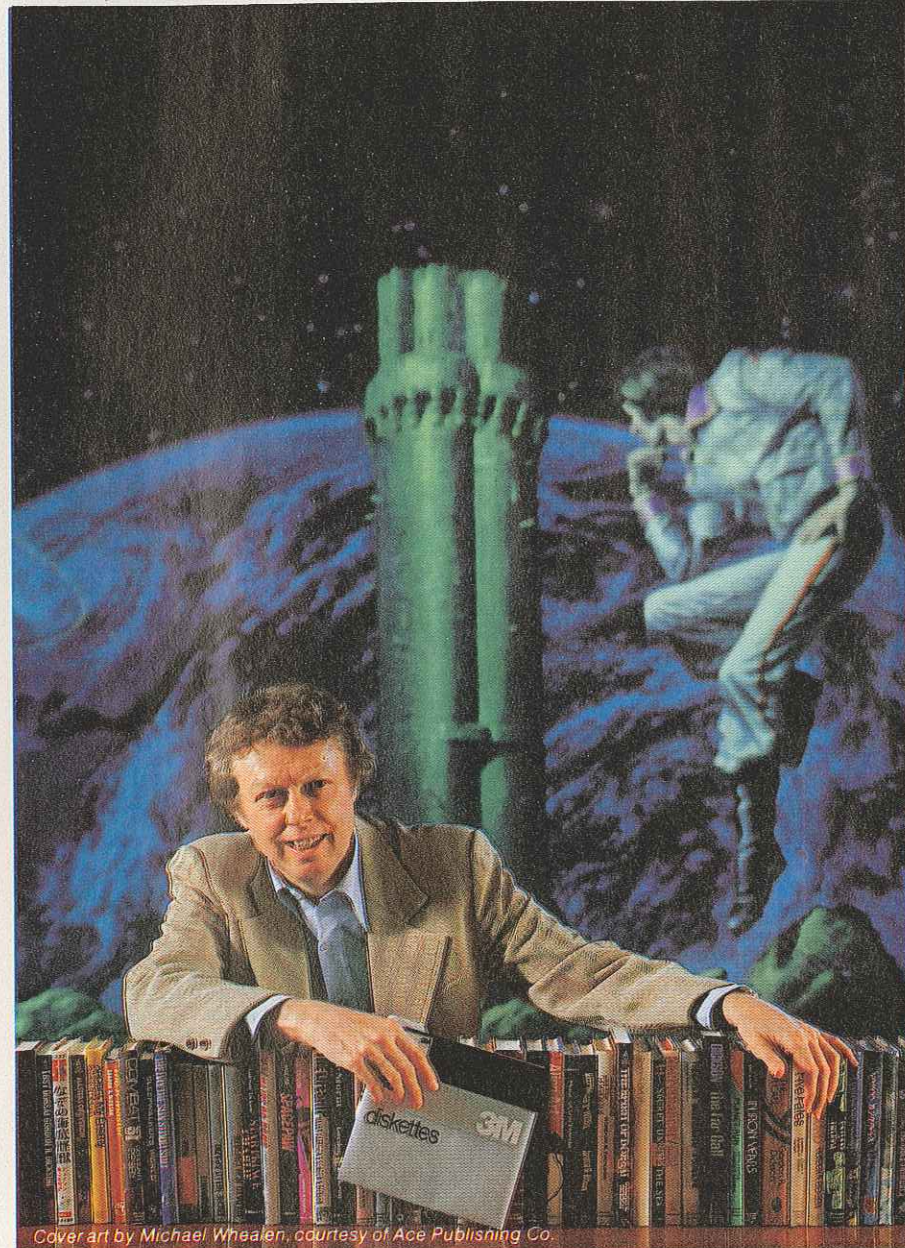


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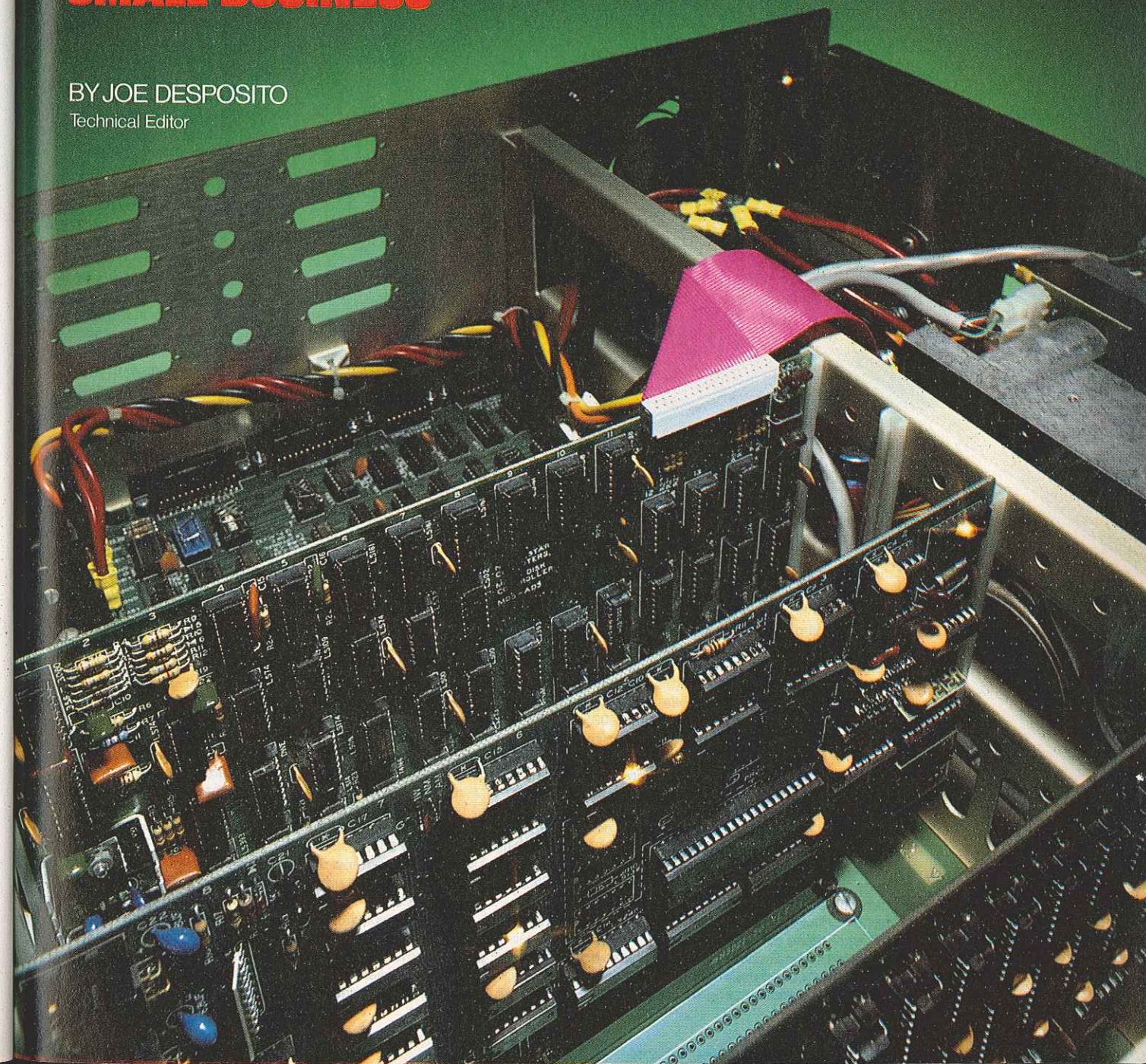
THE ELECTRONIC WORLD

COMPUTERS

**PERSONAL
PROFESSIONAL
EDUCATIONAL
SMALL BUSINESS**

WHICH ONE
IS FOR YOU?

BY JOE DESPOSITO
Technical Editor



The electronic digital computer has been affecting our lives ever since the room-sized ENIAC fired up its tubes and spewed out answers to complex technical problems more than 30 years ago. In recent years, electronic miniaturization has shrunk the size and cost of the basic unit to the point where virtually anyone can own and use a computer. The problem now is not buying a computer, but buying one that best meets an individual's needs.

A computer purchase follows the same laws as purchases of many other products—to get value, you have to weigh factors like price, performance, and desired functions. However, unlike most electrical and electronic products which are "dedicated" systems (for example,

a washing machine can only wash clothes), a computer is capable of performing a variety of tasks from entertainment to record-keeping, to teaching, to communications, etc.

Personal computers come in all sizes and prices so making a decision about which model to buy can be very confusing at times. The uppermost consideration is determining your individual needs, both present and near-future. This will help you narrow your field of choices, and you can make it even smaller by focusing your attention on one of the following areas: personal, professional, education, and small business. You could consider building a kit, too, in the interests of saving money and to provide ease of servicing (should it be required) and hardware education.



Created by Jan Hendricks
Courtesy Real Time Design Inc.

PERSONAL

We will define a personal computer user as someone who plans to use a microcomputer primarily in the home. We'll divide personal users further into two groups: those who want to make a minimal investment in hardware (\$100-500) and those who want to make a more sizable investment (more than \$1000).

People in the first group can get quite a bit of computing power for their dollar if they know what they want. Let's take a look at the general features available at this level to see how "what you want" can help you determine "what you get."

Computers that sell for less than \$500 can accomplish a variety of things. For example, they can help you become computer literate; they can perform calculations; they can entertain and teach you; and they can give you access to data networks by phone. However, not all of the machines in their basic configurations can do all of these things.

Let's consider computer literacy. Many people want to learn about computers and/or want to introduce their children to computer programming, BASIC, RAM, ROM,

bits, bytes, input, and output. Low-cost computers can do a thorough job of making a person computer literate. The Sinclair ZX81, for example, sells for less than \$150 (assembled), but goes a long way toward educating you in the benefits of having a computer in the home. The unit includes an r-f modulator that's used to connect the computer to your TV set. With the addition of an ordinary cassette tape recorder, you have the essentials of a computing system: a central processing unit, a display for input and output, and a storage medium for any programs that you want to save. How far can you go with this little system? You can learn BASIC and begin writing programs, and you can use pre-packaged software available for this computer (several companies provide such software). If, after a while, you begin to outgrow the basic system, you can add a 16K memory module and a small printer. Even with these add-ons, the system costs less than \$350.

However, if you want to play computer games like "Super Bustout" and "Blue Meanies from Outer Space" on your color TV, you'll have to look further than the ZX81. Examples of low-cost computers that offer color graphics are the Commodore VIC-20 for \$299.95 and Radio Shack's Color Computer for \$399. Both systems offer education and personal finance programs as well as the BASIC language that you can use to develop your

own programs. The VIC-20 needs an optional cassette recorder to store programs, while the Radio Shack model, which also has an optional cassette machine available, has provisions for using plug-in ROMs called "Program Paks." This is a factor to consider when looking at base prices. Among other considerations would be the quality and function of the keyboards, and video alphanumeric resolution.

If you're on a low budget now but would like to expand your horizons later, you might consider starting out with either the TI 99/4A from Texas Instruments or the Superboard II from Ohio Scientific. The TI 99/4A, which "lists" at about \$600, but is heavily discounted, can get you started in computing. Like the Radio Shack Color Computer, it uses ROMs that plug into the console so you don't have to buy a cassette recorder immediately. These plug-in ROMs are great for children who might find it difficult to use a tape unit. The basic unit includes 16K of RAM memory, which is considerably more than the other computers mentioned thus far offer with their basic units, though they're all expandable. Probably the most important feature of this machine, for those with expansion in mind, is that it can run LOGO, an innovative language used for educational purposes.

If you're interested in computer music but want to avoid the expense of add-on music synthesizers, the VIC-20, the Color Computer, and TI 99/4A have tone generators that can be programmed to play songs or make other sounds such as whistles or explosions.

The Superboard II is a "bare bones" computer for \$329, which comes without case or power supply. If you enjoy looking at the innards of the machine while working, this is the one for you. The addition of a power supply and r-f modulator (another \$80) will get you rolling. This machine starts you off with the basics, yet offers a great deal of expandability when needed. (The Superboard II is essentially the "guts" of the Ohio Scientific Challenger 1P).

One note of caution. Of the five computers mentioned (and this does not cover every low-cost model available), all have expansion capabilities such as adding a printer. However, expansion means money! If you think you will eventually spend \$1000 or more on a system, you owe it to yourself to check into some of the higher-priced systems *before you buy*. In general, the latter offer more variety of software and peripherals which, in turn, gives a computer more flexibility and power.

Before we discuss higher-priced computer systems, let's examine another type of low-cost item. If you're not interested in programming but would like to hook into one of the giant data networks like CompuServe and The Source, you might consider either the RCA VP3501 Video Data Terminal or Radio Shack's TRS-80 Videotex terminal (each at \$399). These are not versatile computers, but they are capable of "plugging into" the big computer telephone networks. Both of these terminals have built-in modems and r-f modulators. This means that you just plug a phone cord into the terminal, connect the terminal to your TV set, and you're ready for action. The data networks offer an incredible amount of information and services. For example, they provide news, weather and sports from many major newspapers and international news services such as Associated Press and UPI. They offer financial information (with updates) and historical information on stocks, bonds, and mutual funds. In the entertainment field they provide theater, book, movie, and restaurant reviews. Electronic mail service is available so you can send and receive messages from other network users. In addition, they have challenging games, programming languages, word processing, and business and education programs. You can even get parts of computer-related editorial matter from PE.

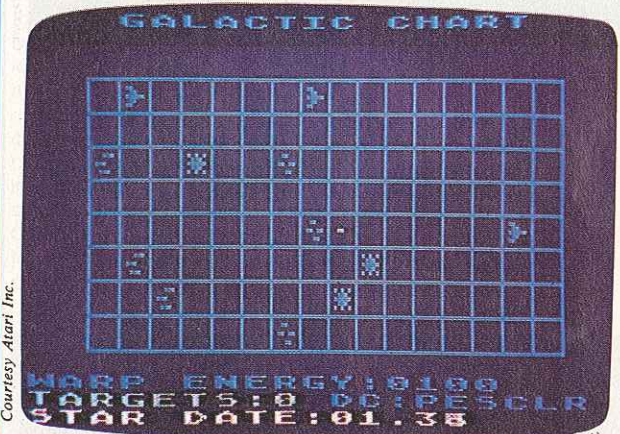
One of the differences between the two terminals is the keyboard. The RCA model has a flat, touch-sensitive

board that's impervious to liquid spills, while the Radio Shack model has a standard typewriter-style keyboard. If you're a touch typist, a difference like this would be important to you. Both terminals are portable, so you can take them wherever you go as long as a telephone and TV are available when you get there.

Clearly, there's quite a bit you can do with a low-cost computer or terminal. But, if you want to spend more money, you can buy a personal computer that is more sophisticated than those mentioned thus far.

To get the most out of a computer, however, you will need to add some peripherals and develop a software base. In general, a substantial system should include a printer, one or more disk drives, a modem (for communications), and maybe a few other accessories such as joysticks, a voice synthesizer, a music synthesizer, a light pen, or a graphics tablet. Of course, adding all these peripherals to your system will skyrocket its cost into the thousands of dollars—and we haven't even considered software yet.

You could write your own programs, but it's more like-



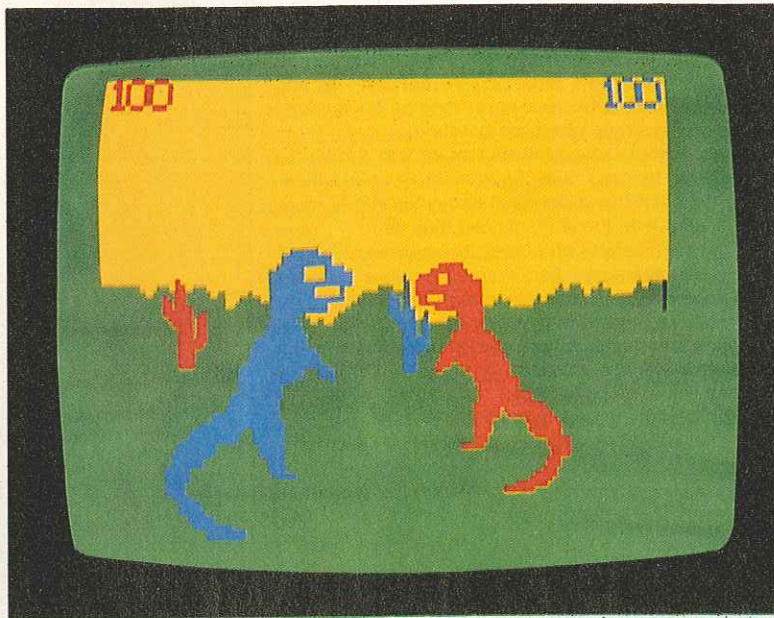
Courtesy Atari Inc.

ly that you'll buy most of the software you need. Some of the top software packages are Word Star and Scripsit for word processing, VisiCalc for financial applications, and CP/M for the computer's basic operating system. Besides these, there are thousands of other software packages to enable your computer to work harder for you. As we observed before, though, your own needs must be considered before you purchase anything.

Sometimes a particular software package will run on one machine but not on another (although most major computers have comparable software packages). Keep this in mind because it might influence you to buy one computer rather than another. (Since usefulness or utility is probably more important than price at this level, we will not make price comparisons among the different computer systems in the following section.)

If you plan on spending more than \$1000 on a computer system, some of the models available include the Apple II Plus, the Heath/Zenith Z89, the Atari 800, the TRS-80 Model III from Radio Shack, the IBM Personal Computer, and the NEC PC8001A. To make an intelligent buying decision, you have to look at some of the unique features of the machines that might be highly appealing to you.

If your main interest is color graphics, here are some features to consider. Color is available on all models except the TRS-80 Model III and the Z89, both of which come equipped with their own built-in monochrome monitors. High-resolution graphics are available on all models except the TRS-80 Model III. The difference between



Courtesy Radio Shack

high- and low-resolution graphics is the number of points or pixels on the screen that can be addressed by the computer (turned on or off). The screen is divided into a certain number of pixels. A typical low-resolution number might be 128 x 48 (6144 pixels), while a high-resolution number might be 280 x 192 (53,760 pixels). The higher the number of pixels, the smaller the individual area that is being addressed. The high-resolution feature allows you to produce sophisticated graphics for animation or detailed figures.

Computers have different ways of displaying text. For example, the Z89, PC-8001A, and IBM Personal Computer have displays that are 80 characters across and 25 lines down. However, the TRS-80 Model III has a display that is 64 characters by 16 lines, while the Apple and Atari use 40 characters by 24 lines. In general, you need a video monitor if you want to work with a line that has more than 40 characters. A television set can't handle lines with more than 40 characters too well because of bandwidth limitations, so the letters are not sharply defined. If you want to use your computer with a high-quality color monitor, the Atari 800, NEC PC-8001A, and IBM Personal Computer provide an RGB (not the usual NTSC or composite signal) video output as a standard feature.

When examining the general quality of a text display, you should consider characteristics such as space between lines, sharpness of characters, and whether lower-case letters like g, j, p, q, y have true descenders; that is, the "tails" of the letters fall below the line as they should.

If you want an "intelligent" terminal, the Z89 is the only model of this group that offers this feature. This terminal has its own microprocessor and can perform operations separately from the computer. The most obvious advantage of this is increased speed since the computer doesn't have to share its processing power with the terminal. In addition, through relative or direct cursor addressing, you can insert and delete characters or lines anywhere on the screen, or erase a line or a page. The terminal also provides automatic scrolling and reverse video among other functions.

If you want a computer with expansion slots that are easily accessible, then the Apple or IBM models hold an advantage. The Apple II Plus has eight expansion slots attached to the motherboard while the IBM has five. If

you want to expand your system with the other computers in this group, you may need an I/O interface, which usually entails an investment of a few hundred dollars. The Z89 is the only one of these computers that includes an RS-232C port as a standard feature (it has three); the others offer it as an option. The RS-232 is the EIA standard serial interface.

The keyboards differ significantly on these computers. For example, a built-in calculator keypad is available only with the IBM, Radio Shack, NEC, and Heath/Zenith models. Some of the computers include user-definable function keys on the keyboard: the IBM has ten, the Z89 has eight, and the NEC has five. All models, except the Apple, include lower case letters as a standard feature. The IBM has many keys which have four selectable functions. This particular feature, it should be noted, is also available on two low-end computers, the VIC-20 and the ZX81.

The TRS-80 Model III and Z89 offer a compact design that includes a standard keyboard, a calculator keypad, a video monitor and space for a disk drive in one unit. (The TRS-80 has space for two drives.) Should you want a computer that runs a diagnostic test on itself before commencing operation, the IBM is the only one of this group that can.

If game and music playing are high on the list of things you want to do with a computer, the Apple II Plus and Atari 800 are your best choices at this time. Paddles or joysticks can be connected to these units to enhance your game-playing pleasure. Atari is the only one of this group that accepts plug-in modules for game playing (however, modules from their popular video game are not compatible with the computer). The Apple II Plus includes a speaker and tone generator for music and sound generation, while the Atari has a speaker and a four-voice sound generator with four octaves per voice. The TRS-80 Model III, because its software is compatible with the pioneer Model I, has many games available for it although you must use the keyboard for input and control of the games, which are in black and white. The IBM computer will be good for games and music, eventually. This computer has excellent graphics capabilities, and a sound generator with one voice and 32 tones. However, because it is a relatively new entry to the market, it lacks the software support of the others.

If home business and professional use are your main concerns, any of these computers can handle word-processing, financial, and data-base management tasks. However, machines like the Z89, NEC, and IBM have an advantage because they have an 80-column format, which is ideal for running programs like Word Star, VisiCalc and DB Master. Also, these computers are CP/M compatible, which opens up a world of software for the machines. To use CP/M on the Apple, you have to purchase a plug-in module.

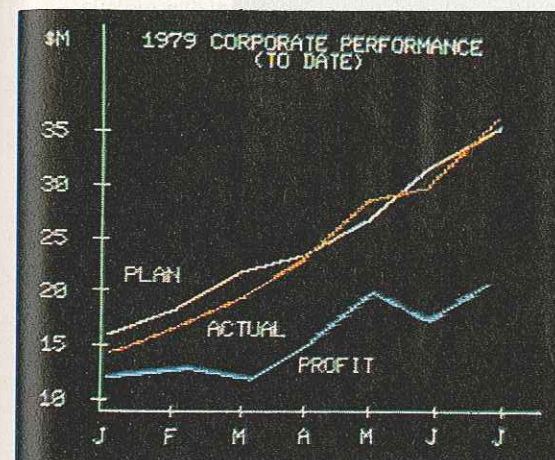
The TRS-80 Model III and Apple II Plus have the most software support at the present time, although the Heath/Zenith, Atari, and NEC models have a generous amount. It's anticipated that IBM will, too, in a year or two. Again, when attempting to make your choice, you should consider the features that you want both in terms of hardware and software before you make a purchasing decision.

PROFESSIONAL

In the last few years, the personal computer has blossomed into a serious tool for professional use. It's being used not only by engineers, scientists, and businessmen, but also by writers, artists, musicians, doctors,

dentists and many others. Usually, no computer knowledge is required because the software is "menu" driven. In other words, a list of options is presented and you need only select the option you want to operate the desired program.

Although the needs of an engineer differ from those of a musician, both can use the microcomputer as an aid to their work. In fact, many professionals are "writing off" the cost of a computer as work-related expense, which indeed it is. Since their needs are different, we'll discuss each area individually.



Courtesy Apple Computer Inc.

Scientists were probably the first group of professionals to use electronic computing power in their work, though they used monster-size computers. Nowadays, engineers as well as scientists use micros for complex calculations, design analysis, graphs, control of experiments, etc. There are tons of programs available, both prepackaged and in books, to accomplish almost any kind of mathematical calculations. The personal computer is a whiz at analyzing the relationships between variables and, in fact, many companies offer software that performs complex chores like linear programming, multiple regression analysis, and circuit analysis. Another great attribute of a micro is that, after all the calculations are made, you can display your results in the form of a graph for visual analysis of the result and communicate with various "mainframes" or with other people.

In addition to the software, there are many electronic instruments available that feed information directly into the computer so that it can be used as a lab instrument for data-recording and device-control applications. These instruments measure temperature and pressure, and sense electrical currents and voltages among other things. The computer acts as a controller that reacts to these inputs by switching circuits on and off to regulate temperature, pressure, etc. The computer can also record, store, analyze, and display the data it receives.

Usually, these instruments are connected to a computer via the IEEE-488 bus. Also known as the General Purpose Interface Bus (GPIB), it is an 8-bit-parallel, byte-serial, standard digital interface that allows your computer to communicate with up to 15 programmable instruments. Using this interface, your computer can control instruments such as logic analyzers, frequency counters, digital multimeters, thermometers, and many others that are manufactured for compatibility with this bus.

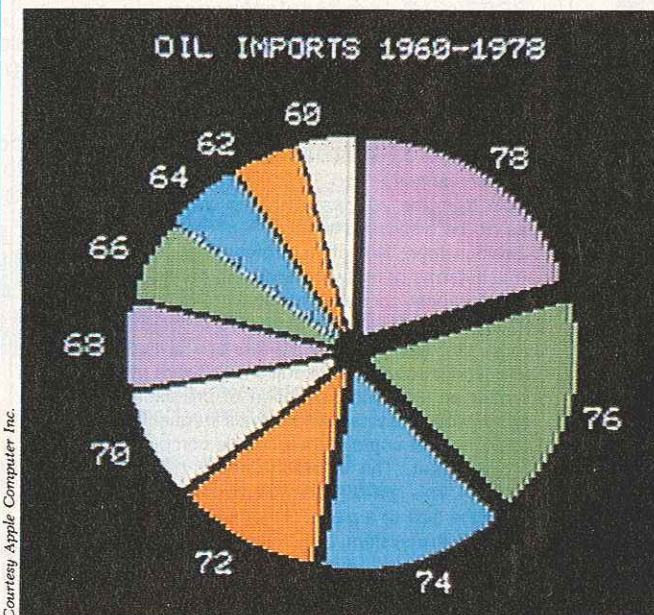
When choosing a micro to use in scientific applications, you have to consider carefully what you want to do with it. Some computers, like the HP-85 from Hewlett-Packard, are geared to the technical professional. This

computer has a compact design that includes a 5" video display, a data cartridge tape drive, a keyboard with programmable keys and a calculator keypad, and a thermal printer. The HP-85 has excellent graphics capabilities so that you can easily print out complex graphs. It also has four levels of security protection for files on its data cartridges if you are security conscious. The company also provides an excellent assortment of technical software packages. There are good business packages, too.

The Apple II Plus, TRS-80 Model III, and Zenith Data Systems' assembled Z-89, because of their wide software bases, are likely to be used for technical applications. However, there are other computers available for this type of work so you should hold off buying anything until you've found the software and peripherals that will meet your needs.

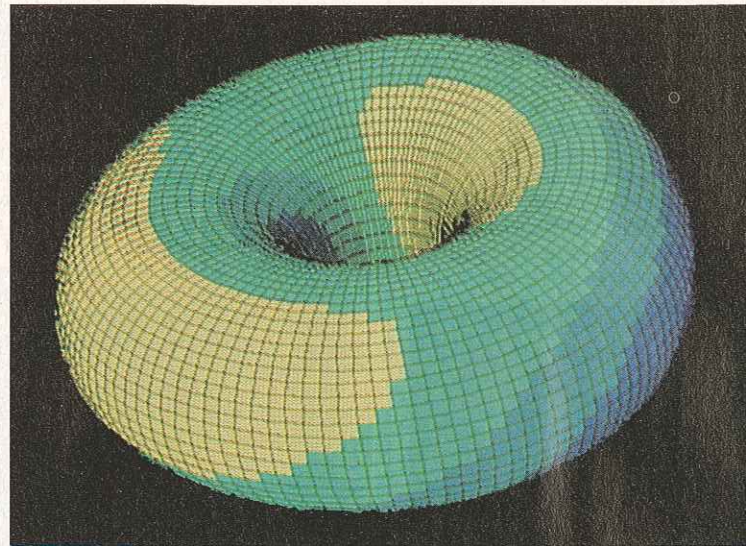
Engineers and scientists are not the only professionals who can take advantage of a personal computer. Medical people like doctors and dentists are finding that computers can help clear up the logjam of paperwork which often overloads their staffs. Billings, for instance, are a source of an endless amount of work that's basically repetitive. Besides using software that is aimed at tackling this kind of work, the computer can be applied to tasks such as appointment scheduling, data management, and word processing. There are also several medical/dental computer bulletin boards that can be accessed by using a modem.

Other people such as writers, artists, and musicians can do wonderful things with a computer. Writers are obvious candidates for word-processing programs. Using a program like Word Star, they can type their manuscripts, edit them on the computer and print them out. Other programs like Spell Star can check a manuscript for spelling errors—it's almost like having a built-in proofreader.



Courtesy Apple Computer Inc.

Artists are finding that the computer is offering them a new mode of expression. Instead of a brush and paints, the artist is equipped with an electronic pen and tablet. Commercial artists can take advantage of the animation properties that a personal computer can provide. Software packages like Painter Power, Micro Painter, Electric Painter, Electric Crayon, and Micro Angelo are designed specifically to exploit a computer's graphic capabilities.



Courtesy Digital Equipment Corp.

Musicians can also use the microcomputer as a new mode of expression. There are synthesizers available which allow you to enter a musical score and listen to it or play along if you like. A musician can enter his own compositions into the computer and it will give him a concrete example of what's been playing in his head. Some of the popular music synthesizers are Music System from Mountain Hardware, the Music Composer cartridge from Atari, Casheab (for serious computer musicians) and the Alf Music Synthesizer.

If you want to buy a computer for word-processing applications, you can select any model which is compatible with the software and printer that you want. Art and music applications narrow your choices down to the Apple and Atari because most of the software is written for these machines.

One of the professional types we haven't discussed yet is the businessman. The person that we're talking about here is someone like an accountant, marketing manager, actuary, etc. This is to distinguish these people from the businessman who owns a small business (to be discussed later).

Businessmen, like other professionals, have certain needs in terms of software and peripherals. They might use a personal computer for scheduling, forward planning, investment analysis, income tax preparation, calculations, etc. Many standard programs are available in books and magazines. In addition, software manufacturers offer an enormous selection of pre-packaged programs. A businessman who travels frequently might do well to consider some of the portable computers that are on the market. The largest portable computer is the Osborne I. This is a full-fledged computer that is approximately the size of a piece of luggage. Not only can you travel with this system, but it includes two disk drives, a standard keyboard, a numeric keypad, and a monitor, plus a CP/M operating system, Word Star, and SuperCalc as standard features.

Although the Osborne I is portable and can run on batteries, you may want a computer that is small enough to be stowed in a briefcase. Computers that fit this description are pocket models like the TRS-80 Pocket Computer (Sharp also markets this model), the Panasonic HHC (also marketed by Quasar), the Hewlett-Packard HP-41, and the Casio FX-702P. If you require your hand-held to interface with a TV set or a modem, then you should investigate the HHC model. Otherwise, all these models offer a printer and cassette-tape storage as options.

EDUCATIONAL

It would seem that the role of the personal computer in education will be a monumental one, eventually. However, at the present time, educators are still struggling with the best ways to implement this powerful new tool in the everyday curriculum. Where do you fit into the educational picture? Even if you're not a teacher or admin-



Courtesy Atari Inc.

istrator, you may want to use the computer in an educational way. Suppose, for example, you are a parent who is being bombarded by words like LOGO, PILOT, tapes, disks, cartridges, and the like when the kids come home from school. You may want to take a more active part in their computer coursework and may even want to supplement it with a system at home that offers comparable material. If your main interest is in the educational uses of the computer there are some things you should know.

If you're hearing words like LOGO or PILOT being bandied about by your children, the school is using one of the innovative languages developed especially for education. LOGO is a language that helps children improve their problem solving abilities. It encourages a child to analyze a task, try different strategies, and modify a strategy until the task is completed. If you wanted to use LOGO with your child, you would need either a TI-99/4A or Apple II Plus because the language is available only for these computers at the present time. To run LOGO on the TI-99/4A, you would have to invest about \$300 in a TI LOGO command module. Other require-

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SERVICE AND SUPPORT – Prompt and professional service and assistance is available nationally through Heathkit Electronics Centers, Zenith Data Systems for commercial users or through Heath factory servicing and phone-in technical assistance.

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ments are a color monitor, disk drive, disk controller, and memory expansion unit. To run LOGO on the Apple, you would have to purchase a LOGO disk. In addition, you would need 48K bytes of memory, a color monitor, one disk drive, and an Apple language card.

PILOT is another language used for educational purposes. It is an interactive language that introduces students to the fundamentals of computer performance. It is available from Atari in cartridge format, from Apple in disk format, and from other sources.

If you're interested in buying other educational software, you should be forewarned that good software is hard to come by. There are many so-called educational programs that just reprint a textbook on the screen rather than taking full advantage of the capabilities of the computer.

If your child's school is not using computers right now, you may want to start a computer literacy program of your own. Traditional group activities like the Boy Scouts, Girl Scouts, Boys Club and 4-H Club offer a convenient vehicle for introducing children to computer fundamentals. If you're thinking of making a hardware purchase, you might consider trading off quality for quantity. Instead of having 20 people huddled around an Apple, you may be better off having five groups of four people working with Sinclair ZX81s.

Education, of course, is not just for children. You may have in mind furthering your own education or using a computer in an adult education program. Software is available for most subject areas, although as mentioned previously, much of it is not top-quality material. Because of the popularity of the Apple and Radio Shack computers, you'll find that most of the software available is written for these machines. Heath is coming up fast in this area, though.

In general, before purchasing any hardware, you should find the software that interests you. It will be written for a certain machine or machines, will require certain peripherals, and need a certain amount of memory. For example, if you're interested in programs from the Minnesota Educational Computer Consortium (MECC) software library, you'll need an Apple II Plus with a disk drive and a minimum of 48K memory. MECC software is not available for any other computers as of this writing. It's evident that knowing what you want in terms of software can be a big help in hardware decision making.

SMALL BUSINESS

For the person who owns a small business, runs a business from the home, or wants to computerize a small department of a large corporation, selecting hardware can sometimes be a treacherous undertaking. If things don't work out when you buy a computer for home use, you can always stash it in the closet. But, if you're making a major investment in hardware to help increase the productivity of your business, you can't just throw the computer away if it doesn't do what you want.

A broad strategy for computerizing a small business is to divide the problem in the following way: making the system work and keeping it that way. Making the system work entails the hardware and software aspects of the system, while keeping the system working concerns the service, training, expansion capabilities, and data-protection procedures of the system.

The first thing to consider is whether or not you can make the system work for you. You have to choose the software package that's right for you and you have to find the hardware to run it.

Some of the most popular business packages available are Word Star, Spell Star, and Scripsit for word processing; VisiCalc and SuperCalc for financial applications; and DB Master for data-base management. Other important software is the computer's operating system. The most popular operating system is CP/M, which is available for most computers. Other operating systems are available, too. Besides CP/M, the Apple III offers the SOS operating system, while Radio Shack offers TRSDOS (NEWDOS and LDOS are also available). Of course, if you can't find pre-packaged software that you're satisfied with, you may have to hire programmers to custom design a software package for you.

As far as hardware goes, you will have to think about peripherals as well as the main computing unit. If you buy a computer like the Northstar or Cromemco, which have an S-100 bus architecture, you will need a video terminal. A "smart" terminal offers features like relative and direct cursor addressing, dual intensity, and underlining among other things. This type of terminal can even change its parameters through software control. Disk storage is also an important factor to consider. Disk drives can be single-sided, single-density; single-sided, double-density; or double-sided, double-density. Also, they come in two sizes, 5 1/4 inches or 8 inches. Note that disk drives, software, and interfaces must all be compatible for a particular system.

Other peripherals that a small business might need that most people wouldn't are a hard-disk drive and a daisywheel printer. The hard-disk drive is usually a sealed unit that stores at least five megabytes of information. Hard disks are important for applications that deal with large amounts of data because they make the operation much more efficient. A daisywheel printer offers true letter-quality printing for use in business correspondence and other applications. Its quality is, of course, reflected in its price.

Keep in mind that the largest share of the microcomputer market is the small-business market. As a result, there is a much greater selection of computers geared for business use than for any other, and it follows that more disk software is available for business purposes than any other. Some popular very-small-business computers are the Apple III, the Xerox 820, the IBM Personal

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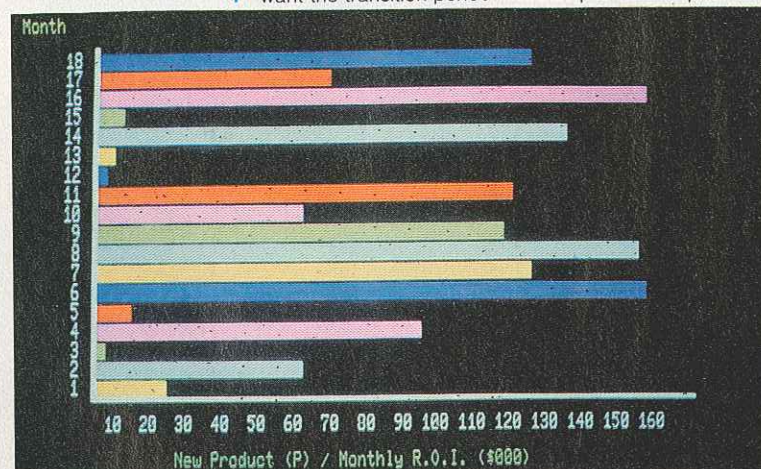
Courtesy Atari Inc.

Computer, the Northstar Horizon, the Commodore CBM, the NEC PC-8001A, the Radio Shack Model II, the Cromemco System One, and the Heath/Zenith Z89.

The main factors to consider after hardware and software are equipment service, personnel training, expansion capabilities of the system, and data and information protection procedures.

Once your system is in operation, your company will depend on it. When it goes down, you will need quick and efficient service to get it running again. You won't be able to wait two or three weeks for a part to arrive. Thus, when purchasing your computer you should pay close attention to the service-contract part of the deal. This is also true of any peripherals you purchase.

When your system first arrives, you'll have to train people to use both the hardware and software. If you want the transition period to be as painless as possible,



Courtesy NEC Home Electronics (USA)

it's a good idea to have key personnel involved in the decision-making process from the start. After all, they are the people most familiar with the day-to-day details of the job and they are the ones who will use the system. It's a good idea to think about the "creature comforts" of the system. How does the keyboard feel? Is the system easy to use? Will you need a green monitor to reduce eye-strain? These and other questions should be considered before you buy.

Keep in mind also that documentation should be clear and easy to understand. If a new person is hired after the system is in operation, he or she may have no other recourse than to "read the book" to learn about specific procedures of the system.

When making your decision this year, don't forget about next year. A system that is operating smoothly and efficiently is a likely candidate for more work. Will you be

able to expand your system if you want to or need to? Are capabilities like networking available for the system that you buy? It was only this past year that Radio Shack announced that it had developed a networking system for its TRS-80 computer.

Once your system is operating efficiently, you want to keep it that way. Inadequate data-protection practices could not only slow you down, they could ruin your business. One of the things you have to think about is a file back-up system. When considering hardware and software needs, you have to think about the need for more than one set of files to protect you against disasters like fire and theft. This may affect your hardware considerations. If, for example, you plan on buying just two disk drives, you have to realize that time must be allowed so that the drives can be used just for making a duplicate copy of the files. When considering the cost of the system, all these things have to be taken into account.

The systems available for small-business applications are the most sophisticated microcomputers on the market so we're not going to try to direct you to one machine or another based on hypothetical needs. However, you *do* have specific needs and by analyzing them carefully and taking into account some of the factors presented above you can make an intelligent choice.

KIT BUILDERS

Building a computer from a kit will appeal to those who want a better understanding of computers. They're interested in the type of microprocessor used and its instruction set; they're perhaps interested in machine language and assembly coding; and they're interested in building a computer from scratch and want to save money in the process.

Kit builders are concerned with either low-cost training computers or full-fledged systems comparable to those discussed in the "personal" users section. There are a number of computers available in both classes. We'll discuss some of the more popular ones.

Some kit builders want to learn the basics of computer operation without making a major investment. They want a "training computer," which is generally a single-board unit that uses a hex-keypad for program and data entry. In the old days (about six or seven years ago), when micros were in their infancy, you had to program them with switches. In a sense, you had to feed the computer a bunch of ones and zeroes (switches that were either *on* or *off*) before you could get the computer to do anything for you. The hex-keypad that's popular today is

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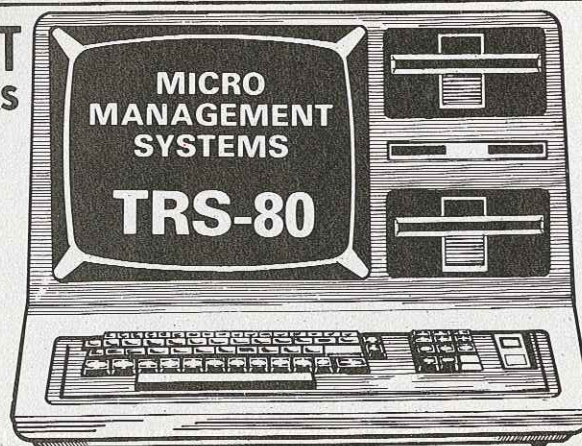
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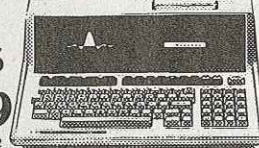
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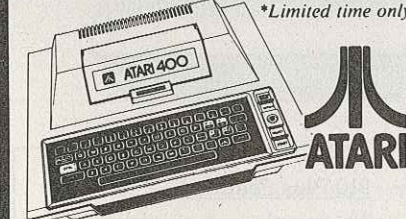
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THE ELECTRONIC WORLD

one step removed from the switch arrangement. This keypad contains the numbers 0 through 9, as well as letters A through F. To program a training computer, one of the things you have to do is enter commands and data in hexadecimal codes like A1 or 11 or 4C (which stand for 10100001, 00010001, and 01001100, respectively).

(Continued on page 60)

SAMPLE CHECKLIST

After you've narrowed your choices to two or three computers, you'll want to take a closer look at each before making your final choice. The checklist shown below is a sample of what you might use to choose among a few high-level personal computers. In this case, the computer is to be used primarily in the home for a range of activities from word processing to game playing, with mailing-list maintenance in between. As you consider each item in the list, check it off. If a particular feature is not standard, but available as an option, note its cost. You may want to keep a notebook to record your observations as you go through the list.

Main Features

- ☐ Microprocessor(s)
- ☐ RAM (standard)
- ☐ RAM (maximum)
- ☐ Language (standard)
- ☐ Languages available
- ☐ FORTRAN
- ☐ COBOL
- ☐ Pascal
- ☐ LOGO
- ☐ PILOT
- ☐ Other
- ☐ Operating system (standard)
- ☐ Operating systems available

- ☐ Highlighting
- ☐ Inverse video
- ☐ General display quality

Audio

- ☐ Sound generator
- ☐ Number of voices
- ☐ Speaker
- ☐ Music synthesizer

Game Playing

- ☐ Cartridge slot
- ☐ Paddles
- ☐ Joysticks

Software availability

- ☐ Word processing
- ☐ Financial applications
- ☐ Data-base management
- ☐ Games
- ☐ Other

Keyboard

- ☐ u/I case
- ☐ Graphics characters
- ☐ Function keys
- ☐ Calculator keypad
- ☐ Typing feel

Input/Output

- ☐ TV output
- ☐ B/W video output
- ☐ NTSC output
- ☐ RGB output
- ☐ Hi-fi output
- ☐ Cassette port
- ☐ Disk-drive port
- ☐ Printer port
- ☐ Modem port
- ☐ RS-232 interface
- ☐ IEEE-488 interface

Peripherals

- ☐ 5 1/4-inch disk drive
- ☐ 8-inch disk drive
- ☐ Television
- ☐ Monitor
- ☐ Modem
- ☐ Printer
- ☐ Graphics tablet
- ☐ Music synthesizer
- ☐ Cassette recorder
- ☐ Speech synthesizer
- ☐ Speech recognition system

Graphics

- ☐ Display resolution
- ☐ Number of colors

General

- ☐ Computer clubs
- ☐ Software exchange
- ☐ Service availability
- ☐ Manufacturer's/dealer's reputation
- ☐ Warranty
- ☐ Documentation
- ☐ Cost

Text

- ☐ Number of characters/line
- ☐ Number of lines
- ☐ Lower-case descenders

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