization, its size, length of time in the microcomputer business, financial health, number of personnel, reputation, reliability, number of similar installations, experience in the governmental marketplace, and availability of personnel to install and support the system?

7) *Additional capabilities*—What other capabilities are available with the system or from the vendor that may be required in the future for a particular system (e.g., additional packaged or off-the-shelf software or programming capabilities, and other equipment)?
8) *Cost*—Relative to other proposals, what is the *total cost* of a proposal, including both initial hardware, software, supplies, and support costs, and operation costs for a five-year period? How does each proposal compare in this respect to each other proposal? (A sample bid evaluation is included in the Appendix.)

Naturally, many persons will ask where to get the information necessary to perform proposal evaluation without the use of a consultant. Evaluations of hardware and some packaged and off-the-shelf software are provided by a variety of publications. These include periodicals like *InfoWorld, Computerworld, Byte, Popular Computing, Consumer Reports,* and many others. DataPro Research Corporation and other organizations publish comprehensive directories of computer hardware and software that provide invaluable information when evaluating systems.

Visits should be made to vendor organizations to see and use proposed systems. Part of the evaluation should also involve visits to local governments and other organizations actually running proposed systems. Vendor proposals and unbiased technical reports are essential documents in a procurement process, and vendor demonstrations of equipment and software are helpful too, but nothing should substitute for seeing a comparable system running on live data in a real local government.

5. **Select a System.** At the conclusion of the evaluation, at least the two top systems in priority order should be recommended to the governing body or other procurement authority for selection. These should be the systems that, as a result of the evaluation, emerged as the organization's preferred choices. With the approval of the governing body or procurement authority, negotiation should be initiated with the system ranked first. In the event negotiations with this vendor fail to produce a satisfactory agreement, discussions should begin with the second choice.

Here is the only place in the procurement process that the issue of the "best" system should be raised. Best is defined as the system that among all proposals received—based on cost, vendor reliability, service, software capability, hardware performance, and other criteria—most closely meets the requirements of the RFP. In other words, best is a relative term and must be viewed in the full context of the procurement process, including the requirements analysis, RFP, evaluation criteria, the local government's needs, and its budget for data processing.

6. **Negotiate a Contract.** *Signing a vendor's standard contract is rarely a good idea.* To do so is to sign a document written by the vendor for his convenience and protection. A local instrument, created to ensure local convenience and protection, is preferable.

However, in the microcomputer marketplace use of a locally written contract may be difficult. The reasons for this—in contrast to the purchase of minicomputer and mainframe systems—are 1) the cost of microcomputer hardware and software is relatively low; hence, fewer incentives exist for vendors to spend the time and money to negotiate locally written contracts that larger purchases encourage; 2) much of the software for micros is the inexpensive (e.g., the $100 to $500 range) off-the-shelf variety that is produced in large quantities for a mass market, and here again vendors lack the incentive to negotiate locally based contracts; 3) many microcomputer sales organizations handle hardware and off-the-shelf software purchases with standard terms and sales agreements which they are unlikely to change; and 4) as a general rule most microcomputer hardware and software are highly reliable.

Thus, microcomputer systems can be treated

like other purchases with which local governments have ample experience, such as office equipment and motor vehicles. In these cases, the use of a vendor's standard purchase instrument or some reasonable version thereof, with modifications as required by local ordinance or state law, is a relatively standard practice, particularly if other steps in a sound procurement process have been followed.

The low cost and high reliability of microcomputer systems also mean that their purchase exposes a local government to less risk than the purchase of mainframe and minicomputer systems. This is another reason to place less value on a locally developed purchase contract.

However, where a locally written contract can be negotiated (e.g., with a turnkey micro system vendor or as the result of a large-scale purchase of several systems), an attempt to do so should be made. The most important aspect of a procurement contract for a microcomputer system is performance. The contract should establish clear performance criteria or standards and provide for system acceptance only after the system continually meets these standards over a reasonable period of time. Then and only then should payment be made. An example of a performance standard might be the requirement of no software failures and CPU up-time effectiveness of 98 percent or better over a 30-day period of continuous run time using live data. Placing additional standards in the contract, of course, is a good idea.

Linking payment to performance is neither new nor radical. It is, however, fundamentally important. Unless a local government establishes and uses performance standards, it will be in a weak position to demand corrective action in the event the system does not work. Adequate remedies like liquidated damages, requirements to repair or replace, and others should be in the contract, and the local government must insist that any lawsuits arising out of the contract be tried in local courts, not in the courts of some distant state in which the vendor's headquarters is located. (A sample contract for the purchase of software is included in the Appendix.)

7. Implement System and Monitor Performance. (44) System implementation typically begins with hardware delivery. The system should be uncrated, connected, plugged in, and turned on. Let it run for several hours a day for a week or two to make sure all the hardware is in working order. This is called the "*burn-in*" period.

Second, various elements of *programming should be installed incrementally*, preferably in some logical order, such as the general ledger system first, then payroll, then utility billing, and so on.

Third, during application program installation, user personnel should receive vendor provided *training* in all program areas as well in operating the hardware.

Fourth, *data files* must be created for all application programs either by manual input or by converting electronically encoded data from other computer systems. This may be the single most difficult and time-consuming part of system implementation.

Fifth, after completing steps one through four, actually *running programs* on the system may begin. During the first month or two, *operating in parallel* may be necessary. That means running the new microcomputer system in parallel with the old manual or electronic system to make sure that all elements of the new system work properly.

Finally, system *performance must be monitored* and established contractual procedures adhered to. One city, using a locally developed performance-based contract, paid for its system prior to completion of acceptance testing. The system failed to perform adequately, and the city spent months haggling with the vendor for a remedy.

Performance monitoring means making sure that hardware and software are delivered on time, that the hardware functions without failure, that the software performs all required functions, that adequate memory and storage are available for processing, and that staff training and software documentation are provided. In other words, for value agreed upon, the vendor performs all required tasks and the system performs all required functions.

C. MICROCOMPUTER SALES AND SUPPORT

Several sources are available from which local governments can purchase microcomputer systems. These include *companies that specialize in microcomputer sales, discount chains, department stores, audio and video stores, farm co-ops, system manufacturers,* and others. Systems can also be purchased through mail order catalogs.

Local governments can buy both hardware and software from the same organization or hardware at one place and software at another. Unless a complete system including hardware and software is acquired, however, the microcomputer will be less than useful.

Several major differences exist among types of organizations that sell microcomputers. Department stores, discount chains, and audio and video shops, for example, are not primarily in the business of selling micros. Therefore, they cannot be expected to be highly knowledgeable about micros, sell a wide range of hardware or software, or be able to provide extensive hardware maintenance or software support. Many of these organizations also sell only home computers or low end business systems, typically 8-bit or small 16-bit micros with limited memory, few peripheral devices, and software that is aimed at the home user market.

Companies that specialize in microcomputer sales—often microcomputer stores—tend to focus their efforts on small businesses. The systems they offer usually can be configured with ample memory and disk storage capacity for such organizations and will support several peripheral devices (disk drives, monitors, printers, tape drives, modems, and others), and programming needed for business applications. Microcomputer stores also offer training in system installation, operation, and the use of application programming. To one degree or another, they also offer continuing software support and will either provide hardware maintenance directly or arrange for maintenance with a service organization.

The one major limitation of microcomputer stores is their lack of knowledge about local government data processing requirements. This (45) may mean that the software proposed or sold by these organizations will not meet a local government's needs. However, quite a bit of the programming sold for standard business purposes can be used effectively without modification, e.g., word processing, inventory, payroll, spreadsheet, and data base management software.

Buying directly from a manufacturer may not be as desirable as from a microcomputer store. This is true if for no other reason than that manufacturers are primarily oriented toward the sale of their brands of hardware. On the plus side, however, these organizations are well-equipped to sell and service their hardware. At least some manufacturers have learned that programming is what is important in micro systems and offer a wide range of application software for use on their machines.

In the last couple of years a new type of microcomputer system vendor has appeared on the market, the so-called OEM's or turnkey vendors. These are organizations that develop software for a vertical market, e.g., local government, and then sell their software together with a particular brand of hardware as a complete system. *OEM's and turnkey vendors serving the local government microcomputer market are becoming more plentiful.*

One of the advantages of buying from an OEM is that software is this vendor's primary concern, and the software has been written for the governmental marketplace, not as a generic application or for business and commercial organizations. An OEM typically will stand behind the quality and functionality of his software through a warranty or a software support agreement that may be unavailable from other organizations.

All microcomputer equipment is sold with warranties of one kind or another, e.g., 30, 60, or 90 days, during which time a malfunctioning piece of equipment can be returned for repair or replacement at no cost. Some equipment is sold with better warranties than others, and the consumer should bear this in mind when purchasing. The larger issue, of course, is what to do after the warranty expires. Should an organization purchase a maintenance contract or assume the risk

associated with equipment failure?

While no advice is absolutely foolproof in this regard, most microcomputer equipment is highly reliable and relatively inexpensive. Hence, the cost of a hardware maintenance contract may not be worthwhile. Making sure that the system is put through a good burn-in during the warranty period will often be sufficient to determine if any devices are defective. This plus careful backup procedures will ensure that any subsequent failures will not cause the loss of data and files. Arrangements should be made with the vendor from whom the system was purchased for rental or loan of replacement devices should any part of the system (printer, disk drive, CPU) go down and have to be out of service for repair for a considerable period.

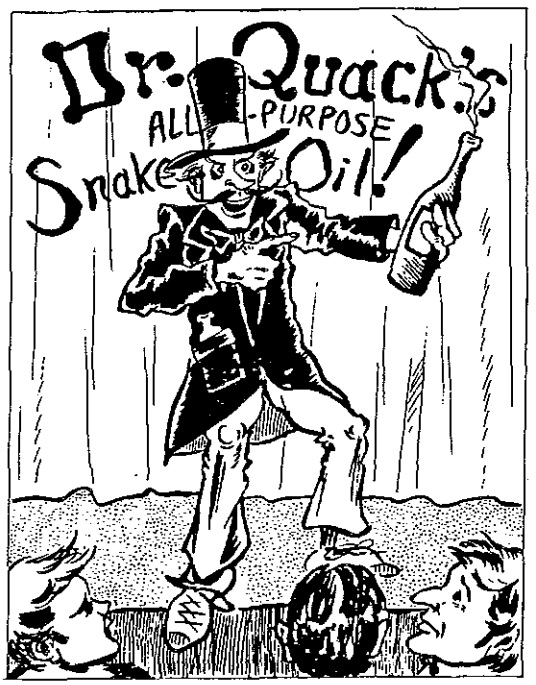
Three alternatives typically can be utilized for (46) hardware maintenance: *on-site* (that is, a repair person appears and performs equipment maintenance on site), *transportation* of the malfunctioning device by the owner to the vendor or service location, or *mailing or shipping* the device to a remote service location. Each of these alternatives has pros and cons. For example, on-site service is the most expensive, and an organization may have to wait hours or days before a repair person appears and is able to correct the problem. Carry-in and mail-in maintenance are less expensive but require that a person from the local government actually take the device to the service location or prepare and ship it to be repaired. In both cases, the user must be prepared to operate without the piece of equipment for days or even weeks while it is being repaired, unless other arrangements have been made.

Software support involves "hand-holding" by (47) the vendor after the sale and initial training (if any training is provided). For many commercially available packages this involves a toll free telephone number that can be reached during normal business hours. Questions can be asked and directions for program use will be provided. Remote diagnosis or correction of software bugs, however, generally is not provided for these packages, although they can often be returned for replacement if they are found to be defective. Another more extensive and expensive type of software support is provided by OEM's and other software developers. Here, a toll free number is frequently available, and the organization will provide continuing support including both hand-holding, remote diagnosis, correction of bugs, provision of updated software releases, and even modifications to installed software. Of course, these more extensive services are more costly.

A local government should decide what, if any, software support will be required and in its RFP ask vendors to respond with descriptions and costs for various levels of software support. As in the case of hardware maintenance, no hard and fast rule is available, but a local government should weigh carefully whether software support is really worth the price. This is particularly true in the case of off-the-shelf packages like word processing, spreadsheet, and database management that are relatively inexpensive and quite reliable. Available toll free answering service support for such software is probably adequate. However, for more detailed and complex packages such as an integrated fund accounting system, a local government

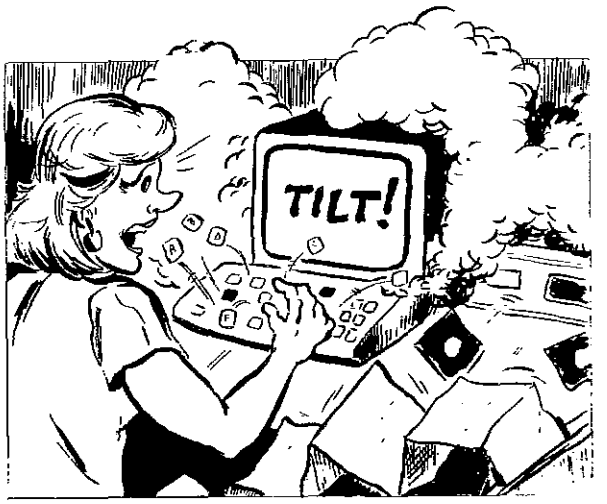
will probably want to pay the extra cost to receive a higher level of vendor support.

A final word of advice on micro sales and support is that a potential buyer should try to purchase his or her system from a reputable vendor. At all costs, avoid the snake oil salesman. A reputable vendor is one who knows microcomputer hardware and software and understands the needs of your organization, one who will be in business next year (and the next and the next), one who offers a wide variety of hardware and software, and a vendor with whom a degree of rapport and trust can be developed.



D. WHERE TO GET HELP

Many local governments, especially small ones, may feel the need for expert assistance in undertaking a microcomputer procurement effort. Numerous sources of such assistance exist. In several states, university-based technical assistance or extension programs provide data processing system procurement help to local governments at no cost or for a nominal fee. In addition, hundreds of independent consultants and firms of various types that specialize in data processing assistance exist. The latter include management consulting firms, accounting firms, data processing consultants, and others. Also, some communities have been able to use local citizen experts satisfactorily. Local governments that lack adequate staff expertise in the area of data processing should look to one or more of these sources for assistance. A few thousand dollars invested in consulting assistance may mean many thousands saved and the avoidance of serious problems later.



The same selection standards should be applied to a prospective consultant as to any other purchase of services. Spending as much on consulting assistance as the microcomputer system will cost is probably not wise or necessary. This may be easy to do, however, since consulting assistance can be expensive compared to the relatively low cost of microcomputers.

Finally, never ask a computer hardware or software vendor to provide consulting assistance unless the vendor will not be allowed to bid on the system. The fox should not guard the chicken coop nor be given the key to the door.

NOTES TO INSTRUCTORS

Chapter VI. Issues of Importance

Several issues, some of which were raised in earlier chapters but deserve added attention, are presented in this concluding chapter. These are issues that potential buyers of microcomputer systems should be familiar with in order to protect themselves during a procurement effort.

Issues included are: hardware expandability and compatibility, software adaptability and transportability, software documentation, training to use the hardware and software, and functional limitations of micros (including CPU memory and disk storage limits, single versus multi-user capabilities, speed, perceptions of micros in organizations, lack of hardware standardization, competition for use of the micro, unnecessary duplication, and the fallacy that installation of a micro will solve basic management problems). Additional issues include the impact of technological change on micro use by local governments and the adoption of a policy on micros in local governments.

This chapter also discusses microcomputer sales and support, describing the major types of organizations that sell micros, and listing some of the strengths and weaknesses of each. Also discussed are the main alternatives for servicing microcomputer components.

Finally, a few words of advice are offered for those local governments in need of assistance in their microcomputer procurement effort, e.g., where to get help.

VI. Issues of Importance

THIS CHAPTER discusses in greater detail several issues of importance to the potential local government microcomputer purchaser. These issues are: hardware expandability and compatibility, software adaptability and transportability, software documentation, training, functional limitations of micros, the rapidity of change in microcomputer marketplace, and a policy on microcomputer procurement.

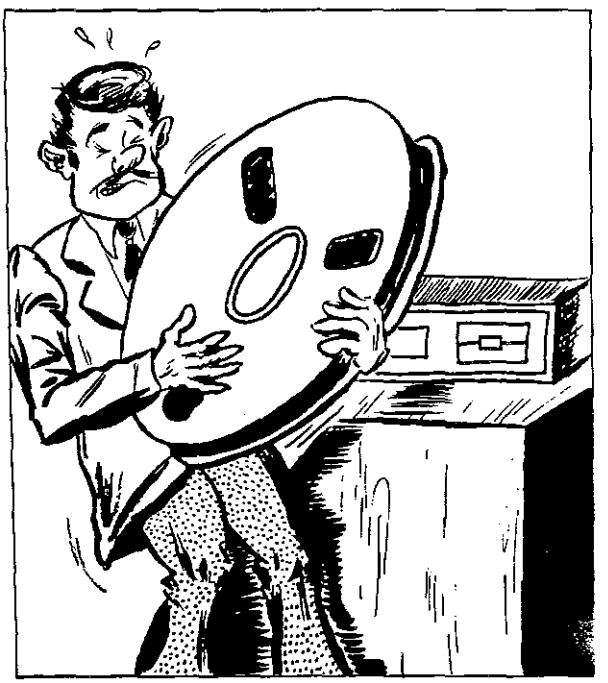
A. HARDWARE EXPANDABILITY

(51)

All computers provide their users with potential benefits and confront them with distinct limitations. Micros are no exception. One major limitation to the use of microcomputers is CPU memory. For example, the maximum available memory for 8-bit micros is 128K. However, many 8-bit systems are limited to 48K or 64K of memory. A local government using an 8-bit system will not be able to expand it beyond this maximum configuration even if data files and application programs require a larger CPU capacity. Similarly, 8-bit micros also have greater disk storage limitations. They are often limited to single or dual floppy disk drives with a maximum capacity of 150K to 300K per diskette. Larger data files will require the use of multiple diskettes.

On the other hand, 16-bit systems have far more CPU capacity than 8-bit systems. For example, 16-bit systems can be purchased with as little as 64K or CPU memory, but many can be expanded to over 700K. They can also handle hard disk drives with up to 40MB of storage capacity. Of course, each expansion increment, whether CPU memory or disk storage, adds an increment of cost to the system. Typically, the larger and more powerful the system, the more expensive it is.

When deciding which type and model of hardware to acquire, a local government should think in terms of both initial and long term requirements. A memory size of 64K or 128K may be adequate initially, but if the organization's computing requirements are expected to grow, the system should be able to grow with them. A 64K or 128K limit may cause problems at a later date, and a system with greater expandability may be a better buy.



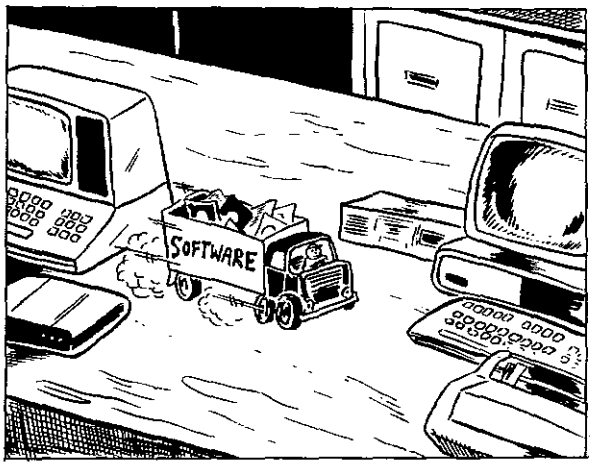
B. HARDWARE COMPATIBILITY

Hardware compatibility is another important consideration, especially for those governments that plan to acquire more than one micro, that already have minicomputers or mainframes, or that want to communicate with other computers. In this regard, two different types of compatibility should be considered. The first is strictly micro to micro compatibility. This can be achieved either by staying with identical or nearly identical hardware, such as all Apple IIe's, or all IBM PC's, or by buying computers with compatible operating systems, such as machines that support CP/M or MS-DOS. In this way, the software that the organization purchases will be able to be run on all of the hardware that it owns. Connecting the micros in what is known as a local area network may also be feasible so that they can communicate with one another and share common data and files.

The second type of compatibility concerns communication with other computers, especially minicomputers or mainframes or with remote computerized networks and data bases. Many micros on the market can be configured with additional hardware or software elements (e.g., modems and communication software) to communicate with other computers. However, the type of communication desired may be a limiting factor. Many micros can act as terminals on larger computers and can upload and download files and data from them. Today, however, micros that can share programming with larger computers are rare.

C. SOFTWARE ADAPTABILITY AND TRANSPORTABILITY

As has been stressed repeatedly, *software is the single most important element of a micro computer system.* Software should not only do the work for which it is intended, such as payroll or utility billing, but it should also be adaptable and transportable. *Adaptability* means that a software package should be capable of being modified for the specific purposes of the organization that purchases it. This means that such things as screen formats, input and output formats, file and record layouts, printing formats, reporting requirements, and many others *must be flexible enough to be adapted to the way the organization does its business rather than having to adapt the organization to the requirements of the software.*



Transportability in part relates to the earlier discussion of hardware limitations. Can the software be used on various micros within the organization? If the hardware or the operating systems are compatible, then the answer is yes. If they are not, then the answer is no. If an organization anticipates purchasing several micros, transportability is an important issue. Transportability means that the organization will not be faced with unnecessary duplication of software purchases; one package can be shared by several users on different machines.

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D. DOCUMENTATION

One of the complaints most frequently voiced by computer users concerns something called *software documentation.* Documentation usually refers to the user's manuals or instruction guides that accompany microcomputer equipment and

programming. These manuals are frequently incomplete, poorly written, difficult to follow, and frustrating to use. They also have been known to contain incorrect information and instruction.

Toll-free hot-line telephone numbers will rarely substitute for good documentation. The user, therefore, should search for systems that not only perform required functions adequately but also are supported by good user documentation.

Documentation can also refer to what is known as the *source code.* This means the actual programming language instructions that create the software. For most local government micro users, source code will not be available and, if available, it should not be desired. The only reasons for having source code are 1) in case the writer of the program suddenly goes out of business, and changes are needed in it or 2) the organization intends to make changes in the program right from the start. The former problem can be avoided by purchasing software that requires no programming level changes. In the latter case, the best solution is not to buy software with the idea of making changes in it, especially if the local government does not have a staff of qualified programmmers.

E. TRAINING

(53)

No one can use a microcomputer system without training, and while some persons learn more quickly than others, efficiency will occur only after some training and a lot of practical application.

Formal training is available at a cost from most microcomputer system vendors. A limited amount of training may be offered "free" with the purchase of hardware or software. Actually, this training is not free. Its cost has been built into the price of the hardware or software.

A greater price is paid, however, when formal training is not acquired, and personnel are expected to learn to operate the system without it. They then have the additional burden of learning the system by trial and error while continuing to do their routine work. It also delays the time when the organization can expect to begin reaping

the benefits of system use. Also, serious mistakes such as erasing data and files can be made as the result of lack of training, and the most efficient methods of system use may never be learned.

Thus, the local government buying a micro generally should spend the necessary time and money on formal training for staff persons. Such training should include both operation of the hardware and instruction in each of the purchased software packages. A sufficient amount of training should be provided to ensure that local staff will be able to use each application program and all system capabilities effectively.

Another way to get training is from the instruction manuals and diskettes and self-taught tutorials that accompany hardware and software. These can be helpful but are often difficult to follow, especially for the uninitiated, and this type of training may require a greater commitment of time and be more frustrating than formal training.

F. FUNCTIONAL LIMITATIONS

To hear some vendors tell it, microcomputers (54) have virtually no limitations and can be used for

virtually all purposes known to man. This is nonsense. Here are some of the more important functional limitations that potential purchasers should know.

1. **Memory and Disk Storage.** At this writing something over 700K is the maximum CPU memory configuration for commercially available 16-bit micros, and 40MB of hard disk is about the maximum effective disk storage capacity. Of course, many micros have far more limited configurations. These capacities, as great as they are, cannot compare with the megabytes of memory and gigabytes (billions of bytes) of disk storage offered on minicomputers and mainframes. Microcomputers are smaller and hence cannot do as much work as larger computers.

2. **Single User.** Their size and internal architecture also limit most micros to being single user systems, although given the proper communication software and hardware linkages, several micros can be connected together to form something of a multi-user environment. Minicomputers and mainframes are truly multi-user, multiprogramming computers that will support a wide range of peripheral devices and numerous users performing a variety of tasks at the same time. True multi-user micros are just now entering the market, and months or years will be required for software development to catch up with the hardware capabilities of these systems.

3. **Speed.** Micros are also relatively slow. Waiting for a micro to retrieve a piece of information from a large data base or to print a lengthy report can be frustrating, especially when a mainframe or minicomputer can accomplish the same task in a fraction of the time. Of course, micros are considerably less expensive than larger systems, and, unless speed is essential, the slower system can easily be justified by the lower cost. Furthermore, even with relatively slow speed, micros are far ahead of the speed of data processing with manual systems.

4. **Perceptions of Micros.** Microcomputers may be perceived as toys in an organization. This can have at least two results. The first is that no one will take the micro seriously and thus it may not be used. It will just sit there and do nothing, not because it will not work, but because no one will use it. The same can happen as the result of fear of microcomputers. People will not use them if they are afraid of them.

Second, almost every organization has a closet programmer or two. As soon as a micro appears, these otherwise mild-mannered souls will burst out of the closet intent on writing programs. This can be a valuable asset if properly channeled, but it can also mean that the introduction of a microcomputer will result in the loss of effective manpower. The closet programmers will spend their time "playing" with the micro rather than doing their work.

5. **Lack of Standardization.** Lack of standardization is a scourge on the microcomputer industry. It means that local governments must be knowledgeable in purchasing micros in order to acquire systems that will work effectively. Although lack of compatibility is the rule throughout the world of computers, the problem is magnified somewhat in relation to micros because they seem so genuinely easy to use and are so inexpensive. There can be no greater (and possibly more costly) surprise than to discover that the newly purchased

micro will not run certain desired programs, that it is incompatible with other systems the organization already owns, or that additional hardware or software elements must be purchased before it will work properly.

6. **Competition.** Competition or conflict within (55) an organization can affect the use of a micro. This may mean competition among staff persons for use of the system. Whose is it? What are the functions to which it is dedicated? Which persons and functions have priority? A second form of competition can occur between the micro and the data processing department in local governments that have larger computer systems. Data processing system managers and personnel may fear the intrusion of micros and the competition from them and, therefore, may oppose the introduction and use of micros into the organization. These persons may also refuse to provide adequate support for micros. Often, the pressure for acquiring micros comes from persons at the departmental level who have been denied effective access to the programming and power of the mainframe. This may serve to increase the degree of conflict over the micro and further hinder its effective use.

7. **Duplication.** In organizations that have other computers, micros, if not acquired carefully, can also lead to unnecessary duplication of effort. That is, micros will be used to do or redo much of what is done or should be done on the minicomputer or mainframe, or micros themselves will be duplicative of one another.

8. **No Panacea.** As pointed out in Chapter II, a microcomputer is not a panacea for bad management practices. Thinking that the introduction of a micro into an organization will cure bad management practices would be foolhardy. It can, however, help good managers to be better by making their work easier, faster, more accurate, and more comprehensive. However, local governments should never automate systems or practices that are inefficient, ineffective, or error prone. To do so will mean that the same mistakes are made faster and retained longer.

G. TECHNOLOGICAL CHANGE

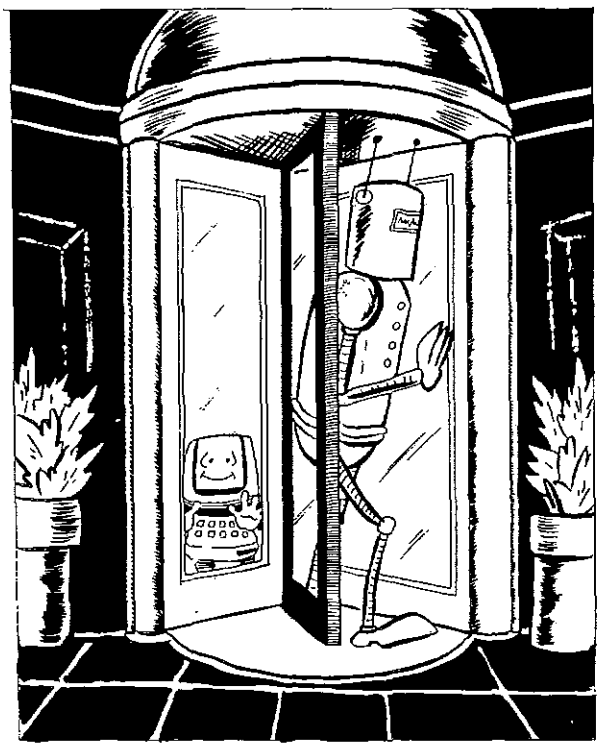
(56)

During the writing of this handbook, numerous new hardware and software products for microcomputers were released, and many more can be expected to be introduced in the future. In this same period, at least one major microcomputer manufacturer (Osborne) went bankrupt, and another manufacturer facing huge financial losses withdrew a highly advertised product from the home computer market (the Texas Instruments 99/4A).

The rapidity of technological change and the volatility of the microcomputer market have given pause to more than one potential purchaser. Issues of concern include at least the following: Will a system bought today be substantially less expensive or even outdated in a few months or years? Will the model acquired still be on the market or the manufacturer still in business in a few months or years?

To answer these questions requires a prescience not available to mortal man. However, the following advice may be helpful.

System usability is the key to the issue. Local governments ordinarily do not buy computers to stay on the leading edge of technological change.



Instead, they buy them in order to accomplish certain specific functions and to do the work of the organization. Hence, an 8-bit micro with 64K of memory and a dual floppy disk drive used for word processing or spreadsheet analysis is as good for its work at three years of age as it was when brand new. A more current 256K 16-bit machine with greater storage capacity that may cost the same today as the 8-bit system did three years ago is really no functional improvement. Waiting to buy a system until the price goes down a few hundred dollars means not having the productivity benefits of a microcomputer in the interim.

In order to guard against the risk that a manufacturer will go out of business leaving the local government with essentially useless equipment, the following considerations may be helpful: buy a system that 1) is one of the more popular brands, 2) relies on one of the more widely used operating systems, 3) has ample third-party software, and 4) has adequate hardware support. A micro purchased with these considerations in mind will remain functionally effective for a long time.

The next major change in the market will probably be the introduction of the true multi-user micro. This shift has already begun, but a few years will be required before it comes to fruition. This is so because of the inevitable lag between hardware availability and software development. Here, too, the question is whether a small local government or even a department in a larger government should wait for the arrival of the multi-user system. The answer is probably no. For the limited computing requirements of most of these organizations, single user micros will be adequate. If they are not, then networking single user micros or the purchase of a minicomputer may be the reasonable alternative.

Technological change and marketplace volatility can be frightening, but the use of common sense and the guidelines presented in this handbook can help to minimize their negative consequences.

H. POLICIES ON MICROS

Local governments may find useful the adoption of formal policies regarding the acquisition of microcomputers. Such policies may be as simple as limiting the amount of funds that can be expended for a given piece of equipment or as comprehensive as specifying the type of hardware, operating system, software capabilities, and price range and requiring review and approval by a purchasing officer or data processing committee.

Regardless of the detail of the policy, an organization that plans to acquire micros needs to ensure hardware and software compatibility, prevent conflict over system use, prevent unnecessary duplication of hardware and software, and maximize the effective use of this technology. In the absence of a formal policy, more limited procurement guidelines that address the issues raised above regarding hardware and software can be beneficial.

FOOTNOTES

[1]The Altair was probably the first microcomputer to appear on the American market. However, it was sold as a kit to be assembled by the user, and its appeal was limited largely to hobbyists. Radio Shack's TRS 80 was on the market earlier than the Apple, but the contemporary litany credits Jobs and Wozniak with opening the micro market with their innovative product.

[2]See Gary B. Shelly and Thomas J. Cashman, *Introduction to Computers and Data Processing*, (Fullerton, CA: Anaheim Publishing Co., 1980), chapter 2, for the number of minicomputers and mainframes. The estimate of the number of micros sold by 1984 was provided by Aaron Goldberg, research manager, International Data Corporation (IDC), Santa Clara, CA, December, 1983.

[3]Donald F. Norris and Vincent J. Webb, *Microcomputers: Baseline Data Report* (Washington: International City Management Association, July, 1983), p. 2; and Donald F. Norris and David R. DiMartino, *Computers and Small Local Governments: A Survey of Computing in the Plains and Mountain States* (Omaha: Center for Applied Urban Research, University of Nebraska at Omaha, August, 1983), pp. 24-26.

[4]Norris and Webb, p. 1, and Norris and DiMartino, pp. 7 and 25.

[5]*InfoWorld*, July 18, 1983, p. 31, interview with John Sculley.

[6]Norris and Webb, pp. 2-3.

[7]*Ibid.*, pp. 7-8.

[8]Norris and DiMartino, pp. 24-26, and Norris and Webb, p. 2.

[9]With appreciation for the humor of Bob Newhart.

[10]This discussion of the evolution of computer technology is based in part on Shelly and Cashman, chapter 2. For persons interested in an especially well-written, understandable text on computers and data processing, this book is highly recommended.

It appears, however, to be incorrect in one respect. As in many other contemporary works, ENIAC is credited with being the world's first electronic computer. Recent litigation has established that Dr. John Vincent Atanasoff of Iowa State University developed the world's first electronic computer in 1939, seven years prior to ENIAC.

[11]Norris and Webb, pp. 2 and 7, and Norris and DiMartino, *op. cit.* Interestingly, a recent survey of 5,000 businesses found that micros were used mostly for spreadsheet analysis (68.7 percent), followed by accounting (61.9 percent) and word processing (48.4 percent). See *Personal Computer Survey* (New York: Dun and Bradstreet Credit Services, 1983), p. 24.

[12]Thanks to John Scoggins, currently an independent consultant and author of *Computers and Local Government* (Athens, GA: Institute of Government, University of Georgia, 1978), for this quotable quote.

[13]This method and these steps, in a somewhat modified form, were originally developed and documented in the training and technical assistance program associated with John Scoggin's handbook on microcomputers and local government. See Scoggins, *op. cit.*

[14]Norris and DiMartino, p. 12.

[15]*1983 Computer Salary Survey* (Source EDP Personnel Services, 1983), p. 14.

NOTES TO INSTRUCTORS

Appendices

The handbook contains seven appendices. The first five are essentially standard documents that with appropriate modifications can be used by governmental organizations in the procurement of microcomputer systems. These appendices are:

- Data Processing Analysis and Recommendations—the recommended study for determining an organization's computing and information management requirements and the feasibility of acquiring a micro.
- Request for Proposal
- Specifications for a Microcomputer—for the organization that does not want or need to use the more elaborate RFP method.
- Evaluation of Proposals—an example of evaluations of proposals for microcomputer system received by a small city.
- Software License Agreement—this or something like it is recommended when purchasing packaged software.

The next appendix is a reprint of an evaluation of several hardware systems. It was adapted from *Creative Computing's Buyer's Guide to Personal Computers, 1984.* This guide will be out of date quickly. Instructors are urged, therefore, to provide more current hardware evaluations for their workshops. These are available from a variety of publications that cover the microcomputer industry.

The final appendix is a list of organizations known to the author that provide packaged programming for local governmental functions. The list, admittedly, is incomplete as probably many more such organizations are or soon will be in business around the country. Instructors and participants are urged to add to the list such organizations as they know that are producing packaged governmental software. (The author would appreciate receiving information about these organizations and the software that they have available.)

APPENDICES

NOTE TO THE READER

The documents included in Appendices A and B were developed initially by David R. DiMartino and Donald F. Norris as part of a demonstration project funded by the W. K. Kellogg Foundation in the acquisition of microcomputers by small local governments. They are printed here in modified form as models for use by other governmental agencies and technical assistance personnel. Naturally, they will require modification and customization to fit particular organizations.

Sections of the "boilerplate" for these documents had their origin in the methodology for procurement of minicomputer systems presented in John Scoggins, *Computers and Small Local Governments: A Workshop* (Athens, GA: Institute of Government, University of Georgia, 1978). Scoggins' work was funded under a grant from U.S. Department of Health, Education, and Welfare.

Appendix A

DATA PROCESSING ANALYSIS AND RECOMMENDATIONS FOR THE CITY OF _____

I. Scope and Purpose

This report presents an analysis with recommendations regarding the data processing needs of the city of _____. The analysis was undertaken pursuant to an agreement dated _____ between the city of _____ and _____.

This report will provide city officials with information on the current status of data processing in their city government and the city's information management data processing needs. The report will also discuss the applicability of microcomputer technology, the probable configuration and cost of a microcomputer system to meet their needs, and recommendations concerning future action by the city in the area of microcomputer system procurement.

II. Microcomputer Technology

Recent advances in technology have brought computers within the reach of many local governments in America. These advances have substantially reduced the cost of computer systems and have also made possible effective computer use by local government personnel who are not data processing experts.

The first advance has been a tremendous reduction in the physical size and cost of computers coupled with dramatic increases in their functional capability. Second, the current generation of application programming, or software, available to local governments is characterized by flexibility and "user friendliness." That is, the programming is designed for interactive use on video terminals by personnel who have little or no knowledge of computer technology or programming. One result of these changes is that local governments today can acquire and use computer systems to aid in performing everyday activities and can do so with a high degree of confidence and at relatively low cost.

The third major advance has been the introduction of the microcomputer. These small, inexpensive, yet relatively powerful machines, when coupled with appropriate software, can become significant tools in the performance of local government functions.

Microcomputers can be used as "personal" computers. That is, they can be single user, single function machines—somewhat analogous to the telephone or adding machine, or they can be used by several persons to perform a variety of activities. Certain microcomputers can also be linked together to form local distributed processing networks of small machines.

III. Acquiring the Technology

Regardless of the type of hardware, a computer system should be viewed as a tool to be used like any other piece of office equipment. It is an integral part of the work routine, just like the typewriter, the telephone, the adding machine, or the filing cabinet.

Computer usage is technically feasible in almost all organizations. Technical feasibility, however, is often less important to local governments than several other factors, including:

- **Cost.** Cost is perhaps the best understood and most definitive means of determining the feasibility of any new system. Is the new system more or less expensive than current methods? Although cost may be the best understood criterion for determining feasibility, accurate cost estimates are often difficult to obtain, especially in cities with limited current data processing capabilities.

A word of caution is in order here. Few local governments that implement computer technology can expect to reduce overall costs. Thus, a strict cost justification for an electronic data processing system may be impossible. At best, a local government can anticipate cost displacement (e.g., the moving of costs from one place in the budget to another) or cost avoidance (e.g., the use of more efficient technology to prevent, avoid, or move into the future costs that would otherwise occur).

- **Ease of Operation.** Some computer systems can be operated only by technically trained personnel. A factor in favor of the current technology, especially the present generation of mini- and microcomputers, is that in many cases local government personnel who are not trained in the technology can easily operate these systems, and a technical staff of programmers is not required.
- **Available Programming.** The availability of proven, easy-to-use software or programming to make a computer system do what a local government wants, when it wants, and how it wants is crucial to system feasibility. Without adequate software, a computer is only an expensive box that fulfills no useful purpose. Software is available in most functional areas of local government from a variety of sources and needs to be considered prior to hardware considerations.
- **Growth.** An important factor in the feasibility of an electronic data processing system is the extent to which it can grow to meet future government requirements. Not only should the system be capable of accepting more sophisticated uses and equipment (hardware) but also of accommodating normal growth in the volume of city activities.
- **Staff Considerations.** The degree of acceptance of computer technology within a local government is a significant consideration in system feasibility. Similarly, the degree of staff ability to perform specific local government functions (e.g., payroll, utility billing, etc.) and staff aptitude and enthusiasm for the use of computers can be constraints on system effectiveness. To put it more plainly, staff support for computerization, competence in positions that will rely on computer technology, aptitude for using automated equipment, and interest or enthusiasm for automation are most important to the effective implementation of a computer system in local government.
- **Political Feasibility.** Finally, political feasibility may well be the single most critical element in the success of computerization in a local government and the most difficult factor to deal with. Political feasibility means the extent to which local elected officials and administrators understand and support the need for an electronic data processing system procurement. On the other hand, the support of these persons can help immeasurably to ensure the smooth acquisition, installation, and operation of a system.

Once a local government has reviewed these factors and determined both the need for and feasibility of acquiring new or enhancing existing automated technology, a *step-by-step procurement plan* should be adopted. This study of the city of _____'s current data processing requirements is the *first step* in such a plan. It will, in turn, lead to the following activities, in order of occurrence.

- A decision by city officials whether to acquire a microcomputer system based on the recommendation contained in this report. This decision should follow shortly after review of this report by city officials.
- In the event the city decides to acquire a system, the city *(or its consultant)* will develop and submit to microcomputer system vendors a Request for Proposal (RFP) to meet the requirements identified in this study.
- Proposals received by the city will be evaluated, and a short list of finalists will

be selected from among all of the proposals for additional consideration.

- City officials will be asked to approve the selection of finalists and to authorize further evaluation of these proposals, including visits to local governments having systems installed by the finalists.
- A detailed evaluation of the remaining proposals will be conducted, and a system will be recommended for selection by the city.
- A contract will be negotiated with the selected vendor.
- Finally, system installation, testing, and acceptance will complete the procurement plan.

This step-by-step plan outline here is recommended for use by the city of _____ as a method proven effective for computer system acquisition in numerous local governments throughout the country.

IV. Current Data Processing in the City of _____

The current level of data processing in an organization, whether manual or automated, is an indicator of the organization's need for improved technology. It also provides insight into potential problems that may arise with implementation of newer technology. A review of an organization's data processing operation also allows the development of a cost-benefit analysis that can be used, in part, to determine whether new or enhanced data processing capabilities are justifiable.

The following is a brief discussion of the data processing activities in the city of _____. Data for this section of the report were provided through interviews with the city manager, city clerk, and other staff personnel.

A. Administrative Offices

The clerk's office in _____ operates a _____ ledger card bookkeeping machine, purchased from a private owner in 1980. Current maintenance costs for the system are $2,250.00 per year, with a one- to two-week turnaround time for necessary repairs. Backup data processing is by hand.

The _____ is an outdated machine. It uses programming on cassette tapes and can perform only one function at a time. Maintenance for the system can be expected to become increasingly costly and difficult to obtain, and the machine lacks expandability to accommodate additional functions. Its salvage value is minimal. Finally, due to its age and functional limitations, enhancement of present operations on this equipment (e.g., a more up-to-date utility billing system) would not be advisable.

Only two functions are currently automated on the _____. These are:

- city payroll—20 biweekly payroll checks (plus approximately a dozen summer employees)
- utility accounts and billing—1,000 customers for sewer and water and 1,250 for garbage services, billed quarterly.

In addition, a service bureau does basic month-end and year-end accounting for the city at a cost of $180 per month or $2,160 annually.

At the end of each month, the city sends the service bureau a list of checks paid and revenues received. The service enters data from these documents onto its computer system and prepares monthly reports for the city, including balance sheet, income and expenditures

journal, and consolidated funds comparison for each department by monthly and yearly totals. A time lag of two to three weeks occurs between the time the city submits its information to the bureau and the receipt of bureau reports. In addition, the data are maintained by the service bureau to facilitate year-end auditing.

The city clerk also operates a _____ memory typewriter. All correspondence, reports, ordinances (25 per year), resolutions (25 per year), and city council agendas (one per month), and council meeting minutes are produced on this machine.

A number of additional functions are performed manually. These include accounts receivable, accounts payable, and personnel records.

In addition the city manager is currently experimenting with in-house automated data processing on an _____ portable computer system with an _____ dot matrix printer, leased for $200 per month. The manager uses the _____ for budgeting preparation, budgetary accounting, and word processing.

B. Other Offices

At present, the chief of police makes no use of electronic data processing. The chief stated his principal need as a computer terminal and printer for data base management. His six-man force processes approximately 400 arrests per year. The desired system would assist with report filing and records searches. These functions would involve the automated accessing of complaint, warrant and criminal history records, drivers' licenses, and motor vehicle registrations.

None of the other departments in _____ presently uses data processing. Moreover, due to the size of the city and the relatively limited volume of administrative work carried out by these departments, automation does not currently appear warranted.

V. Basic Applications to Consider for Computerization

A. Introduction

The use of automated data processing in the city of _____ is relatively limited. This is understandable if for no other reason than the size of the city (pop. 2,300) and its operational requirements. In addition, the _____ currently being used is essentially old technology with considerable limitations as to expansion or enhancement. This equipment also represents a generation of technology that does not permit integration of the city's major administrative functions, e.g., accounting, budgeting, and payroll.

The current generation of data processing technology permits and encourages both functional and data base integration. In fact, the type of system that should be considered by the city should have the following characteristics.

Transaction oriented—When a transaction such as updating the accounts receivable file is made, the system accepts the transaction and either automatically updates all affected ledgers and funds or stores the transaction for later updating. This would, for example, permit automatic distribution of the entry throughout the system and would also provide for an audit trail of the transactions.

On-line—Computer terminal(s) and printer(s) in one or more physical locations in city hall would be connected to the computer's central processing unit.

Real-time—Processing on the system occurs at the time a user begins to work at a

terminal, and no need exists to create punch cards, ledger cards, computer coding forms or other input documents to run through the system at a later time.

Interactive—This means that users communicate directly and immediately with the computer through a video display terminal or CRT.

User-friendly—Computer programming or software is written in such a way that the programming itself instructs users in its operation. At the minimum, user-friendly software is "menu driven," meaning that hierarchical lists of choices of actions appear on the video monitors, and users instruct the system in the completion of required actions by selecting the correct choices.

Data Base and File Management—The system should include software that will enable users to make unique inquiries across data bases, to create unique files, to combine data from various files, and to generate unique (not pre-programmed) reports, all using standard English language commands.

B. Applications

With these requirements in mind, a single stand-alone microcomputer system with programming in the following functional areas should be considered by _____ for automation:

- Integrated financial management system, including the following elements:
  - general ledger accounting
  - budgetary accounting
  - vendor accounting
  - accounts payable
  - accounts receivable
- Payroll/personnel system
- Utility accounting and billing
- Data base management
- Word processing.

VI. Equipment Configuration and Estimated Cost—Microcomputer Alternatives

A. Immediate

A single microcomputer, with 128K to 256K of main memory and 10MB to 20MB of hard disk storage, could fulfill the city's basic data processing needs. The single system would have one work station located in the city clerk's office with a dual mode printer. The programming would include integrated financial management, payroll, and utility billing, data base management, and word processing.

The costs can be expected to range between the two amounts shown in Figure 1.

FIGURE 1

	Low	High
Hardware (CPU, video display monitor, hard disk drive, and printer)	$ 6,000	$ 7,500
Software (as discussed above)	4,500	8,000
Total	$10,500	$15,500

Maintenance for a system of this configuration would cost an estimated $1,200 to $2,000 per year, if deemed necessary. However, except for the disk drive unit, a maintenance policy is not recommended. This is due to the reliability of microcomputer systems in general and the fact that replacement costs for most system elements are relatively low.

B. Future

Future functions that might be considered for automation on additional microcomputer(s) include:

- an integrated law enforcement system for the police department,
- a vehicle and equipment management system for the public works department.

Automation for the police department would require the acquisition of a second microcomputer system with hard disk drive at an estimated hardware cost of $6,000 to $7,500, and an estimated software cost of $5,000 to $7,500.

Automation for the public works department (equipment management only) could be accomplished on the system in the city clerk's office at an estimated cost of $2,500 to $4,000 for software only.

VII. Alternative Methods of Acquiring Computer Technology

A. Alternatives

The city can acquire the required microcomputer system by using one of three basic alternative methods. This is so whether the city chooses a single microcomputer or multiple microcomputer system. These alternatives are:

1. Acquire microcomputer hardware and also develop application software (programming) for the system.
2. Acquire microcomputer hardware and off-the-shelf software and either modify this software or modify city procedures to accommodate the software.
3. Acquire a fully programmed and supported system, including both in-house computer hardware and packaged application software. Such a system would be operated by existing city personnel.

B. Evaluation of Alternatives

1. In-house hardware/in-house software development

This alternative is not deemed acceptable for the following reasons:

- The length of time required to create the required software will be excessive.
- The personnel and cost requirements of in-house software development and support are excessive.
- The limited availability of qualified programmer/analysts with experience in municipal government would result in difficulty in hiring and retaining a qualified programmer(s).

This alternative would take too long, cost too much, and involve too much risk for a small local government to implement a data processing system.

2. **Microcomputer and off-the-shelf software**
   a. **Advantages**
      - The city would own and control its own system.
      - Both hardware and software are readily available, inexpensive, easy to use, and reliable.
      - Little or no training will be required to operate the system.
      - The city can acquire and install such a system quickly.
   b. **Disadvantages**
      - Off-the-shelf software may not be adequate for certain functions, e.g., fund accounting.
      - Staff may not have the ability or background to modify or employ successfully off-the-shelf software for city purposes.
      - Only standard, vendor written purchase contracts are available for this type of acquisition.
3. **Microcomputer and packaged software**
   a. **Advantages**
      - The city would own and control its own system.
      - The software is tested and reliable, and some packages can be modified by the vendor to meet the city's specific requirements.
      - The system can be operated easily by existing personnel.
      - The system provides a relatively easy transition and introduction to electronic data processing.
      - A procurement contract may possibly be executed under which a vendor is fully responsible for system (hardware and software) performance or at least for software adequacy and performance.
   b. **Disadvantages**
      - Certain problems are associated with ownership and control of a computer system, including system depreciation and obsolescence, equipment failure, and use scheduling.
      - Unanticipated vendor problems can occur.
      - Personnel problems can arise involving both training of personnel and personnel fear of and/or opposition to a system.

C. Recommendation

This study recommends that a Request for Proposal (RFP) be developed to solicit proposals for microcomputer hardware and packaged software per the configuration recommended in Section VI of this report. The city should not consider in-house software development or purchase of a microcomputer and off-the-shelf software because neither alternative provides an adequate solution to the city's software requirements.

VIII. Conclusion

Three compelling reasons exist for the city of _____ to proceed with this recommendation. First, the equipment that it currently operates for purposes of utility billing and accounting is antiquated, has essentially no expandability or enhancement potential, and maintenance on this equipment can be expected to become increasingly expensive.

Second, the current generation of microcomputer technology is relatively inexpensive, highly reliable, and will provide the city with a considerably enhanced capability to perform needed data processing tasks. For example, the city will have data management and full word processing capabilities on the system and will have integrated financial management software—none of which are now available on presently owned equipment.

Third, the city can proceed with the recommendation made to submit RFP's for a new system at virtually no risk. That is, no decision regarding acquisition of a replacement system will be made until bids have been received and evaluated and cost comparisons made. At that time, city officials will have a much clearer idea of the costs and benefits of a new microcomputer system versus continuing with present methods.

A new microcomputer system is estimated to cost from $10,500 to $15,500. It will provide computing capabilities in the areas of integrated financial management, payroll/personnel, and utility billing and accounting. If current maintenance and service bureau costs are subtracted from this estimate, the net result is an estimated one-year cost of from $6,090 to $11,090. Amortizing these costs over three- and five-year periods shows that the system will pay for itself in a very short time. See Figure 2. The cost of the system, moreover, can be financed over two or more years, thus reducing its impact on any single budget year.

FIGURE 2

One-year Difference

	Low	High
Estimated cost of microcomputer system	$10,500	$15,500
Current one-year maintenance and service bureau cost	- 4,410	- 4,410
Difference	$ 6,090	$11,090

Three-year Difference

Estimated cost of microcomputer system	$10,500	$15,500
Current three-year maintenance and service bureau cost	- 13,230	- 13,230
Difference	($ 2,730)	$ 2,270

Five-year Difference

Estimated cost of microcomputer system	$10,500	$15,500
Current five-year maintenance and service bureau cost	- 22,050	- 22,050
Difference	($11,550)	($ 6,550)

Appendix B

REQUEST FOR PROPOSAL

REQUEST FOR PROPOSAL

MICROCOMPUTER EQUIPMENT AND PROGRAMMING

FOR THE

_____

TABLE OF CONTENTS

1.0 Introduction

1.1 Purpose

This Request for Proposal (RFP) is submitted to solicit proposals from qualified vendors of computer hardware, software, and support for the _____. In order to receive consideration, a proposed system must meet the requirements of _____ as herein described.

1.2 Submissions/Schedule

Sealed proposals marked "Microcomputer System Proposal" will be accepted by _____ no later than 5:00 p.m. on _____. All proposals shall be submitted in accordance with the conditions and instructions provided herein.

Schedule:	Date
RFP release:	_____
Closing date for submissions:	_____
Oral presentations and system demonstrations:	_____
Evaluation completed and vendor selected:	_____

The schedule is a guideline, and certain dates may vary somewhat from the original intentions. In no event, however, shall the deadline for proposal submissions be changed.

1.3 Selection Process

The selection of a computer system by _____ will involve both objective and subjective elements. The selection process is outlined below.

1.3.1 Evaluation Criteria

The following criteria will be used to evaluate all proposals: hardware, operating system, application software, hardware maintenance/support, software maintenance/support, vendor organization, and cost.

1.3.2 RFP/Bids/Selection

This RFP is issued to provide interested vendors with uniform information concerning the requirements of _____ for an automated information processing system. Vendors shall avoid superficial marketing language and materials and focus on the actual configurations and capabilities of proposed systems. The attached forms shall be used by vendors in bidding their systems. Failure to do so may lead to rejection of proposal by _____.

All proposals will be evaluated by _____ in consultation with _____. _____ will present his recommendation(s) to the _____ of the _____ who will make the final decision regarding contract negotiation and award.

1.3.3 Oral Presentations/Demonstrations

If oral presentations and/or demonstrations of proposed systems are desired, these shall be arranged in advance at a time and place convenient for _____ officials and personnel. Discussion of equipment during oral presentations/ demonstrations shall be confined to the configuration and level of equipment recommended in the proposal. The discussion of applications software shall be limited to currently available systems. The presentation/demonstration is not a negotiating session. Only material in the vendor's formal written proposal will be considered, and all sessions will be limited to a maximum of two hours.

2.0 General Conditions

2.1 Conformity/Uniformity

All proposals shall conform with the requirements presented in this RFP and shall be submitted using the forms provided in Section 6. Failure to conform may result in rejection of proposals.

2.2 Additional Information/Further Contact

Although the RFP and resulting proposals are of great interest to _____, vendors shall direct all inquiries or requests for information relative to this RFP to _____, who is the consultant selected by _____ to assist in this procurement process. Any deviation from this requirement may result in disqualification of a vendor.

2.3 Rights of _____

2.3.1 Right of Rejection

_____ reserves the right to reject any or all proposals, to waive technicalities or informalities, and to accept any proposal deemed to be in the best interest of _____ .

2.3.2 Right to Purchase From Any Source

_____ reserves the right to purchase in part or in whole any desired equipment or services from any source or sources.

2.3.3 Rights to Submitted Materials

All proposals, responses, inquiries, or correspondence relating to this RFP, and all reports, charts, displays, schedules, exhibits, and other documents provided by vendors shall become the property of _____ when received. _____ retains the right to use any or all system ideas presented in any proposal. Selection or rejection of a proposal does not affect this right.

2.3.4 Contract

_____ reserves the right to require a performance based contract or other performance guarantee from the selected vendor. _____ will base payment for the system on system performance.

2.4 Liability and Insurance

The selected vendor shall save and hold _____ harmless from any and all liability arising out of the infringement of any patent or copyright in respect to the normal use of proposed or installed equipment or software.

2.5 Price Protection

Prices quoted in the proposal shall be firm and not subject to increase during the term of any contractual agreement arising between _____ and the vendor as a result of the proposal. Vendors shall provide firm prices less any federal excise tax. Vendors shall stipulate the expiration date of their quoted prices.

If a price on a piece of hardware or software is reduced by the vendor during the term of this proposal, the same shall be made immediately available to _____, and _____ and its consultant shall be notified in writing by the vendor within 10 days.

2.6 Funding Out Clause

Vendors shall signify their willingness to accept a clause in the contract providing that in the event _____'s budget does not allow for funds to maintain an automated data processing system for any following year, a contract for lease or lease/purchase (if either of these options is selected) may be terminated and services discontinued without penalty to _____.

2.7 Delivery Date

Vendors shall specify the delivery date of equipment, services, and/or products (e.g., how long from the time of order to delivery of hardware and/or software). _____ will expect to receive, in part or in whole, the selected materials and services on dates and times specified, and the same will be duly entered into the contract with the selected vendor.

2.8 Maintenance/Support

Vendors shall state their hardware and software maintenance policies. They shall also specify the names and addresses of all service organizations that will provide maintenance of all equipment and operating and application software proposed herein. Vendors shall also specify the maximum response time for all services. The response time quoted shall be the maximum time to elapse between the time a call for service

is made and a service response occurs. Vendors shall also indicate whether service is on-site by vendor representatives, via telecommunications, or will require that malfunctioning equipment or software be delivered by the _____ to the vendor's service location. This information is to be provided on Form 4.

2.9 Systems Responsibility

The contents of this RFP notwithstanding, the vendor has the responsibility to verify the completeness, accuracy, and suitability of his proposal to meet the functional requirements of _____ as stated herein.

If, after installation of the system, any additional equipment or software is necessary to meet _____'s requirements, the vendor shall provide this equipment or software without claim for additional payment. The successful vendor shall be obligated to provide a system that meets all guarantees in his proposal for the price contained therein and one that operates effectively and to the satisfaction of _____.

3.0 Proposal Format

Proposals shall be written in a concise and straightforward manner, and superficial marketing statements and materials shall be avoided.

Proposals shall include the following elements.

3.1 Vendor Identification

Vendors shall identify themselves and provide a list of current users of their systems on Form 1 (see Section 6 of this RFP).

3.2 Application Software

3.2.1 Furnish narrative description, including principal functions and outputs for the application software package in each functional area (Form 2).

3.2.2 Specify cost by application, including license or other fees (Form 2).

3.2.3 Identify computer language(s) in which applications are or will be written (Form 2).

3.2.4 Identify and provide names and telephone numbers of contact persons in local governments or other organizations in which the proposed application software is installed and supported by the vendor (Form 1).

3.2.5 Specify conditions of use, i.e., restrictions, proprietary rights, etc. (Form 2).

3.3 Hardware

3.3.1 Describe proposed equipment configuration (Form 3).

3.3.2 Provide names and telephone numbers of contact persons in local governments or other organizations in which identical or nearly identical systems are installed and supported by the vendor (Form 1).

3.3.3 Provide purchase cost itemized by equipment device (Form 3).

3.4 Maintenance/Support

Specify information related to both hardware and software maintenance and support (Form 4).

3.5 Training

Be able to provide training in system operation and specify the nature and extent of training programs, and the cost, duration, and location of programs, and the qualifications of trainer(s) (Form 5).

4.0 (Organization)

4.1 Size

_____ is a _____ of approximately _____ population located in _____. _____ has a stable population, and no major annexation is currently planned.

4.2 Administration

_____ operates under the direction of _____ who serves as chief operating officer. He will have general responsibility for oversight of the implementation and future operation of the proposed EDP system.

4.3 Functions

The _____ handles the finance, personnel, and utility functions of _____. _____'s annual budget is approximately $ _____. _____ owns and operates a _____ machine currently used to process payroll and utility accounts and billing. The transaction volume includes:

a. Payroll for 20 year-round and 12 seasonal employees, amounting to approximately 600 checks annually
b. Utility accounts and billing for 1,000 customers for sewer and water and 1,250 customers for refuse collection. Customers are billed quarterly.

_____ accounting functions are handled by a service bureau. _____ sends a list of checks paid and revenues received at the end of each month to the service bureau which prepares monthly reports. Reports include balance sheet, income and expenditures journal, and consolidated funds comparison for each department by monthly and yearly totals.

Word processing is accomplished on a _____.

All other functions such as accounts receivable, accounts payable, and personnel records are handled manually. Accounts payable number approximately 100 per month.

5.0 System Requirements

This section of the RFP is intended to assist vendors to structure proposals appropriate to the specific needs of _____. Sufficient processing power, mass storage, and peripheral devices shall be available to serve all required activities efficiently and economically. If the selected system fails to perform according to _____'s requirements and if this failure is determined to be the fault of the vendor, the vendor shall provide all enhancements or additions required for effective performance at no cost to _____.

5.1 System Constraints

5.1.1 Personnel Considerations

The desired system shall be capable of being operated by existing personnel. User operator training will be required.

Programming changes or modifications shall be documented and capable of accomplishment by the original providing vendor.

5.1.2 File Protection and History

In order to safeguard data files, provision must be made by the vendor for a daily system backup of all files to a machine sensing medium (e.g., tape or floppy disk) that can be stored in a different location.

5.1.3 File Security

All computer files shall be accessible in an interactive mode using CRT's. The vendor shall provide security on the system to guard against access to data by unauthorized persons and unauthorized changes to existing data. Such security provisions shall include both hardware and software "lock outs" as well as effective auditing procedures.

5.1.4 Modularity

The proposed system must have the capability for expansion. Increased processing, printing, and mass storage capabilities and networking ability may be needed for future applications. The proposal shall address the means and extent of system expansion in each of these areas.

5.1.5 Data Management

Vendors shall propose data base management and/or file management programming with their proposed systems, describing this programming in full.

5.2 System Hardware

The proposed system hardware configuration shall provide for an on-line, real-time operation with user operating capabilities. Rigid disk must be the primary mass storage medium. The forms in Section 6 of the RFP must be used to specify all hardware characteristics, including ROM and RAM capacities, storage (disk) capacities, 8, 8/16, or 16-bit architecture, etc.

Suggested guidelines for the system are a minimum of 128K of main memory, 10MB of hard disk storage, one video monitor, and one line printer. The actual configuration of the system, however, shall be recommended by the vendor and be based on his proposed system's capabilities and _____'s file, record, and data processing requirements.

5.3 Operating System

The proposed system must have an operating system that supports the requirements listed under hardware, e.g., on-line, real time, and interactive. The system shall have a data/file management capability. _____ prefers that the proposed system use one of the more common operating systems or have the capability to do so, although this is not a requirement.

The operating system and programming languages supported by the hardware must be specified.

5.4 Application Software

5.4.1 General

The development, installation, and performance of the application software are the most important elements of the proposed system. System acceptance and payment will be based on the performance of the initial application software system.

5.4.2 Functions

Proposed systems must provide programming in the following major functional areas: Financial management, payroll, personnel, and utility and billing. _____ is considering the acquisition of programming for police records and reporting at a later date, so vendors shall include this element in their proposals if available.

a. Financial Management

An integrated financial management system designed around a general ledger accounting subsystem is _____'s first priority requirement. The system shall be capable of encumbrance accounting and conform to accepted governmental accounting standards.

The system shall be transaction-oriented, i.e., an entered transaction must not only update the file against which the transaction is made but all other affected files or subsystems.

The system shall be a *governmental fund accounting* program and include but not necessarily be limited to the following subsystems:

- Budgetary accounting
- Accounts receivable
- Accounts payable
- General ledger accounting.

b. Other Functions

Programming in the following functional areas is also of high priority to _____. Vendors shall propose programming in each of the following areas:

(1) payroll
(2) personnel records
(3) utility billing and accounting
(4) spreadsheet
(5) data base management/file management
(6) word processing.

c. Future

(1) police records and reporting

Section 6.0

Forms Required for Proposal Submission

FORM 1

GENERAL INFORMATION

Organization Submitting Proposal

Organization name: _____

Contact person: _____

Address: _____

City/State/Zip: _____

Telephone: _____

Current System Users (local governments or other organizations*):

User 1 - Name: _____

Organization: _____

Address: _____

Telephone: _____

Configuration: _____

User 2 - Name: _____

Organization: _____

Address: _____

Telephone: _____

Configuration: _____

User 3 - Name: _____

Organization: _____

Address: _____

Telephone: _____

Configuration: _____

User 4 - Name: _____

Organization: _____

Address: _____

Telephone: _____

Configuration: _____

*Users listed on this page should have systems comparable to the system herein proposed.
(Use separate page to list additional users.)

FORM 2

SOFTWARE INFORMATION BY FUNCTION

Vendors shall complete one copy of Form 2 for each required software package. These are: Integrated Financial Management System, Spreadsheet, Payroll, Personnel Records, Utility Billing, Word Processing.

Function _____

Name of package: (If more than one package or subsystem, use additional forms.) _____

Source/Vendor: _____

Functions included and description: (attach sample screens) _____

Programming language: _____

Record capacity: _____

RAM required to operate: _____

Disk storage requirement: _____

Peripheral devices required to operate: _____

Documentation (type and brief description— attach samples): _____

Cost (purchase price only): $ _____

FORM 3

HARDWARE CONFIGURATION

Equipment Manufacturer/Model #: _____

	Immediate Costs	Expansion Costs
Memory (CPU):		
a) Proposed RAM capacity: _____	$_____	
b) Expansion increments: _____	_____	($ _____) (per increment)
c) Maximum RAM: _____		
d) ROM capacity: _____		
e) System bit size: _____		
f) Principal operating system: _____		
g) Other operating system capabilities: _____		
Storage (disk drives):		
a) Floppy disk(s) proposed: _____	$_____	
(1) model name/#: _____		
(2) bundled? _____		
(3) diskette type/capacity: _____		
(4) min./max. number drives: _____		
(5) cost per expansion drive: _____		$_____
b) Hard disk proposed: _____	$_____	
(1) model name/#: _____		
(2) bundled? _____		
(3) capacity: _____		
(4) min./max configuration: _____		
(5) cost per expansion drive: _____		$_____
c) RAM required to operate: _____		
(1) floppy drive: _____		
(2) hard drive: _____		
Monitor:		
a) Model name/#: _____	$_____	
b) Columns: _____		
c) Rows: _____		
d) Color: _____		
e) Pixel configuration: _____		
Printer:		
a) Model name/#: _____	$_____	
b) Speed: _____		
c) Type (matrix, other): _____		
d) RAM required to operate: _____		

Networking Ability (explain): _____

Single or Multi-user: _____

Compatibility (with other micros, minis, mainframes): _____

Documentation:		
a) System assembly: _____	$_____	
b) User guide(s): _____	$_____	
c) Language(s): _____	$_____	
Proposed back-up method (specify): _____	$_____	
TOTAL FOR PROPOSED HARDWARE	$_____	

FORM 4

MAINTENANCE INFORMATION: HARDWARE

Organization providing maintenance:

Organization name: _____

Contact person: _____

Address: _____

City/State/Zip: _____

Operating hours of maintenance program: _____

Is hardware maintenance: _____ on-site, _____ depot, _____ mail-in?

Describe typical response time (per covered device) for repair: _____

_____

Type of maintenance program: _____

Devices covered: _____

_____

Annual cost: Memory (CPU): $_____
Floppy disk drive: $_____
Rigid disk drive: $_____
Monitor: $_____
Printer: $_____
Total: $_____

Vendor's recommended hardware maintenance (type, device, cost); please explain below:

FORM 5

SUPPORT INFORMATION: SOFTWARE

Organization providing software support: _____

Organization name: _____

Contact person: _____

Address: _____

City/State/Zip: _____

Type of support offered (e.g., user assistance, program modification, replacement, debugging, etc.) (Please describe.): _____

_____

_____

Operating hours of maintenance/support: _____

Typical response time: _____

Software applications covered: _____

_____

Monthly cost: $_____ (per application)

Annual cost: $_____ (per application)

Vendor's recommended software support (type, application, cost). Please explain below.

FORM 6

TRAINING INFORMATION

Vendor should describe below the type and extent of training in system operation and in use of application programs and also provide cost per training element.

Training Element (describe):	Location	Duration	Cost per Element

Total Cost $ ____________

Appendix C

SPECIFICATIONS FOR A MICROCOMPUTER

SPECIFICATIONS FOR A MICROCOMPUTER

These specifications for a microcomputer procurement were developed by Mr. Michael Carpenter, MIS director, city of Omaha, Nebraska, and are presented here slightly modified with Mr. Carpenter's permission.

For governmental agencies and units *with in-house data processing expertise that have determined their information management requirements,* these specifications can serve as an abbreviated form of request for bid or proposal and are a sound alternative to the lengthier, more detailed procurement method recommended in this handbook. Note that these specifications address hardware, a widely used operating system, and the capability of the system to run off-the-shelf software. Programming written for local governmental functions is not specified.

Finally, providing standard forms would be advisable (such as those in the RFP in Appendix B) with these specifications so that vendors will be forced to provide information in a uniform format. The use of standard forms promotes easier analysis of bids and proposals.

SPECIFICATIONS FOR A MICROCOMPUTER

All features must be available and demonstrable at the time of the bid submission. Contact _____ for additional information.

I. Basic Hardware

One (1) microcomputer with the following features:

- 16-bit processor
- 256,000 characters random access memory
- Minimum of one (1) standard parallel and two (2) RS 232C serial interfaces
- Internal clock/calendar
- Dot-addressable graphics capability.

One (1) 5¼ inch floppy disk drive with a minimum storage capacity of 320K formatted.

One (1) box of 10 5¼ inch floppy diskettes.

One (1) fixed disk Winchester drive with controller having a minimum formatted storage capacity of 10 MB.

Hardware and software necessary to provide a method for backing up the fixed disk Winchester drive (minimum 10 MB formatted capacity) in less than 10 minutes with minimal operator intervention.

One (1) 12-inch or larger color display with dot addressable graphics having a minimum resolution of 640 pixels horizontally and 400 pixels vertically.

One (1) full function QWERTY typewriter style keyboard with 83 or more keys including a numeric keypad.

One (1) dot matrix printer with data processing and correspondence quality printing capability and the following features:

- 132 column at 10 character pitch
- six or eight lines per inch vertical spacing
- dot-addressable graphics
- minimum speed 120 cps in data processing mode and 40 cps in correspondence mode.

One (1) line surge protector to guard equipment from variations in power supply.

II. Basic Software

One (1) MS-DOS release 2.0 or later operating system.

III. System Requirements

System must run using the MS-DOS release 2.0 or later operating system and be able to support SNA/SDLC data communications.

System must be able to run the following general use software: Lotus 1-2-3, Multiplan, VisiCalc, WordStar, dBASEII, TIM3, PFS File, and Report.

IV. Other requirements:

Vendor must provide installation of equipment.

A 90-day warranty must be available for all hardware devices.

Hardware maintenance must be available on a local basis with the following options:

a. Carry-in service (by annual fee and by time and material)

b. On-site service (by annual fee and by time and material)

Maintenance cost must be provided by component if available.

Delivery must be made within 30 days of bid award.

Vendor must provide a minimum of ____ hours on-site training for all equipment devices and ____ hours for each software package.

V. Pricing Information

Purchase prices must be provided by system component.

Prices must include freight, installation, cables, operating system software, i.e., everything to make the system operational.

Appendix D

EVALUATION OF PROPOSALS

Sample Evaluation of Proposals

This sample evaluation of proposals is based on the proposals received by the city of Gordon, Nebraska, in its procurement of a microcomputer system. Eleven proposals were submitted to the city of Gordon in response to its RFP. For the sake of brevity and because the evaluation format and method can be presented through a smaller number of examples, evaluations for only five proposals are shown here. These five are representative of the microcomputer proposals contained in the larger group received. The names of all vendors have been changed to maintain anonymity.

EVALUATION OF PROPOSALS

SOLICITED BY

_____

FOR AN

ELECTRONIC DATA PROCESSING SYSTEM

1. Data Processors, Ltd. (DPL)

DPL is a service bureau and software house located in _____. References are included for two cities, four counties, a college, and six businesses.

Hardware proposed is an XYZ PC system with 128K of memory, a 20MB hard disk system, and a floppy disk drive. The XYZ PC is a 16-bit system with an MS-DOS operating system. Also included in the system are a monochrome monitor (25 x 80 display matrix), and a 100 cps printer.

Hardware is covered by a 90-day warranty and is serviced through XYZ, Computer Stores, Inc., or Major-Chain retail stores. Maintenance beyond the initial 90 days is optional.

A full range of requested software that is developed and tested is proposed.

Software support is provided by DPL via telephone. The first year of support is included in the purchase price; thereafter, software maintenance will cost 10 percent of the purchase price of each software package.

RFP Requirements:

Hardware	
All met	XYZ PC 128K memory 20MB disk storage
Software	
Financial management	yes
Payroll	yes
Personnel	yes
Utility billing	yes
Spreadsheet	yes
Word processing	yes
Data base management	yes

Cost Summary

Hardware (with operating system)	$ 9,135.00
Software	5,364.00
Training	1,000.00
Annual maintenance	
Hardware	570.00/year
Software	636.00/year
Purchase price	$14,499.00
First-year cost	16,069.00
Five-year cost	20,893.00
Average annual cost	4,179.00

Recommendation

This proposal should be selected for further consideration for both hardware and software and for software only in conjunction with the proposal from Grain Elevator and Supply. All specifications are adequate and prices are reasonable.

2. Grain Elevator and Supply (GES)

GES is a local farmers' supply business, in operation for 50 years. It is also an authorized dealer of XYZ personal computers and software. No governmental references are provided.

Hardware proposed is an XYZ PC system with 128K of memory, a 15MB hard disk storage, and two floppy disk drives. The XYZ PC is a 16-bit system with an MS-DOS operating system. Also included in the system are a monochrome monitor (24 x 80 display matrix), and a 200 cps printer.

Hardware is covered by a 90-day warranty and is serviced by GES through Computer Store, Inc. in _____ some 75 miles away. GES proposes a second system at its office as backup.

Software is only partially developed. The general ledger, accounts payable, payroll, and spreadsheet are either packaged systems or have been locally written. However, the personnel and utility billing systems must yet be developed.

Software is warranted for 90 days, but arrangements and costs of maintenance beyond that period are unclear.

RFP Requirements:

Hardware	
All met	XYZ PC 128K memory 15MB disk storage
Software	
Financial management	yes
Payroll	yes
Personnel	to be developed using a data base package
Utility billing	to be developed using a data base package
Spreadsheet	yes
Word processing	yes
Data base management	yes

Cost Summary

Hardware (with operating system)	$ 7,383.00
Software	4,730.00
Training	1,500.00
Annual maintenance	
Hardware	430.00/year (estimated)
Software	not specified
Purchase price	$12,113.00
First-year cost	14,043.00
Five-year cost	15,763.00
Average annual cost	3,153.00

Recommendation

The hardware system in this proposal should be selected for additional consideration in conjunction with software from the Data Processors, Ltd. proposal.

Hardware proposed is adequate and at a reasonable cost, and the vendor's local office location (with system backup) is a strong attraction. Software status is a problem, however; hence, the recommendation of combining the hardware proposal from this vendor with software from a second vendor.

3. Great Plains Micros (GPM)

GPM is located in _____. It is a small software house primarily serving business organizations and school districts. Three references, all schools, were provided.

Hardware proposed is a Champion III based system with 256K of memory, a 20MB hard disk system, two floppy disk drives, a green monitor (24 x 80 display matrix), a 160 cps dot matrix printer, and a video cassette recorder for record backup. The Champion III is an 8-bit system with a proprietary operating system.

Proposed software includes all functions requested. However, the personnel and utility billing functions are not fully integrated with the financial management system, and the utility billing package is relatively new and untested. All other systems are in operation in several organizations.

Software support is provided by Data Systems, Inc., located in _____ for the financial management and payroll packages. Personnel utility billing and spreadsheet packages will be supported by GPM. Software support costs for Data Systems, Inc., are included in the proposal, but no software support costs are provided for GPM.

Training will be provided on-site by GPM for all software systems and for hardware operation.

RFP Requirements:

Hardware	
All met	Champion III 256K memory 20MB disk storage
Software	
Financial management	yes
Payroll	yes
Personnel	yes
Utility billing	yes
Spreadsheet	yes
Word processing	packaged
Data base management	packaged
Cost Summary	
Hardware (with operating system)	$11,828.00
Software	10,595.00
Training	included
Annual maintenance	
Hardware	1,294.00 per year
Software	540.00 per year
Purchase price	$22,423.00
First-year cost	24,257.00
Five-year cost	32,593.00
Average annual cost	6,319.00

Recommendation

Due to its relatively high cost, this proposal should be placed in a secondary priority group for consideration at a later date should the _____ fail to reach a satisfactory purchase agreement with one of the top rated vendors.

This vendor's software is not totally integrated, and system support is split between two vendors. Otherwise the system is adequate.

4. Micros and Software Company (MSC)

MSC is located in _____ NE. This company is also relatively new and provided references including two businesses and one governmental agency.

Hardware proposed is a Super Micro S-200 system with 256K of memory, 10MB hard disk storage, and one 5¼ inch floppy disk drive, a green monitor (24 x 80 display matrix), and a 100 cps dot matrix printer. The Super Micro S-200 is an 8-bit system that uses a CP/M operating system.

Hardware maintenance will be provided by MSC on-site within three working days of receiving a request for service.

Software offered is a "custom package," to be written in Microsoft BASIC by MSC. No details on this package are provided, although MSC says it will meet the city's software requirements for the price of its bid.

Software support will be provided by MSC during regular business hours via telephone or on-site within three days on an "as needed" basis at a flat hourly rate plus travel expenses.

Training for both hardware and application software use will be provided by MSC on-site. The amount of training is not specified.

RFP Requirements:

Hardware	
All met	Super Micro S-200 256K memory 10MB disk storage
Software	
Financial management Payroll/personnel Utility billing Spreadsheet	all application software to be custom developed
Word processing	off-the-shelf
Data base management	off-the-shelf

Cost Summary

Hardware (with operating system)	$ 9,615.00
Software	12,500.00
Training	600.00
Annual maintenance	
Hardware	1,920.00
Software	hourly rate
Purchase price	$22,115.00
First-year cost	24,635.00
Five-year cost	31,315.00
Average annual cost	6,463.00

Recommendation

Because of its relatively high cost, the lack of cost data for software maintenance, the lack of detail on application software systems, and the fact that application software is not yet written, this proposal should not be selected for further consideration.

5. Western Computer and Data Processing (WCDP)

WCDP is located in _____NE. It is a relatively new company and provided only one governmental and three corporate references.

Hardware proposed is a Megamicro M-20 microcomputer with 512K of memory, 20MB hard disk storage, and an eight-inch floppy disk drive, a green-on-black monitor (34 x 80 or 34 x 132 display matrix), and a 150 cps dot matrix printer. The M-20 is a 16-bit system that uses a proprietary operating system.

On-site hardware maintenance is available through a third party service organization located in a city 400 miles distant. Depot service is also available with a 48-hour turnaround time during regular business hours.

A full range of requested software is proposed with the exception of a personnel package. Word processing is also available for an additional cost of $500.00.

Software support is provided by WCDP and Megamicro in the form of toll free telephone assistance during regular business hours, typically with no greater than a two-hour response time. Software support is included with the software purchase.

A total of six days of training for system operation and on the application software would be provided on-site by WCDP. The cost of training is included in the cost of the software.

RFP Requirements:

Hardware	
All met	Megamicro M-20 512K memory 20MB disk storage
Software	
Financial management	yes
Payroll	yes
Personnel	no
Utility billing	yes
Spreadsheet	yes
Word processing	yes
Data base management	yes

Cost Summary

Hardware (with operating system)	$16,480.00
Software	6,950.00
Training	included in software purchase cost
Annual maintenance	
Hardware	1,393.00
Software	included in software purchase cost
Purchase price	$23,430.00
First-year cost	24,823.00
Five-year cost	30,395.00
Average annual cost	6,079.00

Recommendation

Due to its relatively high first-year and five-year costs, this proposal should be placed in a secondary priority group for consideration should an agreement not be reached to acquire one of the top-rated systems.

II. SUMMARY OF EVALUATIONS

Vendor	System	Total (five-year) Cost	Average Annual Cost	Purchase Price	Recommendations
DPL	XYZ P/C (128K-20MB)	$20,893	$ 4,179	$14,499	Select total system for further consideration
GES	XYZ P/C (128K-15MB)	15,763	3,153	12,113	Select hardware for further consideration
GPM	Champion III (256K-20MB)	32,593	6,319	22,423	Second priority consideration; cost and software integration
MSC	Super Micro S-200 (256K-10MB)	31,315	6,463	22,115	No further consideration; cost and software and maintenance
WCDP	Megamicro M-20 (513K-20MB)	30,395	6,079	23,430	Second priority consideration; cost and hardware support

Appendix E

SOFTWARE LICENSE AGREEMENT

Software License Agreement

This software license agreement, or something similar to it, is strongly recommended for governments that purchase packaged (as distinct from off-the-shelf) software. It provides adequate protection to both the vendor and the purchaser. Section XI of the agreement enables the purchaser to return for a full refund any software with which he or she is dissatisfied within six months of purchase at no penalty.

This agreement was developed by a vendor who sells and supports local government software on microcomputers, American Fundware, Inc., of Steamboat Springs, CO, and is used here in modified form with permission of American Fundware.

SOFTWARE LICENSE AGREEMENT

This program license agreement (hereafter "this agreement") is entered into by and between the VENDOR and the LICENSEE:

I. Grant of License, Agreement to Provide Related Materials and Related Services. In consideration for Licensee's payment of the one-time license fee, but subject to all of the terms, conditions, and limitations of this agreement, Vendor grants to Licensee the personal, non-exclusive, non-transferable right to use the current release as of this date of the licensed program in machine readable form and the right to use the related materials, defined below, on or in connection with the central processing unit of the designated computer system. In further consideration for such one-time license fee, Vendor agrees to provide the related services defined below.

II. Definitions.

A. The "licensed program" shall mean the specific application program(s) listed in Section XIV, in machine readable form. "Licensed program" shall further include all new or additional releases made by Vendor to the licensed program during the one-year period following the delivery date of the current release.

B. "Related materials" shall mean all other materials furnished by Vendor and officially released pertaining to the licensed program including, for example, instructional documentation, user and operational guides, and training guides.

C. "Related services" shall include:

(1) Installation support and training of Licensee's employees in the use of the licensed program at the (vendor or licensee location) for the number of days during the first year set forth above. Related services does not include training or retraining of Licensee's employees with respect to general data processing concepts, machine operations, keypunch training, system security, and/or backup procedures; and

(2) Software support, maintenance, and any necessary telephone consultations, for one year commencing on the delivery date.

III. Additional Charges. The one-time license fee shall not include the following, all of which shall be paid by Licensee as additional charges:

A. A fee for time expended by Vendor's employees, at a reasonable hourly rate, for training or retraining Licensee's employees in the use of the licensed program after the initial installation support;

B. Per Diem at _____ per day, plus travel and lodging expenses of Vendor's employees, for the on-site support after the initial training specified above;

C. Direct costs of transmitting new releases of or changes to the licensed program, except those necessitated by defects in the current release;

D. Telephone charges;

E. Programming fees at current rates for any modification to the licensed program requested by Licensee and agreed to be performed by Vendor not necessitated by defects in the licensed program.

IV. Term. The license herein granted shall be perpetual and shall be terminable by Vendor or by Licensee only upon the terms and conditions set forth in this agreement.

V. Defects in Licensed Program. During the first year of Licensee's use of the licensed program, Vendor will provide programming services, without additional charge for time or out-of-pocket expenses, to correct the unaltered current release of the licensed program if it shall contain any error, malfunction, or defect. Licensee agrees to advise Vendor in writing of the precise nature of any suspected error, malfunction, or defect and to provide Vendor with all relevant information upon request in order that Vendor may render such programming services.

VI. Use of Licensed Program by Licensee. Licensee shall use the licensed program only for its own purposes and not in service on a fee basis for any other person, entity, or governmental unit. Use of the licensed program on any additional computer equipment (other than a unit installed in complete substitution for the central processing unit) shall require payment of an additional license fee. Licensee shall not copy the licensed program in whole or in part except for safekeeping and backup purposes. Only the number of machine readable copies of the licensed program that are necessary for such backup purposes will be in existence on or off the Licensee's premises at any one time. Licensee is granted only the use of the licensed program, and such program shall remain the property of Vendor. Licensee shall never assign, transfer, convey, or give the licensed program or related materials to any party, nor shall it disclose the licensed program or related materials or any portion or aspect thereof to any party.

VII. Licensee's Employees. Licensee's employees will have access to the licensed program and related materials. Licensee agrees that it will, prior to making the licensed program and related materials available to any employee, obtain reasonable assurance from each employee that they will not disclose or convey any release of the licensed program or related materials or any aspect thereof to any person or entity.

VIII. Security. Licensee agrees that it will take reasonable steps to secure the licensed program and related materials from theft, destruction, and unauthorized disclosure.

IX. Responsibilities of Licensee. Licensee shall be exclusively responsible for the supervision, management, and control of its use of the licensed program, including but not limited to (a) establishing adequate backup plans, (b) insuring access to qualified Vendor programming personnel to assist Vendor in diagnosing, patching, and repairing licensed program defects in the event of a program malfunction; and (c) implementing

sufficient procedures and check points to satisfy the requirements for security and accuracy of report and output as well as restart and recovery in the event of a malfunction.

X. Responsibilities of Vendor. Vendor shall ensure the proper machine configuration, shall install all licensed programming, and shall provide _____ days of user and management training for Licensee personnel in the operation of all licensed programs. In the event the machine configuration shall be inadequate to run the application programs and their data bases as specified in Section XIV, Vendor will at no cost to Licensee add such increments of memory or disk storage to the system as required to make it run said programming and data bases.

XI. Warranty and Limitation of Liability. If Licensee is dissatisfied with the licensed program or related materials after reasonable efforts at using them, then Licensee may, at its discretion during the six-month period commencing on the actual delivery date, return all copies of the licensed program and related materials to Vendor and receive a full refund of the one-time license fee, after deduction of any charges then outstanding and payable from Licensee to Vendor. Notwithstanding such return, Licensee and its employees shall continuously remain liable under their covenants not to convey, assign, donate, or disclose the licensed program and related materials and the provisions of this agreement for Vendor's damages. After the return of the licensed program and related materials, Licensee's right to use the licensed program and related materials or any aspect or derivative thereof shall cease.

Licensee and those claiming under Licensee specifically agree that their sole and exclusive remedies under this agreement shall be reimbursement to Licensee of the one-time license fee. In no event shall Vendor be liable to Licensee or any third parties for loss of profits or other economic loss, or for any indirect, special, consequential, or other similar damages, arising out of any breach of this agreement or malfunction of the licensed program, even if Vendor has been advised of the possibility of such consequential damages.

XII. Hardware Supplied by Licensee. Any new hardware supplied by Licensee under this license agreement shall be subject to the specific manufacturers' warranties only and not those of Vendor. Any used hardware supplied by Licensee under this license agreement shall not be subject to any warranties unless expressly written and attached to and made part of this lease agreement by all parties.

XIII. Complete Agreement. Vendor and Licensee acknowledge that they have read this agreement, understand it, and agree to be bound by its terms. The parties agree that this agreement is the complete and exclusive statement of the agreement between them, and that it also includes as an integral part hereto Licensee's Request for Proposal dated _____, Vendor's Proposal dated _____ (as amended by _____) and correspondence dated _____ between Vendor and Licensee.

XIV. List of Licensed Programs Purchased by Licensee.

1. _____

2. _____

3. _____

4. _____

etc.

VENDOR:

By: _____

LICENSEE:

By: _____

Appendix F

MICROCOMPUTER HARDWARE

Computer Comparison Chart

BY JOSEPH DEVLIN AND DIANE KONCUR

Adapted from:

Creative Computing Buyers' Guide to Personal Computers and Peripherals, 1984

Computer				Memory		Languages		Keyboard	Display			Storage		Interfaces		Operating Systems	
Vendor	Model	Base Price	Micro-processor	RAM (stand/ max)	ROM	Included	Options		Method of Display	Text	Graphics Resolu-tion	Disk Included	Disk Options	Standard	Optional	Standard	Optional
$500 to $1,500																	
Apple Computer Inc Cupertino, CA (408) 996 1010	Apple IIe	$1,395	8-bit 6502B	64K/ 128K	16K		Basic, Pas-cal, Pilot, Fortran, Logo	typewriter-style	separate color CRT or TV	40/24, 80/24 optional	40x48 or 280x192		up to 6 5.25" 140K drives	cassette port, 2 joystick ports	serial port, par-allel port, IEEE-488 port	propri-etary	CP/M
Franklin Computer Corp. Cherry Hill, NJ (609) 482-5900	Ace 1000	$1,095	8-bit 6502	64K	12K	Apple Basic		integrated typewriter-style with numeric keypad	separate color CRT or TV	40/24	40x48 color, 280x192		up to 6 5.25" 143K drives	8 periph-eral con-nectors, joystick port	RS-232 port, Cen-tronics parallel port	Apple com-patible DOS 3.3	
$1,500 to $2,500																	
Canon U.S.A. Inc. Lake Success, NY (516) 488-6700	AS-100 M	$2,325	16-bit 8088	128K/ 512K			Canon Basic, Microsoft Basic, Cobol	typewriter-style with numeric keypad	mono-chrome CRT, color optional	80/25	8 colors optional		10Mb Win-chester, 2 5.25" 640K or 2 8" 1Mb drives	Cen-tronics interface	4RS-232 Centron-ics, sync communi-cations interface		CP/M-86, MS-Dos, OASIS-16
Commodore Business Machines West Chester, PA (215) 431-9100	SuperPet	$1,995	8-bit 6510, 8-bit 6809	96K	38K	Waterloo Basic, as-sembler, Fortran, Pascal, Cobol, APL		integrated typewriter-style with numeric keypad	integrated mono-chrome CRT	80/25	128 graphic characters		up to 8 5Mb or 7Mb Win-chester drives, or up to 8 5.25" 340K or 1.1Mb drives	IEEE 488 parallel port, RS-232 serial port		propri-etary	CP/M expected
Cromemco, Inc. Mt. View, CA (415) 964-7400	C-10	$1,785	8-bit Z80A	64K	24K	Basic	Fortran, Ratfor, Lisp	detached typewriter-style	12" mono-chrome CRT standard	80/25	graphics charac-ter set included	5.25" 390K drive	2nd 390K drive	RS-232 port, serial printer port, par-allel port		CDOS (CP/M-like)	
Franklin Computer Corp. Cherry Hill, NJ (609) 482-5900	Ace 1200	$2,195	8-bit 6502, 8-bit Z80B	128K	12K	C-Basic, Floating Point Basic		integrated typewriter-style with numeric keypad	separate color CRT or TV	40/24, 70/24 80/24	280x192 40x48 color	5.25" 143K drive	up to 4 143K drives	8 periph-eral con-nectors, joystick port		Apple com-patible DOS, CP/M-80	
IBM Boca Raton, FL (305) 998-6607	IBM Personal Computer (PC)	$1,355	16-bit 8088	64K/ 640K	40K	Cassette Basic	Basic, Pascal, Fortran, Cobol	detached typewriter-style with numeric keypad	separate mono-chrome or color CRT or TV	80/25	320x200 (4 color), 640x200 (B/W)	5.25", 160K drive	up to 2 160K or 320K drives, 2 10Mb and/or 20Mb Win-chester drives	cassette port	RS-232 port		MS DOS (PC DOS), CP/M-86, UCSD p-System
Kaypro Corp. Solana Beach, CA (619) 755-1134	Kaypro II (trans-portable)	$1,595	8-bit Z80	64K	2K	MBasic	Pascal, Fortran, Cobol	detached typewriter-style with numeric keypad	built-in 9" mono-chrome CRT	80/25		2 5.25" 191K drives		RS-232 port, parallel printer port		CP/M 2.2	

Computer				Memory		Languages		Keyboard	Display			Storage		Interfaces		Operating Systems	
Vendor	Model	Base Price	Micro-processor	RAM (stand/ max)	ROM	Included	Options		Method of Display	Text	Graphics Resolu-tion	Disk Included	Disk Options	Standard	Optional	Standard	Optional
Morrow Sari Leandro, CA (415) 430-1970	Micro-Decision	$1,590	8-bit Z80A	64K	4K	Microsoft Basic, BaZic	Pilot	detached typewriter-style with numeric keypad	12" mono-chrome monitor included	80/25		5.25" 200K drive	up to 4 5.25" 200K or 384K drives	2 RS-232 ports, Centronics port		CP/M 2.2	
NEC Home Electronics Elk Grove Village, IL (312) 228-5900	8800 Series	$2,497	8-bit Z80A, 16-bit 8086 co-processor optional	64K/ 128K, 28K/ 294K (16-bit version)	32K/56K	NBasic, N-88 Basic		detached typewriter-style with numeric keypad	12" mono-chrome CRT included, color CRT available	80/25	640x400	2 5.25" 320K drives	10Mb Win-chester, 2 8" 1.2Mb drives	Centronics parallel port RS-232		CP/M 2.2	MS-DOS
$2,500 and up																	
Apple Computer Inc. Cupertino, CA (408) 996-1010	Apple III	$2,695	8-bit 6502	256K/ 512K	4K	Applesoft Basic	Business Basic, Pascal Cobol	typewriter-style with numeric keypad	separate color CRT or TV	40/24	140x192 or 280x192 (16 colors); 560x192 mono-chrome	5.25" 140K drive	up to 6 5.25" 140K drives, 4 5Mb Win-chester drives	cassette port, joystick port RS-232 port	serial port, parallel port IEEE-488 port	proprietary	
Apple Computer Inc. Cupertino, CA (408) 996-1010	Apple Lisa	$9,995	16-bit 68000	1Mb	16K		Basic Plus, Pascal, Cobol	typewriter-style with numeric keypad and mouse	integral 12" mono-chrome CRT	44/144	364x720	5Mb Win-chester drive, 2 5.25" 860K drives		2 RS-232 ports, parallel port		proprietary	CP/M-86, Xenix
Apple Computer, Inc. Cupertino, CA (408) 996-1010	Macintosh	$2,495	32-bit 68000	128K/ 512K	64K		Pascal Fortran Basic	typewriter style, mouse attachment numeric keypad	9" black and white bit-mapped high resolution monitor	80/24	512x342 BW	3½" Sony micro-floppy disk drive, 400K per single sided diskette	up to 2 3½" micro floppies	RS-232 serial (printer) mouse interface 422 port for modem external disk drive networking for Macintosh		proprietary	
Bytec-Hyperion Div. Ottawa, Ontario Canada (613) 226-7255	Hyperion (trans-portable)	$3,195	16-bit 8088	256K 20K display RAM	8K	Microsoft Advanced Basic	Cobol, Fortran, Pascal	detached typewriter-style with numeric keypad	built-in 7" amber CRT	80/25	320x200, 640x200, 320x250, 640x250	5.25" 320K	2nd 5.25" drive, 5Mb or 10Mb Winchester drive	RS-232 serial port, RS-423 serial port, Centronics parallel port	7-slot IBM expansion chassis	MS-DOS	CP/M-86 UCSD p-System
Columbia Data Products Columbia, MD (301) 992-3400	Columbia VP portable (trans-portable)	$2,995	16-bit 8088	128K/ 256K		Basic		detached typewriter-style with numeric keypad	built-in 9" mono-chrome CRT	80/25		2 5.25" 320K drives	12Mb Winchester drive	RS-232 and Centronics ports, IBM-compatible expansion slot		MS-DOS CP/M-86	
Compaq Computer Corp. Houston, TX (617) 536-0470	Compaq Portable (trans-portable)	$2,995	16-bit 8088	128K/ 512K	8K	Microsoft GW Basic included with operating system		typewriter-style with numeric keypad	built-in 9" mono-chrome screen	25/80		320K 5.25" drive	2nd 5.25" drive	Centronics parallel interface	async communi-cations card compatible with IBM PC cards	MS-DOS 1.1	CP/M-86 UCSD p-System

Computer				Memory		Languages		Keyboard	Display			Storage		Interfaces		Operating Systems	
Vendor	Model	Base Price	Micro-processor	RAM (stand/ max)	ROM	Included	Options		Method of Display	Text	Graphics Resolu-tion	Disk Included	Disk Options	Standard	Optional	Standard	Optional
Corona Westlake Village, CA (213) 706-1505	Corona PC & Portable (trans-portable)	$2,595, $2,545 for portable	16-bit 8088	128K/ 512K	8K/ 16K	Microsoft Basic		detached typewriter-style with numeric keypad	integral 12" (9" on portable) monochrome CRT	80/25	640x325	5.25" 320K drive	2nd 320K drive, 10Mb Winchester	RS-232 port, Centronics port		MS-DOS	
Digital Equipment Corp. Maynard, MA (617) 897-5111	Profes-sional 325/350	$3,995	16-bit PDP-11 compatible	256K/ 1Mb			Dibol, Cobol, Fortran, Pascal, Basic	detached typewriter-style with numeric keypad	12" mono-chrome CRT standard, color CRT optional	80/25 or 132/25	960x240	2 5.25" 400K drives	5Mb Winchester drive	2 RS-232/ 423 ports		subset of RSX-11M	UCSD p-System CP/M
Digital Equipment Corp. Maynard, MA (617) 897-5111	Rainbow 100	$3,495	8-bit Z-80A, 16-bit 8088	64K/ 256K	24K		C, MBasic	detached typewriter-style with numeric keypad	12" detached monochrome CRT standard	80/24 or 132/24	800x240	2 5.25" 400K drives	5Mb Winchester drive, up to 4 5.25" 400K drives	RS-232 port, RS-423 port	RS-423 port, RS-422 port	CP/M-86-80	MS-DOS
Epson America Torrance, CA (213) 539-9140	QX-10	$2,995	8-bit Z80	64K/ 256K 32K/ 128K video RAM	8K	MBasic		detached typewriter-style with numeric keypad	12" mono-chrome CRT standard	80/25	640x400	2 5.25" 380K drives		RS-232 port, serial port, parallel port		CP/M 2.2, TPM II	
IBM Boca Raton, FL (305) 998-6607	IBM Personal Computer XT	$4,995	16-bit 8088	128K/ 640K	40K	Basic	Pascal, Fortran, Cobol	detached typewriter-style with numeric keypad	separate monochrome or color CRT or TV	80/25	320x200 (4 color), 640x200 B&W	5.25" 360K drive, 20Mb Winchester	up to 2 320K drives, 2 20Mb Winchester drives	RS-232 port	20mA current loop		MS-DOS (PC-DOS) CP/M-86, UCSD p-System
Kaypro Corp. Solana Beach, CA (619) 755-1134	Kaypro 10 (trans-portable)	$2,795	8-bit Z80A	64K	2K	MBasic, SBasic	Pascal, Fortran, Cobol	detached typewriter-style with numeric keypad	built-in 9" mono-chrome CRT	80/24	160x100	5.25" 392K drive, 10Mb Winchester drive		2 RS-232 ports, parallel printer port, light pen interface		CP/M 2.2	
Morrow San Leandro, CA (415) 430-1970	Decision 1	$4,995	8-bit Z80A	64K/ 1Mb	2K	Microsoft Basic, BaZic	C, Pascal	detached typewriter-style with numeric keypad	separate 12" mono-chrome CRT	80/25		5.25" 400K drive 10Mb Winchester drive	up to 4 drives and 4 Winchester drives	3 RS-232 ports, parallel printer port, S-100 bus	3 additional parallel ports	CP/M 2.2	Micronix (Unix-like)
Radio Shack Fort Worth, TX (817) 390-3011	TRS-80 Model 12	$3,199	8-bit Z-80A	80K		Basic	Cobol, Fortran	typewriter-style with numeric keypad	Integrated 12" mono-chrome CRT	80/24 40/24	680x240 optional	single 8" 1.25Mb drive	up to 4 1.25Mb drives, 4 10Mb Winchester drives	2 RS-232 ports, parallel port		TRS DOS proprietary	CP/M 3.0
Radio Shack Fort Worth, TX (817) 390-3011	TRS-80 Model 16B (multi-user)	$4,999	8-bit Z80A, 16-bit 68000	256K/ 768K		Basic	Cobol, Fortran	typewriter-style with numeric keypad	integrated 12" mono-chrome CRT	80/24 40/24	680x240 optional	single 8" 1.25Mb drive	up to 4 1.25Mb drives, 4 12Mb Winchester drives	2 serial ports, parallel port		Xenix (Unix-like), TRS-DOS	CP/M 3.0
Texas Instruments Dallas, TX (800) 527-3500	Profes-sional Computer	$2,595	16-bit 8088	64K/ 256K	8K/16K	Basic included with operating system	Basic, Fortran, Cobol, Pascal	detached typewriter-style with numeric keypad	separate mono-chrome or color CRT	80/25	720x300	5.25" 320K drive	up to 4 320K drives, 5Mb or 10Mb Winchester drive	RS-232 port, joystick/ light pen port			MS-DOS, CP/M-86, UCSD p-System

Appendix G

MICROCOMPUTER SOFTWARE VENDORS FOR LOCAL GOVERNMENTS

LOCAL GOVERNMENT MICROCOMPUTER SOFTWARE

This Appendix contains the names, addresses, and telephone numbers of organizations providing software on microcomputers for governmental units. This list is far from exhaustive, if for no other reason than the rapidity of change in the microcomputer field and because new vendors of microcomputer software for governmental organizations are almost constantly appearing. Nevertheless, the list should be valuable to the interested local government.

The vendors appearing here were compiled by the author and Mr. Robert Hober from a variety of sources. These included vendors known to the author, names provided by other parties, and a list supplied by the Southwest Innovation Group, Inc., Anaheim, CA. In all cases, Mr. Hober contacted the vendor organization by telephone to confirm vendor address, software offerings, language(s) in which the software is written, and operating system for which the software was developed. This information appears on the table.

No effort was made to evaluate any of the software offerings as such an undertaking was beyond the scope of this project. Hence, the ancient advice, *caveat emptor,* is once again in order.

Two conclusions may be drawn from the compilation of this list. First, as recently as two years ago, many of the vendors listed either did not exist or did not write local government software for micros. Thus, the development of this particular vertical market is relatively recent. Second, several vendors on the original list were found not to be in business or to have software that will not be available until some unspecified future date. Thus, the survival of at least a certain proportion of vendors in this market can be said to be precarious, and not all announced software is really developed.

LOCAL GOVERNMENT MICROCOMPUTER SOFTWARE VENDORS

Vendor	Available Software	Language	Operational System
American Fundware Box 773028 Steamboat Springs, CO 80487 (303) 879-5770	Broad range	COBOL	AFOS MS-DOS AOS
Arizala and Associates Box 1906 Ann Arbor, MI 48106 (313) 769-6270	Broad range	BASIC	AOS AOSVS
Big Sky Data Systems 1201 Grand Avenue, Suite 3 Billings, MT 59102 (406) 252-2299	Broad range	BASIC	Alpha Micro
Joe R. Chance Box 1096 Livingston, AL 35470 (205) 652-2844	Payroll, utility billing, licenses	BASIC	TRS DOS
Charter Micro Application 215 Piedmont Avenue N.E. Atlanta, GA 30308 (404) 881-1785	Broad range (MUNIS package)	COBOL Pascal	CP/M MS-DOS UNIX
Civilsoft 290 S. Anaheim Boulevard Anaheim, CA 92805 (714) 774-5740	Traffic and transportation, coordinate geometry, and storm drain analysis	Compiled in machine code	MS-DOS PC-DOS CP/M-80
Community Systems and Services 8300 Greensborough Drive McLean, VA 22102 (703) 448-0606	Broad range	Pascal	UCSD
Computer Business Systems Box 389 Phillipsburg, KS 67661 (913) 543-2216	Broad range	dBase II BASIC	CP/M CP/M-86 MS-DOS
Computer Center 366 U.S. Rt. 1 Falmouth, ME 04105 (205) 781-2260	Broad range (MUNIS package)	RM COBOL	ALTOS XENIX CP/M MS-DOS
Consulting Group Lincoln Stewart Building, Suite 1055 Lincoln, NE 68508 (402) 475-1511	Electric utility load monitoring	BASIC	TRS DOS MS-DOS

Vendor	Available Software	Language	Operating System
Executive Data Systems 290 Interstate N., Suite 116 Atlanta, GA 30339 (404) 955-3374	Broad range (association management)	COBOL	CP/M-80 MS-DOS
FairField Graphics 1923 First Avenue, Suite 300 Seattle, WA 98101 (206) 682-2879	mapping, graphics, and spreadsheet	FORTRAN Pascal BASIC	p-System CP/M Apple DOS 3.3
Gemunis 5001 W. 80th Street, Suite 1030 Bloomington, MN 55437 (612) 835-5521	Broad range	Pascal	MS-DOS
HMS, Inc. 2700 Delk Road, Suite 200 Marietta, GA 30067 (404) 953-4863	Broad range	COBOL	AOS
Innovative Decision Systems 1109 East Carmen Street Tempe, AZ 85283 (602) 838-3659	Broad range	dBase II	CP/M MS-DOS
Integrated Computers Box 1767 Grand Island, NE 68802 (308) 381-1228	Broad range	BASIC COBOL	IMOS CP/M MS-DOS CP DOS
Jorgenson Maintenance and Management Systems 110 Ryan Court, Suite 5 San Ramon, CA 94583 (415) 838-2088	Parks and grounds maintenance	BASIC	MS-DOS 2.1
Kapner, Wolfburg and Associates 7120 Hayvenhurst Avenue Van Nuys, CA 91406 (818) 781-8851	Maintenance management	dBase II	CP/M MS-DOS
LWFW, Inc., Group 12700 Park Central, Suite 1805 Dallas, TX 75251 (214) 233-5561	Work management	dBase II	MS-DOS
Mark Systems, Inc. 750 Welch Road, Suite 305 Palo Alto, CA 94304 (415) 368-6161	Data manipulation programs	Pascal	p-System Corvus Concept

Vendor	Available Software	Language	Operating System
Morse Data Processing 914 West 4th Street Hastings, NE 68901 (402) 462-4311	Broad range	COBOL	CMS BTOS
Planning Data Systems 1601 Walnut Street, Suite 1524 Philadelphia, PA 19103 (215) 665-1551	Mapping	FORTRAN Assembler	PC-DOS
Sammanish Data Systems Box 70382 Bellevue, WA 98007 (206) 644-2442	Data base management and mapping	dBase II Compile BASIC	CP/M MS-DOS
Technomics 100 Ardmore Street Blacksburg, VA 24060 (703) 552-5609	Utility billing	BASIC Pascal	TRS DOS p-System

ORGANIZATIONS TO CONTACT REGARDING MICROCOMPUTER SOFTWARE FOR GOVERNMENTAL UNITS

Organization	Services Offered
International City Management Association 1120 G Street, N.W. Washington, DC 20005 (202) 626-4600	Municipal government software Microcomputer software newsletter Training programs
Lincoln Institute of Land Policy 1000 Massachusetts Avenue Cambridge, MA 02138 (617) 661-1152	Land use software Training programs
Public Technology, Inc. 1301 Pennsylvania Avenue, N.W. Washington, DC 20004 (202) 626-2400	Local governmental software Training programs Technical assistance
U.S. General Services Administration Federal Software Testing Center, and Federal Software Information Exchange Office of Software Development and Information Technology 5203 Leesburg Pike, Suite 1100 Falls Church, VA 22041 (703) 756-6156	Governmental software Information about software Newsletter
U.S. Department of Transportation MTP Support Center DOT/Transportation Systems Center DTS-62 Kendall Square Cambridge, MA 02142	Transportation related software Transportation planning users' group Newsletter Acquisition and user manuals

INDEX

TRANSPARENCY SECTION

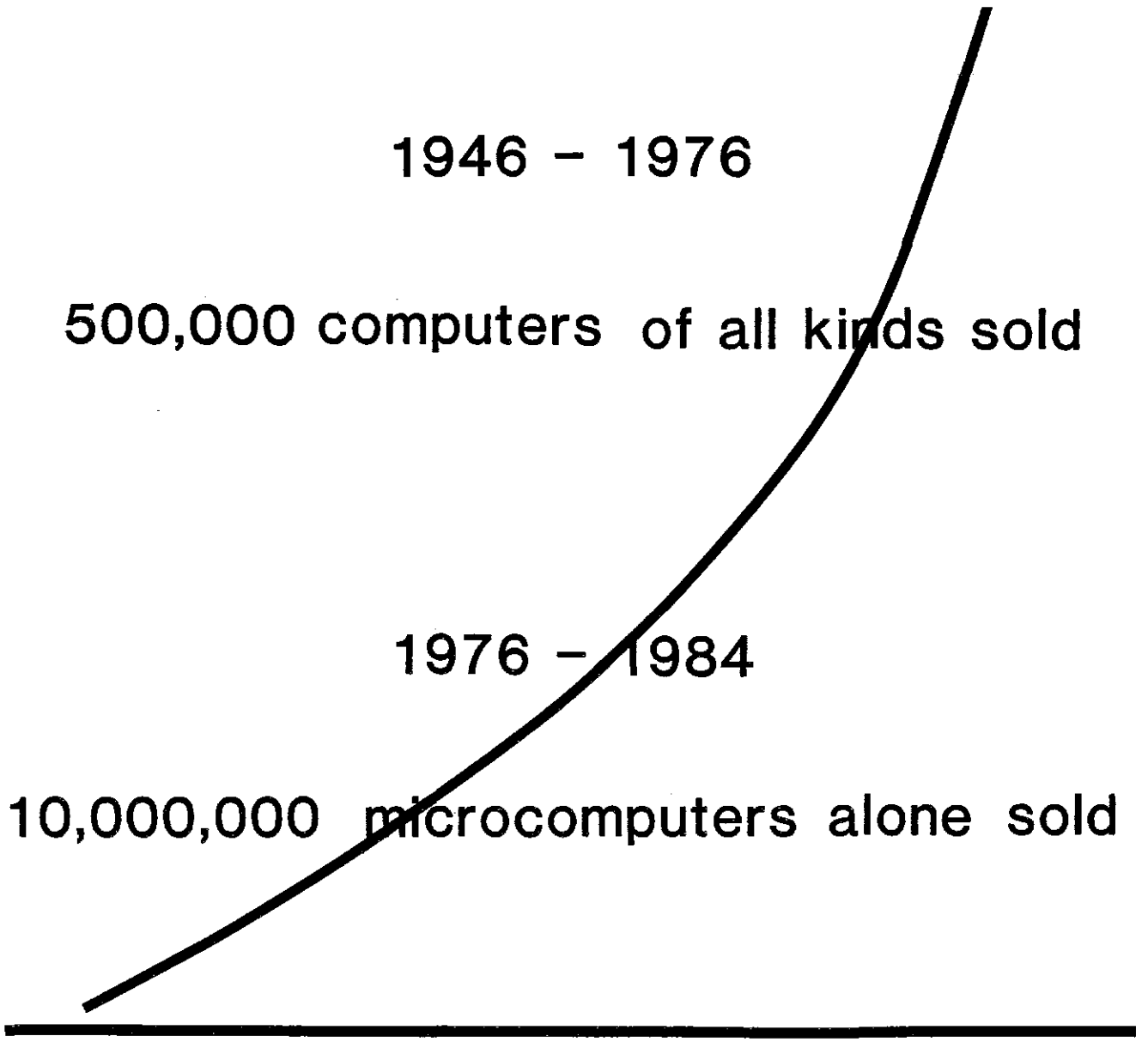
The following section contains pages for use in making overhead transparencies. They are numbered to correspond to the places they are to be used.

1946 - 1976

500,000 computers of all kinds sold

1976 - 1984

10,000,000 microcomputers alone sold



FOUR COMMON THEMES

Microcomputers

1. are inexpensive
2. sales growing rapidly
3. are easy to use
4. have tremendous capabilities

1982 ICMA STUDY

13% of city governments had micros

1983 UNO STUDY

7% of small cities and counties had micros

1982 ICMA STUDY

35% of all city governments
planned to buy micros

1983 UNO STUDY

11% of small cities and counties
planned to buy micros

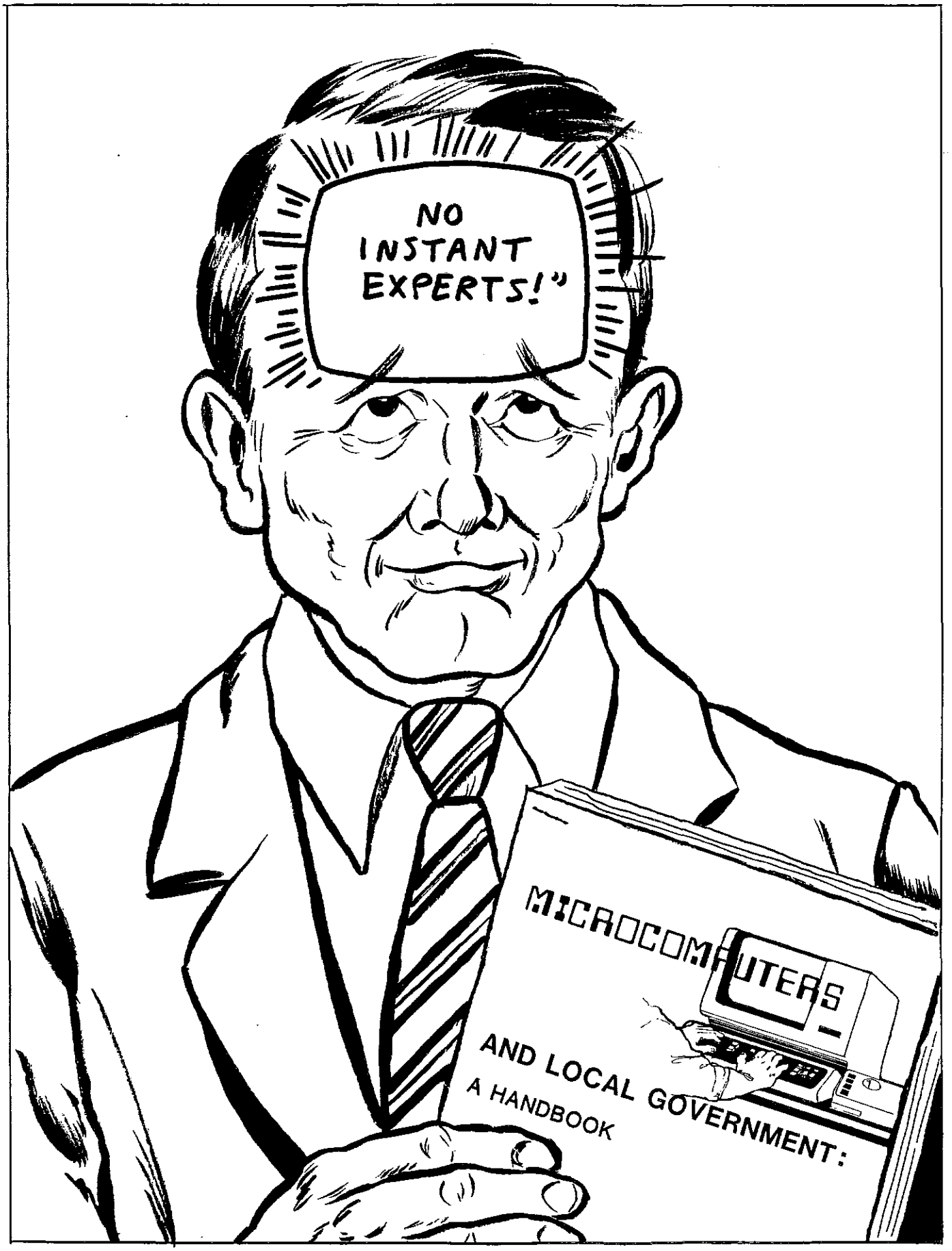
- OEM – original equipment manufacturer
- Turnkey vendors – sell complete system
- Packaged software – programming written and sold for specific function

PURPOSES OF THE HANDBOOK

1. Provide overview

2. Introduce microcomputers
   - Uses
   - Limitations

3. Provide procurement guidelines


NO INSTANT EXPERTS!"
MICROCOMPUTERS
AND LOCAL GOVERNMENT:
A HANDBOOK

DATA PROCESSING

Collection
Compilation
Manipulation

} of facts to produce information

INFORMATION

Coherent
Organized

data to provide knowledge about

Events
Activities
Phenomena

PURPOSE OF DATA PROCESSING

To provide

- ○complete
- ○accurate
- ○reliable

} information for management purposes

MANAGEMENT PURPOSES

Anything that decision-makers

need to know to do their jobs

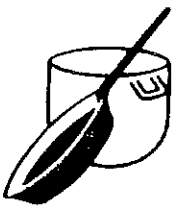
HOUSEKEEPING ACTIVITIES

Budgetary accounting

Accounts payable

Cash Management / Accounts receivable

Payroll



Personnel management

Utility billing and accounting

Department record keeping

Word processing

DECISION MAKING ACTIVITIES

Spreadsheet programs

Data base management

Decision support

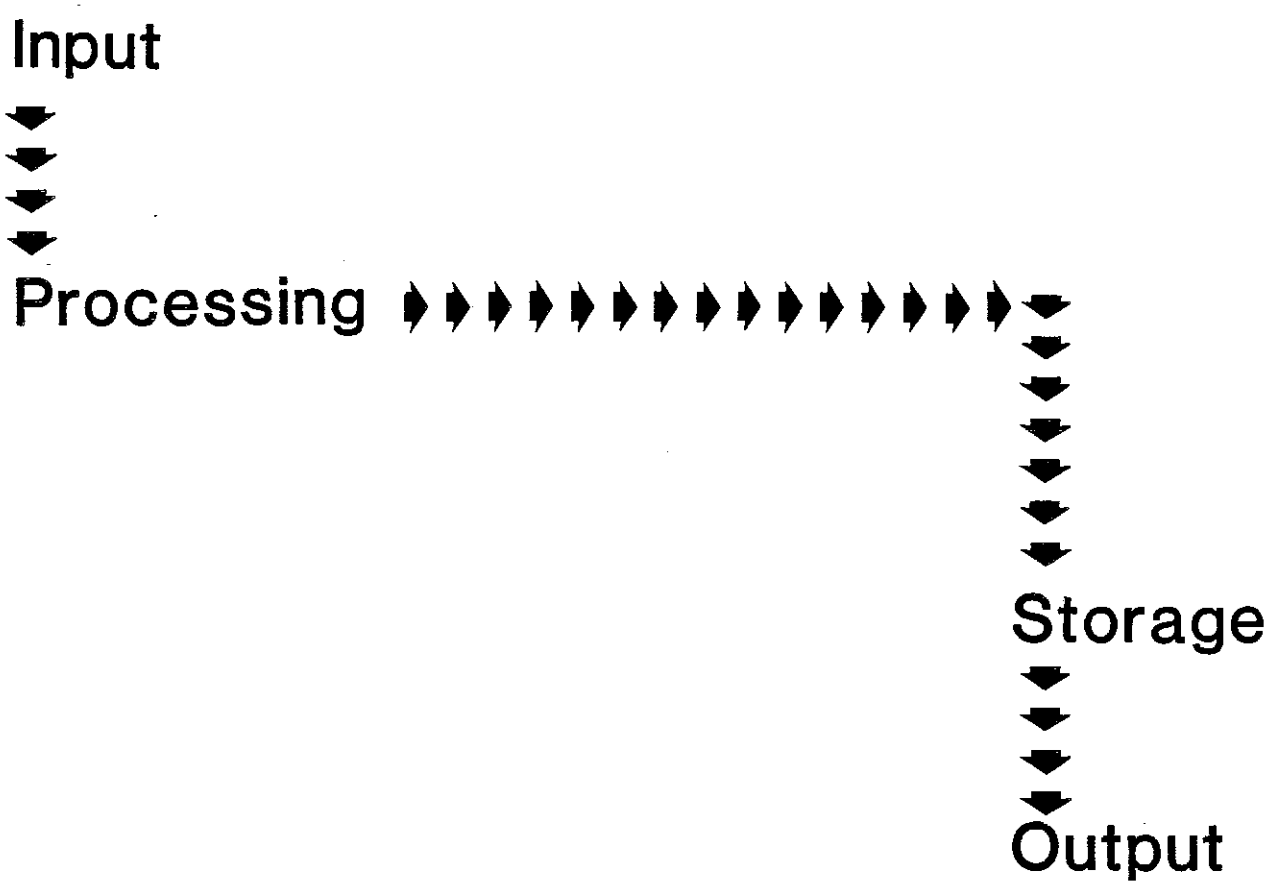
TYPES OF COMPUTERS

Micros

Minis

Mainframes

BASIC COMPUTER FUNCTIONS



QUICK ACCESS FILES
MASS STORAGE
INPUT-OUTPUT
COMPUTER

TECHNOLOGICAL DIFFERENCES
THE OLD VS. THE NEW

Speed

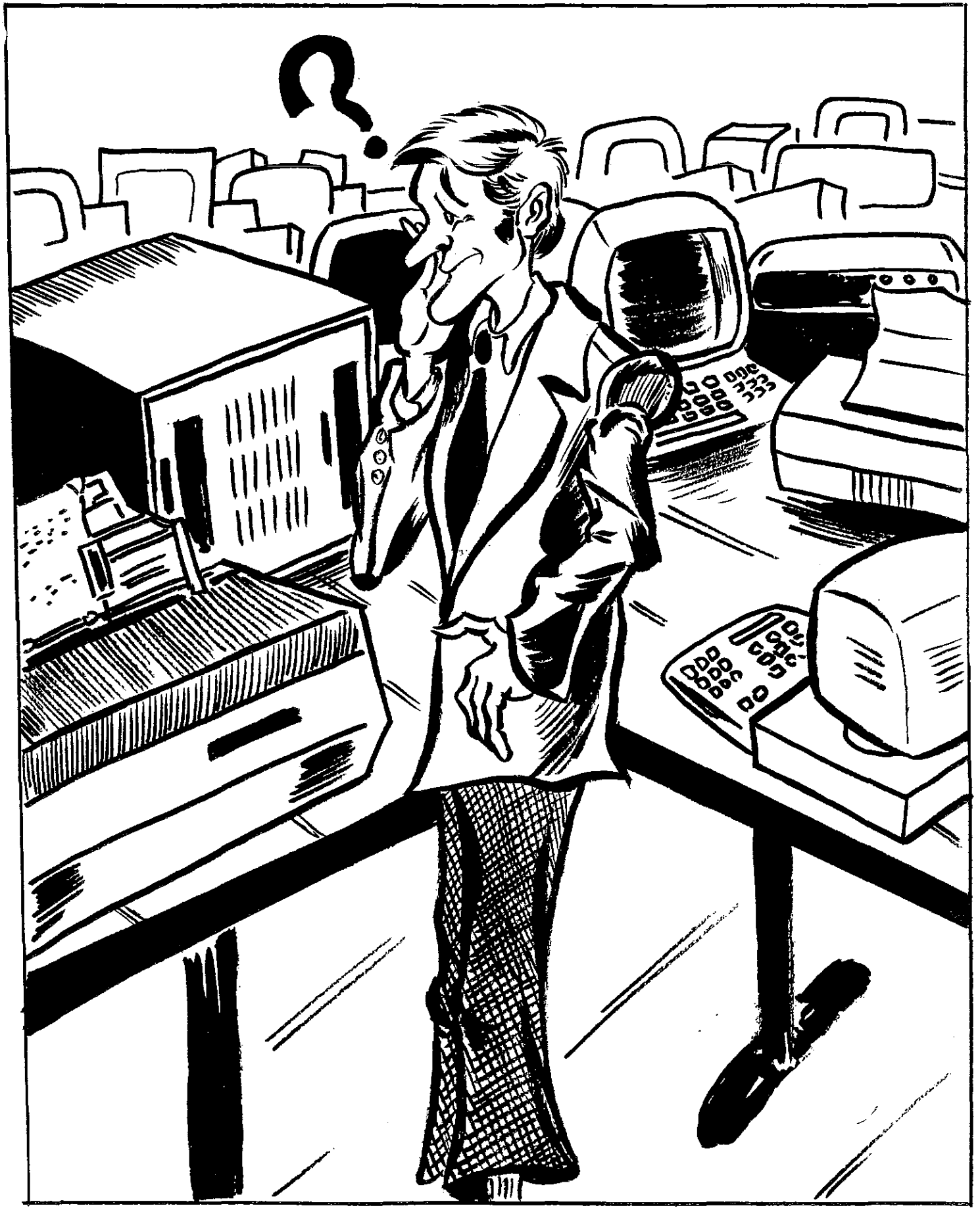
Accuracy

Efficiency

Equipment

Complexity

COMPUTERS ARE NOT PANACEAS



HARDWARE

CPU

Storage device

- disk (floppy, hard)
- tape

Terminal (CRT)

Printer

Modem

SOFTWARE (PROGRAMMING)

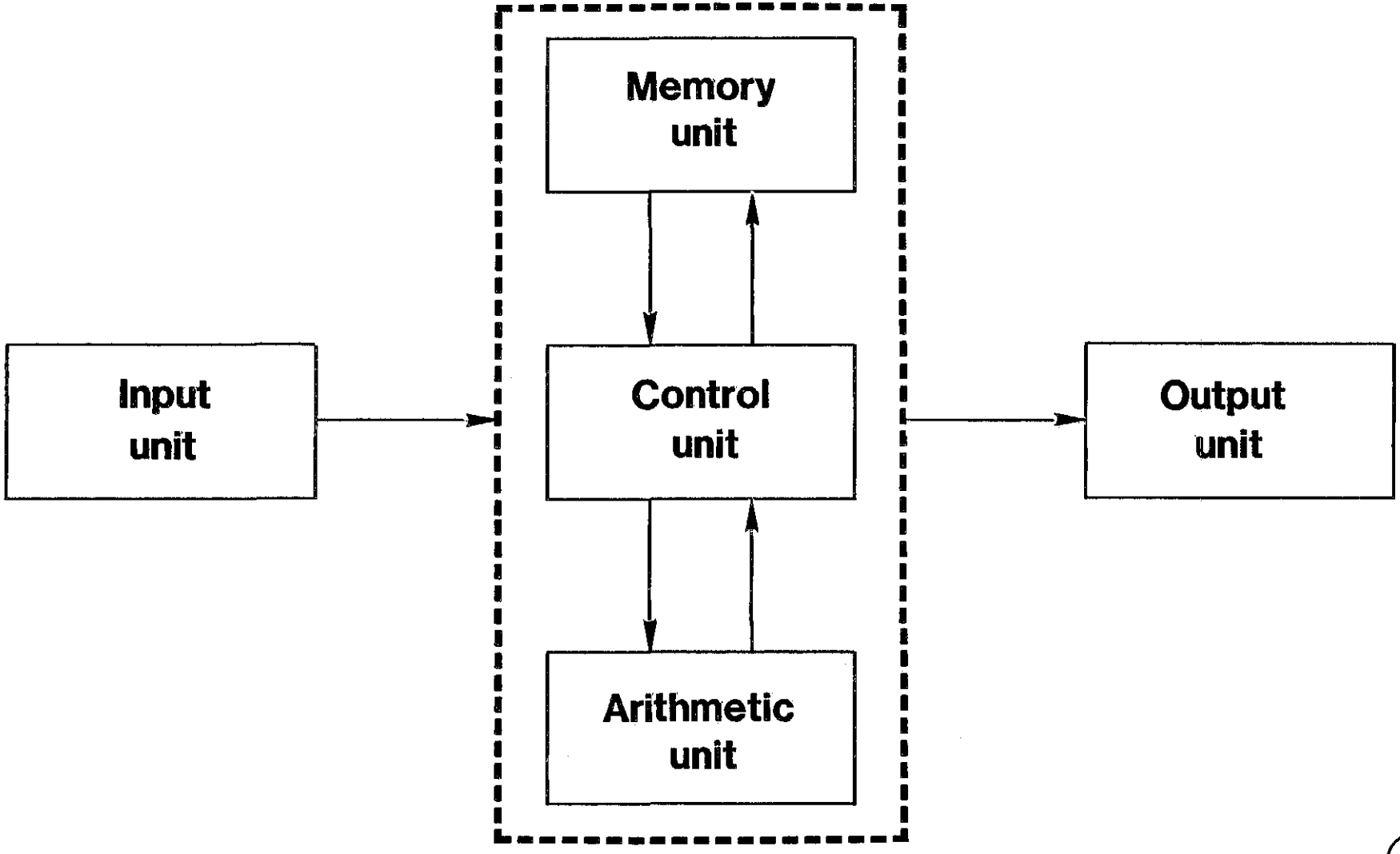
Operating systems

Application programs

- BIT – BInary digiT

BYTE – 8 bits

Central Processing Unit
(CPU)

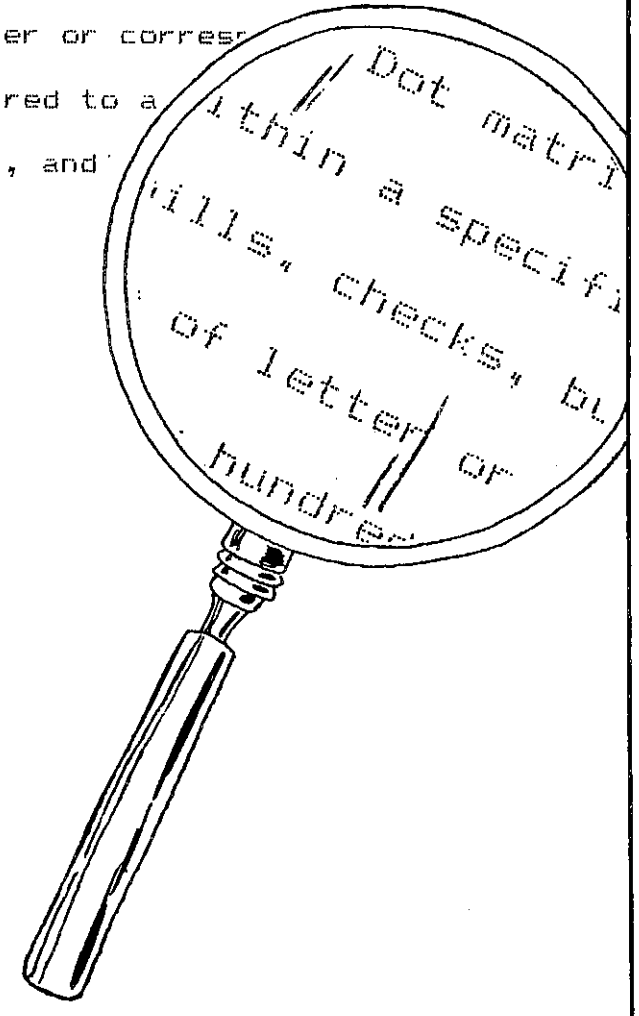


- RAM – Random Access Memory
- ROM – Read Only Memory

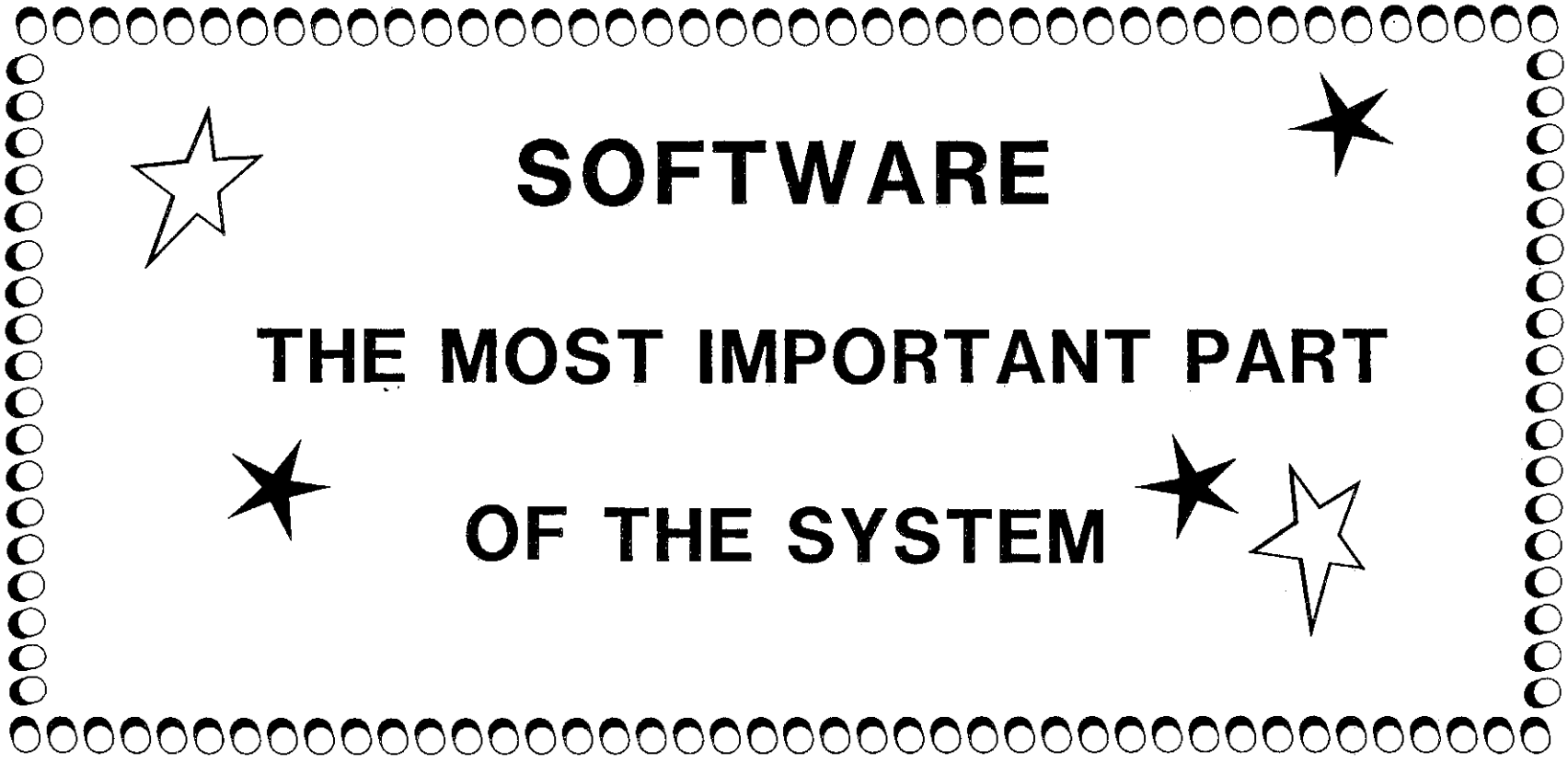
BIT SIZE

8 – bit
16 – bit
32 – bit

Dot matrix printers form characters within a specified matrix. These printer bills, checks, budget reports, and other be of letter or corres a few hundred to a durability, and



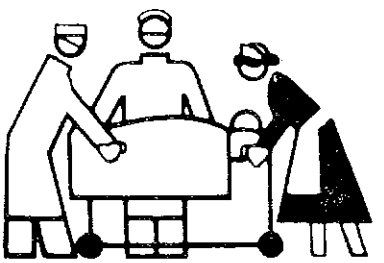
Letter quality printers get their looks as if it came from a typewriter. for correspondence, narrative reports, Although letter qualit are now on the mar needed for most thousand dollar


SOFTWARE
THE MOST IMPORTANT PART
OF THE SYSTEM

OPERATING SYSTEMS

Reside on computer's memory

Control activities of system



8-BIT SYSTEMS

TRSDOS
AppleDOS
CP/M

16-BIT SYSTEMS

MS-DOS
CP/M 86
UNIX

APPLICATION PROGRAMS

Perform the work of the organization

COMPUTER LANGUAGES

BASIC –

Beginner's All-purpose Symbolic Instructional Code

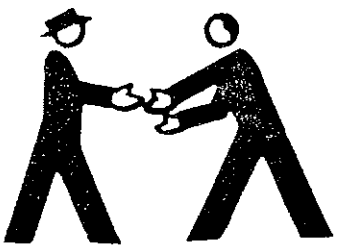
COBOL –

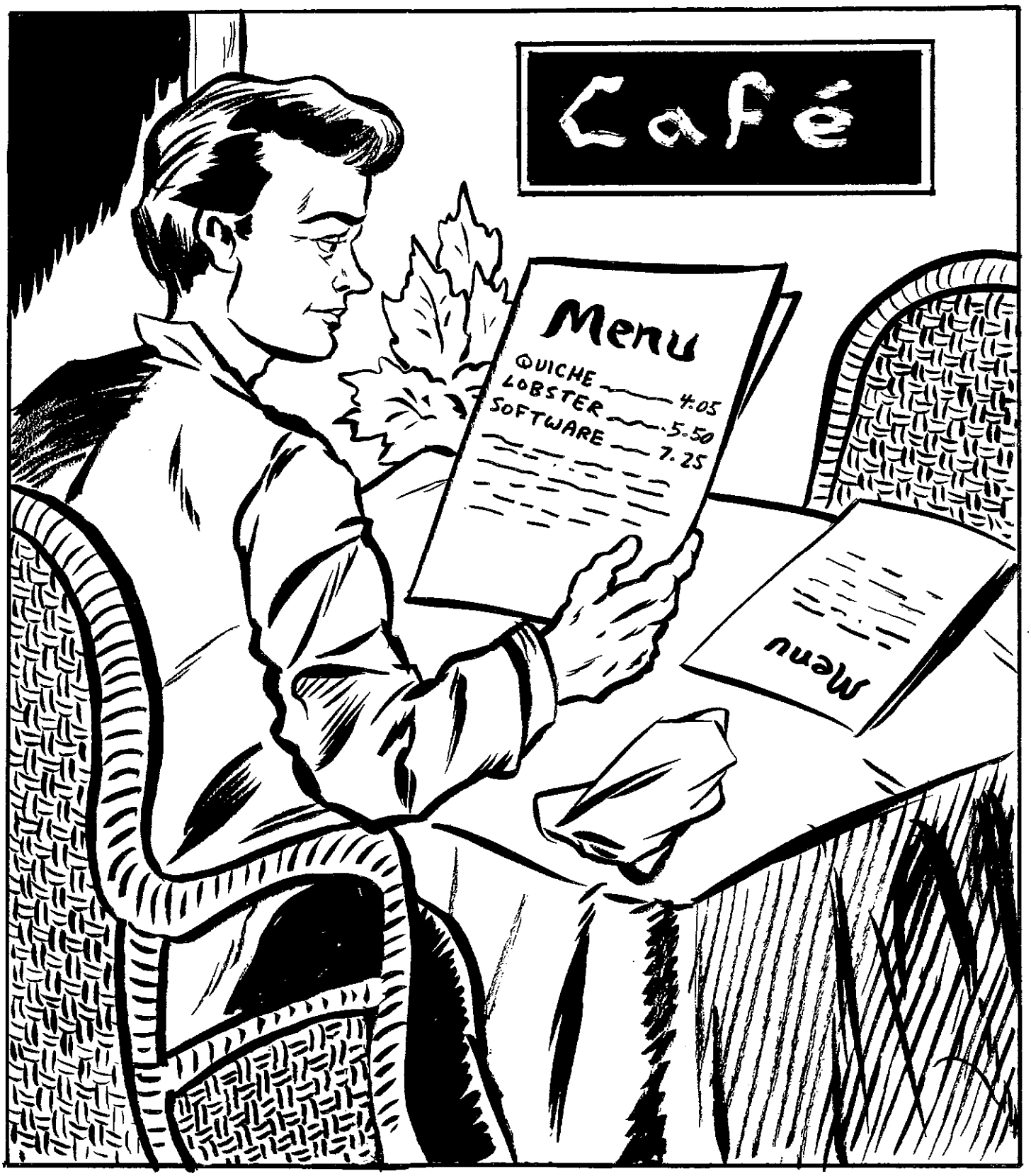
COmmon Business Oriented Language

FORTRAN –

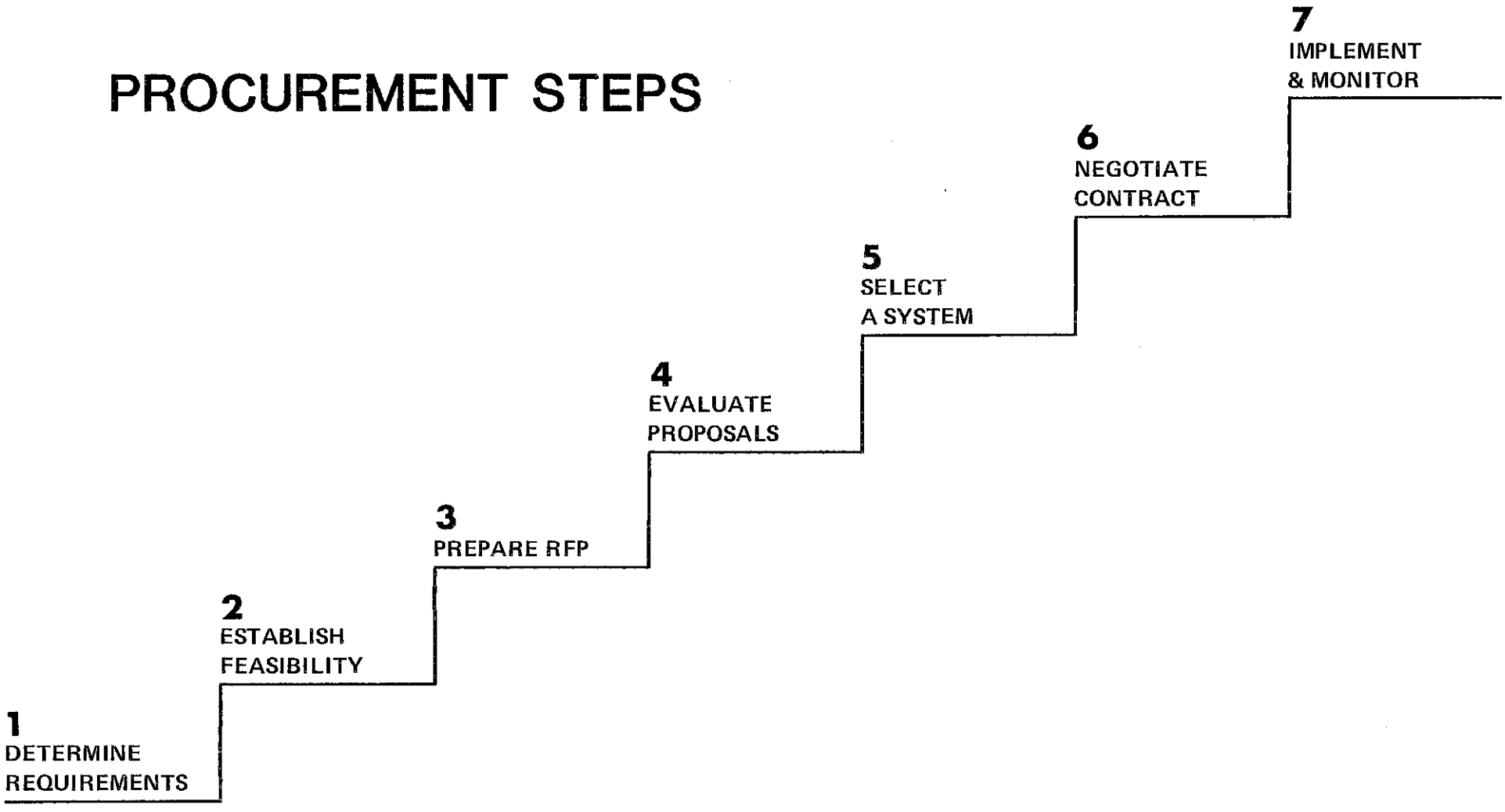
FORmula TRANslation

- ON-LINE
- OFF-LINE
- REAL TIME
- MULTIPROGRAMMING
- MULTIPROCESSING
- USER FRIENDLY




Café
Menu
QUICHE ——— 4.05
LOBSTER ——— 5.50
SOFTWARE ——— 7.25
menu

PROCUREMENT STEPS



DO YOU NEED A MICRO?

YES!

NO?

MAYBE

TOTAL SYSTEM COSTS

Hardware

Operating system

Application programs

Hardware maintenance

Software support

Supplies

Electrical and facility modifications

Furniture

Data conversion

SOFTWARE OPTIONS

Off-the-shelf

Packaged

Buy and modify

Write in-house

POINTS TO EVALUATE

- RFP requirements
- Hardware
- System expandability
- Hardware maintenance
- Software support
- Vendor organization
- Additional capabilities
- Cost

SYSTEM IMPLEMENTATION

Burn-in period

Install programming

Training

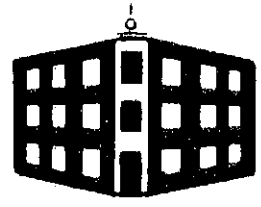
Create data files

Run programs

Monitor performance

SOURCES OF MICROCOMPUTERS

Microcomputer stores



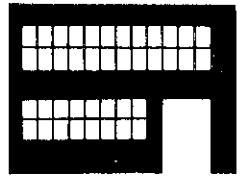
Discount chains

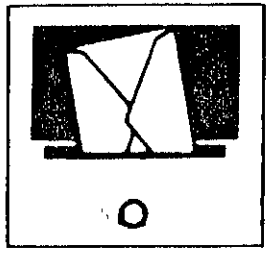
Department stores

Audio and video stores

Farm co-ops

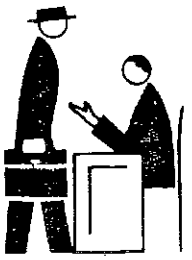
System manufacturers



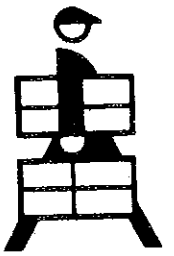


Mail order firms

MAINTENANCE ALTERNATIVES

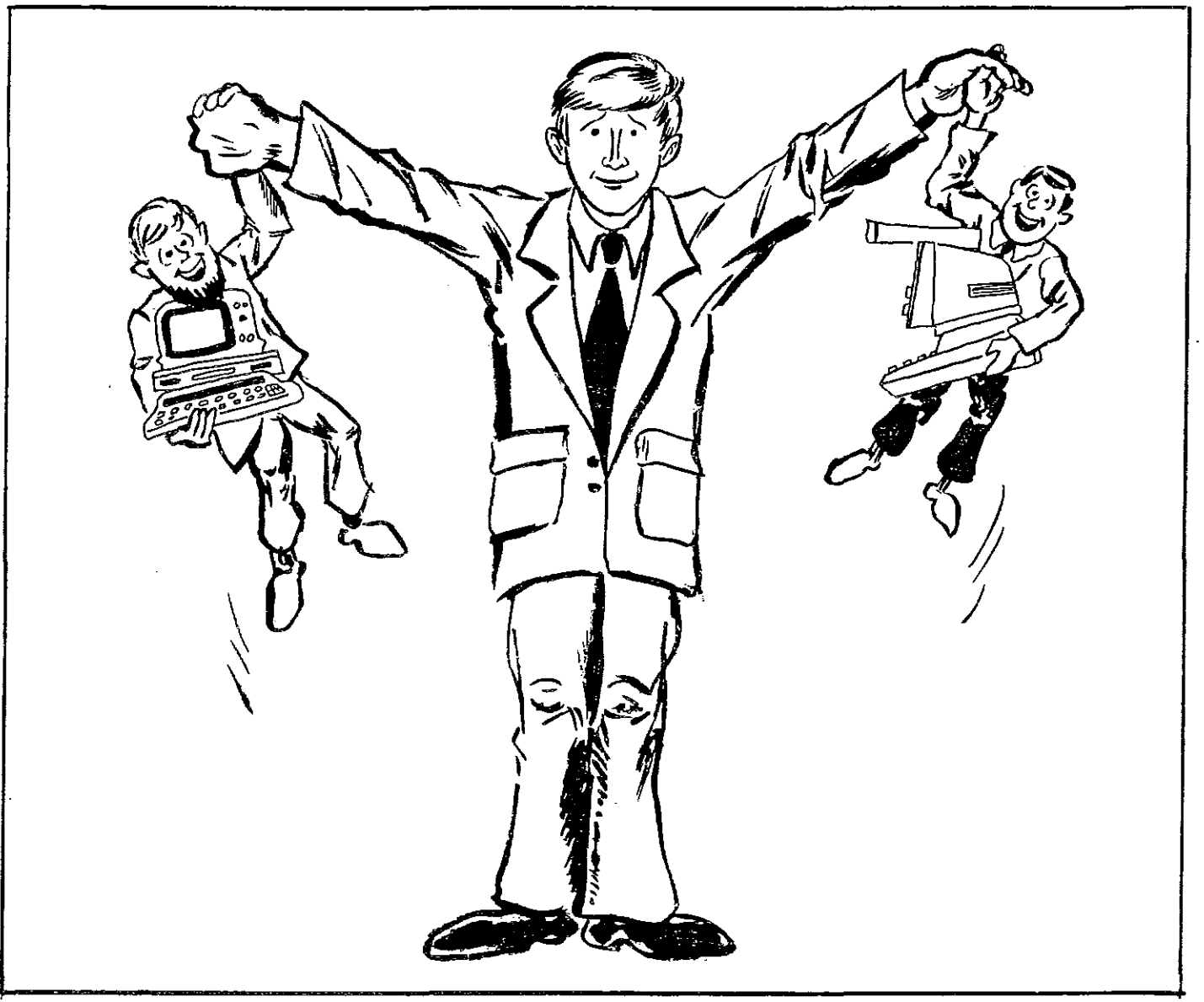


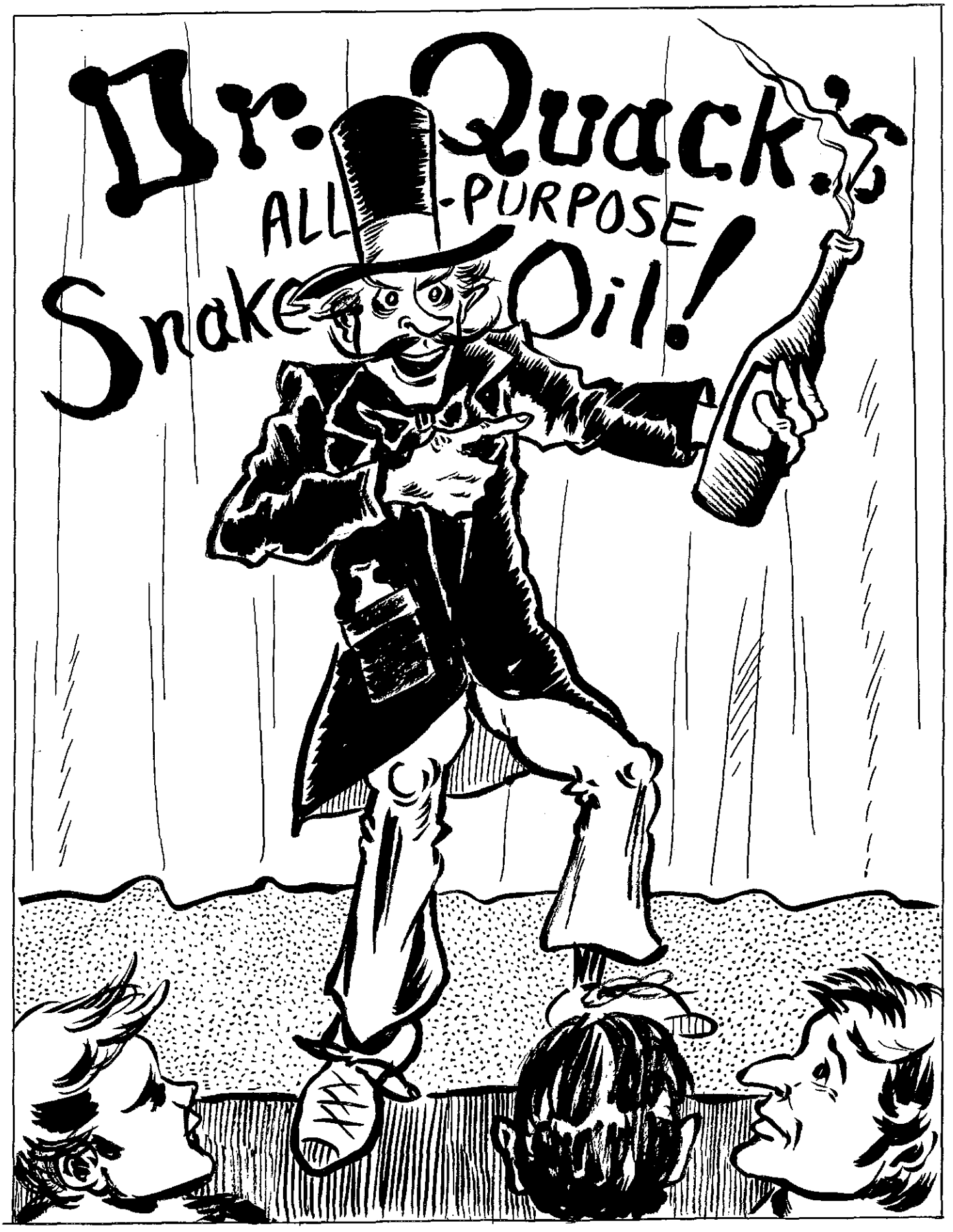
On-site



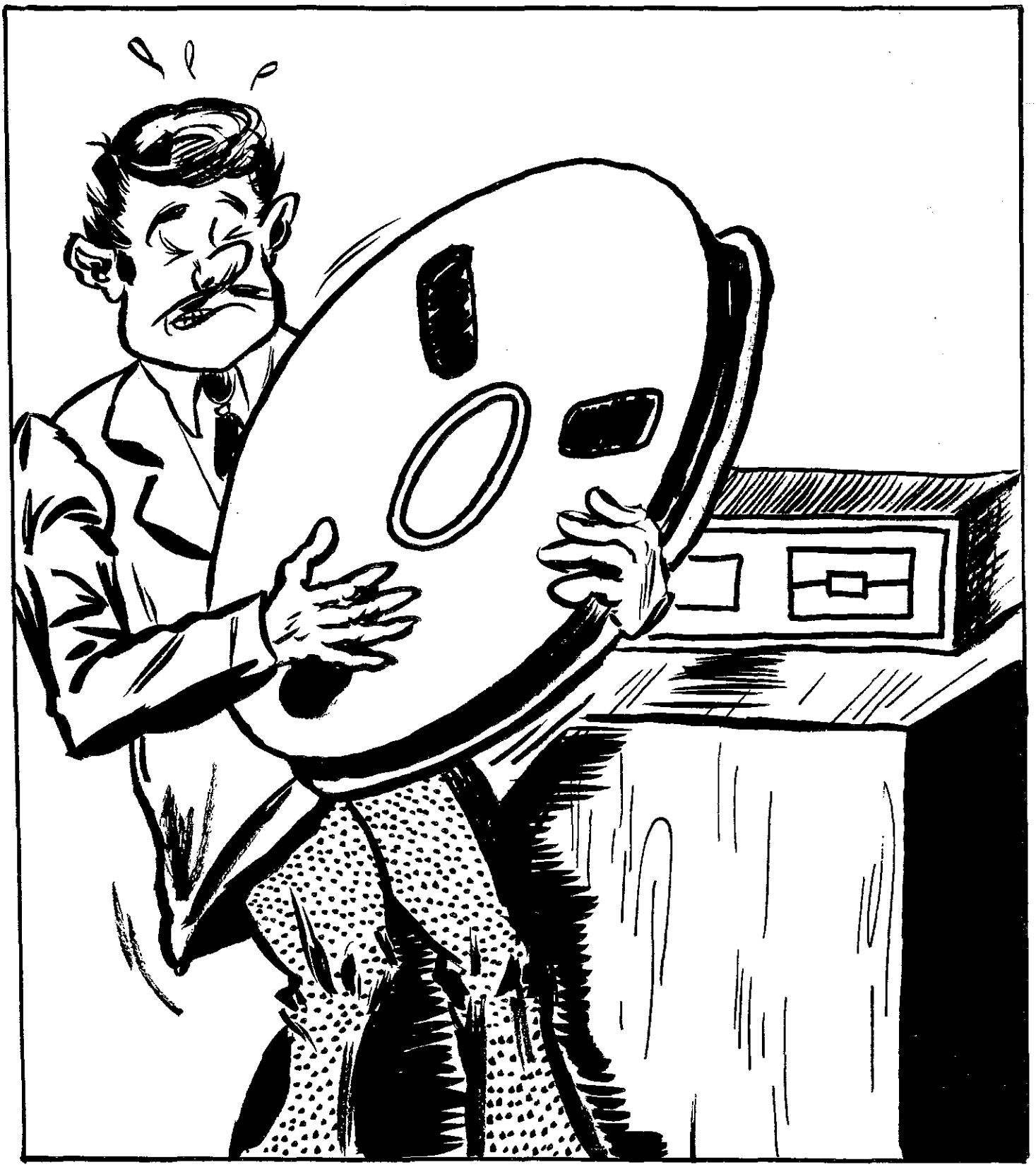
Carry-in

Mail-in




Dr. Quack's
ALL-PURPOSE
Snake Oil!

TUTU



SOFTWARE


TRAINING