apple

The Personal Computer Magazine and Catalog.

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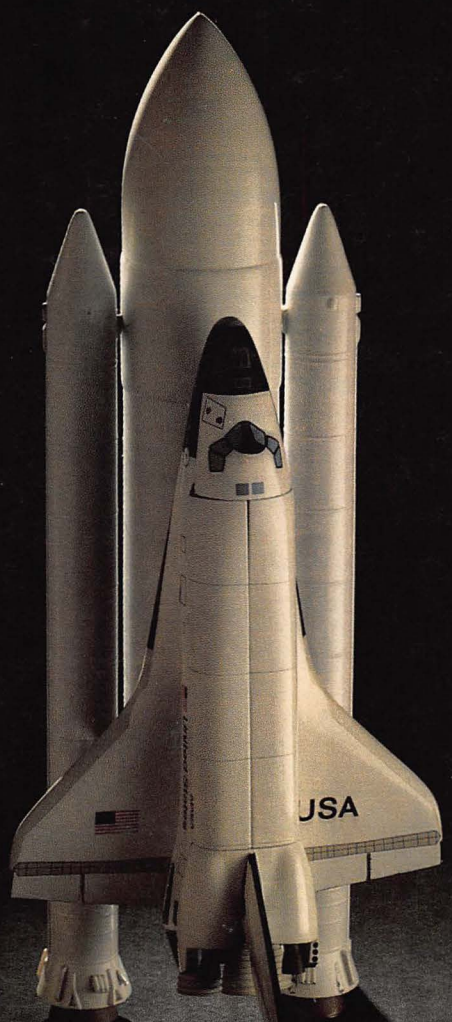
The Challenge of Personal Computers in Industry and Science

Pascal in Education

Apple-The New King of the Road



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WALTER H. MATHEWS, EDITORIAL DIRECTOR
TERRY BERKE, ASSOCIATE EDITOR
BEV RINDFLEISCH, ASSOCIATE EDITOR
MAURICIO ARIAS, ART DIRECTOR
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EDITORIAL

The Pervasive Microcomputer

Don Valentine, one of the astute California venture capitalists who specialize in spotting and investing in high technology of the future, said recently his company decided a few years ago "that smaller computers were becoming more pervasive and we should have several investments in that area."

One of the meanings of pervasive is "extending its influence throughout" and nowhere is that trend more evident with personal-size computers than in the world of science and industry, the subject of our cover story in this issue of APPLE.

In doing our research, the APPLE editorial staff found an unlimited supply of story possibilities: scientists using personal computers as an aid to research without the complexities of accessing a mainframe computer; engineers using them as a design tool which saves them literally hundreds of prototyping before going back to the drawing board; industrial managers using them to control manufacturing steps previously monitored by hand or a more expensive piece of equipment.

Our conclusion was to pick a random sampling of some of the more off-beat applications we felt would provide something of interest to the greatest number of readers. But because many of these applications are just beginning to unfold, we plan to cover them on a continuous basis in APPLE.

Please let us know how the pervasive microcomputer is extending its influence throughout your life.

—Walter Mathews

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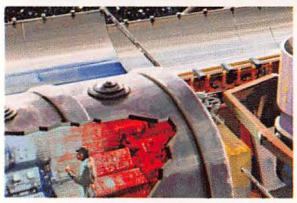
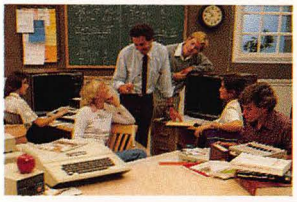
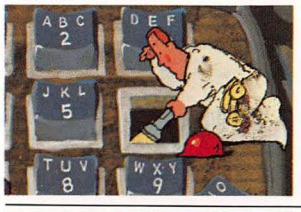
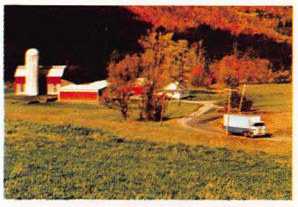
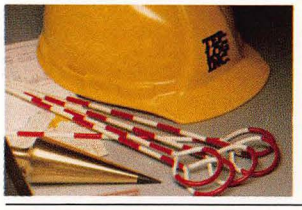
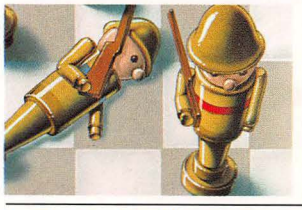


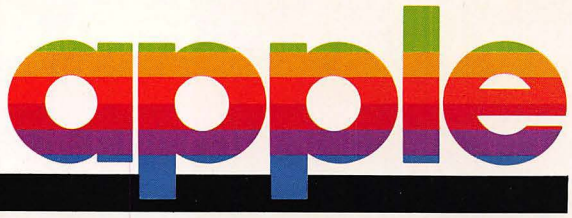












THE CHALLENGE TO PERSONAL COMPUTERS IN SCIENCE AND INDUSTRY

The liftoff of the NASA space shuttle, powered into orbit by 3 million pounds of thrust, is now planned for early 1982. To those of us in the personal computer market, all attention will be focused on the little 11-pound Apple II computer on board. If the space shuttle itself is another giant step for mankind, it is also a giant step for anyone who believes there is a great (and as-yet untapped) market for microcomputers in the industrial and scientific marketplace.

That is not to say there isn't a great deal of activity already underway toward realizing the potential of this market. I have heard reports of industrial uses of personal computers (and we really have to do something about that name as these amazing small computers find their way into an ever-expanding list of impersonal applications), ranging from the drilling of oil wells to determining the sex of chicken eggs in commercial chicken breeding. I have heard of them in scientific uses ranging from my own company's work with the

BY DR. M. JOSEPH WILLSON
President
INTERACTIVE STRUCTURES, INC.


USA

the space shuttle to laboratory experiments that help doctors measure human lung capacity, thus leading to the detection of lung disorders.

Those are only a few, of course, and many of the readers of this magazine will know of other instances where the computerists are getting together with industry and science to explore the great potential for low-cost computing power in environments where it has never been used before.

But having tempted you with news of the space shuttle, let me supply a few details first.

The Apple II will have the responsibility for one of many experiments aboard the 15 × 60 foot NASA Space Lab. It will monitor a plant-growing experiment, from which NASA hopes to piece together a scientific puzzle determining what effect gravity has on the mysterious "helical" spiraling path followed by plant seedlings as they grow. Plant growth will be recorded with a videotape camera and other pertinent information, such as temperature and illumination, will be transmitted back to scientists on earth. Each phase of the experiment will be controlled and monitored by the Apple II. The overriding goal is to sharpen up on our experimental techniques in space.

That the personal computer is capable of handling sophisticated scientific experiments may come as a surprise to scientists, as well as to a few manufacturers of larger minicomputers, but it is certainly no surprise to those of us who have been pursuing the market. There are a number of companies around similar to Interactive Structures who are trying to fill a niche as a supplier of the interface equipment which will speed the utilization of microcomputers in these markets.

My own belief from the beginning of the so-called "home computer" revolution was that this was an instrument capable of doing more than just playing games or being useful only to computer-trained engineers and hobbyists who could tailor it to their own needs.

There are two major limiting factors on the development of the market at present. One is the problem of developing the appropriate interface devices through which computers such as the Apple II can be combined with other industrial and scientific equipment. The second is the distribution problem, since at the moment most stores selling personal computers have greater knowledge of the business or the educational applications, and thus are hard-pressed to discuss the computer's potential with scientists or industrial engineers.

We have made great strides in solving the first problem. Typical is my company's AI-02, an analog input card that transforms the Apple into a new cost-effective contender in the measurement and control market. The AI-02 measures the variables that must be controlled in an industrial/scientific setting (e.g., light, temperature, pressure). In effect, it acts as an interpreter between man and the computer.

If the person monitoring the application decides to alter a variable, such as pressure, another Interactive Structure development, the AI-03 output card goes to work, allowing the user to control and change the process. With these two small cards, we've managed to close the communications loop with the computer, since Input and Output are both available.

Let me cite a few examples:

- Using the AI-02, the Apple II can manage and analyze a complete solar heating system. Temperature sensors are placed at "in" and "out" flow points on solar collectors and heat storage elements. Flow metering devices are installed to sense the rate of flow and the number of BTU's gained or lost at each point. Valves and switches are operated by the system, which can then run the collectors only when there is enough sunlight or efficient heat collection.
- Beginning machine operators can be trained with the AI-02. A simulated control panel, outfitted with photo-electric resistance sensors would be the heart of the system. The AI-02 would read the position and velocity of all controls, and transmit the information to the program. The trainee's responses would be diagramed on the screen, and selected aspects of his performance could be evaluated by the computer.

It's clear that this is a fantastic opportunity for any kind of lab or research organization. They have much more processing power at their fingertips than ever before. You can also take the Apple home at night and work out a problem without any time-sharing budgetary considerations one confronts using another company's computer.

People in industry are just now beginning to discover what we learned two or three years ago, that the Apple was destined for broader uses than initially envisioned. In the very near future, I believe there will be a large expansion of this type of industrial/scientific application of personal-sized computers.

The second problem, that of distribution channels, will probably be solved only by recognizing it as a problem and generating greater interest in the market potential.

"IF THE SPACE SHUTTLE ITSELF IS ANOTHER GIANT STEP FOR MANKIND, IT IS ALSO A GIANT STEP FOR ANYONE WHO BELIEVES THERE IS A GREAT MARKET FOR MICRO-COMPUTERS IN THE INDUSTRIAL AND SCIENTIFIC MARKET-PLACE."

Word spreads quickly in the industrial/scientific community and when one company, or one laboratory, hears of the accomplishments being made at places similar to theirs (at costs well within their budgets), they will seek out and find the people who can provide the details. As they come knocking on the door with greater frequency, those involved in sell-

ing such equipment will make it their business to find the answers.

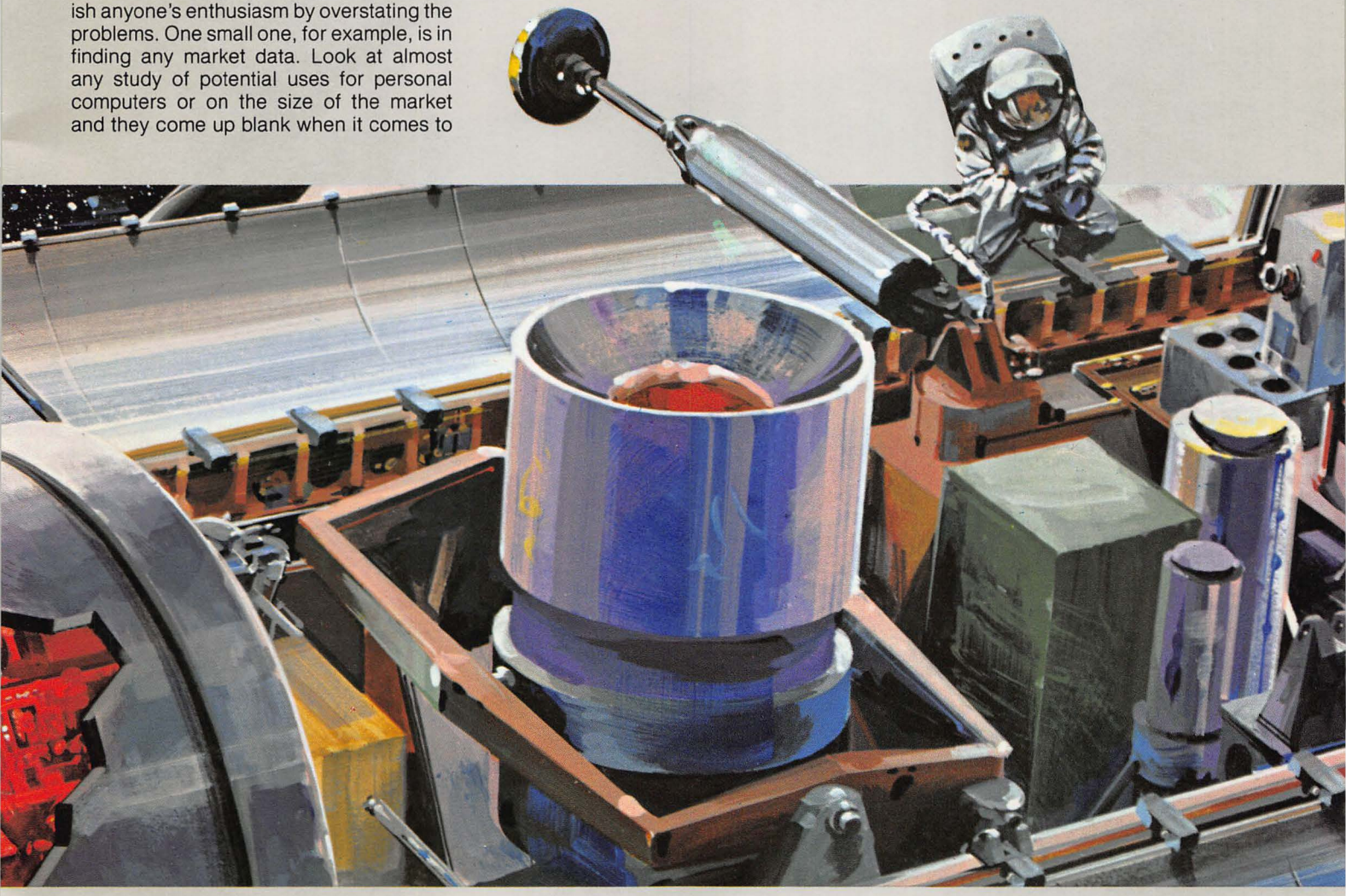
We get a steady stream of such calls, many of them from large industrial firms, especially those with research and instrumentation departments. Some already have a microcomputer, but many don't. They only have heard that small computers such as the Apple II are providing computational power and flexibility to perform well in an industrial environment, and they want to know more. I tell them, because I firmly believe it, that the graphic display capabilities of the machine plus the ease with which it can be interfaced to printers and other computers, allows it to compete favorably with instruments costing between $20,000 and $400,000.

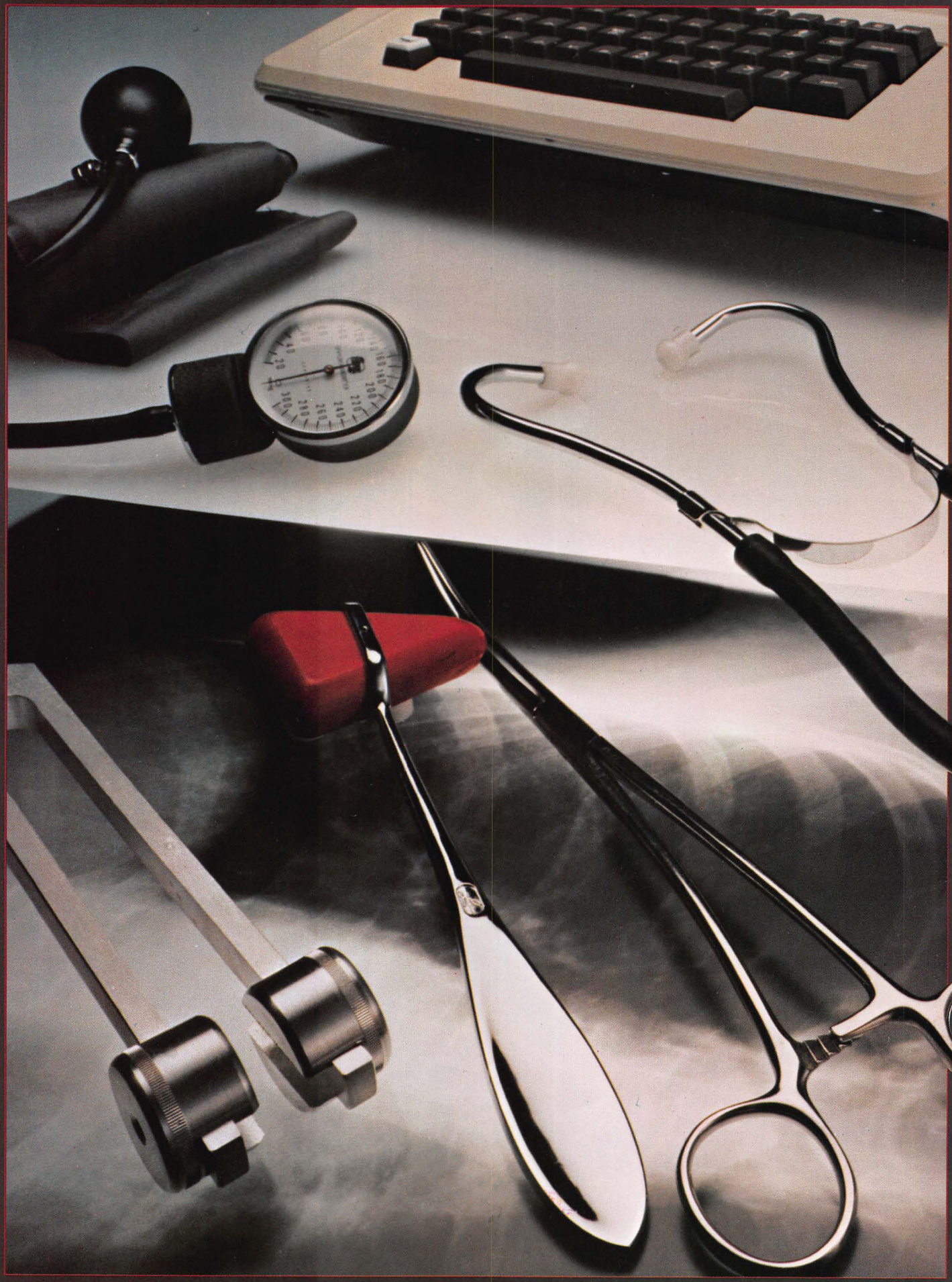
Of course, I haven't touched on all the challenges ahead in meeting the needs of this marketplace, but I don't want to diminish anyone's enthusiasm by overstating the problems. One small one, for example, is in finding any market data. Look at almost any study of potential uses for personal computers or on the size of the market and they come up blank when it comes to the industrial/scientific market. Another very real problem comes from the management of companies where the engineers and scientists can see the potential; the front offices are filled with managers who still think of a personal computer as a "toy" and have to be convinced it is a "real" machine capable of delivering in industrial and scientific applications.

Part of this latter problem will be overcome with greater environmental testing. It can't hurt at all to know that the Apple II passed all of the necessary vibration and storage temperature testing required by NASA for the space shuttle program. As further test data are accumulated, industry—which loves test data—will be easier to convince.

As for the immediate future, I'm assured that this issue of APPLE magazine will provide a good overview of the many types of industrial and scientific applications already being pursued. Beyond that, we see the market growing as quickly as industry and science can be handed the right building blocks—such as the analog input techniques and the analog output techniques that can turn every microcomputer into a turnkey system which meets their needs.

Hopefully, by the time the Spacelab Mission I takes off with its Apple II on board, microcomputers will be in such widespread use that absolutely no one will be surprised to hear that it performed in space as well as it does right here on Earth.





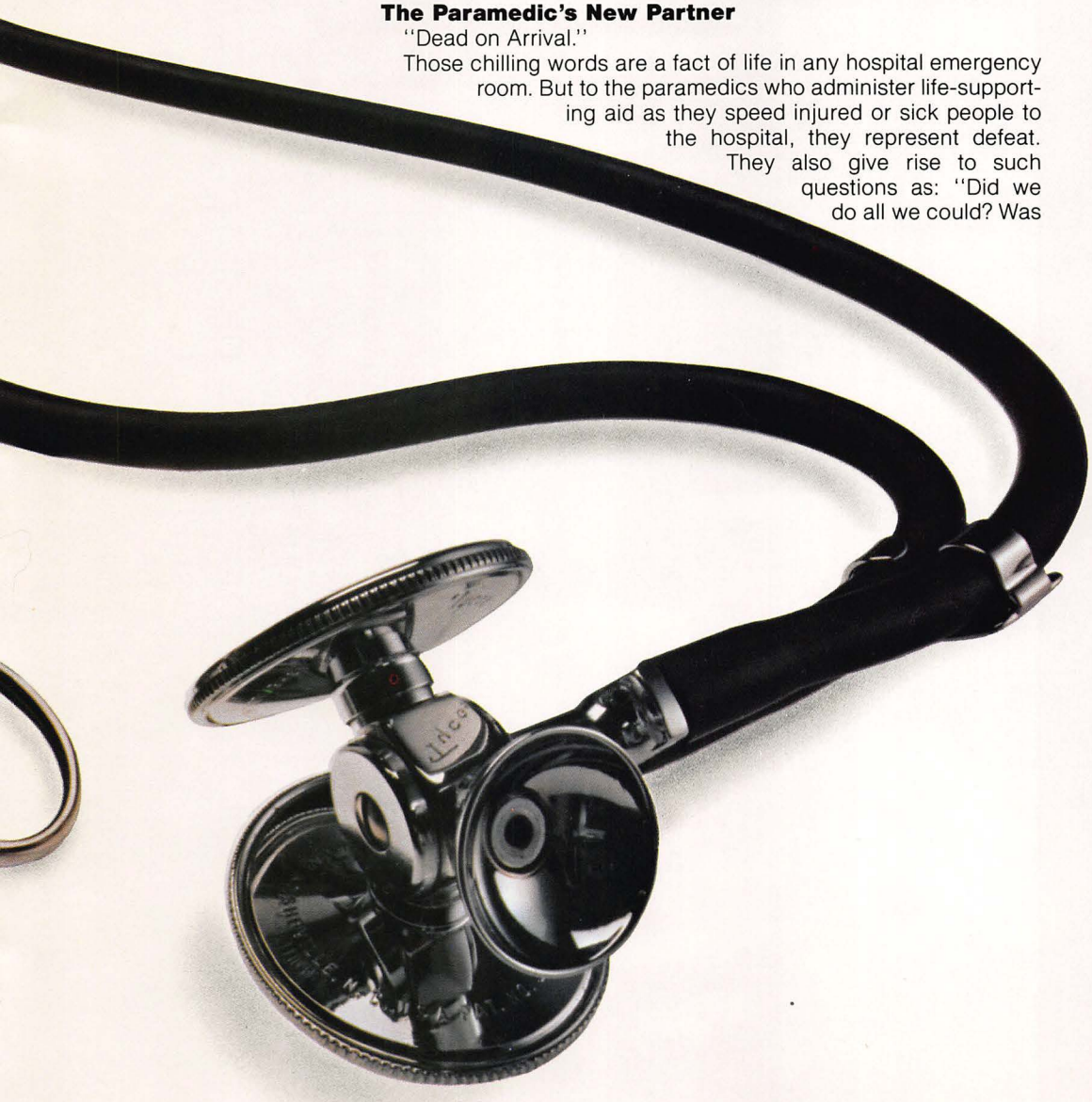
Is there a Microcomputer in the house?

Microcomputers will never replace the doctor who peers down your throat while you say, "Aah." They are, nevertheless, making remarkable contributions to the world of medicine as a new low-cost tool for use in the improvement of health care and in medical research. The following reports from around the country indicate the growing variety of roles being played by "personal" computers in hospitals and laboratories.

The Paramedic's New Partner

"Dead on Arrival."

Those chilling words are a fact of life in any hospital emergency room. But to the paramedics who administer life-supporting aid as they speed injured or sick people to the hospital, they represent defeat. They also give rise to such questions as: "Did we do all we could? Was



the medication and emergency treatment appropriate and adequate under the circumstances?''

At Loyola University Medical Center in Maywood, Illinois, a computer is helping ambulance services improve the prehospital emergency care that could help prevent such tragedies.

As the key component in the Emergency Medical Services (EMS) Microcomputer Data Collection and Evaluation System, the computer compiles information fed into it from coded ambulance reports which detail 128 different parameters. It then generates reports that go to all subscribers to the service, including the State of Illinois. What subscribers receive are 12 reports per month tabulating information such as EKG rhythms, descriptions of aid given per patient and the results of that aid, medications administered, and response times, to name a few.

But even more important, says Harlan Felt, EMS Director, is the follow-up report that documents what happens after the patient is delivered to the hospital.

''Before, all the state wanted to know was whether or not the patient was alive when he got to the hospital, the so-called 'saves.' The old criteria was how many patients who were considered dead when the ambulance picked them up were later revived and brought to the hospital alive. If the patient died three minutes after arriving at the hospital, it was not in the reports.

''Now, with the help of our computer, we can see how many patients who were in a life-threatening situation were delivered in a more 'viable' condition due to the treatment they received in the ambulance,'' Felt said.

''As more patterns emerge, we can track whether certain treatment or medication administered by the paramedics do reduce the morbidity of the patients' injury or illness, lessen their hospital stay, and make them more productive citizens when they leave the hospital.''

PATIENTS AT MERIDIAN PARK HOSPITAL IN OREGON CAN BE CONFIDENT THAT THEY ARE RECEIVING THEIR MEDICATION IN DOSAGES THAT ARE JUST RIGHT FOR THEIR INDIVIDUAL SYSTEMS.

The ambulance companies also use the reports to determine if their staffing levels are correct, if they need more stations to provide faster service and if they need a public education program to inform the public who to call when a medical emergency arises. Because the Loyola University Medical Center is also designated as a resource hospital, EMS also aids in paramedic training. The Apple II helps prepare paramedic exams and keeps track of when paramedics should be tested.

Felt, who used to work for IBM and who did all the EMS programming himself, said that the reaction to the service has been so good that requests come from all over the country for information on how to set it up at other hospitals. And no wonder. Compared to when ambulance reports were compiled by hand, he claims that they are now getting 10 times as much information in 1/10 time.

''When we were dealing with 200 ambulance calls per month, compiling the information wasn't a problem. But now we're receiving closer to 500 per month. Also, we were previously evaluating only 15 parameters; now it's 128.''

Towards Safer Pill Dispensing

Back in the days of the alchemist, patients took prescribed medication on a wing and a prayer, trusting that it was doing more good than harm. Even today many people are nervous about taking potent medication that is sometimes dispensed with little explanation of its possible harmful side effects.

Patients at Meridian Park Hospital in Oregon, however, can be confident that they are receiving their medication in dosages that are just right for their individual systems. For that they can thank Bob Swayze, director of pharmaceutical services, and his Apple II.

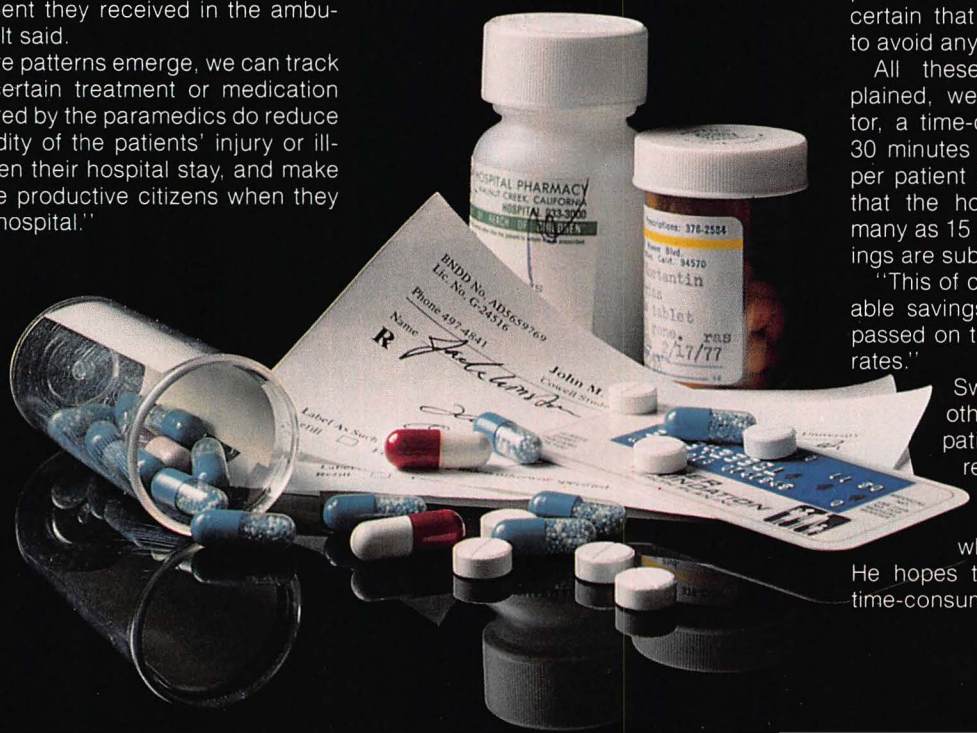
Swayze has programmed the computer to ask questions about a given patient's age, weight, height, sex, and various bodily functions, along with the prescribed medication. Quickly, the computer reports all the information Swayze needs to know about administering the medication to that particular person, including the dosage, the dosage interval and the upper limit of how much that patient can tolerate if more medication is called for.

''This exactness is especially critical when we're dealing with a certain classification of heart drugs that must be administered very carefully. Take for example a certain antibiotic that's extremely potent. Besides being very toxic to the kidneys, it is also a potential agent for making a person deaf. We've got to be absolutely certain that we're within the right range to avoid any of this from happening.''

All these calculations, Swayze explained, were once done on a calculator, a time-consuming process that took 30 minutes as compared to two minutes per patient by the computer. Considering that the hospital pharmacy handles as many as 15 patients per day, the time savings are substantial.

''This of course also means a considerable savings in cost, which is ultimately passed on to the patient in lower hospital rates.''

Swayze is now working on another program that will review patients' medical profiles which report what kind of drugs they are taking and what safety factors must be considered when combining those drugs. He hopes to do away with the present time-consuming manual reviews of these



profiles that must be done twice during each shift.

UCLA Counts Sheep—For Mom's Sake

Researchers are hooking up expectant mothers to an Apple and keeping them there for 30 days at the UCLA (University of California, Los Angeles) Medical School.

Sound inhuman? It is. The mothers are sheep, not humans, and the purpose of the experiments is to find out more about the role of the endocrin system in the birth process.

The computer setup—which goes under the unwieldly name of Biophysical Variable Signal Processing System—assists in the monitoring of various processes in both the fetus and the mother, according to Dr. Kitch Wilson, a faculty member in the Department of Pediatrics and the father of the computer system. Transducers, he said, are implanted in the fetus and in the mother's uterus and blood veins to monitor everything from blood and inter-uterine pressure to oxygen and blood flow.

The sensors are attached to a black box that converts pressure readings into electrical signals and finally into digital numbers which are analyzed by the computer and then stored on a disk and used later in cornrelation analyses. Various experiments are performed before and during labor, while the sensors continue their monitoring function.

Although Dr. Wilson finds it doubtful that such a system would be used on humans, at least in the near future, he considers the system a valuable tool in unraveling the mysteries of the endocrin system's role in the birth process.

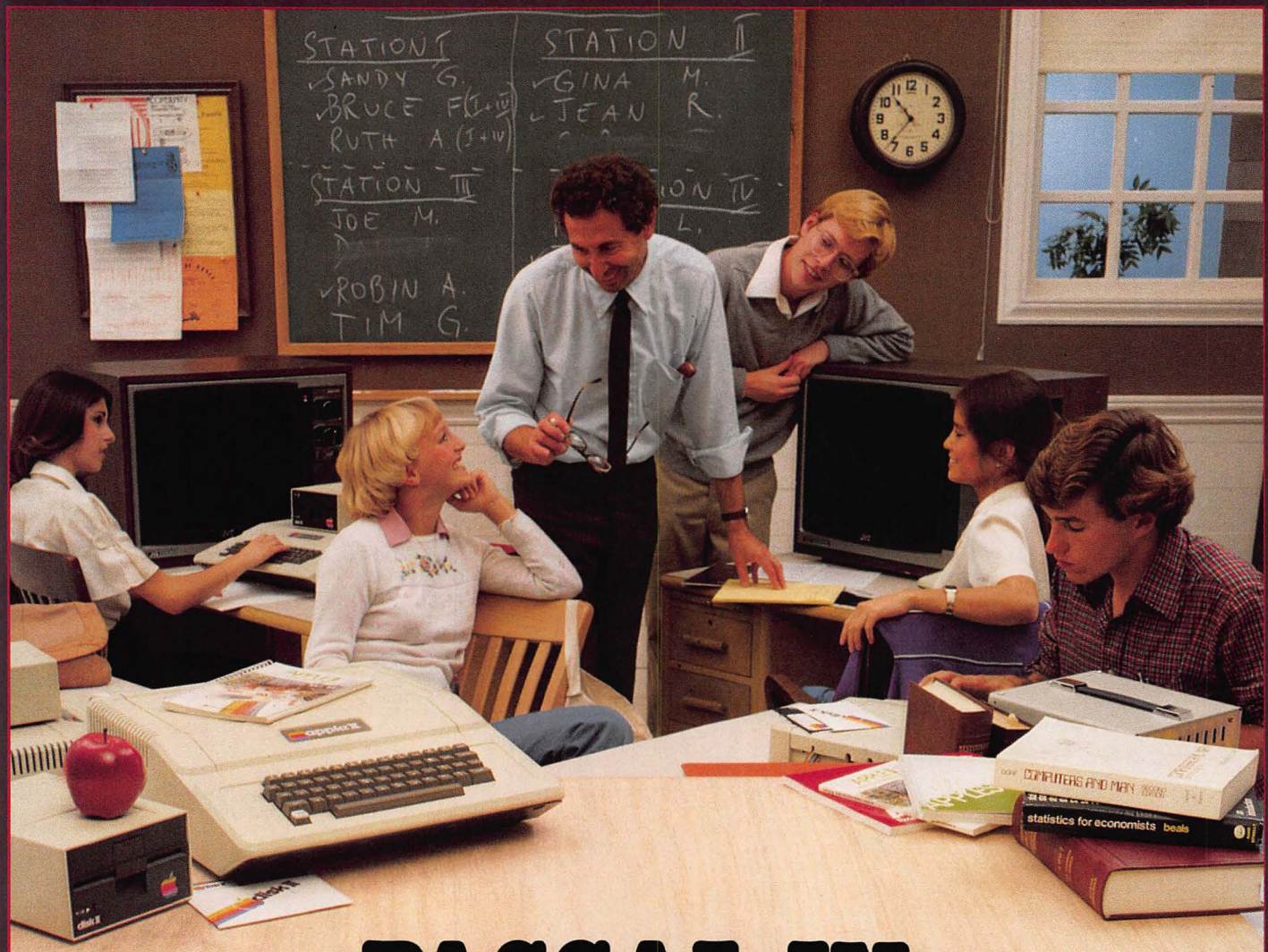
The final correlation analyses will be done by a larger minicomputer, but the Apple II does all the signal processing and the real-time acquisition and data analysis. It does it especially well, Wilson said, because it's interruptable.

"It's like having two computers. First, it does monitoring and housekeeping chores; then, every 10 milliseconds it's interrupted and goes down into the assembly language program where the input is processed. When that's finished it goes back to the BASIC program of monitoring."

Wilson, who has a Ph.D. in engineering systems and biomedical engineering, said that cost was a big factor in choosing a microcomputer, particularly because he plans to set up three or four more systems in the laboratory.

"A good minicomputer would cost around $20,000. Add to that the cost of software—approximately $27,000 in salaried time—and you're nearing $50,000. This compares to a $32,000 initial investment for the microcomputer-based system ($5,000 for hardware and the same $27,000 for software)."

Since the project is being funded by a grant from the National Institute of Health, getting funds for three or four such systems will be much easier with microcomputer price tag, Dr. Wilson indicated.



PASCAL IN EDUCATION

JEF RASKIN, MANAGER, ADVANCED SYSTEMS APPLE COMPUTER INC.

There are two quite different classes of ways that the computer can be used in education: to teach about computers, and to teach about other things. Pascal can make a solid contribution in both areas.

Pascal is a computer language designed for computer science students by Professor Niklaus Wirth. This, coupled with the success of the Pascal language in many diverse computer applications gives some indication of why Apple Computer was delighted when the University of California at San Diego showed the world that a full-feature computer language could be implemented on microcomputers.

PASCAL IN TEACHING PROGRAMMING

If you are teaching computer programming on a microcomputer you know the importance of subroutines, and the various methods of passing parameters. With BASIC, this important facet of programming cannot be demonstrated; even with FORTRAN, only one method of parameter passing is generally available.

A second advantage of Pascal over the other languages previously available on microcomputers, principally BASIC and assembly language, is structure. A program represents the solution to a problem. Structure, in a program, is the organization of the program in such a way that it parallels the organization of the solution to the problem. Pascal makes it easy and natural to break a problem down into subproblems, each independent and separately solvable. With BASIC, subroutines are available, but the absence of local variables and parameter passing means that all parts of a pro-

gram are interdependent. BASIC also lacks many of the clear methods Pascal has for representing loops, making the logical flow of the program in BASIC much more difficult to express than it would be in Pascal.

Pascal has so many features that there is not room to discuss them all in this short article. However, one is so important and unusual that it cannot be omitted. That one is the variety and power of Pascal's data structures.

Far less well recognized and discussed in the literature than Pascal's programming techniques, the data types of Pascal allow the student to represent the objects the program manipulates in the terms of the problem being solved, rather than in some possibly awkward representation used only for the convenience of the computer. For example, if you wanted to represent the colors BLACK, BROWN, RED, ORANGE, YELLOW, GREEN in BASIC, you could either represent them with numbers, or (in a few BASICs) perhaps as an array of strings. In Pascal, you can create a new type of data, called (for example) COLORS, which can take on only the values given in the list above. Not only simple data types like this, but more complex structured data types can be created. Again, the emphasis in Pascal is toward solving the problem in the terms you would use to describe the problem to another person, rather than restricting you to the constructs provided by the designer of the language.

Any teacher of programming can immediately see the many advantages Pascal offers—especially since it is now available on a small, inexpensive system.

PASCAL TEACHES WORKING WITH A COMPUTER *SYSTEM*

Pascal, as implemented on the Apple II and the Apple Plus, is more than just a language. The language is embedded in an operating system that can be used to demonstrate a typical range of features found on most large operating systems. There is a Filer, which allows you to manage programs and data stored on diskettes, an Editor for creating programs and editing text (this article was written on the Apple Pascal Editor), a full-feature macro assembler, a Linker and more. For the student who will use a wide range of computers after leaving the programming course, the Pascal system provides a broader basis of experience than most other microcomputer environments.

USING PASCAL IN NON-PROGRAMMING COURSES

Occasionally, students will write programs in a non-programming course, but the majority of such course will use programs prepared by the teacher, another educator, the computer manufacturer, or a commercial firm specializing in educational software. These programs can do Computer Assisted Instruction (CAI), simulations, or allow the student access to a database (such as a library card catalog).

"FOR THE STUDENT WHO WILL USE A WIDE RANGE OF COMPUTERS AFTER LEAVING THE PROGRAMMING COURSE, THE PASCAL SYSTEM PROVIDES A BROADER BASIS OF EXPERIENCE THAN MOST OTHER MICROCOMPUTER ENVIRONMENTS."

In these situations, the advantages of Pascal show up in its cost and time saving aspects. For a program of any size, it is less costly to write it in Pascal than in BASIC or assembly language (the two options open to most users of microcomputers before Pascal was available). For most applications, writing and debugging the program in Pascal will be easier than it would otherwise have been. This saving in programming and debugging time means more cost-effective educational tools.

A Pascal program takes up less space in memory than an equivalent program written in BASIC. In practice, this means that—for a given size computer—more significant projects can be undertaken. The use of Pascal effectively makes the computer larger.

Pascal programs execute more quickly than they would in most BASICs. The student can get results faster and interaction can proceed at a higher rate. As every teacher knows, prompt response keeps student interest high.

PASCAL HAS WIDE EDUCATIONAL ACCEPTANCE

Not only is Pascal used at most major universities today as the primary instructional language in the computer sciences, but a version of Pascal has been adopted by the United States government as its standard language for most major contracts. Where BASIC varies considerably from computer to computer, Pascal tends to be stable, so that programs written on one computer can be easily transported to any other computer that runs Pascal. This means that programs can have a longer life, and that you need not re-do all your educational software when changing from computer to computer—if they both offer Pascal.

The University of California at San Diego, which, under the direction of Dr. Kenneth Bowles, developed the most widespread microcomputer Pascal system has made the Apple its computer of choice for teaching Pascal. Dr. Wirth, the inventor of Pascal, has expressed interest in using Apples for his teaching. The Minnesota Education Computer Consortium (MECC) as well as other educational institutions have publicly announced plans to use Pascal in their Apple-based instructional curricula.

Pascal can no longer be thought of as a parochial language. It makes economic, pedagogic and practical sense. Its time has come.

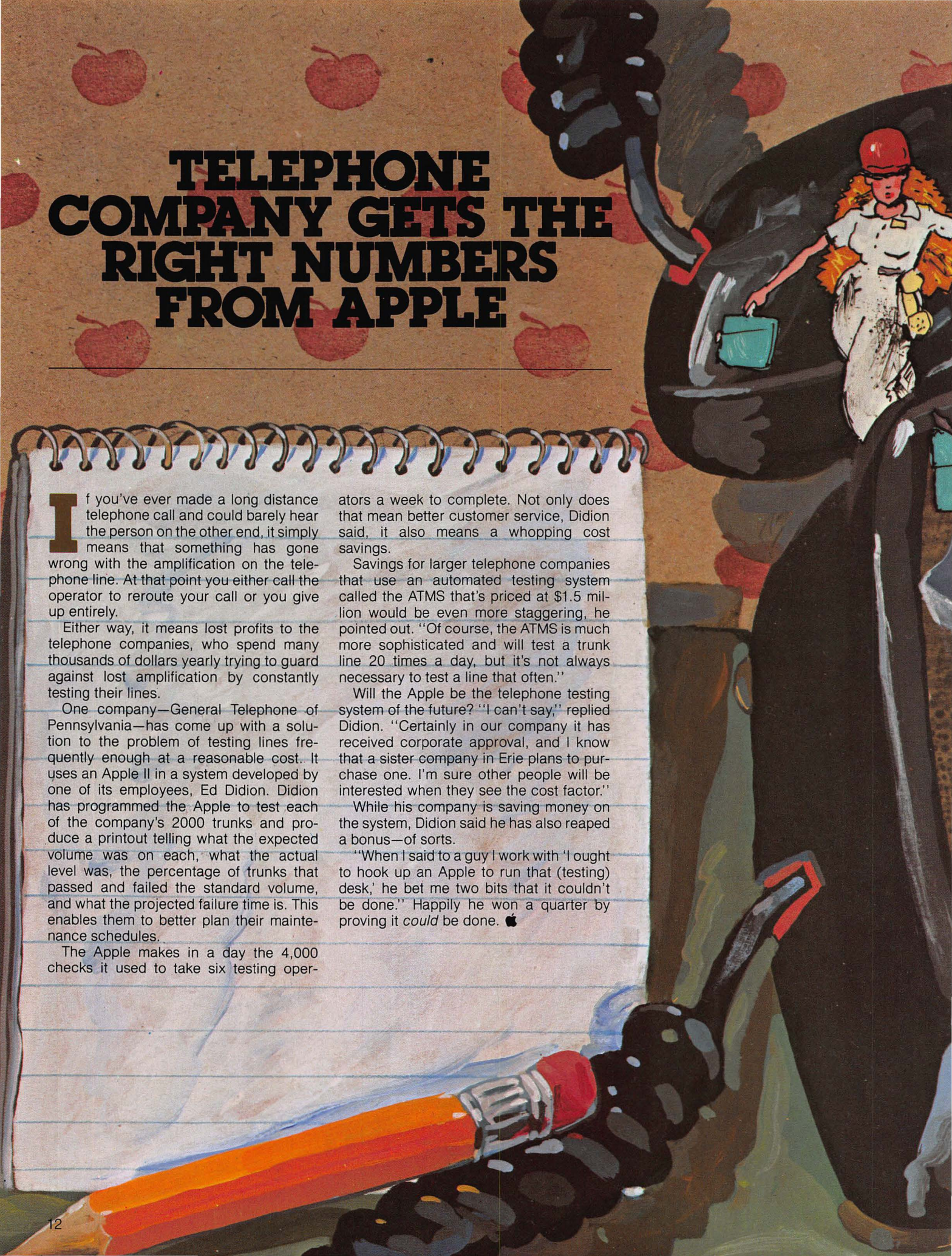
WHY SOME COMPUTER LANGUAGE NAMES ARE CAPITALIZED

I have been asked why "BASIC" and "FORTRAN" are written in capital letters, while "Pascal" has only its initial letter capitalized. There is a simple rule: When a computer name is an acronym, where the letters stand for a phrase, it is written in capitals. Otherwise, only the first letter is capitalized. Here's what a few of the more common programming language names actually mean.

ALGOL	ALGOrithmic Language
APL	A Programming Language
BASIC	Beginners All-purpose Symbolic Instruction Code
COBOL	COmmon Business Oriented Language
FORTRAN	FORmula TRANslator
Pascal	Named for Blaise Pascal, a famous French Mathematician
PL/I	Programming Language 1 (note the back-slash and Roman numeral)
RPG	Report Program Generator

Fortunately, the craze for naming languages with acronyms is finally dying out. At one time there were at least a dozen languages whose names ended in -OL (aside from ALGOL and COBOL there were DIBOL and SNOBOL and . . .). This all goes to show that fashion is just as strong an arbiter in the programming world as it is everywhere else.

TELEPHONE COMPANY GETS THE RIGHT NUMBERS FROM APPLE



If you've ever made a long distance telephone call and could barely hear the person on the other end, it simply means that something has gone wrong with the amplification on the telephone line. At that point you either call the operator to reroute your call or you give up entirely.

Either way, it means lost profits to the telephone companies, who spend many thousands of dollars yearly trying to guard against lost amplification by constantly testing their lines.

One company—General Telephone of Pennsylvania—has come up with a solution to the problem of testing lines frequently enough at a reasonable cost. It uses an Apple II in a system developed by one of its employees, Ed Didion. Didion has programmed the Apple to test each of the company's 2000 trunks and produce a printout telling what the expected volume was on each, what the actual level was, the percentage of trunks that passed and failed the standard volume, and what the projected failure time is. This enables them to better plan their maintenance schedules.

The Apple makes in a day the 4,000 checks it used to take six testing operators a week to complete. Not only does that mean better customer service, Didion said, it also means a whopping cost savings.

Savings for larger telephone companies that use an automated testing system called the ATMS that's priced at $1.5 million would be even more staggering, he pointed out. "Of course, the ATMS is much more sophisticated and will test a trunk line 20 times a day, but it's not always necessary to test a line that often."

Will the Apple be the telephone testing system of the future? "I can't say," replied Didion. "Certainly in our company it has received corporate approval, and I know that a sister company in Erie plans to purchase one. I'm sure other people will be interested when they see the cost factor."

While his company is saving money on the system, Didion said he has also reaped a bonus—of sorts.

"When I said to a guy I work with 'I ought to hook up an Apple to run that (testing) desk,' he bet me two bits that it couldn't be done." Happily he won a quarter by proving it *could* be done.


SIEMENS
ABC
2
DEF
GHI
4
JKL
5
TUV
8
WXY
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MNO
6
OPER
0

APPLE-THE NEW KING OF THE ROAD

The nation's independent truckers have become folk heros of a sort. Rugged individuals who answer only to themselves and the whims of fate on the road, they embody the pioneer, free-wheeling spirit that is long faded from the lives of most people.

Now, independent truckers have discovered the computer and while they still roam wherever the job takes them, the Apple II is helping them do it more profitably.

T-Comm. Inc., of Colorado Springs, has designed an Apple-based system that links truck stops—and the drivers who frequent them—with truck brokers around the nation. The system, designed for Loadmaster, Inc., of Wheatridge, Colo., translates telephone touch tone signals into computer language.

Truck brokers need only call the computer and use the telephone keys to communicate their latest load information—both new jobs and updates on old jobs. The Apples, located in key truck stops, display the information on a monitor. Truckers scan the monitor, identify jobs they may be interested in hauling and which broker to contact. There's even up-to-date information listing where and when fuel will be available on the road ahead.

Brokers, in addition to keeping their load constantly updated, find they're getting maximum exposure to the independent truckers.

Truck stops are saving time and money by having the Apples handle the laborious job-posting, which before the computer had to be done by hand.

And the independent trucker, the undisputed King of the Road, has immediate access to available work wherever he may roam.


TEP-
LOG
INC.

PROSPECTING BY COMPUTER

Prospectors of an earlier age may have been happy with a mule, a pick and a pan. Today's prospectors, however, are not individuals but corporations, and they are turning to computers to help improve the chances of a "strike."

Tep-Log, Inc., of Alice, Texas, is such a company and uranium is the treasure it is seeking throughout the Southwest. They do it by drilling test holes in the earth to determine the presence of uranium deposits. The probe measures a gamma radiation and relays its findings to the surface by means of electrical pulses at a rate as rapid as 100,000 per second.

Other factors are also involved, such as resistivity (the electrical resistance of the earth), and traditionally these data have been recorded on a strip chart recorder which must be evaluated later by hand.

Thanks to an Apple II and a program developed by Elbelco, an electronic design firm in San Antonio, Tep-Log has now found a way to get an instantaneous real time reading of the data so that the characteristics of a particular hole are known by the time the probe is withdrawn.

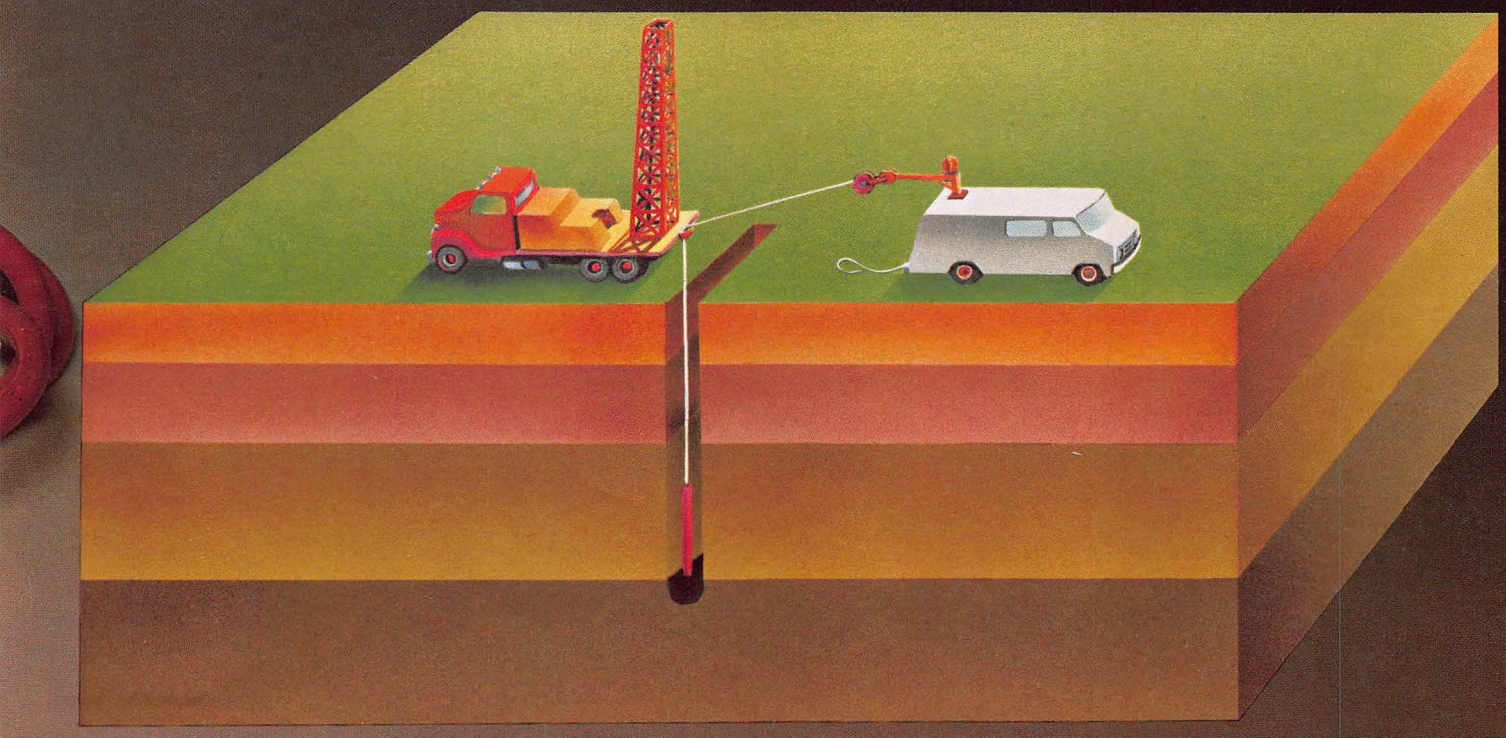
According to Charles Elbel, owner of Elbelco, his firm designed the Apple II into a ruggedized system capable of year-round outdoor operation. Equipment interfaced to the Apple include two six-digit frequency counters to accept the radioactivity pulses and measure their rate. The outputs are available to the computer for direct display and calculation.

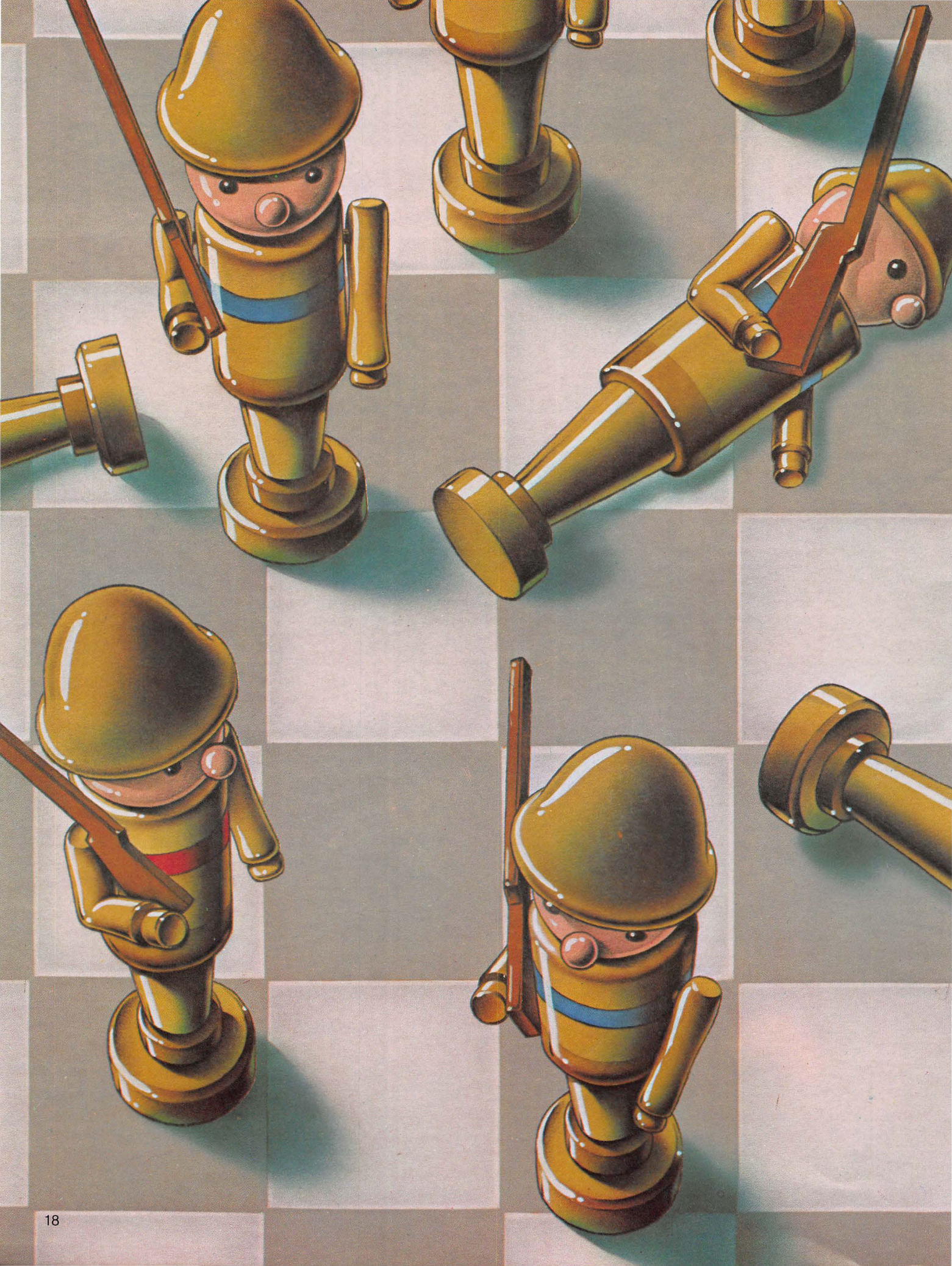
Another interface, Elbel said, accepts the distance pulses and informs the computer exactly how far the probe has traveled.

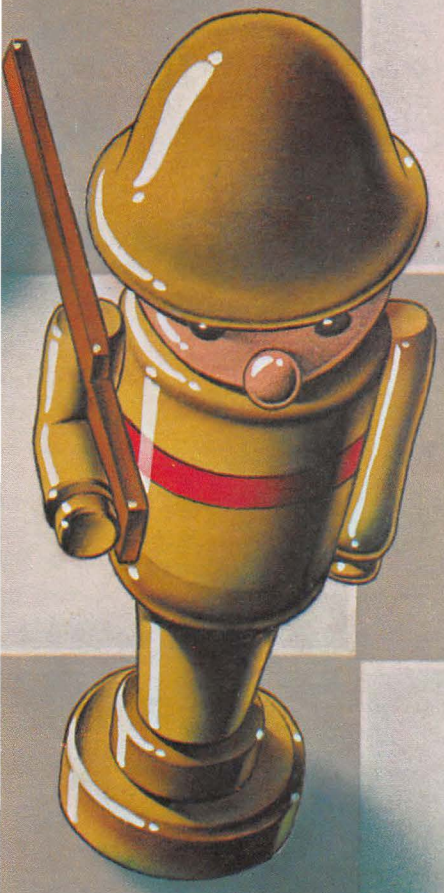
A third element of the system is an analog-to-digital converter with two input channels to measure the spontaneous potential and resistivity factors.

Elbelco designed the software, all written in conversational BASIC so that field personnel can operate it easily with no prior exposure to a computer.

The end result? Improved speed and cost-effectiveness of the teams of modern-day-prospectors whose livelihood depends upon finding out whether "there's uranium in them thar hills."







LITTON GETS SERIOUS ABOUT VIDEO "GAMES"

Some people use their personal computers to play video games, some use them to keep financial records, and still others use them to play military games—*real* military games.

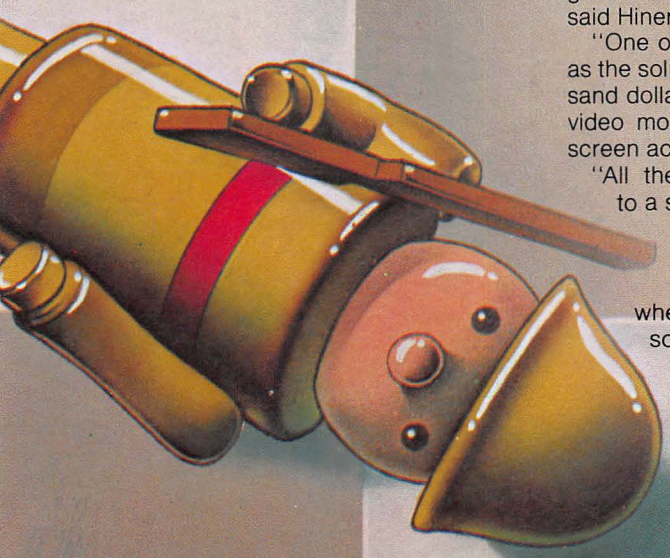
Frank Hiner bought his first personal computer to work on small home projects. Soon, however, he was able to see that the computer could be a valuable asset in his business: "command and control" military research at Litton Data Systems in Van Nuys, California.

While developing an extremely powerful military computer (80 million instructions per second) known as TAP (tracking array processor), it occurred to Senior Scientist Hiner that it would be easier, more efficient, and less expensive to use an Apple II to interface with the computer rather than to design and build his own programmer's control unit.

"The Apple is the tool whereby a programmer can modify and check out programs which are stored in the TAP," said Hiner.

"One of the reasons we saw the Apple as the solution is that for a couple of thousand dollars we could get an Apple and a video monitor, thus giving us immediate screen access to our computer.

"All the programming required to talk to a screen, to talk to a keyboard had been done, and moreover, the machine is inexpensive. Why should we pay for this work when someone's already done it so nicely for us?"



It is not uncommon for Litton scientists to use the Apple II as a programmer's control unit in the morning, and to plug in some other device for a totally different project in the afternoon. This versatility—supplied by the input/ouput capacity of the Apple—served as a key factor in Frank Hiner's choice of the Apple II as a small computer.

"The ability to have multiple I/O—as well as doing all the other things it does—is a very useful feature," he said.

Because of this capability, Frank Hiner is able to use his Apple II for a multitude of military research projects including an ongoing one dealing in radar simulation.

Using the high-resolution graphics capability of the Apple II (54,000-point array), he is able to develop aircraft flight paths and then to describe events—such as an aircraft turning sharply—which might realistically occur. This information is then transferred to a high-speed simulator which creates live radar video, just as though the radar were tracking approaching enemy bombers.

These computer controlled radar sets are then used for training and testing in defense work. The ability to program the Apple II with high-resolution graphics enables true-to-life activity to be emulated on the radar screen according to Hiner, thus helping the military to prepare for the possibility of the day when aircraft indicated on a radar screen are not just the product of Apple's imagination.

LETTERS TO APPLE

ESEA TITLE IVC FOR ME?

In Apple's Vol. I, No. 1 your article "Computers—In My Classroom?" mentions that their Apple was purchased through an ESEA Title IVC grant for innovation in education. Please send information on this grant and how to apply for it.

Are there any other grants or means by which I might acquire an Apple for use in physical education instruction and research projects in sports? I think the Apple has a great future in education and research.

Elizabeth Petrakis, Ed.D.
Assistant Professor
University of Nebraska-Lincoln

I am interested in writing an application for Title IV monies for the purchase of a microcomputer. We are involved in learning more about computers because we plan to purchase one.

Robert Goff, Principal
Lincolnwood High School
Raymond, Illinois

Editor's Note: *We have had many letters requesting further information on the Federally funded ESEA Title IV grants.*

Monies are allocated to each state and are available on an annual basis for an innovative educational program. Schools should work through their local district offices to find out what programs are currently being funded in their states and the parameters for submitting proposals. Forms for submitting proposals, along with detailed guidelines, are available from your State Department of Education.

The funding is primarily for the execution of the program, with a limited amount of money available for hardware and software. In our article, "Computers—In My Classroom?" the Apple II was funded under Section B of Title IV which requires a less-lengthy proposal, while the "innovative education" program was funded under Section C requiring a 100-page proposal of objectives, budget, and procedure description. Mid and year-end evaluation is an integral part of proposal acceptance.

Guidelines for annual proposal submission are usually issued in the fall of the year, with proposals being due between December and February, depending on the nature of your application.

You may also apply to the newly formed Apple Education Foundation—a nonprofit corporation established to support the development of new methods of learning through the use of small computers. You may write requesting a complimentary brochure detailing the guidelines and the procedures to: Administrator, Apple Computer, 20605 Lazaneo Drive, Cupertino, CA 95014.

AN APPLE A DAY

I want to thank you for the Apple II Basic Programming Manual. As Manager of the Central Teaching Facility of Duke U. School of Medicine, I perceive the benefits of Apple II for both my staff and the medical students.

Several instructors will use the Apple for teaching support and the MD's and Ph.D.'s will develop programs which adapt to their busy schedules.

I would be very happy to exchange ideas with others in my area of work. Hopefully, local dealers will form exchange groups of Apple II users in the local businesses and universities to this end.

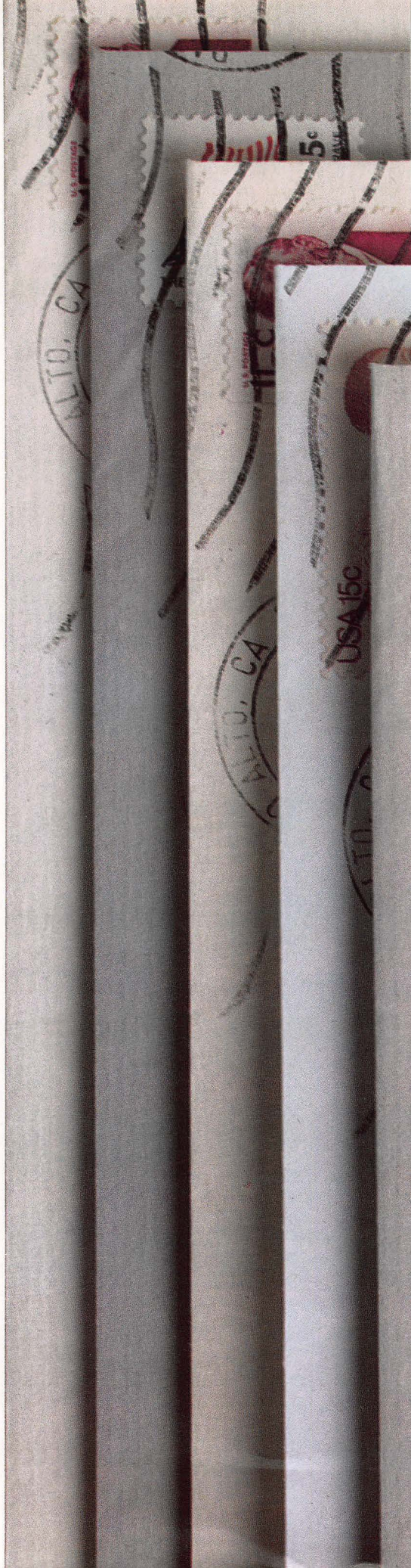
J. Edward King, Manager
Central Teaching Facility
Duke University Medical Center
Durham, North Carolina

LIGHTS, CAMERA, APPLE

I am on the faculty at Cal Arts, and I teach color TV production in the Film-Video School. We have a complete three-camera color studio, large production switcher, and 3/4-inch cassette with editing facility. I gave a demonstration of my recently purchased Apple in the studio and did many special effects. It was quite exciting and generated a lot of interest in the Apple. I know of one sale that resulted, and another is planned.

Congratulations on the Apple II. I think you have a winning combination with it and your Applesoft program.

John F. Mahin
California Institute of the Arts
Valencia, California



Don't forget to fill out and mail back the enclosed reply card for your free subscription to Apple Magazine.

TIONARY OF COMPUTERESE

rbage collection."

nat did you expect?

eek alphabet. But that's dictionary. In technical ns the smallest positive mputer can calculate, uterese it means anynconsequential. "That on of being inedible."

[illegible] Many of these terms came from the large community of computerniks who chat with each other over the ARPA network, which see. The definitions given here are by the author, with help from Don Reed and David Casseres.

DICTIONARY, continued

Arpanet
A computer network set up by the Advanced Research Projects Agency of the Defense Department. This is an international network that allows users to access data from and use the facilities of dozens of different computers. Aside from the technological interest of such a system, the extensive use of the ARPAnet for personal intercommunication and sharing of knowledge has tremendous implications for the personal computer user. The advantages of having a personal computer will be multiplied a thousandfold when large networks become available for the use of individual computer owners.

For a useful analogy, think of how handy your telephone would be if nobody else had one.

Crash
To fail suddenly and catastrophically. Usually said of a computer system, or a disk. Surprisingly, personal computers, because of their simplicity, crash less often and in less damaging ways than large systems.

Crock (slang)
A hastily conceived or poorly thought-out scheme. For example, when a computer gives an error message such as "RDBC 308," meaning that you typed a comma when the computer expected a period.

Crunch
To compact data. When data is erased, it may leave empty spaces in memory or on a disk. When a user invokes a program that compresses out the spaces, he or she is said to "crunch" the data. Under some circumstances this process has another

[illegible] (slang)
A synonym for "variety," "kind" or "type." As in "What flavor of car did you buy?" "A Checker sedan."

Flush (slang)
To erase information.

Foo (slang)
One of a large number of words that many programmers use as a name, whether for a program variable or (more commonly) as a file name. Also appears as FUBAR or FOOBAR. This term comes from World War II, where it was an acronym for "Fouled Up Beyond All Recognition." Perhaps only the Navy said "fouled": the Army might have used another term. See SNAFU.

Fifo
Acronym for "First In, First Out." This is a queue, such as you expect to see at a ticket counter. The first person to step up to the window should be the first person to get a ticket. See LIFO

Fudge (slang)
To fake a result, as when a programmer uses a hasty means to get a program to work. This term is familiar to physics students, to whom it commonly means adjusting the data to fit the theory.

Garbage Collection
The process of finding unused places in memory and collecting them so that they may be reused. This term has no relation to the famous computer culture saying: "Garbage In, Garbage Out."

Gigo
This translates to "What did you expect?" or the Arab saying "It is the will of Allah." Usually accompanied by a shrug of the shoulders, it is an acroynm for the phrase "Garbage In, Garbage Out." See FIFO and LIFO.

Grok (rather literate slang)
To understand thoroughly and completely. It is a term from Robert Heinlein's novel, "Stranger in a Strange Land" which all hackers seem to have read (see HACKER in an earlier issue of the Apple Magazine.)

Hung
See WEDGED.

Infinite (slang)
Big, the opposite of EPSILON (which see).

Lifo
Acronym for "Last In, First Out," the scheme you use when piling plates in a cupboard. The most recently washed and dried plate is put on top of the stack, and is the first to be used. In computerese, this kind of arrangement is called a "stack." See FIFO.

Moby (slang)
Very large. "That's a moby program," referring to a program that's 3000 lines of code. Originally applied to cetacean.

Modulo
In most computer languages there is a MOD operator which gives a remainder (seven divided by four gives one, with a remainder of 3, thus 7 MOD 4 is 3.) In slang it means "except for." For example "That computer is OK modulo the fact it doesn't work." The word is always pronounced in full in this useage.

Mumble (slang)
Another word, like "FOO" that you use when you can't think of a better name for a variable or a file. Also used when you are speaking to someone, and don't have a snappy reply. A common occasion for the use of words like "MUMBLE" is when you have a file you want stored temporarily on a computer system. Amateurs will call the file "TEMP."

Mung (slang)
To FLUSH something accidentally. To destroy anything. "He munged his new Checker sedan."

Patch (slang)
To fix a program, usually in a quick-and-dirty fashion. The fix itself is also called a patch.

Pessimal (slang)
The worst. A made-up word (what word isn't) to be an opposite to "optimal," by analogy with "optimist" and "pessimist."

Pop
To remove the top element from a STACK. Also see PUSH. In slang, it means to return to a previous topic in a conversation. ". . . the cost of beans. Pop. Have you gotten your car fixed yet?"

Punt (slang)
To give up. If you are upset with something you are trying to do on the Apple, and you press the RESET button out of frustration, you are said to punt. The term comes from football, and the analogy is quite good.

(continued next issue)

APPLE PERSONAL COMPUTER SYSTEMS

TABLE OF CONTENTS

APPLE PERSONAL COMPUTER SYSTEMS

APPLE PERSONAL COMPUTER SYSTEM

APPLE II will change the way you think about computers. That's because it is specifically designed to handle the day to day activities of education, business, financial planning, scientific calculation, and entertainment. It makes learning to use computers enjoyable and creative, by bringing to the user a new level of simplicity through design sophistication.

Getting Started

APPLE II is faster, smaller, and more powerful than its predecessors. And it's more fun to use too, because of built-in features like:

—BASIC—The Language that Makes Programming Fun
—Fifteen-Color Standard Graphics (in an 1,880-Point Array) for Spectacular Visual Effects
—High-Resolution Graphics (in a 54,000-Point Array) for Finely-Detailed Displays
—Sound Capability that Brings Programs to Life
—Hand Controls for Games and Other Human-Input Applications
—Internal Memory Capacity of 48K Bytes of RAM, 12K Bytes of ROM; for Big-System Performance in a Small Package
—Eight Accessory Expansion Slots to let the System Grow With Your Needs

You don't need to be an expert to enjoy APPLE II. It is a complete, ready-to-run computer. Just connect it to a video display and start using programs (or writing your own) the first day. You'll find that its tutorial manuals help you make it your own personal problem solver.

New Features—APPLE II Plus

Now APPLE has a new twist—the APPLE II Plus, with our extended APPLESOFT BASIC as the standard language. The APPLE II Plus is designed for the serious user, with 9-digit arithmetic precision and exclusive Auto-Start that can run programs automatically when you turn the computer on. Both APPLE II and APPLE II Plus provide the same exciting color graphics, sound, hand controls and computational features. And both systems can take advantage of PASCAL, APPLE's superlanguage, with installation of the new Language System (See Expansion Options, pg. C-9).

Color and Sound

APPLE's advanced graphics commands make brilliant color displays something even a beginner can master. Its color graphics can be used for applications ranging from business charts to architectural design. They make any program more effective.

APPLE's built-in loudspeaker prompts you for inputs, warns you of errors, and lets you explore synthesized music and speech applications.

A Learning Tool

APPLE will help you learn what computers are all about. Discover how easy it is to create your own computer programs. Introduce your children to APPLE, and watch them explore and master today's most exciting new technology. Use the Apple Software Bank to start your own library of programs that make learning fun.

APPLE Grows With You

Your APPLE is ready to grow when you are. Whether you choose APPLE II or II Plus, you can use all of APPLE's broad line of peripherals, accessories, and software. For example, a basic system can easily be expanded for business applications by adding two disk drives, printer, and General Business System software.

Introduce yourself to APPLE—advanced tools that set the standard of excellence in personal computers.

APPLE II AND APPLE II PLUS

TECHNICAL OVERVIEW

Two types of computers are presently available from Apple Computer Inc. They differ only in the language firmware, demo programs, and documentation supplied.

APPLE II—This computer system is supplied with Integer BASIC, hi-res. graphics routines, mini-assembler, disassembler, and system control firmware in ROM. Demo programs and manuals are oriented around Integer BASIC.

APPLE II PLUS—This system is supplied with Applesoft extended BASIC (including hi-res. graphics routines), disassembler, and new Auto-Start system control firmware in ROM. Demo programs and manuals are oriented around Applesoft extended BASIC.

Both APPLEs are self-contained computers based on the 6502 microprocessor. Standard features include: color graphics hardware, sockets for up to 48K bytes RAM, cassette interface, I/O connectors, typewriter-style ASCII keyboard, high-efficiency switching power supply, and rugged structural foam case.

BASIC Language

Both BASICs are available on either APPLE. Integer BASIC is included in the APPLE II, and Applesoft BASIC in the APPLE II Plus. Both BASICs are also available as plug-in card options. In addition, PASCAL and both BASIC languages are provided for use with the APPLE Language System (see Expansion Options, page C-9).

Integer BASIC is a fast language that is ideal for games and high-speed graphics. Applesoft BASIC is an expansion of Microsoft's popular floating-point BASIC that includes 9-digit arithmetic for business and scientific applications plus easy-to-use, high-resolution graphics commands. (See Apple Software Bank for more information.)

Video Display

The APPLE displays text, color graphics, or high-resolution graphics—software selectable. Its graphics commands allow either of two screen "pages" to be displayed, with 4 lines of text below the display area.

TEXT MODE
- —40 characters/line, 24 lines
- —5 × 7, upper-case characters
- —Normal, inverse or flashing characters
- —Extensive display control software in ROM
- —Full cursor control—protected screen feature
- —Fast display—1000 cps

COLOR GRAPHICS MODE
- —40h × 48v resolution (40h × 40v with 4 lines text)
- —15 colors

HIGH RESOLUTION GRAPHICS MODE
- —280 × 192 resolution (or 280h × 160 with 4 lines text). Six colors: black, white, violet, green, blue, orange
- —Software character generator available for lower case characters and labeled displays. (See Apple Software Bank.)

Memory

User memory (RAM) is organized in 16K byte increments, and may be easily expanded to 48K bytes of total RAM by inserting the memory elements into plug-in sockets on the motherboard. Language (ROM) memory is organized into six blocks of 2K bytes each.

System Control is a standard feature and uses 2K bytes. The APPLE II Plus uses the remaining 10K bytes to store Applesoft BASIC. The APPLE II uses 8K bytes to store Integer BASIC and utility routines (described under Programmer's Aid #1).

"Apple values your opinion. Please take a few minutes to tell us a little about yourself and your personal computer needs. Thank You."

1. **Do you own a personal computer?** ☐ yes ☐ no
   Brand _____

2. **How would you rate your current computer skills?**
   ☐ beginner ☐ some experience ☐ very experienced

3. **Where do you think you would use Apple?**
   ☐ at home for personal or family use
   ☐ at home for business use
   ☐ in a department of large business
   ☐ in a small business
   ☐ in my profession
   ☐ in education

4. **What are the two areas where you most want to use a personal computer?**
   ☐ personal finance, budgeting
   ☐ data base management
   ☐ business accounting
   ☐ word processing
   ☐ engineering calculations
   ☐ learning about computers
   ☐ writing programs
   ☐ entertainment
   ☐ hobby
   ☐ other _____

5. **What two Apple features are most important to you?**
   ☐ new Pascal language
   ☐ graphics
   ☐ color
   ☐ other _____
   ☐ quantity and quality of software available
   ☐ peripherals
   ☐ easy to use
   ☐ quality of instructions and manuals
   ☐ attractive packaging and portable
   ☐ reputation for reliability and service
   ☐ price/performance value

6. **How did you learn about Apple?**
   ☐ from a radio or TV ad
   ☐ visited a computer store
   ☐ from a newspaper or magazine ad
   ☐ other _____

Comments _____

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

No Postage Necessary if Mailed in the United States

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 453 CUPERTINO, CALIFORNIA

Postage will be paid by:

10260 Bandley Drive
Cupertino, California 95014

APPLE II AND APPLE II PLUS

TECHNICAL OVERVIEW

Inputs and Outputs

All APPLEs include as standard an ASCII keyboard, audio cassette interface, 8 peripheral board connectors, speaker, I/O connector and two hand controllers.

—Reliable, typewriter-style keyboard
—Fast cassette interface—1500 bps
—Peripheral board connectors
Fully buffered, with interrupt and DMA priority structure
—4 analog (0-150K ohm resistive) control inputs
—3 TTL inputs and 4 TTL outputs

Built-In System Control

The APPLE system control ROM brings your computer to life quickly and easily upon power-up. It offers these additional features:

—Disassembler (and single-pass assembler—APPLE II only)
—Automatic Input/Output device assignment
—Keyboard and screen editing features
—Register examine/modify and read/write cassette routines
—Hex add/subtract for relative branch calculations
—Simulated single-step and trace modes; breakpoint handling (APPLE II only)
—Automatic start-up in BASIC (APPLE II Plus only)
—Automatic execution of disk programs on start-up (APPLE II Plus only)

Ordering Information

Four APPLE computer options are available: APPLE II, APPLE II Plus, APPLE II EUROMOD, and EUROPLUS. Standard APPLE versions offer 110 VAC operation and provide an NTSC (American standard) composite video output. The EURO versions have been designed for European (220 VAC) power supply and video output requirements, and are available through Eurapple (international operations of Apple Computer Inc.) in Cupertino, California.

MODEL	BASIC LANGUAGE	POWER SUPPLY	VIDEO
APPLE II	Integer BASIC	110V,50/60Hz	NTSC Compatible
APPLE II Plus	APPLESOFT BASIC	110V,50/60Hz	NTSC Compatible
APPLE II EUROMOD	Integer BASIC	220/240V,50/60Hz	CCIR (625 lines)
EUROPLUS	APPLESOFT BASIC	220/240V,50/60Hz	CCIR EUROMOD

Each of the above four models is available with 16K, 32K, or 48K of memory, using the following order numbers:

Memory(RAM)	APPLE II (U.S.)	APPLE II Plus (U.S.)	APPLE II EUROMOD	EUROPLUS (EUROMOD)
16K bytes	A2S0016	A2S1016	A2S0016P	A2S1016P
32K bytes	A2S0032	A2S1032	A2S0032P	A2S1032P
48K bytes	A2S0048	A2S1048	A2S0048P	A2S1048P

DISK II FLOPPY DISK SUBSYSTEM

General Description

Disk II expands your computer horizons with fast, low-cost retrieval of programs and information. It makes inventory, address file, and recipe programs suddenly feasible. It means you can store a year's worth of financial records in one place, and sort through them quickly. And it allows you to handle many other applications that just were not practical before.

Features

—Powerful Disk Operating Software Supports up to 6 Drives
  —Name Access to Files for Ease of Use
  —BASIC Program Chaining to Link Software Together
  —Random or Sequential File Access to Simplify Programming
  —Dynamic Disk Space Allocation for Efficient Storage
—Individual File Write-Protection Eliminates Accidental File Alterations
—Loads an 8K Byte Binary Image in 6.5 sec. (1.2 sec. in Pascal)
—Storage Capacity of 116 Kilobytes (143K Bytes with Pascal) on Standard 5¼" Diskettes
—Powered Directly From the APPLE (Up to 6 Drives) for Convenience and High Reliability
—Packaged in Heavy-Duty, Color-Coordinated Steel Cabinet

Specifications

PARAMETER	DESCRIPTION
Access Method:	Random or Sequential—arbitrary record length
Track Access Time:	Varies with number of tracks crossed. 200msec (avg.), 600msec (max. across 35 tracks)
Disk Capacity:	116K bytes (formatted), soft-sectored (143K Bytes with Pascal)
Controller:	Up to two drives per controller. Multiple controllers can be used.
Min. System Config.:	32K RAM Apple II or II Plus

Ordering Information

Order Number: A2M0004. Supplied with:

—Floppy Disk Interface Card
—Bootstrap in ROM
—Disk Drive and Connecting Cable
—System Software on Diskette
—Manual
—Blank Diskette

Order Number: A2M0003. Supplied with:

—Second Disk Drive and Connecting Cable

TELECOMMUNICATIONS

Modem IIB

Modem IIB is a communications package that extends the power of your APPLE by allowing it to tap the resources of timesharing services, computerized bulletin boards or your office computer from the comfort of your home. It allows you to transfer programs to a friend's APPLE over the telephone network. It even permits you to control an APPLE in San Francisco from another computer in New York. And, with programs like our Dow Jones Portfolio Evaluator it makes your APPLE an intelligent terminal, able to request and process information from large remote data bases.

The Modem IIB package consists of an acoustic coupler (modem) and a Communications Interface Card. The coupler is a 103A-type asynchronous device, suitable for data communication at 110 or 300 baud (10 or 30 char/sec). It operates in either the Originate or Answer modes. Connection to the phone system is accomplished by placing the telephone handset in position on top of the modem. No permanent connection or wiring changes are required.

Order No. A2M0017-U.S., A2M0017P-European. Supplied with:

—Communications Interface Card
—Connecting Cable
—Demonstration Tape
—Documentation

Communications Interface Card

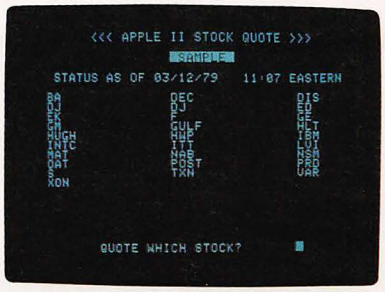
The Communications Interface Card is available separately to allow you to connect your APPLE to modems, CRT terminals, and other devices employing a serial RS-232C interface. The card's built-in intelligence lets you control these devices easily, in BASIC.

Features

—Firmware Control Programs—No Software to Write
—Easily Controlled from BASIC using Simple Commands
—Communicates at 110 or 300 Baud, Half- or Full-Duplex
—RS-232C-compatible Serial Interface

Specifications

PARAMETER	DESCRIPTION
Signal Level:	EIA RS-232C
Data Word Format:	1 start bit, 1 or 2 stop bits, 7 or 8 data bits; odd, even or no parity



Ordering Information

Order No. A2B0003. Supplied with:

—Firmware in ROM
—DB-25 Connector and Mounting Bracket
—Demonstration Tape
—Operating Manual

PRINTERS AND INTERFACES

Two printers are available to meet your needs for reports, listings, and label generation.

Printer IIA (Centronics 779)

Printer IIA is a medium-speed impact printer for home and business applications requiring low-cost, multi-copy printing. It prints 80 to 132 (5 × 7) dot-matrix characters per line, at 60 characters per second. This printer is capable of reproducing the 64-character, upper-case ASCII set; and its tractor paper feed allows printing of five-part forms in widths to 9.8″. The mechanism is packaged in a low-profile, desk-top cabinet. Printer IIA is supplied with a Printer Interface Card, cable and connector, operating documentation, and warranty. (Order No. A2M0011)

Printer II (Centronics Microprinter-PI)

This compact, desk-top printer employs electric discharge technology to print up to 80 characters per line at 150 lines per minute. The printer produces 5 × 7 dot-matrix characters at 5, 10, or 20 characters per inch. It prints the full 96-character ASCII set, including lower-case letters. It is quiet and reliable and uses no toner or ribbon. It prints on 4.75″, aluminum-coated roll stock. The printer is supplied with a Printer Interface Card, cable and connector, operating documentation, and warranty. (Order No. A2M0010)

Interfaces

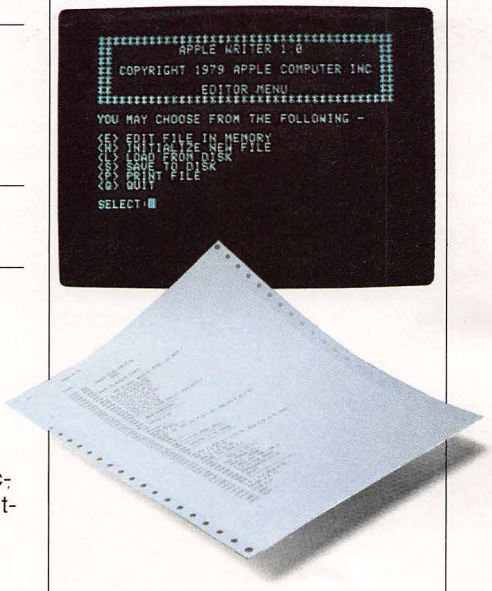
The Parallel Printer Interface Cards are also available separately, to allow the use of other parallel printers with your APPLE computer.

Features

—Built-in Firmware Allows Printing With Simple BASIC Commands
—Prints up to 255 Char/Line for format flexibility
—High Speed—up to 5000 Char/Sec (3700 LPM @ 80 Char/Line
—Easy to Use with Most Popular Printers (Axiom, Centronics, SWTP, Selectric conversions)

Specifications

PARAMETER	DESCRIPTION
Data and Control Signals:	7–8 Parallel Data Bits, STROBE and ACKNOWLEDGE
Print Line Width:	40–255 Char/Line. Automatic formatting of BASIC listings



Ordering Information

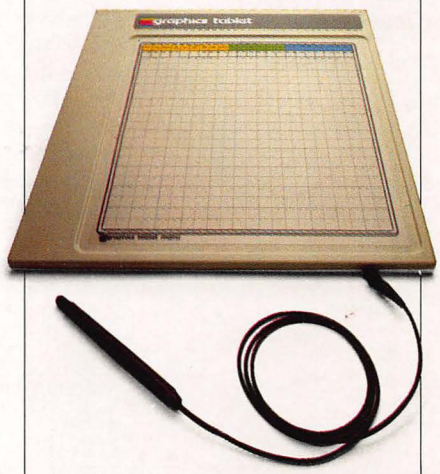
Standard Card (A2B0002), for general purpose use.
Supplied with:
—Configuration Jumper Block
—Ribbon Cable (User supplies connector)
—Manual

This version of the card issues a Line Feed after receiving a Carriage Return character.

Centronics Card (A2B0007), for use with Centronics 779 and Microprinter.
Supplied with:
—Pre-wired Configuration Jumper Block
—Ribbon Cable w. Centronics Connector
—Manual

This version of the card does not issue a Line Feed after receiving a Carriage Return character. It is for use with Centronics (or other) printers that automatically line feed after they receive a Carriage Return character.

GRAPHICS TABLET



General Description

The Graphics Tablet is an image input device that allows the user to enter pictorial information directly (by sketching or tracing) from:
—maps and photographs
—logic diagrams and schematics
—histograms
—architectural drawings
—fine art

Tracing a shape on the tablet surface converts the image to digital values. This information is displayed on the video monitor and may be stored on disk for later processing by the Apple.

The 11″ × 11″ tablet surface area facilitates entry of large and complex figures. Line segments may be specified by their endpoints, allowing lines to be accurately drawn by hand. A reducer function assists the user in doing detailed work. Area and distance calculations (in user-specified coordinates) may be performed on the resulting figures.

Powerful software provides a comprehensive set of functions selected with the stylus from a menu. This software is written in Applesoft BASIC so the user may easily change or add menu functions to suit a particular application.

Features

—Direct Input Simplifies Production of Complex Images
—Hand Calculations of Graph Coordinates And Figure Dimensions are Eliminated
—Coordinated Cursor Allows Function Selection From Command Tables on Tablet
—Control Program in Applesoft BASIC makes for Easy User Modification
—Tablet provides 167 points/inch Resolution For Detailed Figures
—Allows User Specified Functions

Specifications

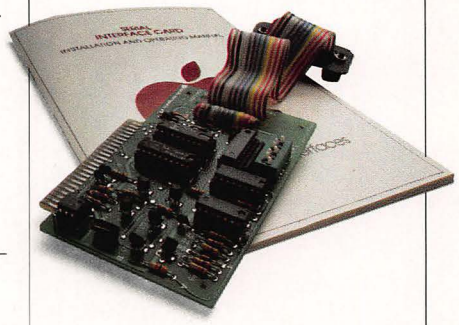
Unit consists of stylus, external digitizing tablet, and plug-in interface card.

Tablet Size: 15″ square (11″ square active area), 1″ high
Resolution: 167 points per inch
Input Modes: Continuous or upon command
Data Rate: Up to 100 coordinate pairs per second
Scaling: User selectable
Minimum System Requirements: 48K RAM, Applesoft BASIC, Disk II

Ordering Information

Order Number: A2M0029. Supplied with:
—Tablet, Interface Card, Connecting Cable and Stylus
—Manual and Transparent Mylar Overlay
—Control Firmware in ROM
—Software Programs on Diskette

SERIAL INTERFACE CARD



General Description

The Serial Interface Card allows an APPLE computer to exchange data with computers, printers, and other devices in serial format (one bit at a time). It is intended for use (in place of the Communications Interface Card) in applications that:
—Use data rates other than 110 or 300 baud (10 or 30 char/sec)
—Involve serial printers that don't require "handshake"

The Serial Card features on-board firmware that provides BASIC control in both block-data-transfer and printer-operation modes. A number of hardware and software switches on the card serve to adapt it to a wide variety of applications, yet it remains simple to use because of its built-in intelligence.

Features

—Permits BASIC Control of High-Speed Printers and Plotters
—Quickly Transfers Large Blocks of Data by Telephone (through a modem), or Directly to Local Equipment
—Handles Half-Duplex Communication from 75–19.2K Baud
—Programs Easily with Switch-Selectable Preset Conditions for Speed, Line Length, Auto Line Feed and Carriage Return Delay

Specifications

PARAMETER	DESCRIPTION
Signal Level:	EIA RS-232C or 20mA current loop
Data Word Format:	1 start bit, 1 or 2 stop bits, 5–8 data bits; odd, even, or no parity. Checksum is optional.
Character Handling Options:	Lower-case characters optionally converted to upper-case or passed through unmodified and displayed in inverse video.

Ordering Information

Order Number: A2B0005. Supplied with:
—Interface Card
—DB-25 Connector and Mounting Bracket
—Manual

APPLE EXPANSION OPTIONS

EXPANSION OPTIONS

A wide range of products are available to expand the capabilities of APPLE computers.

Language System

This package includes the Language Card, which allows APPLE users to take immediate advantage of the powerful PASCAL language as well as the Integer and Applesoft BASIC interpreters. The Language Card's 16K bytes of RAM memory electrically replace the ROM firmware built into each APPLE. Upon start-up, this RAM memory is automatically loaded from disk with the user's choice of languages, then electrically protected from change. The loading is controlled by the AUTO-START ROM, also contained on the card. The complete system also includes diskettes containing a language selection "Hello" program, PASCAL, Applesoft BASIC, and Integer BASIC. The reference manuals for all the above languages are also included. (Order No. A2B0006)

Applesoft Firmware Card

The Applesoft Firmware Card provides access to the library of programs written in this extended BASIC language. It contains hardware and software controls that allow it to electrically replace the existing Integer BASIC firmware in APPLE II computers. (Order No. A2B0009)

Integer Basic Firmware Card

This card provides access to a library of programs written in the Integer BASIC language. It contains hardware and software controls that allow it to electrically replace the existing Applesoft BASIC firmware APPLE II Plus computers. (Order No. A2B0010)

Auto-Start ROM

The Auto-Start ROM makes any APPLE II friendlier and easier to use by adding such features as:

—Automatic Start-Up in BASIC For Systems Without Disks
—Automatic Disk Program Loading When System Turns On
—RESET Protection—RESET Key Halts Program, Returns to BASIC
—Easy Screen Editing, With up to 90% Fewer Keystrokes

The device is a plug-in replacement for the existing monitor ROM. It is included in APPLE II Plus systems, Applesoft ROM Cards, and the Language System. (Order No. A2M0027)

16K Byte Expansion Memory Module (RAM)

This module allows user memory expansion in 16K byte increments for any 16K or 32K APPLE computer. The module contains 8 RAM devices, installation instructions, and a test program to insure that installation was done properly. (Order No. A2M0016)

APPLE EXPANSION OPTIONS

EXPANSION OPTIONS

Clock/ Calendar Card

This plug-in card provides a 388-day calendar and clock, with resolution to 1/1000 second. The clock is crystal controlled to yield .001% accuracy. A built-in rechargeable battery keeps the clock on time up to four days without system power, and external batteries may be used for longer periods. Optional interrupt capability simplifies control applications. Supplied with complete operating instructions and rechargeable battery. (Order No. A2M0024).

Monitor II

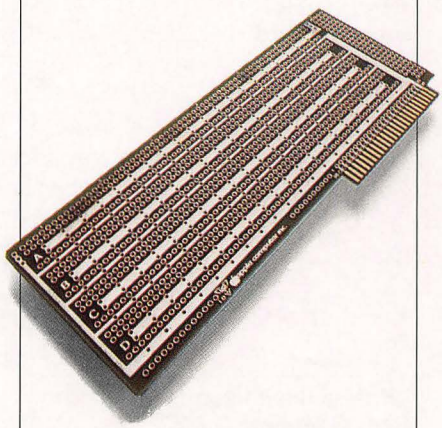
This 9-inch (diagonal) video monitor is the ideal display for the APPLE when color output is not required. It sits neatly on top of the computer, and provides a very clean and sharp picture. It accepts direct video input from the computer. Monitor II comes complete with cable adapter and documentation. (Order No. A2M0005)

Tape Recorder

A tape recorder is the basic program and data storage mechanism for the APPLE. This one offers the convenience of pushbutton operation; and it runs from either batteries or the AC line. (Order No. A2M0018)

Hobby/ Prototyping Card

Create your own APPLE interface boards with this wire-wrap card. The 2-3/4″ × 7″, double-sided circuit board includes a hole pattern (on 100-mil centers) that accepts all conventional IC's and passive components. It plugs directly into any APPLE expansion connector, and fits entirely within the computer case. Supplied with complete bus documentation to aid the interface designer. (Order No. A2B0001)



System Furniture

Apple offers an attractive desk and side return combination to support your computer system hardware. Both units have Apple beige sides, chocolate brown legs, and contrasting teakwood-grain formica tops. Their design keeps equipment well organized and cables out of sight.

Order Numbers:
Desk (30″ × 48″)—A2M0034
Left Side Return (18″ × 30″)—A2M0035

SYSTEM FIRMWARE / SOFTWARE

PASCAL

APPLE PASCAL, incorporating UCSD PASCAL™, offers extended features in a complete, interactive package employing today's most sophisticated structured programming language. It provides advanced capabilities that boost performance and cut development time for large business, scientific, and educational programs.

The software package provides a powerful set of tools for the serious programmer:

Editor

—Fast, screen-oriented editor for program development and word processing
—80-character lines (upper/lower case) available with external CRT terminal
—80-character lines supported in standard APPLE using horizontal scrolling.

Compiler

Standard PASCAL plus extensions for strings, disk files, graphics, system programming:
—Hi-Res:
"Turtlegraphics":
INIT turtle, PENCOLOR, TURNTO, TURN, MOVE, TEXTmode, GRAFmode.
—Text:
—GOTOXY procedure for cursor addressing
—Split screen or horizontal scrolling
—FUNCTION Keypress tells whether character available
—Library Routines:
—FUNCTION RANDOM
—PROCEDURE RANDOMIZE
—FUNCTION PADDLE
—FUNCTION BUTTON
—PROCEDURE TTLOUT
—FUNCTION KEYPRESS
—And more . . .

Relocatable Assembler

Permits relocatable assembly language routines to be generated and linked to PASCAL programs.

Filer

General purpose program for manipulating all system disk files.

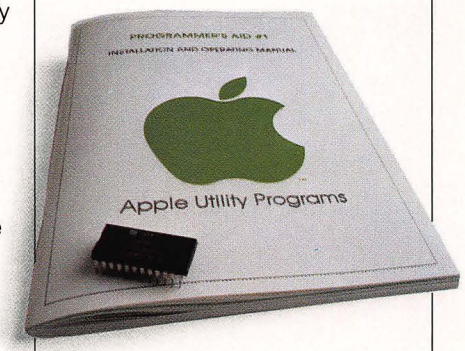
System Utilities

—DESK CALCULATOR—performs basic calculations
—PARAMETER—allows examination and modification of system operating environment.

PASCAL operates in a 48K APPLE II or II Plus with one to six disk drives and the APPLE Language System. An external 80-column terminal can be attached. The package includes:
Language Card
5 diskettes, including
Integer BASIC
Applesoft Extended BASIC
PASCAL System
IC puller
3 PASCAL manuals
3 BASIC Language manuals
Installation & Operation manual
(Order as the Language System: Number A2B0006)

UCSD™ PASCAL is a registered trademark of the regents of the University of California.

SYSTEM FIRMWARE/SOFTWARE



Programmer's Aid #1

Programmer's Aid #1 is a ROM-based library of routines to simplify and enhance your Integer BASIC programs. Its capabilities include:
—High-Resolution Graphics Generation
—Program Renumbering and Linking
—Tape Verification
—Musical Tone Generation (12 timbres and 5 octaves)
—RAM Testing
—Machine Language Program Relocation

Programmer's Aid #1 is packaged as a single 2K-byte ROM to be inserted in a socket of the APPLE II. The routines upon which it is based are completely documented in the manual which accompanies the package. (Order No. A2M0019. Note: this ROM is now included in APPLE II computers.)

Disk Utility Pack

The Disk Utility Pack includes exciting new software for disk-based APPLEs, designed to make your programming life easier . . .
—Disk Operating System (DOS)—With all the latest features
—Update—Updates Existing Diskettes to current DOS And Preserves Their Contents
—Applesoft CHAIN—links Applesoft programs together
—Applesoft Renumber/Merge—Renumbers and merges Applesoft routines into a single program
—DOS Manual—Over 170 pages of examples and detailed user information

Order No. A2D0010. Supplied with:
—System Master Diskettes (Integer & Applesoft versions)
—Blank Diskette
—Manual

The package is included in A2M0004 disk drives and Auto-Start ROM packages.

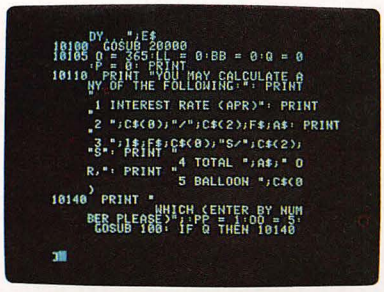
Integer Basic

This language is a fast integer BASIC that includes the following features (in addition to normal BASIC capabilities):
—Any-length variable names (ALPHA, BETA$)
—Syntax and range errors indicated immediately when entered
—Multiple statements on one line
—Integers from −32767 to +32767
—Strings to 255 characters; Single-dimension integer arrays
—Graphics Commands
—Paddle read function
—TEXT and Graphics Commands to set display mode from BASIC
—Immediate execution of most statements
—Break and Continue program execution
—Debug commands: line number trace and variable trace
—Switchable I/O device assignments
—PEEK, POKE, CALL, POP commands
—Auto line number mode
—RND, SGN, ASC, LEN and ABS functions
—GOTO expr, GOSUB expr allowed

Integer BASIC is supplied as on-board ROM in the APPLE II and is included with the APPLE Language System. The language is also available on the Integer BASIC ROM card.

SYSTEM FIRMWARE/SOFTWARE

Applesoft II Extended Basic Language



Applesoft II is an expanded version of Microsoft's popular floating-point BASIC. Its 9-digit arithmetic and large function library make it ideal for business and scientific applications. Features like high-resolution graphics routines and user-programmable error messages make the language both powerful and easy to use. Capabilities include:

—3 Data Types—Real, Integer, and String
—N-Dimensional Arrays and N-Letter Variable Names (first two letters significant)
—Extensive Mathematical, Logical and Scientific Capabilities
  —EXP, LN, SQ. RT., SIN, COS, TAN, ARCTAN
  —AND, OR, NOT, ABS, INT, RANDOM, SIGN
—String Operations to Aid the Business Programmer:
  —Compare: =, >, <, >=, <=, ><
  —Concatenate: +
  —Variable Type Conversion: ASC, STR, VAL
  —Substring Separation: LEFT, RIGHT, MID, LEN
—Graphics Statements that Simplify Display Programming:
  —Print Format Control: NORMAL, INVERSE, FLASH
  —Graphics Control: COLOR, PLOT, POSN, LINE DRAW, SCRN, GRAPHICS, TEXT, HIRES, ROT, SCALE, SHAPELOAD
—General Operations that Include and Extend Upon Dartmouth BASIC:
  —Program Manipulation: CLEAR, NEW, LIST, RUN, CONT, LOAD, SAVE
  —Variable and Function Definition: DATA, DEF. FUNCT, DIM
  —Data Handling and Storage: READ, RESTORE, STORE, RECALL
  —Loops and Branching: FOR . . . NEXT, IF . . . GOTO, IF . . . THEN, ON . . . GOTO, ON . . . GOSUB, ONERRGOTO, RESUME, GOTO, GOSUB, RETURN
  —Input/Output and Format Control: INPUT, PRINT, IN#, PR#, VTAB, TAB, HOME, PADDLE
  Machine Level Statements: PEEK, POKE, CALL, POP, LOMEM, HIMEM

Applesoft II is supplied as a diskette, tape, or plug-in ROM card; and is included in APPLE II Plus systems. The diskette version requires 32K RAM (48K for high-resolution graphics). The tape version requires 16K of RAM (32K for high-resolution graphics). The ROM version requires 16K RAM if high-resolution graphics are used. A comprehensive reference manual is included. (Order Numbers: A2B0009—card, A2T0004—tape.)

APPLE SOFTWARE BANK

APPLICATIONS SOFTWARE CATALOG

The Apple Software Bank supplies programs to handle a wide range of applications. Program medium is indicated by the model number. Numbers starting with A2D are supplied on diskette, and those starting with A2T are supplied on tape. All programs run on 16K, Integer BASIC systems unless otherwise noted.

Business and Finance

General Business System—The Controller (GBS I)

THE CONTROLLER gives a business control of its revenues and expenses through General Ledger, Accounts Payable, and Accounts Receivable computer software. THE CONTROLLER is designed for a non-technical manager or clerk. It handles accrual bookkeeping, and can easily maintain the ledger, customer, and vendor accounts of many small businesses. THE CONTROLLER provides better control of cash flow, reduces paperwork, eliminates last-minute "catch-up" accounting, prints checks and monthly account statements, and provides information in concise summary reports that allow a manager to make better decisions.

THE CONTROLLER has been designed with failsafe operation in mind. Its unique data entry system signals typing errors with an audible warning. It automatically makes copies of data files for historical purposes, in case of loss of the originals. And it automatically prints reports before the system will allow the user to close out the monthly books.

THE CONTROLLER Business System consists of three program modules:

The GENERAL LEDGER module maintains a file of up to 250 types of journal accounts with up to $90 million in any one account. Up to 750 journal entries can be made per month, and a unique feature allows customer and vendor account transactions to be created and posted to the general ledger automatically, without redundant typing. The system produces detailed, easy to read management summaries of journal accounts, revenues, and expenses; as well as balance sheets and income statements.

The ACCOUNTS RECEIVABLE module maintains up to 250 customer files per data diskette (up to 3 diskettes can be used). Each diskette can handle 750 sale and payment transactions per month, and the balance-forward system automatically summarizes transactions into account ageing periods at month end. Individual transactions can be for up to $90,000 each. The system produces a detailed summary of receivables, organized by the number of days each bill has been outstanding (aged trial balance). Monthly account statements are printed automatically for customer billing purposes, with optional finance charges added to overdue accounts. The system also produces mailing labels, customer lists, and sales commission reports by salesmen.

The ACCOUNTS PAYABLE module maintains a file of 100 vendors and allows 300 invoices for up to $1 million each, or $90 million cummulative. Payables are organized by due date, so that in planning cash flow a business can customize bill paying to take advantage of discounts and varying net terms. Checks are printed automatically, along with summaries of case requirements by due date and vendor. The system prints summaries of checks paid, new accounts, and a list of vendors.

THE CONTROLLER is packaged in an attractive 3-ring binder with a manual and diskettes. It requires 48K RAM, dual disk drives, Applesoft BASIC language, and Printer IIA. (Order No.: A2D0012)

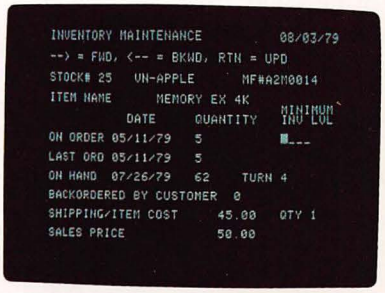
APPLICATIONS SOFTWARE CATALOG

The Cashier

THE CASHIER is an inventory control and cash register simulation system. It simplifies the retailer's job by eliminating redundant work in filling out lists and forms. Once a customer account is entered, the information is automatically used to generate sales receipts, billing records, mailing lists, and accounting summaries. THE CASHIER also gives a retailer better control of inventory, resulting in reduced shrinkage.

THE CASHIER can process backorders, down payments, and refunds, managing an inventory of more than 800 stock numbers.

The system is packaged in a binder with a manual and diskettes. It requires 48K RAM, dual disk drives, Applesoft BASIC language, and Printer IIA. (Order No.: A2D0025)



Apple Post

APPLE POST is a data base system that handles the creation and maintenance of mailing lists of up to 500 names per diskette. It allows for easy entry and editing of names, addresses, and phone numbers, and can print lists or actual labels in order by name or zip code. APPLE POST makes it possible to locate names and phone numbers quickly, and uses a unique "phonetic search" feature to locate names even when correct spelling is not known.

The mailing list system is packaged including a manual and program diskette. It requires 48K RAM, 2–6 disk drives, Applesoft BASIC language, and Printer IIA. (Order No.: A2D0013)

Apple Writer

The APPLE WRITER gives you the ability to edit memos, letters, programs, or even a novel. You can enter text, delete mistakes, move blocks of text, save and insert segments from a diskette, and search throughout the text to replace letters, words, or phrases automatically. Using the APPLE WRITER with a printer, you can print your edited material on paper, letter-perfect every time.

The APPLE WRITER is packaged with a manual and a program diskette. It requires 48K RAM and one disk drive. For printing out documents, a printer and interface are necessary. (Order No.: A2D0026)

Portfolio Evaluator

Maintain up to 50 stock portfolios on a diskette, analyzing each to provide summaries of short and long term gains and losses, current values of each portfolio, and shares held. Disk II, 32K RAM, and Applesoft BASIC required. (Order No.: A2D0007)

Checkbook With Financial Data Base Management

Maintains a data base of transactions: the date, amount, recipient, and classification code for each item. It allows check records to be saved, sorted, searched, and displayed. Trial balances can be run, and the account can be reconciled against a bank statement. The program eliminates most of the drudgery associated with checking account management. (Order No.: A2T0001)

Education

Education Series: The Shell Games

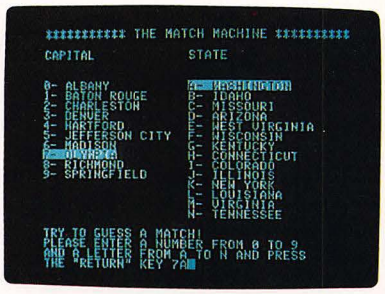
THE ANIMATED APPLE

The intriguing story of how APPLE grew from a tiny flower . . . See it all in this engrossing cartoon.

MATCH MACHINE

The Magnificent Match machine displays two columns of words that match. One of the columns is scrambled. Your job is to straighten them out! When you have matched every match, make up your own list on any subject. The Match Machine will help you make them a permanent part of the program.

APPLICATIONS SOFTWARE CATALOG



PROFESSOR TRUE — A true/false quiz at its finest, Professor True will ask you interesting questions and then tell you something more about it. For example: The most famous naval battle of the Civil War was between the Monitor and the Virginia. True or False?

When you've mastered what the professor has to offer, create your own quizes; the Shell Games editor makes it fun and easy.

MR. MULTIPLE — When did the first nuclear reactor go critical? Who played the dog onTV's Cosmo Topper? How should you dress for 15 degrees Celcius? If the answers to these burning questions are keeping you awake nights, Mr. Multiple is for you.

And if you know all the answers, how about making up some questions, using the built-in Shell Games Editor.

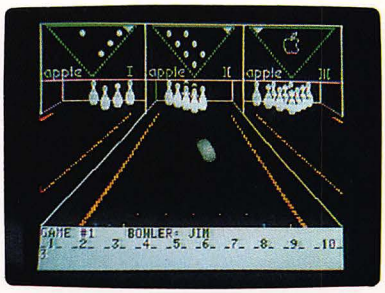
THE SHELL GAMES is packaged to include a manual and a program diskette. It requires 48K RAM, Integer BASIC, and one disk drive. (Order No.: A2D0014)

Utility

RAM TEST — A test program that provides peace of mind during RAM expansion by testing the installed RAM (Order No. A2T0006)

DATAMOVER — A program used to move data and programs from one APPLE computer to another over the phone lines (Order No A2T0012)

Entertainment



APPLE TREK
SPACE WAR — Apple's version of the popular galactic warfare game. Supplied with: Man the guns of a rebel starship and try your marksmanship. (Order No. A2T0002)

BRICK OUT — Knock all the bricks out of the playing field and you're a winner! (Order No. A2T0003)

CHESS — Try your skill at this ancient game of strategy. Plays at eight levels of skill, so you're always evenly matched. (Order Nos. A2T0013—tape, A2D0009—disk)

APPLE BOWL — Enjoy this realistic simulation of a bowling alley. You have complete control of the ball; APPLE keeps the score. (Order Nos. A2T0015—tape, A2D0018—disk)

CONTRIBUTED SOFTWARE

The Contributed Software section of Apple Software Bank supplies programs to handle a wide range of applications. Currently available programs are supplied on an "as-is" basis in a series of five volumes (Contributed Software Vol. I–V).

The volume number to consult for each program is shown in parenthesis right after the program title.

Business

FILE CABINET (3) — General data base for storing, searching, and sorting lists of all types of data.

Education

COLORMATH (1) — Color/sound quiz in basic arithmetic

HANGMAN (1) — Color/sound guessing game that builds word skills

APPLE SOFTWARE BANK

CONTRIBUTED SOFTWARE

MASTERMIND (1)	A popular strategy game that builds logic skills.
THE INFINITE NUMBER OF MONKEYS/ Integer Basic Subroutine Package (5)	Combining an enjoyable animated story with a serious exploration of advanced programming techniques in Integer BASIC.
ENGINE (3)	HI-RES animation of an automobile-type gasoline engine, including a manual step-through mode.
THE GREAT AMERICAN PROBABILITY MACHINE (5)	Intuitive exploration of the laws of probability through LO-RES animation.
CALIFORNIA DRIVING TEST (5)	A practice test for California drivers and a fine example of educational programming for all.
HAMMURABI (1)	A fascinating economic simulation of a small agrarian country. The lives and prosperity of its inhabitants depend upon the player's decisions.
MORSE CODE (1)	APPLE II now has a perfect fist over a wide range of speeds, for those who want to build their skill at Morse Code.

Scientific Calculation

BONE TUMOR DIFFERENTIAL DIAGNOSIS (1)	To assist qualified medical practitioners in the diagnosis of bone pathologies.
AIRFOIL (3)	HI-RES graphics program that will plot the shape of an aircraft wing given the parameters.

Utility Programs

HI-RES GRAPHICS (3)	A package of graphics routines to assist the user in plotting on the HI-RES screen.
HI-RES CHARACTER SET (3)	A program to put characters on the HI-RES screen.
HEX CONVERTER (1)	Converts numbers between bases 10, 16, and 2. Simple sums and differences in these bases can also be computed.
INTEGER BASE CHR$ FUNCTION (1)	This program gives you the same ability in integer BASIC that the CHR$ function delivers in Applesoft BASIC.
INTEGER BASIC RENUMBER AND APPEND (5)	A programmer's aid to renumber entire programs or "glue" one program to another.

Entertainment

BLACKJACK (1)	SHOOTOUT (3)	PINBALL (1)	NIGHTMARE #6 (1)
CHASER (5)	INTERCEPT (3)	SINK THE SHIP (1)	23 BRICKS (1)
KALEIDOSCOPE (3)	APPLE-VISION (3)	CATCH (1)	YAHTZEE (1)
MISSION: U-BOAT (5)	SLOT MACHINE (1)	CURVES (1)	MAGIC LANTERN (2, 4)
APPLE ORGAN (5)	BIORHYTHM (1)	SEVEN (1)	INTERCEPT (3)
ADD-LIBS I (5)	OTHELLO (1)	TOWERS OF HANOI (1)	

APPLE DOCUMENTATION

APPLE products come with complete documentation for users at every level of technical expertise.

APPLE II Integer BASIC Programming Manual

This manual starts from the beginning and guides the user's first programming efforts. A humorous style and abundant examples make this the ideal textbook for newcomers to personal computing. (Order No. A2L0005, 125 pages. Supplied with APPLE II systems.)

APPLE II Reference Manual

This manual addresses the details of the system: hardware schematics, firmware listings, special system features, and use of the monitor. It is aimed at the user who is comfortable with BASIC and wishes to become familiar with the advanced features of APPLE computers. (Order No. A2L0001, 151 pages. Supplied with APPLE systems.)

Applesoft BASIC Reference Manual

This extended BASIC reference manual is written for the user who is familiar with the BASIC language. (Order No. A2L0004, 170 pages. Supplied with APPLE II Plus systems.)

Applesoft BASIC Tutorial Manual

This manual is for the extended BASIC beginner. It provides programming examples and a detailed explanation of the language. (Order No. A2L0018. Supplied with APPLE II Plus systems.)

6500 Microprocessor Hardware Manual

This manual is directed at the hardware designer who wants detailed information about the 6502 microprocessor used in the APPLE. (Order No. A2L0002, 165 pages.)

6500 Microprocessor Programming Manual

This manual addresses the internal structure and assembly language programming of the 6502 microprocessor. It assumes that the reader is moderately familiar with computer concepts. (Order No. A2L0003, 239 pages.)

Disk II Reference Manual

The Disk II Reference Manual explains the installation and operation of Disk II Hardware. It also provides a comprehensive introduction to Apple's Disk Operating System software. (Order No. A2L0012. Supplied with Disk II and Disk Utility Pack.)

APPLE Pascal Reference Manual

This manual provides complete information on those elements of the Pascal Operating System that are particular to the APPLE implementation. It is written for readers who are already familiar with the Pascal language. (Order No. A2L0019. Supplied with the Language System.)

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10049 Sante Fe Dr.
Overland Park 66212
(913) 492-8882

*Personal Computer Center
3819 W. 95th St.
Overland Park 66206
(913) 649-5942

Barney and Associates
425 N. Broadway
Pittsburg 66762
(316) 231-1970

High Tech (Retail)
1036 W. Pawnee
Wichita 67213
(316) 942-9695

Team Electronics No. 048
791 N. West St.
Wichita 67293
(316) 942-1415

KENTUCKY

Sound Impulse Inc.
910 Bellefonte Rd.
Flatwoods 41139
(606) 836-3161

Data Domain
506½ Euclid Ave.
Lexington 40220
(606) 233-3346

*Computerland
813 Lyndon Lane No. B
Louisville 40222
(502) 425-8308

LOUISIANA

Delta Micro Computer
104 Constitution Blvd. No. A
Alexandria 71301
(318) 442-0217

*Computer Place, The
3340 Highland Rd.
Baton Rouge 70802
(504) 388-7693

Computer Place, The
1904 Pinhook Rd.
Lafayette 70508

*Computer Shoppe Inc.
3225 Danny Park
Metairie 70002
(504) 454-6600

Micro Computers of New Orleans
2025 Canal St.
New Orleans 71812
(504) 821-0870

*Micro Business Systems
3823 Gilbert
Shreveport 71104
(318) 869-3027

MAINE

Harper Electronics
114-2 S. Commercial St.
Portland 04101
(207) 772-1156

MARYLAND

Computer Center of Columbia
9143G Red Branch Rd.
Columbia 21045
(301) 730-5186

Frederick Computer Products
Frederick Municipal Airport
Frederick 21701
(301) 694-8884

Custom Computing
806 Frederick St.
Hagerstown 21740
(301) 339-6500

Your Own Computer Ltd.
10678 Campus Way South
Largo 20870
(301) 350-6680

The Comm Center
9624 Ft. Meade Rd.
Laurel 20810
(301) 953-9535

*The Computer Workshop
1776 Plaza—1776 E. Jeffer
Rockville 20852
(301) 468-0455

*Computerland
16065 Frederick Rd. (Rt. 3)
Rockville 20855
(301) 948-7676

Computers Etc.
13A Allegheny Ave.
Towson 21204
(301) 296-0520

*Computers Unlimited Inc.
907 York Rd.
Towson 21204
(301) 321-1553

MASSACHUSETTS

*Lebow Labs Inc.
424 Cambridge St.
Allston 02134
(617) 782-0600

Ferranti-Dege Inc.
455 Brookline Ave.
Boston 02115
(617) 661-7650

*Computer Store Inc.
120 Cambridge
Burlington 01803
(617) 272-8770

*Computer Store Inc.
1689 Massachusetts Ave.
Cambridge 02138
(617) 354-4599

Harvard Cooperative Society
1400 Massachusetts Ave.
Cambridge 02138
(617) 492-1000

Tech-Coop/MIT Student Center
84 Massachusetts Ave.
Cambridge 02138
(617) 492-1060

Computer City
5 Dexter Row
Charleston 02129
(617) 242-3350

Sound Co., The
Fairfield Plaza
Chicopee 01020
(413) 593-5330

*Computer Store, The
Rt. 9 Deerskin Plaza
Framingham 01701
(617) 879-3720

Two-Way Radio Service
358 Main St.
Hyannis 02601
(617) 775-8176

Component Systems
46 Mechanic St.
Leominster 01453
(617) 534-5124

*Retail Computer Center
455 Center St.
Ludlow 01056
(413) 788-3900

Computer Source
26 Dunham Mall
Pittsfield 01201
(413) 443-7181

Sound Co., The
447 Sumner Ave.
Springfield 01180
(413) 736-3626

*Computer Packages Unlimited
244 W. Boylston St.
W. Boylston 01583
(617) 829-2570

*Computerland/Boston
214 Worcester St.
Wellesley 02181
(617) 235-6252

*Computer Place, The
11 Harvard St.
Worcester 01608
(617) 799-4181

MICHIGAN

*Newman Computer Exchange
1250 N. Main St.
Ann Arbor 48104
(313) 994-3200

Computer Connection
38437 Grand River
Farmington Hills 48024
(313) 477-4470

Computer Center
28251 Ford Rd.
Garden City 48135
(313) 422-2570

Computer House Div/FLC Inc.
1407 Clinton Rd.
Jackson 49202
(517) 782-2132

*Computerland/Grand Rapids
2927 28th St. SE
Kentwood 49508
(616) 942-2931

Team Electronics No. 029
P. O. Box 232 M & M Plaza
Menominee 49858
(906) 863-7878

*Computerland
301 S. Livernois Ave.
Rochester 48063
(313) 652-9000

Computer Mart
560 W. 14 Mile Rd.
Royal Oak 48017
(313) 288-0040

Computer Mart
3145 Shattuck Rd.
Saginaw 48603
(517) 790-1360

*Computerland
29673 Northwestern Hwy.
Southfield 48034
(313) 356-8111

*Team Electronics No. 159
1180 S. Airport Rd. West
Traverse City 49684
(616) 946-8326

MINNESOTA

*Team Electronics No. 147
207 Third St.
Bemidji 56601
(218) 751-7880

*Let 3 Inc.
Hwy. 218S & Main St.
Blooming Prairie 55917
(507) 583-2494

*Computerland
8070 Morgan Circle Dr.
Bloomington 55431
(612) 884-1474

*Zim Computers
5717 Xerxes Ave. North
Brooklyn Center 55429
(612) 560-0336

*Digital Den
2138 Burnsville Center
Burnsville 55337
(612) 435-5445

*Compudata Corporation
104 W. Superior
Duluth 55802
(218) 722-6319

Team Electronics No. 165
504 E. 4th St.
Duluth 55805
(218) 727-4900

*Audio King
7101 France Ave. South
Edina 55435
(612) 920-4272

*Team Electronics No. 095
204 Southdale Center
Edina 55435
(612) 920-4817

Team Electronics No. 163
Westridge Mall
Fergus Falls 56357
(218) 739-4443

Computerland
11319 Highway 7
Hopkins 55343
(612) 933-8822

Team Electronics No. 023
Madison East
Mankato 56001
(507) 387-7937

Team Electronics No. 044
3000 White Bear Ave.
Maplewood 55109
(612) 777-3737

Personal Business Systems
4306 Upton Ave. South
Minneapolis 55410
(612) 929-4120

Team Electronics No. 001
2640 Hennepin Ave. South
Minneapolis 55408
(612) 377-9840

Team Electronics No. 050
1311 4th St. SE
Minneapolis 55414
(612) 378-1185

Team Electronics No. 133
Cedar Mall
Owatonna 55060
(507) 451-7248

Team Electronics No. 066
350 Rosedale Center
Roseville 55113
(612) 636-5147

*Team Electronics No. 004
110 6th Ave. South
St. Cloud 56301
(612) 251-1335

Team Electronics No. 131
Crossroads Shopping Center
St. Cloud 56301
(612) 253-8326

Schaak Electronics
1415 Mendota Heights Rd.
St. Paul 55120
(612) 454-6830

Team Electronics No. 002
455 Rice St.
St. Paul 55013
(612) 227-7223

Team Electronics No. 058
1733 S. Robert St.
W. St. Paul 55118
(612) 451-1765

MISSOURI

Kemper & Dodd Stereo
Town Plaza Shopping Center
Cape Girardeau 63701
(314) 334-0578

*Central Missouri A.V.
1000 W. Broadway
Columbia 65201
(314) 874-2111

*Computer Country North
235 Dunn Rd.
Florissant 63031
(314) 921-4434

High Technology/St. Louis
1847 Dunn Rd.
Florrisant 63033
(314) 838-6502

Computerland
1214-A S. Noland Rd.
Independence 64055
(816) 461-6502

Personal Computer Center
11327 E. 23rd St.
Independence 64055
(816) 254-7101

*Computer Video Room
1811 Westport Rd.
Kansas City 64111
(816) 531-1050

*Computers ASP Inc.
7115 NW Barry Rd.
Kansas City 64152
(816) 741-8013

*Kaleidoscope
1316 N. Baltimore
Kirksville 63501
(816) 665-1953

Computerland
11990 Dorsett Rd.
Maryland Heights 63040
(314) 567-3291

*Computer Mart
1904-B E. Meadow Mere
Springfield 65804
(417) 862-6500

*Computer Country South
4479 Lemay Ferry Rd.
St. Louis 63129
(314) 487-2033

*Forsyth Computers
7748 Forsyth Ave.
St. Louis 63105
(314) 721-4300

Futureworld Inc.
12304 Manchester Rd.
St. Louis 63131
(314) 965-4540

MISSISSIPPI

A & S Copy and Computer
44 N. State St.
Jackson 39207
(601) 948-4673

Entertainment Electronics Ltd.
1855 Lakeland Dr.
Jackson 39216
(601) 981-7341

Southern Computing Systems
603 W. Canal St.
Picayune 39466
(601) 798-2330

Waynesboro Electronics
608 Mississippi Dr.
Waynesboro 39367
(601) 735-3431

MONTANA

*Computer Store, The
1216 16th St. West
Billings 59102
(406) 245-0092

*Team Electronics No. 035
613 Central Ave. Box 2154
Great Falls 59401
(406) 453-3246

Team Electronics No. 037
1209 W. Kent
Missoula 59801
(406) 549-4119

NEBRASKA

Team Electronics No. 137
148 Conestoga Mall Hwy. 2
Grand Island 68801
(308) 381-0559

*Altair Computer Center
611 N. 27th St.
Lincoln 68503
(402) 474-2800

*Team Electronics No. 027
1844 North St.
Lincoln 68510
(402) 435-2959

Team Electronics No. 149
The Mall/1000 S. Dewey
N. Platte 69101
(308) 534-4645

*American Computers
4442 S. 84th St.
Omaha 68127
(402) 592-1518

Byte Shop
8525 Park Dr.
Omaha 68127
(402) 339-7350

Computerland
11031 Elm St.
Omaha 68144
(402) 391-6716

Computers West
7423 Pacific So.
Omaha 68114
(402) 393-2100

Team Electronics No. 028
304 S. 72nd St.
Omaha 68114
(402) 397-1666

NEVADA

*Century 23
4566 Spring Mountain Rd.
Las Vegas 89102
(702) 876-7997

*Home Computers
1775 E. Tropicana No. 2
Las Vegas 89109
(702) 736-6363

Byte Shop
4104 Kietzke Lane
Reno 89502
(702) 826-8080

NEW HAMPSHIRE

Bitz'N Bytes Computer Ct.
56-B Pleasant St.
Concord 03301
(603) 224-8233

Audio of New England
777 So. Willow St.
Manchester 03103
(603) 668-4400

Computer Mart
170 Main St.
Nashua 03060
(603) 883-2386

Computerland
419 Amherst
Nashua 03060
(603) 889-5238

NEW JERSEY

Video World
Village Green Shopping Center
E. Brunswick 08816
(201) 254-4111

Brielle Computer Store
400 Higgins
Brielle 08730
(201) 528-7773

Computer Emporium
Bldg. 103-Ave. of Americas
Cherry Hill 08002
(609) 667-7555

Computerland
1442 E. Rt. 70-Pine Tree P.
Cherry Hill 08034
(609) 795-5900

Shore Computers
Circle Plaza
Eatontown 07724
(201) 544-0022

*Computer Nook, The
Pine Brook Plaza Rt. 46
Pine Brook 07058
(201) 575-9468

*Computer Corner of New Jersey
240 Wanague Ave.
Pompton Lakes 07442
(201) 835-7080

*Computer Encounter
2 Nassau St.
Princeton 08540
(609) 924-8757

*Stonehenge Computer Shop
89 Summit Ave.
Summit 07901
(201) 277-1020

*Shore Computers
3 Washington St.
Toms River 08753
(201) 341-2288

*Computer Mart of New Jersey
501 Route 27
Iselin 08830
(201) 283-0600

*Computerland
74 Elm St.
Morristown 07960
(201) 539-4077

*Computerland/Bergen City
Highway E65 Rt. 4
Paramus 07652
(201) 845-9303

NEW MEXICO

Computer Technologies
607-A San Mateo NE
Albuquerque 87108
(505) 266-9848

Southwest Computer Center
121 Wyatt Dr. No. 7
Las Cruces 98001
(505) 526-2842

NEW YORK

*Micro Systems Store Inc.
269 Osborne Rd.
Albany 12211
(518) 459-6140

Digital Designs
870 Willis Ave.
Albertson 11507
(516) 742-1800

*Computerland
1612 Niagara Falls Blvd.
Buffalo 14150
(716) 836-6511

*Computerland
79 Westbury Ave.
Carle Place Li 11514
(516) 742-2262

*Computer Shop of Syracuse
3470 Erie Blvd. East
Dewitt 13214
(315) 446-1284

*Computer Tree
409 Hooper Rd.
Endwell 13760
(607) 748-1223

*Computer Word Inc., The
422 Northern Blvd.
Great Neck 11021
(516) 487-7830

*Binary Orchard
S-5854 Camp Rd.
Hamburg 14075
(716) 648-7167

Applied Microcomputer Systems
Fairfield Plaza
Hudson 12534
(518) 828-3565

B C Communications Inc.
207 Depot Rd.
Huntington Station 11746
(516) 692-2735

*Computerland
225 Elmira Rd.
Ithaca 14850
(607) 277-4888

*Micro World Computer Store
435 Main St.
Johnson City 13790
(607) 798-9800

Byte Shop East
2721 Hempstead Turnpike
Levittown 11756
(516) 731-8116

Li Computer General Store
103 Atlantic Ave.
Lynbrook 11563
(516) 887-1500

Computer Micro Systems
1311 Northern Blvd.
Manhassett 11030
(516) 627-3640

*Eastern Tech Elect.
213 Broadway
Menands 12204
(518) 434-1412

Byte Shop East Inc.
130 E. 40th St.
New York 10016
(212) 889-4204

*Computer Factory
485 Lexington Ave.
New York 10017
(212) 687-5001

*Datel Systems Corporation
1211 Avenue of Americas
New York 10036
(212) 921-0110

Harmony House II
1167 York Ave.
New York 10021
(212) 751-9188

McGraw Hill Bookstore
1221 Avenue of Americas
New York 10020
(212) 997-4100

New York Astrology Center
127 Madison Ave.
New York 10016
(212) 679-5676

*Super Business Machines
95 Trinity Place
New York 10006
(212) 943-4130

Video Mart
514 W. 57th
New York 10019
(212) 246-4114

Communications Tech Group
448 Merrick Rd.
Oceanside 11572
(516) 536-5724

*ASD Home Computer Center
Van Wyck Plaza
Poughkeepsie 12603
(914) 473-9400

Micro Computer World
519 Boston Post Rd.
Pt. Chester 10573
(914) 937-6662

Custom Computer Specialists
208 Roanoke Ave.
Riverhead 11901
(516) 369-2199

*Computer Store/Rochester
2423 Monroe Ave.
Rochester 14618
(716) 244-5000

Home Computer Center
671 Monroe Ave.
Rochester 14607
(716) 244-6237

Video World
2716 Erie Blvd. East
Syracuse 13224
(315) 446-5357

Phone World Inc.
1028-A Union Rd.
West Seneca 14224
(716) 675-7016

Mr. Computer
Imperial Plaza Rt. 9
Wappingers Falls 12590
(914) 297-1223

*Audiotech Computer Shop
Route 28
West Hurley 12491
(914) 679-2559

*Computer Corner, The
200 Hamilton Ave./Mall
White Plains 10601
(914) 949-3282

Phone World International
4239 Transit Rd.
Williamsville 14221
(716) 633-2220

NORTH CAROLINA

Byte Shop
6341 Albemarle Rd.
Charlotte 28212
(704) 568-8100

Compushop Distributing
1937 S. Interstate 85
Charlotte 28204
(704) 399-4136

Computer Room
4231 Monroe Rd.
Charlotte 28205
(704) 377-9821

*Computerland/Charlotte
3915 E. Independence Blvd.
Charlotte 28205
(704) 536-8500

Computer Works Inc.
2514 University Dr.
Durham 27707
(919) 489-7486

Byte Shop
218 N. Elm St.
Greensboro 27401
(919) 275-2983

Carolina Business Computers
350 3rd Ave. NW Oakwood C
Hickory 28601
(704) 328-3939

Southern Computer Systems
105 E. Franklin St.
Monroe 28110
(704) 289-4080

*Byte Shop
1213 Hillsborough St.
Raleigh 27605
(919) 833-0210

NORTH DAKOTA

Team Electronics No. 030
2304 E. Broadway Box 1512
Bismark 58501
(701) 223-4546

*Team Electronics No. 026
1503 11th Ave. Box 1277
Grand Forks 58201
(701) 746-4474

*Team Electronics No. 032
209 11th SW Box 536
Minot 58701
(701) 852-3281

OHIO

*Basic Computer Shop, The
2671 W. Market St.—Fairlawn
Akron 44312
(216) 867-0808

*Compushop
16 Convention Way
Cincinnati 45201
(513) 651-2111

*Compushop
4816 Interstate Dr.
Cincinnati 45246
(513) 874-0600

Graham Electronics Supply
239 Northland Blvd.
Cincinnati 45246
(513) 772-1661

*Computerland/Cleveland East
1288 Som Center Rd.
Cleveland 44124
(216) 461-1200

Computerland/West
4579 Great Northern Blvd.
Cleveland 44070
(216) 777-1433

Computerland
6429 Busch Rd.
Columbus 43229
(614) 888-2215

Cybershop
1451 S. Hamilton Rd.
Columbus 43227
(614) 239-8081

*Personal Computers
3280 Morse Rd.
Columbus 43229
(614) 475-2609

*Computer Solutions
1932 Brown St.
Dayton 45409
(513) 223-2348

*Micro Computer Center/Dayton
7900 Paragon Rd.
Dayton 45459
(513) 435-9355

OKLAHOMA

Contemporary Sounds Inc.
432 S. Van Buren
Enid 73701
(405) 233-3883

*High Technology
1808 Liberty
Lawton 73501
(405) 353-4497

*Pro-Am Photo & Microcomp
513 W. Gray
Norman 73069
(405) 364-5992

Bits Bytes and Micros
2918 N. MacArthur Blvd.
Oklahoma City 73127
(405) 947-5646

*High Technology (Retail)
1611 NW 23rd St.
Oklahoma City 73106
(405) 528-8008

Team Electronics No. 086
1867 Penn Square
Oklahoma City 73118
(405) 848-5573

Team Electronics No. 115
7000 Crossroads Space 2010
Oklahoma City 73149
(405) 634-3357

*Computerland
10621 N. May Ave.
Oklahoma City 73120
(405) 755-5200

*High Technology
2601-D S. Memorial
Tulsa 74129
(918) 664-9754

OREGON

Byte Shop Northwest
3482 SW Cedar Hills Blvd.
Beaverton 97005
(503) 644-2686

*Team Electronics No. 151
1023 SW First
Canby 97013
(503) 266-2539

Computer Store Corvallis
2015 NW Circle Blvd.
Corvallis 97330
(503) 754-0811

*Computer Solutions
1170 Garfield
Eugene 97402
(503) 484-6376

*Custom Computer Corporation
259-2 Barnett Rd./K-Mart Plaza
Medford 97501
(503) 779-2983

F & H Sound Production
1516 SW Immigrant
Pendleton 97801
(503) 276-3772

Byte Shop
2033 SW 4th Ave.
Portland 97201
(503) 223-3496

*Camera & Computer Emporium
921 SW Morrison
Portland 97205
(503) 228-5242

*Team Electronics No. 129
2230 Fairground Rd. NE
Salem 97303
(503) 364-3289

*Computerland
12020 SW Main St.
Tigard 97223
(503) 620-6170

PENNSYLVANIA

*Byte Shop
1045 Lancaster Pike
Bryn Mawr 19010
(215) 525-7712

*Erie Computer Co.
2127 W. 8th St.
Erie 16502
(814) 454-7652

*T J Enterprises
Route 40E
Grindstone 15442
(412) 785-5311

Zelie Office Equipment
Northgate Center—Rt. 19 N.
Harmony 16037
(412) 452-9821

Newell's Valley TV
On the Diamond
Ligonier 15658
(412) 238-2381

Computerland/Harrisburg
4644 Carlisle Pike
Mechanicsburg 17055
(717) 763-1116

*Computer Workshop-Pittsburgh
3848 William Penn Hwy.
Monroeville 15146
(412) 823-6722

Television Parts Co.
518 5th Ave.
New Brighton 15066
(412) 846-3000

*Computerland
81 E. Lancaster Ave.
Paoli 19301
(215) 296-0210

Personal Computer Corp.
24-26 W. Lancaster Ave.
Paoli 19301
(215) 647-8463

University Business Machines
37229 Locust Walk
Philadelphia 19174
(215) 387-5955

*Computer House, The
1000 Greentree Rd.
Pittsburgh 15220
(412) 921-1333

*Compucon
3672 Marietta Ave./POB 30
Silver Springs 17575
(717) 285-3440

Computer Source
546 Penn Ave.
W. Reading 19602
(215) 378-1149

Computerland/Lehigh Valley
1457 MacArthur Rd.
Whitehall 18052
(215) 776-0202

RHODE ISLAND

Computer Store, The
1500 Oaklawn Ave.
Cranston 02910
(401) 463-8160

Digital World Inc.
329 Bald Hill Rd.
Warwick 02886
(401) 738-9447

SOUTH CAROLINA

*Byte Shop
1920 Blosson St./POB 5144
Columbia 29205
(803) 771-7824

CDS Micro-Computers Inc.
214 W. Evans St.
Florence 29501
(803) 669-3716

*Datamart Inc.
1901 Laurens Rd.
Ye Olde Towne Sq.
Greenville 29607
(803) 233-5753

SOUTH DAKOTA

Team Electronics No. 040
1101 Omaha St.
Rapid City 57701
(605) 343-8363

Computer Systems Design
2525 W. Main St. No. 216
Rapid City 57701
(605) 341-3662

*Team Electronics No. 011
613 W. 41st St.
Sioux Falls 57105
(605) 336-3730

Team Electronics No. 132
4001 W. 41st/Sioux Emp. Ma.
Sioux Falls 57106
(605) 339-2237

Team Electronics No. 019
223 9th Ave. SE
Watertown 57201
(605) 886-4725

TENNESSEE

*Rush Electronics Inc.
1315 Bluff City Hwy.
Bristol 37620
(615) 764-0831

*Eastern Microcomputer Store
5613 Kingston Park
Knoxville 37919
(615) 584-8365

Mid-So. Data Proc. Service
13 Emory Park
Knoxville 37917
(615) 523-3427

*Computerlab of Memphis
627 S. Mendenhall Rd.
Memphis 38117
(901) 761-4743

Opus 2
4284 Summer Ave.
Memphis 38122
(901) 682-2455

*Doc's Computer Center
1016 8th Ave. So.
Nashville 37203
(615) 254-5085

TEXAS

*Computer Corner
1800 S. Georgia
Amarillo 79109
(806) 355-5618

*Computerland
3300 Anderson Lane
Austin 78757
(512) 452-5701

*Computers 'N' Things
2825 Hancock Drive
Austin 78731
(512) 453-5970

KA Electronic Sales
8910 Research Blvd.
Austin 78758
(512) 458-2257

*Young Electronics Service
1808 'F' Brothers Blvd.
College Station 77840
(713) 693-8080

*Microcomputer Shoppe
5301 Everhart Sp. H
Corpus Christi 78411
(512) 855-4516

*Compushop
13929 N. Central Ave.
Dallas 75243
(214) 234-3412

*Computer Imagineering UN
2825 Valley View Lane No. 112
Dallas 75234
(214) 247-6393

Computerland/Dallas
8061 Walnut Hill Lane Ste.
Dallas 75231
(214) 363-2223

*KA Computer Store
9090 Stemmons Freeway
Dallas 75247
(214) 634-7870

*Compu Shop
6353 Camp Bowie Blvd.
Ft. Worth 76116
(817) 738-4442

Comtel Inc.
5970 Broadway Blvd.
Garland 75043
(214) 563-8428

KA Electronic Sales
1117 S. Jupiter
Garland 79042
(214) 494-2488

*Compu Shop
211-A FM 1960 W. Cypress St.
Houston 77090
(713) 893-2060

Computer City
12704 N. Freeway
Houston 77060
(713) 821-2702

*Computer Craft
3211 Fondren
Houston 77063
(713) 977-0664

Computer Center of Houston
2129 Westheimer
Houston 77098
(713) 527-8008

*Computerland
6439 Westheimer
Houston 77057
(713) 977-0909

*Computerland
Camino Village
17647 El Camino
Houston 77058
(713) 488-8153

Foleys Distribution Center
2103 Ernestine
Houston 77223
(713) 651-6863

Interactive Computers
7620 Dashwood
Houston 77036
(713) 772-5257

Kwik Kopy Computers
5225 Hollister Rd.
Houston 77040
(713) 939-1010

Microage Computer Store
1220 Melbourne Dr.
Hurst 76053
(817) 284-3413

Spinet Music
2819 North St.
Nacogdoches 75961
(713) 564-8311

*Computer Patch
3952 'U' E/42nd St.
Odessa 79762
(915) 563-3506

Byte Shop
1490 W. Spring Valley Rd.
Richardson 75080
(214) 234-5955

Computerland
1535 Promenade Center
Richardson 75080
(214) 235-1285

Concho Communications
3102 Knickerbocker Rd.
San Angelo 76901
(915) 949-8365

*Computer Shop/The
6812 San Pedro
San Antonio 78216
(512) 828-0553

*Computer Solutions
5135 Fredericksburg Rd.
San Antonio 78229
(512) 341-8851

Wichita Computer Systems
210 Free-Mar Valley
Wichita Falls 76301
(817) 723-6006

UTAH

Cooks Inc.
84 W. First North
Logan 84321
(801) 752-6432

*Computer Specialists Inc.
635 25th/POB 96
Ogden 84401
(801) 393-7375

Allen's Camera & Sound
36 N. University
Provo 84601
(801) 373-4440

*Computer Hub
5899 So. State
Salt Lake City 84107
(801) 252-5416

*Inkley Photo Centers
1984 So. State St.
Salt Lake City 84115
(801) 486-3921

Inkley's
137 S. Main
Salt Lake City 84115
(801) 328-0561

*Computerland/SLC
161 E. 2nd So.
Salt Lake City 84111
(801) 364-4416

*Computer Room, The
1515 S. 1500E
Salt Lake City 84105
(801) 466-8345

VERMONT

Computer Mart of Vermont
159 Pearl St.
Essex Junction 05452
(802) 879-6535

Electronic Applications
36 Merchants Row
Rutland 06701
(802) 773-3415

Macdata
733 Queen City Park Rd.
S. Burlington 05401
(802) 658-2161

VIRGINIA

*Computers Plus Inc.
6120 Franconia Rd.
Alexandria 22310
(703) 971-1996

Piedmont Computers
Box 197-B Rt. 250
Greenwood 22943
(804) 823-5232

Computer Works, The
Rt. 6 Box 65A
Harrisonburg 22801
(703) 434-1120

Chaney Computer Services
Tidemill Shop Center/Gloucester
Hayes 23072
(804) 642-2138

Tyson's Computer Emporium
1984 Chain Bridge Rd.
McLean 22102
(703) 821-8333

Home Computer Center
12588 Warwick Blvd.
Newport News 23607
(804) 595-1955

Computer Techniques Inc.
9207 Midlothian Turnpike
Richmond 23235
(804) 320-7933

Computer Place, The
2718 Colonial Ave. SW
Roanoke 24015
(703) 982-3661

Computer Workshop
5240 Port Royal Rd.
Springfield 22151
(703) 321-9047

*Computerland, DC
8411 Old Courthouse Rd.
Tyson's Corner 22180
(703) 893-0424

Home Computer Center
2927 Virginia Beach Blvd.
Virginia Beach 23452
(804) 340-1977

WASHINGTON

Computerland
14340 NE 20th
Bellevue 98007
(206) 746-2070

Omega Computer
839 106th Ave. NE
Bellevue 98004
(206) 455-1138

Western Micro Computer Center
4204 Guide Meridian
Bellingham 98225
(206) 676-9558

*Computerland
1500 S. 336 St. No. 12/Parkway C
Federal Way 98003
(206) 838-9363

*Korten's Inc.
1400 Commerce Ave.
Longview 98632
(206) 425-3400

Team Electronics No. 161
1024 14th St.
Longview 98632
(206) 425-3600

*Omega Computers
5421 196th Ave. NE
Lynnwood 98036
(206) 775-7585

Sounds Great
1301 B Riverside Dr.
Mt. Vernon 98273
(206) 424-4354

United Business Machines/NW
604 S. 3rd
Mt. Vernon 98273
(206) 336-9541

*ICM Computer Systems
716 1st Ave. So.
Okanogan 98840
(509) 422-6579

*ABS Computer Center
122 N. Capitol Way
Olympia 98501
(206) 943-9628

*Ye Olde Computer Shoppe
1301 Geo. Washington Way
Richland 99352
(509) 946-3330

Empire Electronics Inc.
616 W. 152nd
Seattle 98166
(206) 244-5200

*Omega Computers
1032 NE 65th
Seattle 98155
(206) 522-0220

*Electro-Mart Factory Dir.
E. 3611 Sprague Ave.
Spokane 99202
(509) 535-2451

*Personal Computers Inc.
South 104 Freya
Spokane 99202
(509) 534-3955

*Computerland
8791 S. Tacoma Way
Tacoma 98449
(206) 581-0388

Empire Electronics
894 Southcenter Mall
Tukwila 98188
(206) 246-6120

Cliff Miller's Cameras
2076 Yakima Mall
Yakima 98901
(509) 575-8806

*Cliff Miller's Cameras
22 No. 2nd St.
Yakima 98901
(509) 248-1585

Team Electronics No. 127
423 W. Yakima
Yakima 98902
(609) 453-0313

WISCONSIN

*Sound World
3015 W. Wisconsin
Appleton 54911
(414) 733-8539

Team Electronics No. 006
2321 E. Clairemont Parkway
Eau Claire 54701
(715) 834-1288

*Byte Shop/Milwaukee
6019 W. Layton
Greenfield 53220
(414) 281-7004

Team Electronics No. 017
1505 Losey Blvd. S.
Lacrosse 54601
(608) 788-2250

*American TV
2202 Beltline
Madison 53713
(608) 271-3322

*Blue Lakes Computing
438 No. Frances
Madison 53703
(608) 257-4424

*Computerland/Madison
690 S. Whitney Way
Madison 53711
(608) 273-2020

Team Electronics No. 008
3365 E. Washington Ave.
Madison 53704
(608) 244-1339

*Computerland/Milwaukee
10111 W. Capitol Dr.
Milwaukee 53222
(414) 466-8990

Team Electronics No. 015
7512 W. Appleton Ave.
Milwaukee 53126
(414) 461-7800

*Team Electronics No. 075
3301-3500 S. 27th St.-South
Milwaukee 53215
(414) 672-7600

*Video Experience
11521 W. North Ave.
Milwaukee 53214
(414) 453-2444

*Computerlab
218 No. Commercial St.
Neenah 54956
(414) 725-3020

Computerlab
311 Park Plaza
Oshkosh 54901
(414) 233-7480

*Colortron Computer Division
2111 Lathrop
Racine 53405
(414) 637-2003

*Team Electronics No. 128
Sunrise Plaza/Hwy. 8 E
Rhinelander 54501
(715) 369-3900

Team Electronics No. 018
2207 Grand Ave.
Wausau 54401
(715) 842-3364

WYOMING

Team Electronics No. 126
207 S. Montana
Casper 82601
(307) 235-6691

*Team Electronics No. 152
Cole Shopping Center No. 432
Cheyenne 82001
(307) 635-2836

D D Camera Corral
60 Broadway
Jackson 83001
(307) 733-3831

Team Electronics No. 018
2207 Grand Ave.
Wausau 54401
(715) 842-3364

AUSTRALIA

Computerland/Sydney
55 Clarence St.
Sydney NSW Austr.-2
TLX AA 24657

CANADA

*Computerland
678 Guelph Line No. 1
Burlington Ontario L7R 3M8
(416) 632-5722

Compushop
4014 Mac Leod Trail So.
Calgary Alberta T2G 3R7
(403) 243-4846

*Computerland
1212 1st St. SE
Calgary Alberta T2G 2H8
(403) 237-6423

Computer Shop,The
3515 18th St. SW
Calgary Alberta T2T 4T9
(403) 243-0301

*Compu Shop of Alberta
723 14th St. NW
Calgary Alberta T2N 2A4
(403) 283-0751

Galactica Computers Ltd.
10021 103rd Ave.
Edmonton Alberta
(403) 424-1755

Personal Computers
10991 124th St.
Edmonton Alberta T5M 0H9
(403) 455-5298

*Central Distributors Ltd.
350 Des Erables
Lacine Quebec H8Z 2P9
(514) 364-4222

Vulcan Computer Systems
20571 Fraser Hwy.
Langley British Columbia V3Z 4G4
(604) 530-8572

Compucentre (Eastside)
Galeries D'Anjou
Montreal Quebec
(514) 351-2798

Compucentre Computer Center
Place Bonaventure
Montreal Quebec
(514) 866-5944

Compucentre Computer Center
Place Ville Marie
Montreal Quebec H1J 1Z4
(514) 866-0475

*Cesco Electronics
4050 Jean Talon St. W
Montreal Quebec H4P 1W1
(514) 735-5511

Compucircuit Inc.
400 Dorchester Blvd. W
Montreal Quebec H2Z 1V5
(514) 866-9512

Futur Byte Computers
1191 Phillips Sq.
Montreal Quebec H3P 2Z1
(514) 861-3120

*Computer Innovations Ltd.
171 Slater St.
Ottawa Ontario K1P 5H7
(613) 233-8413

*Compumart
411 Roosevelt Ave.
Ottawa Ontario K2A 3X9
(613) 725-3192

Compucentre (Westside)
Fairview Shopping Ctr.
Pt. Claire Quebec
(514) 695-3620

Custom Computing Systems
1965 Hamilton St.
Regina Saskatchewan
(306) 242-7808

Micro Shack of W Canada
333 Park St.
Regina Saskatchewan
(306) 543-4079

Custom Computing Systems Inc.
122 2nd Ave. N
Saskatoon Saskatchewan S7K 2B2
(306) 242-7808

Light Computer Ltd.
Scarborough Town Ctr.
Scarborough Ontario M1P 4P5
(416) 296-2406

*Computerland
2180 Yonge St.
Toronto Ontario M4S 2B9
(416) 485-6700

Compucentre
20 Bloor St. E
Toronto Ontario
(416) 961-5978

Compucentre
218 Yonge St.
Toronto Ontario
(416) 598-1628

Byte Shop/Vancouver
2151 Burrard St.
Vancouver BC
(604) 736-0511

*Compushop
1500 W 0
Vancouver BC V6G 2Z6
(604) 687-5545

C G Computer City Inc.
153 Portage Ave.
Winnipeg Manitoba R3G 0V5
(204) 786-3381

Computerland/Winnipeg
715 Portage Ave.
Winnipeg Manitoba R3G 0M8
(204) 772-9519

C C Computer City Inc.
153 Portage Ave.
Winnipeg Manitoba R3G 0V5
(204) 786-3381

JAPAN

BMC Int'l/Uemachi Bldg. 3
Higashi-Ku
Osaka 540
768-7791

ESD Labs
6-16-3 Hongo Bunkyo
Tokyo

Kashiwagi Research Corp.
2-19-11 Aobadai Meguro-Ku
Tokyo
03-719-4641

KOREA

Korea Software Institute
138-107 Yongdoc-Dong
Dongdaemoon-Ku
Seoul

MEXICO

Microprocesadoras
Sierra Nevada 670
Mexico 10 DF
520-06-19

*Micro Computadoras SA
Ave. Popocatepetl-196 Loc
Mexico 13 DF
(905) 524-9549

*Indicates Level 1 Service Ctr.

apple computer inc.
10260 Bandley Drive
Cupertino, California 95014
(408) 996-1010

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