DAVID H. AHL

The First Decade of Pers

Question: What is: an Altair, a Sphere, a Jolt, an RGS, a Scelbi, an SWTPC, a Micro 440, a Mike 2?

Answer: They are all micro-computers available at the end of 1975.

Most of the companies who made these systems are not around today (SWTPC, Southwest Technical Products, is an exception); indeed, many lasted only two or three years. Right from the beginning, commercial success in the personal computing field has been elusive. Why is this, and how did personal computers get to where they are today? To answer these questions, we will have to run the clock back to the late 50's.

Up until the late 50's, most computers were room-filling monsters which required a small army of people to operate and maintain. Only eight companies were actually making general purpose computers: IBM, Univac, Honeywell, Burroughs, General Electric, RCA, NCR, and Control Data. IBM had already achieved a position of dominance, so this group was known as Snow White (IBM) and the seven dwarfs.

One-on-One Computers

However, in the late 50's several newcomers entered the field with smaller, cheaper machines known as minicomputers. The two leaders in this field were Digital Equipment Corp. (DEC) and Hewlett Packard (HP). For the first time, there were computers that could be operated by a single person. In a sense, these were the first personal computers although their price ($30,000 and up) put them out of reach of home users.

For the most part, makers of mainframes were selling single machines to end users and providing a great deal of handholding after-sale support. Minicomputer makers, on the other hand, were selling mostly in quantity to OEMs and value added resellers and providing very little after-sale support. The only exceptions were small groups at DEC and HP that sold systems to end users such as colleges and laboratories. Even so, the support provided was relatively minimal. Thus, although plans to sell computers to in-

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dividuals were occasionally proposed to various mini makers, such plans generally fell on deaf ears at the corporate level.

Thus, the personal computing revolution was destined to come from outside the established corporate environment. The seeds of this revolution were scattered all over the country. Although today we may think of the personal computer industry as being centered in Silicon Valley, in 1975 the active players were located in Bountiful, UT; Huntsville, AL; San Antonio, TX; Albuquerque, NM; Northbrook, IL; Milford, CT; and Santa Clara and Los Altos, CA.

What did it require to be an active player in the early 70's? Not much, as it turns out. A good knowledge of circuit design, enough money to build a working prototype and buy a few ads in *Byte*, and a partially empty garage. The typical company founder in those days was an engineer (usually self-taught, but occasionally with formal training). Some of the early designs were clean and efficient, but more often the designs were considerably short of perfection and had jumper cables and "fixes" all over the boards.

In many cases, the actual production of a computer or peripheral was financed by the orders of the first customers. The typical scenario went something like this: Engineer has wonderful idea for computer (or peripheral), designs it on paper, builds a kludgy prototype, and places ads for it. Customers send in orders with checks (or bankcard number). Engineer uses money to buy parts and sets up assembly line in garage. Almost without exception, the computer designers were poor businessmen and ran into trouble making the shift from entrepreneur to business executive. Some did it with more grace than others, but the low survival rate of the pioneering companies in the field is evidence that running a successful company requires a different set of talents than designing a computer.

Nevertheless, these pioneers accomplished a tremendous amount. You may think that the Apple II (1977) was the first integrated com-

puter. Not so; the Sphere computer (1975) designed by Mike Wise contained the processor, keyboard, and display all in a case that looked very much like Hazeltine terminal or TRS-80 Model III. The Processor Technology Sol (1976) designed by Lee Felsenstein did not include the display, but it had the processor and keyboard in a single unit that was able to accept plug-in S-100 bus boards.

The Kit Era

But we're getting ahead of ourselves. Let's take a close look at several early personal computers available in 1975. One of the first, and certainly the most commercially successful, was the Altair 8800 designed by Ed Roberts of MITS. The computer itself was the same size and shape as existing minicomputers (19" x 19" x 10") and housed a motherboard, a front panel with switches and lights which indicated the contents of registers, a power supply, and up to 16 slots for the processor board, memory, and peripherals. The basic computer, in kit form, cost $429; assembled and tested, it cost $621.

It came without memory or interfaces. A 1K board cost $97, and a 4K board went for $264. Interface boards cost between $92 and $128 each. The only mass storage available was tape cassette; hence hobbyists became adept at listening to the horrible rasp of digital data on tape to determine the correct volume and tone settings for their recorders. MITS sold two types of terminal for the Altair, a Comter (CRT) kit for $760 and an ASR-33 Teletype for $1500. Most hobbyists sought out used teletypes which could be had for as little as $300 depending upon the condition.

The cheapest Altair configuration that could run anything other than machine code was an 8K system that MITS sold at a special $995 price. However, to that you had to add a cassette interface and recorder, and a terminal. Hence the total price of an 8K Basic-speaking computer kit was about $1900. Today, that sounds outrageous, but MITS sold thousands of these systems to hobbyists across the country.

The Altair used the S-100 bus, so named because it had 100 pins. In a very wise decision, Ed Roberts brought every signal of the 8080 microprocessor out on the bus; hence it was relatively easy to add memory and pe-

ripherals. As a result, companies like Godbout, Tarbell, Cromemco, Processor Technology, CMR, Dutronics, and Polymorphic brought out a wide variety of boards that plugged into the S-100 bus. Several of these companies would go on to manufacture computers —all based on the S-100 bus.

The only other early machine to use the S-100 bus was the IMSAI 8080, announced in December 1975. The IMSAI was virtually identical to the Altair except it had a much cleaner design. The subminiature toggle switches on the Altair front panel were replaced on the IMSAI by rocker switches. It had a much larger power supply, and the board layout was cleaner. Indeed, within a year, the IMSAI was actually outselling the Altair.

As people started adding peripherals to their Altairs, the limited capacity of the power supply reared its ugly head. Hence, Howard Fulmer brought out a beefy power supply to replace the original Altair unit. Ed Roberts had been attacking the board compatible companies, calling them parasites, so in a burst of honesty, Fulmer called his company Parasitic Engineering.

The Scelbi-8B was designed by Nat Wadsworth prior to the Altair. It was built around the 8008 chip, a less powerful processor than the 8080. A 1K machine in kit form was priced at $499. Unfortunately, Nat suffered several heart attacks in this period, dropped the computer project, and went into publishing software and books.

Mike Wise's Sphere 1 was an all-in-one computer built around the Motorola 6800 mpu. With 4K of memory, it sold for $860 in kit form, and $1400 assembled. Sphere was one of the few companies to offer floppy disk drives (8"). However, at a kit price of $6100 and assembled price of $7995, the company didn't sell many dual floppy disk Sphere 4 systems.

Another system built around the 6800 was the Southwest Technical Products 6800. This machine used an S-50 bus and was one of the first systems to incorporate a loader and mini-operating system (Mikbug) in ROM. With 2K of memory and a terminal interface, the kit sold for $450. SWTPC also made a terminal kit for use with any TV set priced at only $175. Dan Meyer's SWTPC is one of the few survivors from the early days. The company is still making 6800 and 68000-based systems, the majority of

which are sold on an OEM basis to Fisher Scientific.

Like the Scelbi-8B, the Micro 440 was designed around a much less powerful chip than the 8080, the 4004. A kit with 256 bytes of memory cost $275. The Micro 440 never caught on, and its manufacturer, Comp-Sultants, was one of the first casualties in the field.

RGS sold primarily ICs and components, but in mid '75 announced a kit based on the 8008. It never went

> *People were hungry for information, and new clubs were springing up like dandelions.*

anywhere, and shortly thereafter RGS also went out of business.

Bare bones computer kits on a single board were quite popular in 1975, primarily because of their low price. In general, these units consisted of an mpu, less than 1K of memory, a numeric keypad with a few extra keys, say 20 total, and little else. Some of those available were the Martin Research Mike family, Microcomputer Associates Jolt, Iasis (Computer in a Book), Hal MCEM-8080, National Semiconductor SC/MP, and MOS Technology KIM-1.

Going into 1975, there were just two companies active in the microcomputer field: Scelbi and MITS. By the end of the year, the dream had spread like wildfire and there were 27 manufacturers, two magazines (*Creative Computing* and *Byte*), and ten user groups and clubs. Also, in 1975, Dick Heiser opened the first retail computer store in Los Angeles, and Paul Terrell opened the first Byte Shop in Mountain View. Bill Gates and Paul Allen wrote a Basic interpreter for the Altair, and Adam Osborne self-published *An Introduction to Microcomputers*. But the fun was just beginning!

So far, all the successful computers had been built around the Intel 8080 or Motorola 6800 mpus. However, Federico Faggin, designer of the Intel 4004, had broken off from Intel to form Zilog. Their first mpu was the Z80, a faster, more powerful version of the 8080. Meanwhile, MOS Technology had introduced another chip with

an extended instruction set, the 6502. Chuck Peddle of MOS then decided to sell 6502 chips at the 1976 Wescon (a West Coast electronics trade show) for $20 each. The chips of other companies were priced much higher at the time; furthermore, most semiconductor manufacturers sold only to established accounts in large quantities.

One of the customers for Peddle's $20 6502 was Steve Wozniak, then a technician at Hewlett Packard. He had already designed an inexpensive home terminal that used a TV set for a display and the game of Breakout for Nolan Bushnell at Atari, but he had not designed an entire computer. Interestingly, he did not start with the computer itself, but chose first to write a Basic language interpreter for the 6502. When he finished that, he set out to make a computer on which to run it. A few weeks later, in the spring of 1976, he unveiled his computer, the Apple I, at the Homebrew Computer Club.

Talk about a bare bones computer! The Apple I had no keyboard, no power supply, and no case. But Steve Jobs and Paul Terrell were impressed with the machine. Jobs was impressed enough to form a company to sell them, and Terrell was impressed enough to order 50 units for his Byte Shop. There was just one problem—Terrell wanted the machines assembled. To pay for a PC board design, Jobs sold his Volkswagen, Woz sold his two HP calculators—their most valuable possessions. Woz kept his job at HP while Jobs hired his sister and

Dan Kottke, a college student, to assemble the units. They were working under excruciating time pressure since all the parts they bought were on 30 days net; that meant they had to deliver the 50 machines to Terrell within 30 days. Terrell got his machines on the 29th day.

In the next few months, Jobs sold another 150 or so computers—mostly to stores in the Bay Area. The price for this little wonder was $666.

By the end of the summer, Woz was working on a design for the successor to the Apple I. It was to include a keyboard, power supply, and plug-in slots for peripherals like those found on the S-100 and S-50 bus machine. But perhaps the most important thing that happened to separate Apple from the rest of the field was not the computer—good as it was—but A.C. "Mike" Markkula. An engineer by training, Markkula also had solid business experience gained from time with both Intel and Fairchild during the meteoric growth period of both companies. Intel stock options had made him a millionaire, and at age 34, Markkula had retired.

One day, however, Markkula paid a visit to the garage of Jobs and Woz and was hooked. A few months later, Markkula put $91,000 of his own money into the venture and assumed an active role in planning and management. He hired Mike Scott as president and set out to get Apple listed in the Fortune 500 within five years.

Meanwhile, other designers were attracted to these two new chips as

well as to the older ones. 1976 saw the introduction of Harry Garland's Cromemco Z-1 (a Z80-based assembled system with 8K, serial I/O, and resident monitor for $2495). Prior to that, Cromemco had been making some of the most interesting add-on boards for S-100 bus machines—the TV

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dazzler, digital to analog converter (allowed the use of joysticks), bytesaver, and camera/digitizer.

Processor Technology introduced the Sol Terminal Computer, the Cadillac of small computers with solid walnut sides and heavy metal case. The basic machine for $995 (kit) came with 1K of RAM, 1K of video display memory, 1K of ROM, 85-key keyboard, serial and parallel interfaces, cassette interface, "personality" module, power supply, five slots for S-100 boards, and the Basic language on cassette. Processor Tech also introduced 16K RAM cards ($529 assembled) and a dual 8" disk system ($1895 kit or $2295 assembled). This was a rugged machine, but unfortunately Felsenstein had not designed it for ease of assembly. Thus, as the market shifted from kits to assembled computers, the factory assembled Sol was overpriced compared with the competition. This, coupled with the low reliability of the Helios disk system, eventually spelled the downfall of Processor Technology.

Another Cadillac design was that of Robert Suding's Digital Group computers. The Digital Group machines were among the first that could use different processors (8080, Z80, 6800) almost interchangeably, an interesting concept that crops up from time to time but that has never really caught on.

As the price of ROM and PROM chips continued to decline, manufacturers started building in loaders, monitors, and rudimentary operating

Key players in the early days of Apple included Steve Wozniak, Mike Scott, and Mike Markkula.

systems to make their machines easier to use. The Poly 88 from PolyMorphic Systems, Xitan from Technical Design Labs, Challenger from Ohio Scientific, Intecolor 8001 from Intelligent Systems, and several others all used this approach.

Also, in 1976, manufacturers were starting to offer an interesting range of S-100 boards and peripherals. Of course, memory boards were the bread and butter items with board manufacturers gaining an advantage by charging lower prices than the computer makers. In the add-on board market, companies like Seals, Solid State Music, Mini Term, Vector Graphic, Tarbell, Electronic Control Technology, and Morrow all made the scene. Computalker introduced a speech synthesizer; Comtek, a real time clock; and Percom, Midwest Scientific, and North Star all introduced floppy disk add-ons. Also in 1976, Gary Kildall's new company, Digital Research, announced the first advanced disk operating system, Control Program for Microcomputers, or CP/M. By the end of the year, the number of companies active in the field had topped 100.

Although there were 30 or so computers and a wide assortment of peripherals available, there was little software. Cromemco offered four programs to show off their TV Dazzler, and most manufacturers offered one or another version of Basic. However, there were no companies specifically in the software business, and most users

Howard Fullmer (L) and Gary Fitz (R) of Parasitic Engineering show off their new Equinox 100 computer at the first West Coast Computer Faire, April 1977.

typed in programs from magazines and books.

People were hungry for information, and new clubs were springing up like dandelions with 132 in existence by the end of 1976. Some of the club newsletters were decidedly professional—among them, Interface put out by the Southern California Computer

Society and the newsletter of the Amateur Computer Group of New Jersey. In addition to newsletters and meetings, clubs started holding conferences and shows, although honors for the first big microcomputer conference go to David Bunnell who organized the World Altair Computer Conference in March 1976. It was followed two months later by the first Trenton (NJ) Computer Festival organized by Sol Libes and the first Midwest Area Computer Club Conference which drew a staggering 4000 people.

The first national show was put together by John Dilks and held in a seedy hotel in Atlantic City, NJ. Nevertheless, the enthusiasm ran high, and attendees bought everything in sight. People were hungry for any information they could lay their hands on; the technical sessions were packed and magazines like *Creative Computing, Byte,* and the recently announced *Kilobaud* took thousands of subscription orders on the show floor.

The Move Toward Packaged Systems

Although most manufacturers offered their systems in both kit and assembled versions, the majority of their customers opted for the kit versions. After all, the kit was usually 25% or 30% cheaper than the assembled version—a significant amount considering the cost of a system in those days. However, three systems were announced in 1977 which swung the pendulum in the direction of assembled systems. Two systems were announced simultaneously on April 15 at the West Coast Computer Faire, the Apple II and the Commodore Pet, while the third, the TRS-80, was announced 3½ months later on August 3 in New York. Deliveries of all three machines started practically simultaneously in the fall of 1977.

I talked to Mike Markkula at the West Coast Faire. He explained the concept of Apple, "We want to be *the* computer company, not the small business computer company or something else—just *the* personal computing company. That's the reason you see a molded plastic case, Basic in ROM, and color graphics." I asked about memory, and Markkula opined the "4K of user space is more than adequate." At that time, an assembled Apple with 4K, two game paddles, and carrying case cost $1298.

The First West Coast Computer

Faire put together by Jim Warren was an event to be remembered. Warren had figured on an attendance of 7,000 to 10,000. However, by 9:00 a.m. Saturday morning, two three-abreast lines stretched around the Civic Auditorium in San Francisco. It took over an hour to reach the door. By the time the Faire closed on Sunday, more than 13,000 people had jammed the aisles to talk to blue jean and T-shirt clad exhibitors. At one point the crush

> *Few people paid much attention to who was buying personal computers.*

around the *Creative Computing* booth was so dense that people in back climbed on the shoulders of friends and waved dollar bills to get copies of the magazine. Other booths were equally mobbed as were the sessions given by speakers like Carl Helmers, Ted Nelson, Lee Felsenstein, and me. Virtually every active person and company in the industry was there, and from then on the West Coast Faire was the leading show of the industry.

At that time, the main conference/trade show of the mainframe/minicomputer industry was the National Computer Conference sponsored by AFIPS (American Federation of Information Processing Societies). In 1976, I convinced the NCC organizers to set aside one day for personal computing sessions. I put together the sessions and invited speakers like Frederick Pohl (a science fiction author), Bill Mayhew of the Boston Children's Museum, and Scott Adams (who would later found Adventure International). The day was a great success, but it was not until 1978 that NCC formally recognized the importance of personal computers and included a Personal Computing Festival as a major part of the conference. Three years later when the personal computing portion of the conference equaled the size of the rest of it, AFIPS abolished it and rolled everything into one.

As mentioned previously, 1977 was really a turning point from kits to assembled systems. Nevertheless, in the article, "Selecting a Micro," in *Creative Computing* in July, we discussed the five types of systems then available.

The least expensive were PC boards with 1K or less of memory and no I/O like the Jolt and SC/MP. Next were all on one board kits like the KIM-1, Intercept Jr., and Mike-3. A box with lights and switches was a big jump up; these included the Altair, IMSAI, and ETC-1000. Next were boxes with built-in loaders in ROM like the SWTPC 6800, PolyMorphic Poly-88, and Wave Mate Jupiter II. All-in-one assembled systems included the Compucolor 8001, Apple II, and Commodore Pet 2001. Of course, many of these were still sold in kit form. The powerhouse of electronic kits, Heathkit, also joined the fray with its H8 and H11 computers and H9 terminal.

Also making the scene in 1977 were five new magazines: *Personal Computing, Kilobaud* (later, to evolve into *Microcomputing*), *ROM* (survived nine issues and was merged into *Creative Computing*), *Dr. Dobb's Journal,* and *Microtrek* (survived only two issues). Also, *SCCS Interface* had evolved into a slick magazine that would become *Interface Age.*

Other interesting things proposed in 1977 included Hal Shair's idea for coin operated computers in public libraries. (The cost of computers dropped so fast that people could afford their own machines, and the idea died a quiet death.) A national computer club was proposed, and several organizing meetings were held, but the scheme had little to offer that users could not get from magazines and local clubs; it also died. Some researchers at Stanford and NJIT were promoting the idea of computer conferencing, but it was not until four or five years later
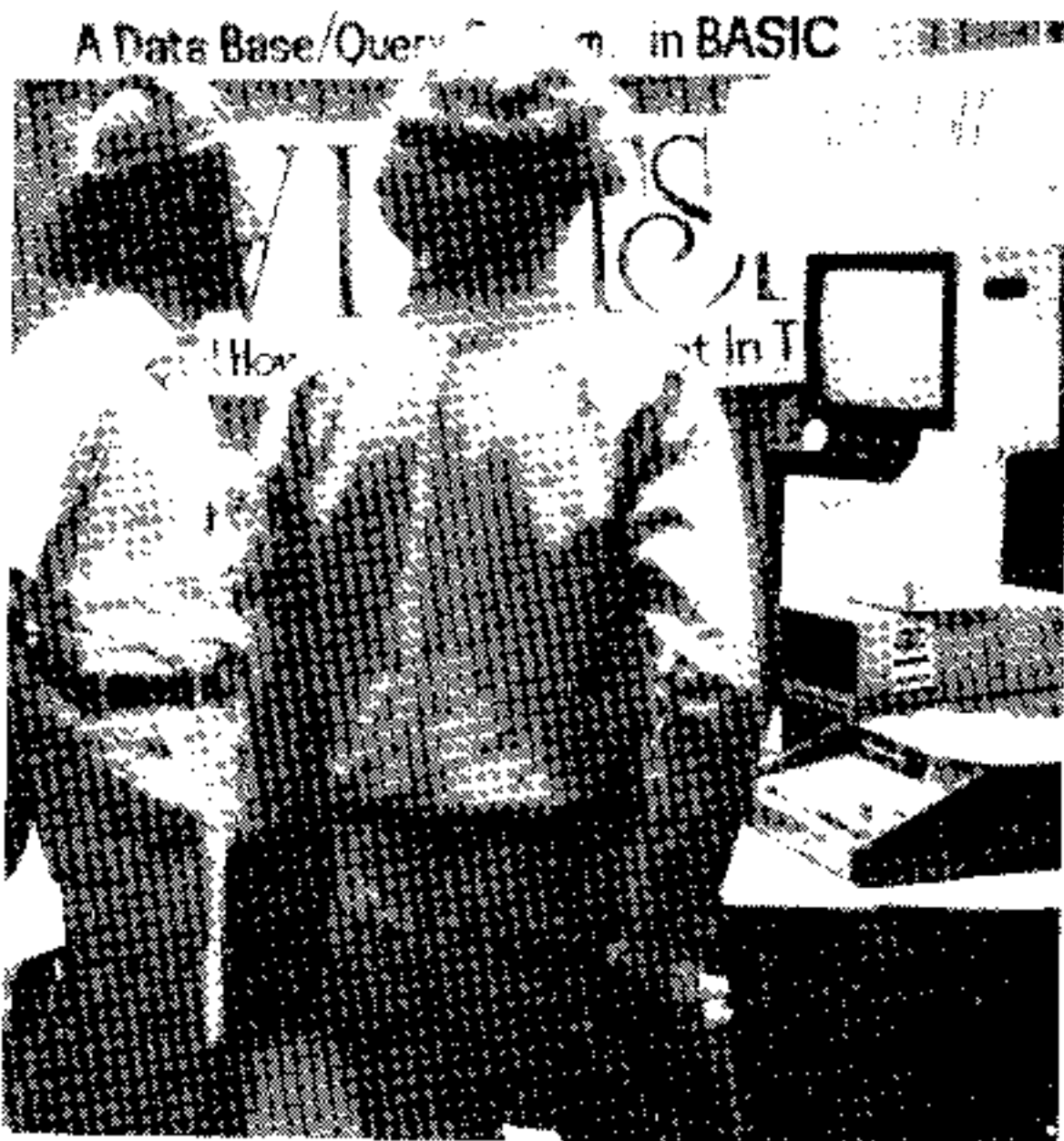
Lyall Morrill, Jr. (L) of Computer Headware showing his WHATSIT database package on a Sol at PC'78.

that the price of modems came down enough to make the idea practical. Now, of course, CompuServe, The Source, and innumerable local bulletin boards demonstrate the practicality of the idea daily.

And Then There Was Software

In December 1977, there were only two advertisers of applications software in *Creative Computing*. One, Scientific Research, offered four 8" CP/M floppy disks, each containing a variety of text-oriented programs of widely varying quality. The other, Software Records, offered a 12" LP record of Basic programs that could be played "through your Tarbell, Kansas City, or Altair cassette interface." Of course, several book publishers—notably Sybex, Scelbi, and Creative Computing Press—were selling programs in book form. Also, in late 1977, Microsoft— then still in Albuquerque—placed its first ads for 4K and 8K Basic ($350) and Fortran ($500).

However, by mid-1978, scores of companies, offering an incredible array of software offerings, had sprung up across the country. Personal Software (*Microchess* by Peter Jennings and *Bridge Challenger*), Program Design Inc. (educational programs), Connecticut Microcomputer (word processing), *Cursor* (cassette magazine for the Pet), Adventure International (adventure games), Rainbow Computing (assorted Apple programs), Sensational Software (games and education), Computrex (utilities and games), Softape (speech phone tables), AJA (utilities), PRS (utilities), MicroPro International (word processing, sorting), Technical Systems Consultants (word processing, utilities), Tarbell (languages, utilities), Structured Systems (business), Lifeboat Associates (utilities), Smoke Signal Broadcasting (languages, utilities), Graham-Dorian (business), and Instant Software (games). Quick quiz: how many of these companies are still around today? Clue: you can count them on one hand.

Also in mid-1978, both Apple and Radio Shack announced 5¼" floppy disk drives, a move which threw open the floodgates for future software development. Then, in the fall of 1978, Dan Bricklin got together with Bob Frankston to produce the now legendary *VisiCalc*. Shown at the West Coast Computer Faire in April 1979 and NCC in June, *VisiCalc* became the first software package that would jus-

tify the purchase of an entire computer system.

There were several other milestones in the 1977-79 period. One, first uncovered by *Creative Computing*, were the scams pulled off by Norman Hunt (a.k.a. David Winthrop). In June 1977, *Interface Age* carried full page ads for boards and terminals from Data Sync Corp. in Santa Maria, CA. A month later, the same ads appeared in *Byte* and *Kilobaud*. The prices were irresistible, and the orders rolled in. However, it was all an elaborate con game, and Hunt was arrested and sent to prison for grand theft in late 1977. He escaped in February 1978 and shortly thereafter set up World Power Systems in Tucson, AZ.

This time Hunt was shooting for bigger stakes, and placed six-page inserts in *Interface Age, Byte, Kilobaud,* and, months later, *Creative Computing*. These ads showed all types of boards, disk drives, and memory add-ons, all priced about 20% less than the competition. The photos were of actual products of other companies with the manufacturer names stripped out and the negatives reversed. Realizing from a phone call that he had been uncovered, on April 25, 1979, Hunt loaded up a van with equipment, closed out his bank account, and left Tucson. As far as we know, he is still on the loose.

Also, during this period, the rapid growth of the personal computer industry lured several consumer electronics manufacturers into the business. Thus, we saw such products as the Bally Arcade, APF PeCos and Imagination Machine, Exidy Sorcerer, Interact, Video Brain, and, in mid-1979, the Texas Instruments TI 99/4 and Atari 400 and 800. Bally, APF, and Video Brain went straight to mass merchandisers completely bypassing computer stores and magazines. They even skipped the personal computer shows and exhibited instead at the Consumer Electronics Show (a trade show for mass retailers). As a result, they were the first to fail. TI and Atari had considerably more staying power due to a broader marketing approach and better financing.

The Market Starts to Divide

Through the end of 1978, few people paid much attention to who was buying personal computers. The shows were a hodge podge of exhibitors— chip houses, clubs, parts distributors, bookstores, T-shirt vendors, and every

imaginable type of computer, peripheral, and software manufacturer. Indeed, at one of the early West Coast Computer Faires, Lyall Morrill of Computer Headware wore a beanie with a propellor on it in a booth with hand lettered signs to promote his database program, WHATSIT (Wow! How'd All That Stuff Get In There?). The very next booth was occupied by IBM. The booth had fancy chrome display racks to show off the IBM 5100, but the three men in pinstripe suits mostly stood around watching hordes of customers, checkbooks in hand, line up at Morrill's booth to buy his program.

As I said, manufacturers didn't much care who was buying their wares. Just about everything was selling, and if a product turned out to be a dog, the manfacturer would simply throw in the sponge and start something else or join a more successful company. The cost of entry into the business was relatively low, and business plans were practically unheard of.

However, by 1979, things were changing. Venture capitalists discovered the industry and, in exchange for money, imposed some management discipline on the companies in which they invested. Second, larger manufacturers such as Radio Shack and TI were behaving like professionals. And third, word processing packages and *VisiCalc* were proving to business people that microcomputers were a justifiable expense.

As a result, by 1980, the industry started to take on a completely new character. Sure, there were still scores of garage shops and two-man operations—there still are today—but by and large the major players were beginning to conduct their business in a highly professional manner. For many companies this meant focusing on a specific type of customer. Thus, manufacturers of S-100 bus systems tended to move toward laboratory and business customers while manufacturers of less flexible, packaged systems moved toward home and educational customers.

This division was even more pronounced among software manufacturers. Although mid-1979, Personal Software, one of the industry leaders, had games, educational packages, and business software, by 1981 they had changed their name to VisiCorp and had all but dropped anything but business packages. Likewise, Programma and Automated Simulations (now Epyx) went heavily into games, while Edu-Ware and PDI specialized in education. (Brief aside: Programma was founded by Dave Gordon who over-expanded and bought every program in sight. Caught in a cash crunch, he sold out to Hayden. Disgusted with Hayden's financial controls, he walked out on his contract several months later and founded Datamost. In 1982, Datamost had more games on the market than anyone else, but in '83, they pulled more games than they introduced.)

Although the most costly hardware and software systems were targeted at business applications, in 1980, the really big volume was in games.
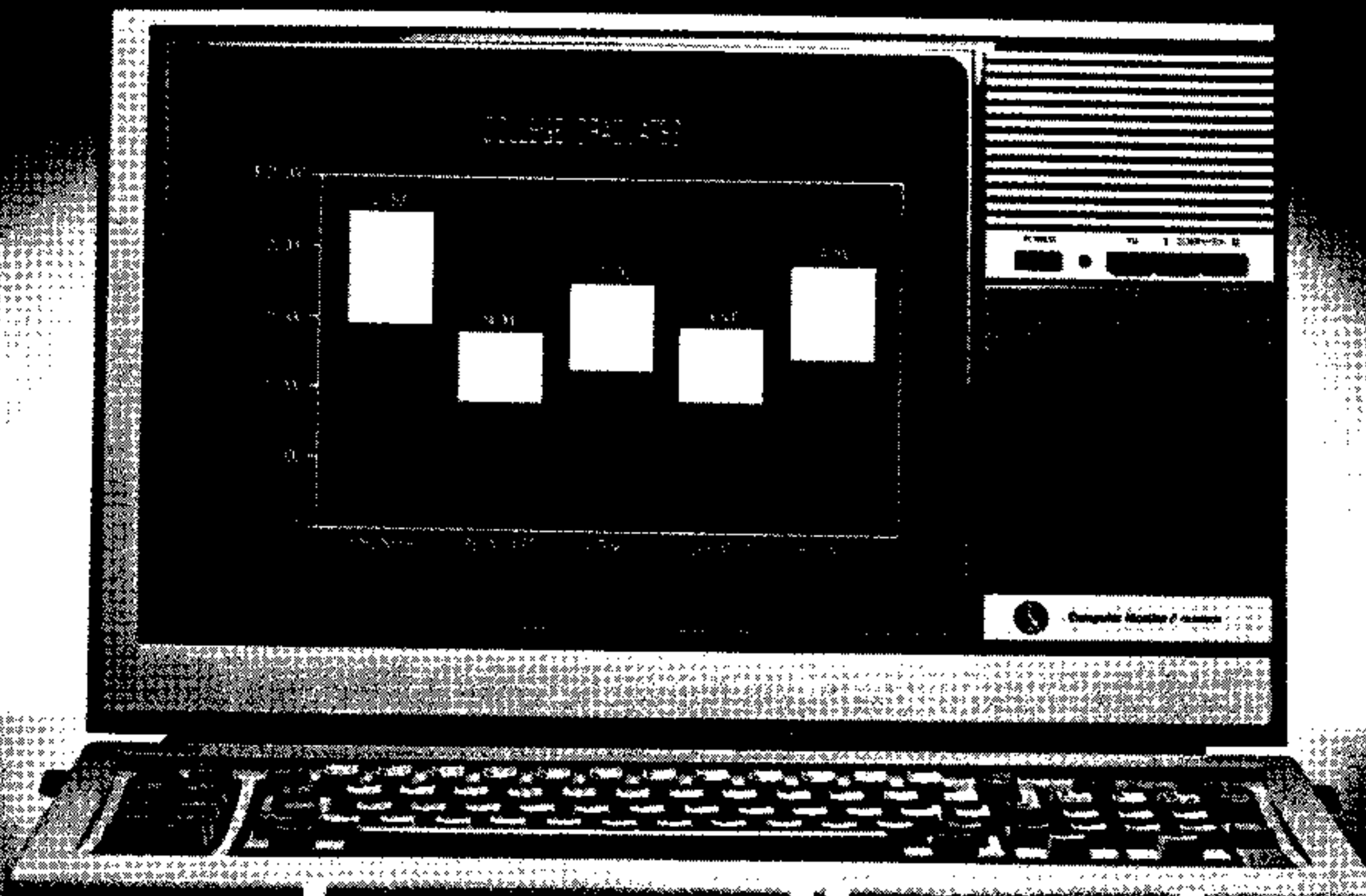
over competitive packages. The fallout has not come as quickly to these manufacturers since most of the packages are priced at $100 or more, but the signs of a shakeout are already evident.

The Entry of IBM

Going into 1981, there was no clear winner among suppliers of business systems. Major players included Apple, Tandy, Exidy, and even Commodore at the low to medium end. Higher up were North Star, Cromemco, Ohio Scientific, Intertec, Vector Graphic, Hewlett Packard, NEC, Midwest Scientific, and a large group of S-100 bus manufacturers. With the exception of the S-100 makers, most of whom offered the CP/M operating system, the others offered a bewildering array of incompatible operating systems: TRSDOS, Apple DOS, Flex, and other proprietary systems.

Applications software, too, had to be customized for each different hardware combination. For example, Michael Shrayer wrote no fewer than 78 different versions of his *Electric Pencil* word processing package for various mpus, operating systems, and video display boards. However, most software producers did not go this far and offered packages for only a limited number of machines.

More than anything else, success in the business market was determined by the strongest computer store in a local area. So much customizing was required between computers, peripherals, and software, that knowledgeable personnel were required to put a system together as well as provide after sale training and handholding. Indeed, stores became so important that several large stores and chains started buying boards and boxes and assembling their own systems. Among them were Prodigy from Computer Mart of New Jersey, Archive from GRC, and Vista from Advanced Computer Products.

However, all this was to change as a result of an announcement on August 12, 1981 at the largest press conference hosted by IBM since the introduction of the 360 in the mid 60's. The response by the press, by store owners, and by customers to the IBM PC was immediate and overwhelming. Our report in *Creative Computing* summed it up. "IBM has done just about everything right."

Looking back we can see some flaws—the limited 64K memory, single

Paul Allen (L) and Bill Gates (R) of Microsoft with computers manufactured by some of their customers, including Radio Shack, Apple, NEC, Datapoint, and Commodore.

density disk drives, and expensive color graphics board—but at the time it looked great. People enthused over the 16-bit mpu, detached keyboard, 80-character text resolution, PC-DOS operating system, wide choice of applications software, and seemingly excellent documentation.

Although people were enthusiastic about the IBM PC very few people realized at the time the profound effect it would have on the market. In fact, there were even detractors; from the comments of industry pundit Adam Osborne at the West Coast Computer Faire in March 1982, one would have thought the entry of IBM was a non-event. (Osborne, of course, had introduced the Osborne 1 just one year earlier at the same West Coast Faire.) And Apple ran a full page ad in *The Wall Street Journal* with the headline, "Welcome IBM." Clearly, Apple did not regard IBM as a major threat.

At the risk of repeating an oft but seldom correctly told story, here is how IBM wound up with PC-DOS instead of CP/M. Prior to their first meeting with Bill Gates of Microsoft in July 1981, IBM, as is their custom, asked Gates (and Steve Ballmer) to sign a non-disclosure agreement. Gates couldn't see much point in it, but signed. After a second meeting in August, Gates signed a consulting agreement with IBM to suggest how the companies could work together—specifically to implement Microsoft Basic on the PC.

Demonstrating their lack of familiarity with the microcomputer market, IBM asked Gates if he could also sell them the CP/M operating sys-

tem. Gates explained that he didn't own CP/M but that Gary Kildall of Digital Research was the man to see. Gates called Kildall and alerted him to the impending visit from IBM, which was then set up for the next day.

The next day, Kildall flew off on some previously scheduled business and asked Dorothy McEwen, who handled licensing agreements with hardware manufacturers, to deal with the IBM people. She greeted them but refused to sign the non-disclosure agreement because she felt it would put Digital Research in a vulnerable position. Company lawyer Jerry Davis agreed with her. The IBM representatives were rather miffed, turned around and flew back to Seattle where they asked Gates if he could supply an operating system as well as Basic.

Thus it was that Bill Gates got together with Tim Patterson at Seattle Computer Products and converted SCP's new operating system for the 8086, SCP-DOS, to MS-DOS for the 8088 in the IBM PC (IBM calls it PC-DOS). Once the specs of the operating system were fleshed out, IBM started making the rounds of applications software developers to arrange for conversions of software like *VisiCalc, EasyWriter,* the Peachtree business packages, and even Microsoft's version of *Adventure.*

IBM started shipping in September 1981 and by the end of the year had shipped 13,000 machines, a reasonable, but not staggering volume. However, over the next two years, IBM's volume kept climbing, and by the start of 1984 they had shipped an estimated 500,000 machines.

Right from the start, Apple instituted a policy of publishing both internal hardware and systems software specifications. This "open architecture" policy attracted third party vendors to market a wide variety of software and peripherals—much more than Apple could have produced internally. This seemed like a good approach to IBM and, in a major departure from corporate policy, they made available the specs of the PC to outside parties. As a result, software and peripheral manufacturers fell over themselves in a rush to offer add-ons and software for the PC.

Partially as a result of this great outpouring of software and partially because of the three magic letters, I, B, and M, other manufacturers beat a path to the door of Microsoft for its MS-DOS operating system. Less than one year after the announcement of the PC, the first PC compatibles were announced and, by 1984, there were nearly a dozen from which to choose. In addition to the compatibles, manufacturers of scores of other new 16-bit computers (Wang, DEC, TI etc.) also chose to use MS-DOS.

With this dominance of MS-DOS for 16-bit machines, things looked a bit glum for Digital Research since CP/M-86 (the 16-bit version of CP/M) was stalled in its tracks. Nevertheless, looking ahead to multi-tasking and multi-user systems, Digital Research announced Concurrent CP/M (recently renamed Concurrent DOS), a system that appears to have taken an early lead for multi-tasking applications.

As manufacturers increasingly followed in IBM's footprints, what happened to all the S-100 and other business computer manufacturers of pre-IBM days? Sad to say, the majority of them didn't make it. However, this shakeout—or competition, as we prefer to call it—was not limited to the high end of the market.

The Great Price War

In 1980 the dividing line between home and business systems was a murky one. Home systems tended to be priced from $400 on up while business systems were often the same computers with additional memory, peripherals, and software. Then at the Personal Computer World Show in September 1980, a red-headed genius from Cambridge, England announced the first computer for under $200. His name

was Clive Sinclair, and the computer was the ZX80. A little over a year later, the ZX81 appeared with a price under $100.

Thus began the great price war of 1982-83. Although Sinclair may have been the catalyst, it was Jack Tramiel at Commodore who played the game with a vengeance. Although TI was his alleged target, his price cutting affected nearly every manufacturer (existing and new entrants) of low-end computers.

Briefly, the chronology went something like this. In the spring of 1982, the TI 99/4A was priced at $349, 16K Atari 400 at $349, and Radio Shack Color Computer at $379, while Commodore had just reduced the price of the Vic 20 to $199 and the C64 to $499. August '82: TI announces a $100 rebate (street price of 99/4A is now $199). October '82: Tandy cuts CoCo price $70, and Atari throws in an extra 16K free. A month later, Tandy cuts the price of the CoCo another $100. In December (having lost the holiday buying season to Commodore) Atari cuts the price of the 400 to $200 and 48K 800 to $500.

In January 1983, Tramiel slashes the price of the Vic to $139 and the C64 to $400. TI reacts a month later with a rebate that lowers the street price of the 99/4A to $149. Tramiel turns around and cuts the price of the Vic to under $100, forcing TI to drop the 99/2 project and announce a further cut in the price of the 99/4A to $100 to take effect in June, thus effectively halting sales for three months. Atari responds by cutting the price of the 400 to $89, actually selling ma-
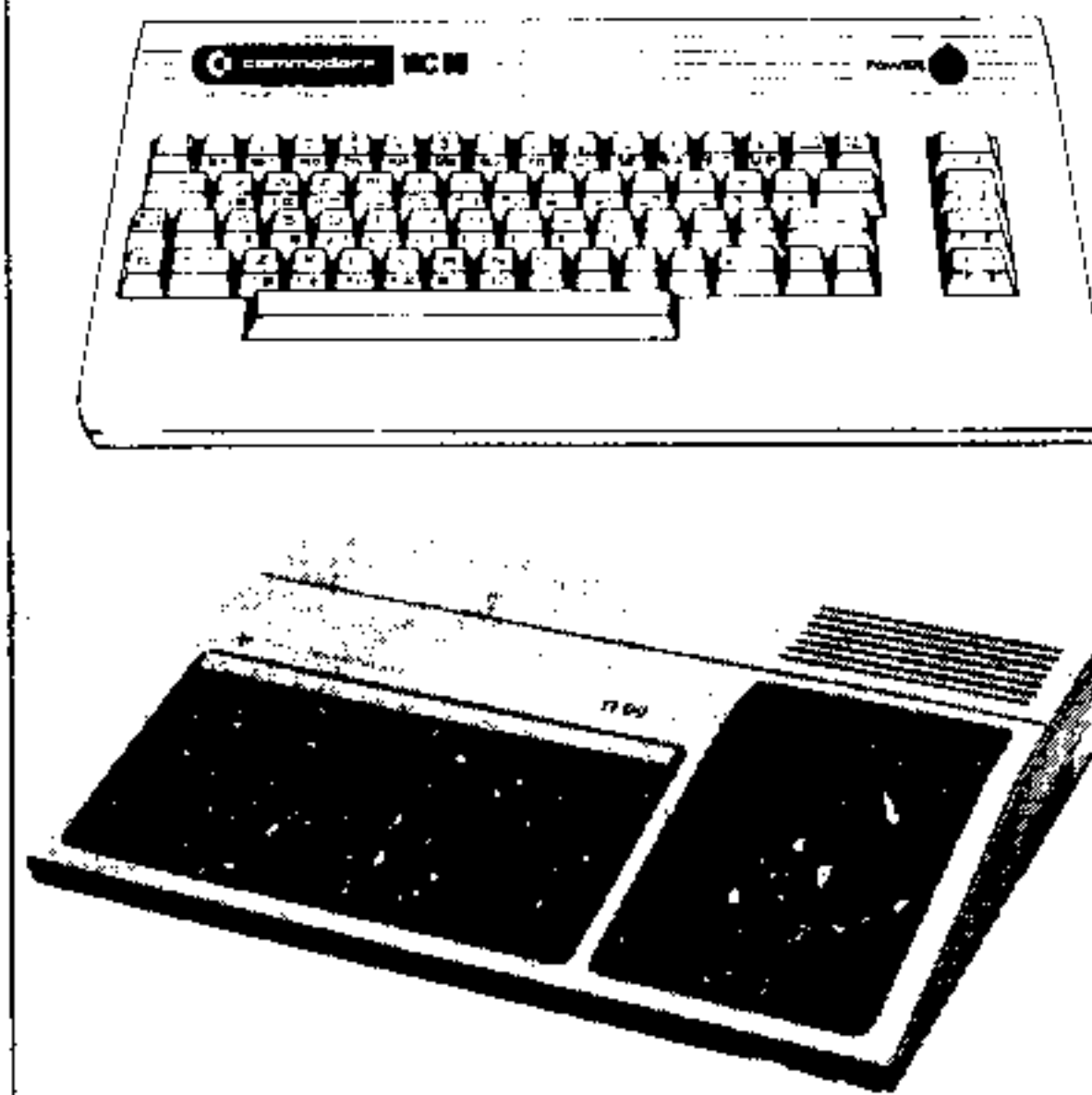
The Commodore Vic-20 and TI 99/4A figured prominently in the 1983 price war.

chines for less than the manufacturing cost. Timex, who was the exclusive distributor of Sinclair computers in the U.S., cut the price of the ZX81 to $49, while Tandy cut the CoCo price to $199. TI, desperate by this time, gave production workers extended vacations and instituted an expansion box giveaway with the purchase of peripheral cards.

In June '83, Coleco entered the market with its Adam, an innovative machine with a daisy wheel printer, priced at $600 for the whole works. On June 10, 1983, TI announced the largest loss in their corporate history and three months later withdrew from the home computer market. Tramiel, still looking for market share, slashed the price of the C64 to $200 and virtually walked away with the 1983 holiday buying season for the second year in a row.

During this period, Mattel attempted to enter the market with the Aquarius, failed miserably, and, a year later, withdrew from consumer electronics altogether. Timex waited a year after the introduction of the Sinclair Spectrum in England to introduce it in the U.S. (as the 2068), also failed, and withdrew from the market. Milton Bradley invested heavily into voice recognition add-ons for the Atari and TI computers, and, facing enormous losses, was acquired by Hasbro. In 1984, Atari, struggling with a declining market for video games as well as losses in computers, was sold by its parent company, Warner Communications, to none other than Jack Tramiel who had recently left Commodore. NEC quietly withdrew their 6001 from the market, while SpectraVideo, APF, and Video Technology never got off the ground at all.

Although the price wars were most visible at the low end, competition was taking its toll at the medium and upper end was well. Some of the more notable victims included Osborne, Computer Devices, Vector Graphic, Victor, OSI, and Exidy.

Nevertheless, today there are more computer manufacturers than ever before, and the demise of one company seems to be followed by the entry of two new ones. Desktop computers were followed by transportables and, more recently, by notebook computers. Thus, the personal computer business remains one of the most exciting, alluring, and interesting businesses in the world. ∎

Ascent of the Person

1974

Intel announces the 8080 microprocessor
Motorola announces the 6800 microprocessor
Nat Wadsworth markets Scelbi-8H computer kit
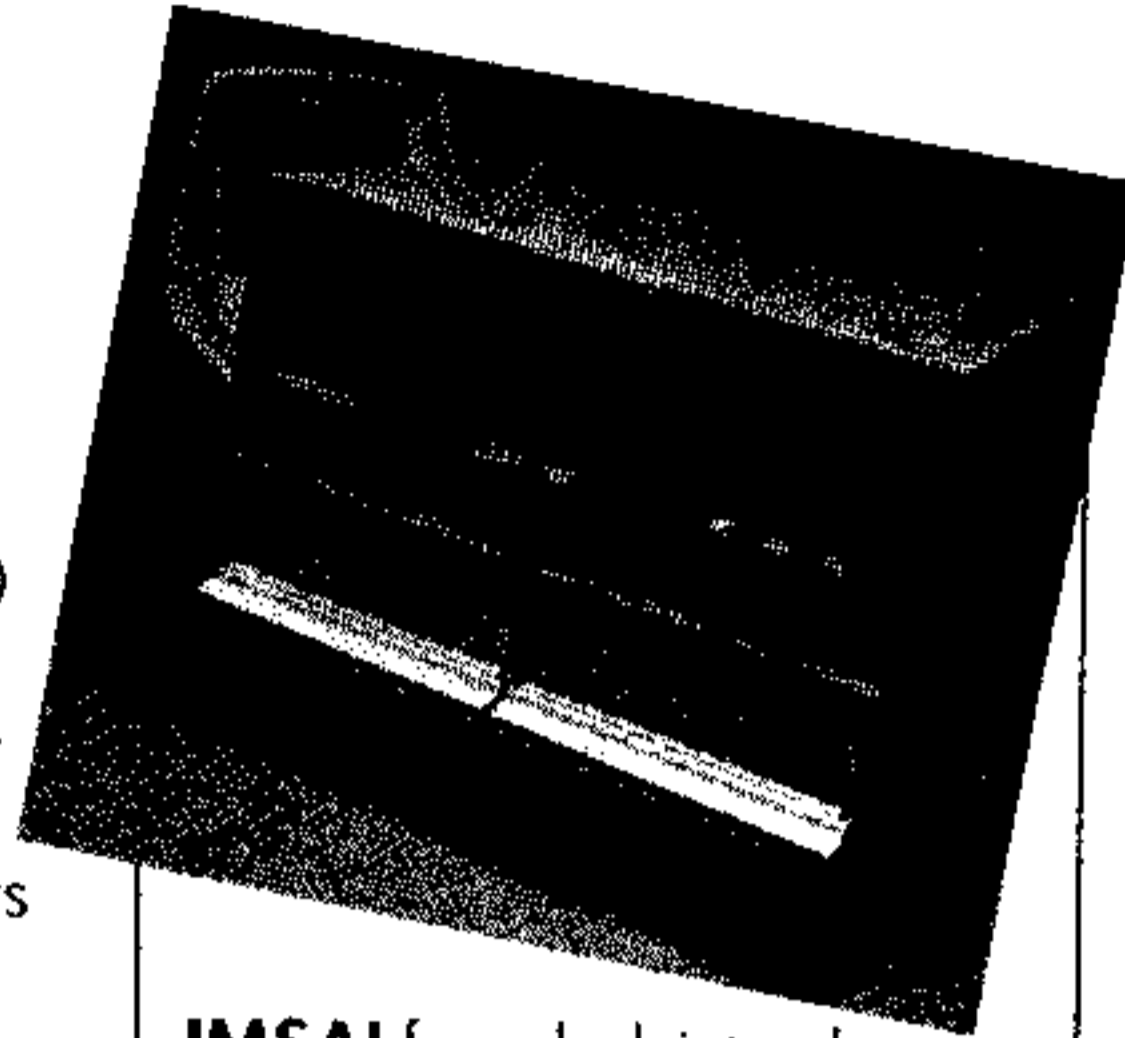
David Ahl publishes first issue of *Creative Computing*
Ted Nelson publishes *Computer Lib/Dream Machines*
Radio Electronics publishes plans for Mark-8 computer

1975

Ed Roberts' Altair 8800 kit is featured in *Popular Electronics* cover story
Cromemco founded; introduces PROM programming board
Processor Technology founded; introduces video display board
Polymorphic founded; introduces A/D board
Wavemate founded; introduces Jupiter II kit

IMSAI founded; introduces 8080 computer
Sphere founded; introduces line of 6800-based computers
Southwest Technical Products introduces 6800 computer
Bill Gates and **Paul Allen** write Basic for the Altair
First computer clubs founded (**Homebrew** in San Francisco, **SCCS** in Los Angeles, **ACGNJ** in New Jersey)
Dick Heiser opens first retail computer store in Santa Monica
Paul Terrell opens first Byte Shop in Mountain View
Wayne Green publishes first issue of *Byte*
Adam Osborne publishes *An Introduction to Microcomputers*

1976

Zilog announces Z80 microprocessor
MOS Technology announces 6502 microprocessor; **Chuck Peddle** sells them at Wescon for $20 each
Processor Technology introduces Sol
Cromemco introduces Z-1 microcomputer
Steve Wozniak designs Apple I; Apple founded by Wozniak and **Steve Jobs**

George Morrow founds MicroStuff (later Thinker Toys and Morrow Designs)
Steve Leininger joins Radio Shack to design a computer
Gary Kildall founds Intergalactic Digital Research (Intergalactic dropped later); introduces CP/M
Michael Shrayer announces *Electric Pencil*
David Bunnell organizes World Altair Computer Convention
John Dilks organizes first national trade show in Atlantic City
David Ahl organizes first personal computing sessions at NCC

First issues of *Dr. Dobb's Journal, SCCS Interface*
100 companies active in field by year end
132 computer clubs in existence by year end

1977

Commodore announces Pet designed by Chuck Peddle
Apple II announced
Radio Shack TRS-80 announced

Heathkit announces H8 and H11 computer kits
North Star Horizon announced
Vector Graphic announces S-100 system
Technical Design Labs announces Xitan
Ohio Scientific announces line of Challenger computers
Ed Roberts sells MITS to Pertec
Structured Systems announces CBasic
Scientific Research sells first applications software disks
Software Records announces 12" LP of programs
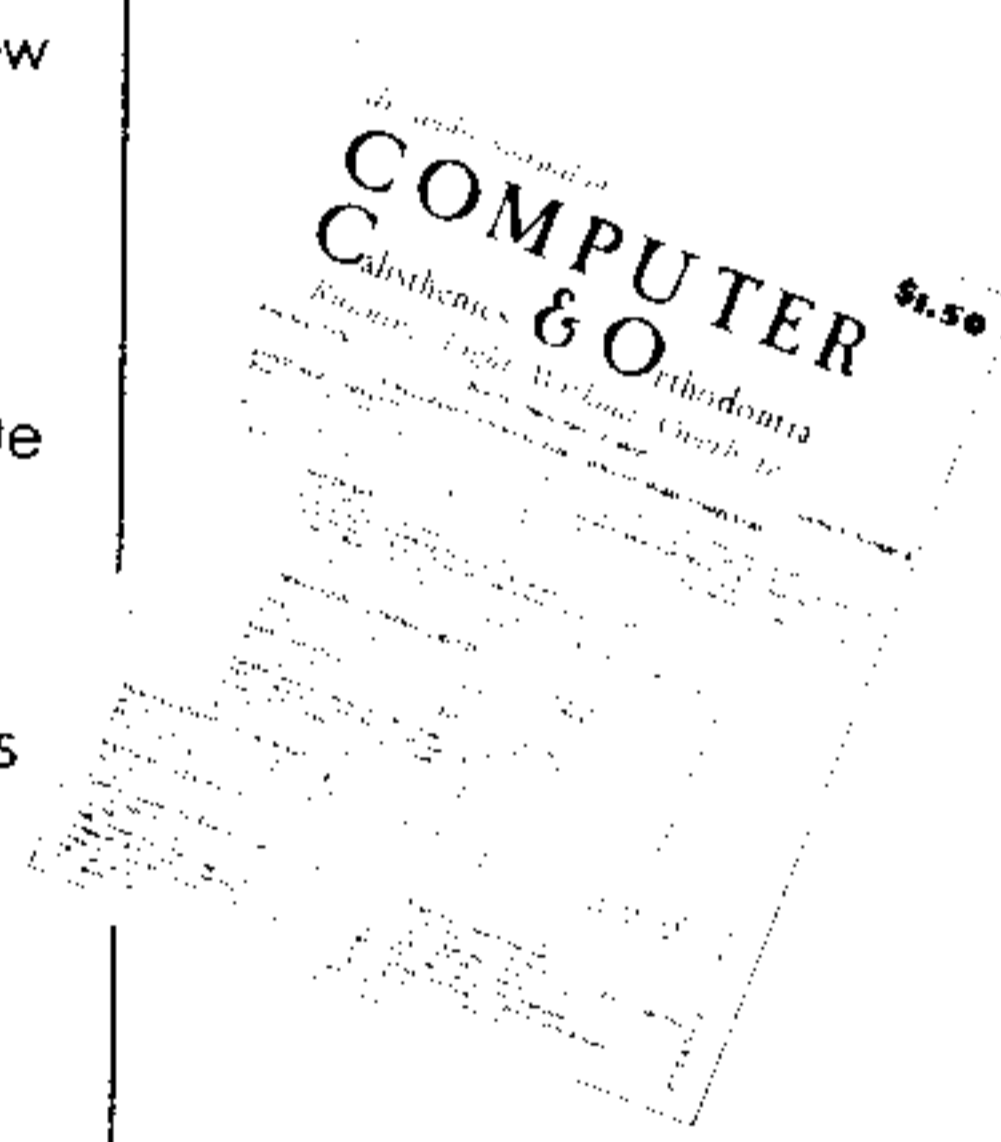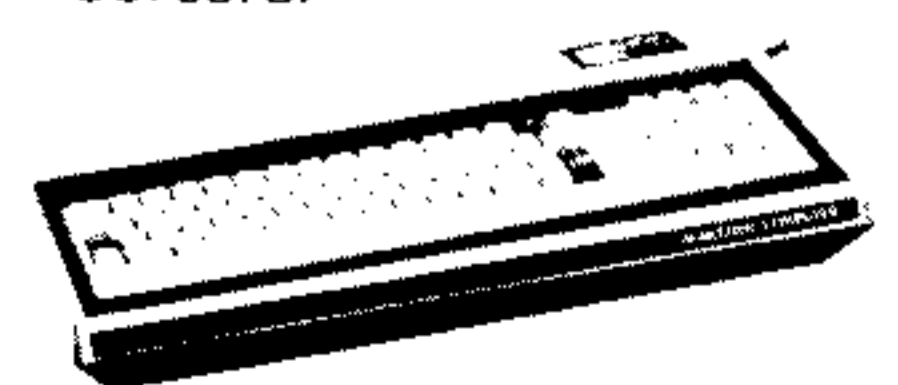First **Microsoft** ads for Basic and Fortran
Scott Adams founds Adventure International
Jim Warren organizes First West Coast Computer Faire
First **Computerland** franchise store opened in Morristown, NJ; 24 stores open by year end
First issues of *Kilobaud, Personal Computing, ROM, Microtrek*
Over 200 active manufacturers by year end

1978

Atari announces the 400 and 800 computers
Exidy announces the Sorcerer

al Computer

Video Brain computer introduced

More than 20 S-100 bus computers announced

Alpha Micro announces 16-bit S-100 boards

Apple and **Radio Shack** announce 5¼" disk drives

Ithaca Audio (later, Ithaca Intersystems) founded; announces memory chips for TRS-80

Houston Instruments announces HiPlot plotter

Summagraphics announces Bit Pad, first digitizer

Micro Works announces Digisector, first video imaging product

SubLogic announces 3-D graphics software

Personal Software founded; announces two games packages

Ed Zaron founds Muse (Microcomputer Users Software Exchange)

Computer Headware announces Whatsit database manager package

MicroPro International founded; announces Word-Master and Super-Sort

Dan Bricklin and **Bob Frankston** write VisiCalc

Micro Systems Services announces Dial-A-Program (software by phone)

NCC holds first Personal Computing Festival

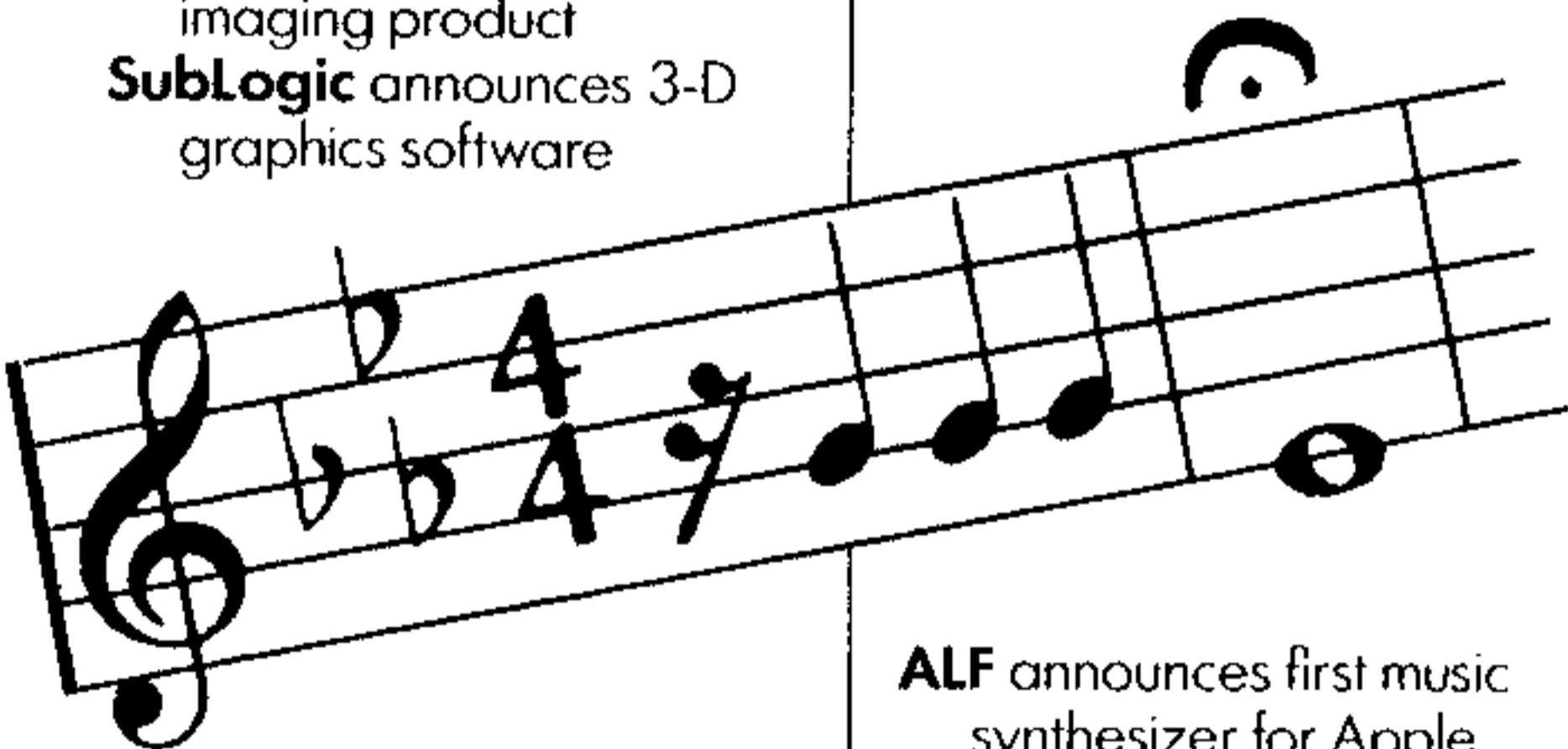## 1979

Texas Instruments introduces 99/4

Radio Shack announces Model II business computer

APF introduces the Imagination Machine

Mattel announces keyboard unit for Intellivision

Commodore offers a standard keyboard with the Pet

First Apple knockoff, the Orange, shown at West Coast Faire

ALF announces first music synthesizer for Apple

Heuristics introduces Speechlab, first voice recognition system

Hayes announces Micromodem 100

Novation introduces the Cat acoustic modem

Automated Simulations (now Epyx) offers first package, Starfleet Orion

MicroNet announces CompuServe service

The Source founded

Microcomputer Industry Trade Association formed

Introl announces first home control system

MicroPro announces WordStar

Sesame Place Theme Park includes a computer center

David Ahl's Basic Computer Games becomes first million selling computer book

1980

Sinclair ZX80 introduced—first computer under $200

Radio Shack introduces the Color Computer

Hewlett Packard introduces HP-85

Apple introduces the Apple III

Epson announces the MX-80

Exatron introduces "stringy floppy" tape system

Digital Research introduces CP/M-86

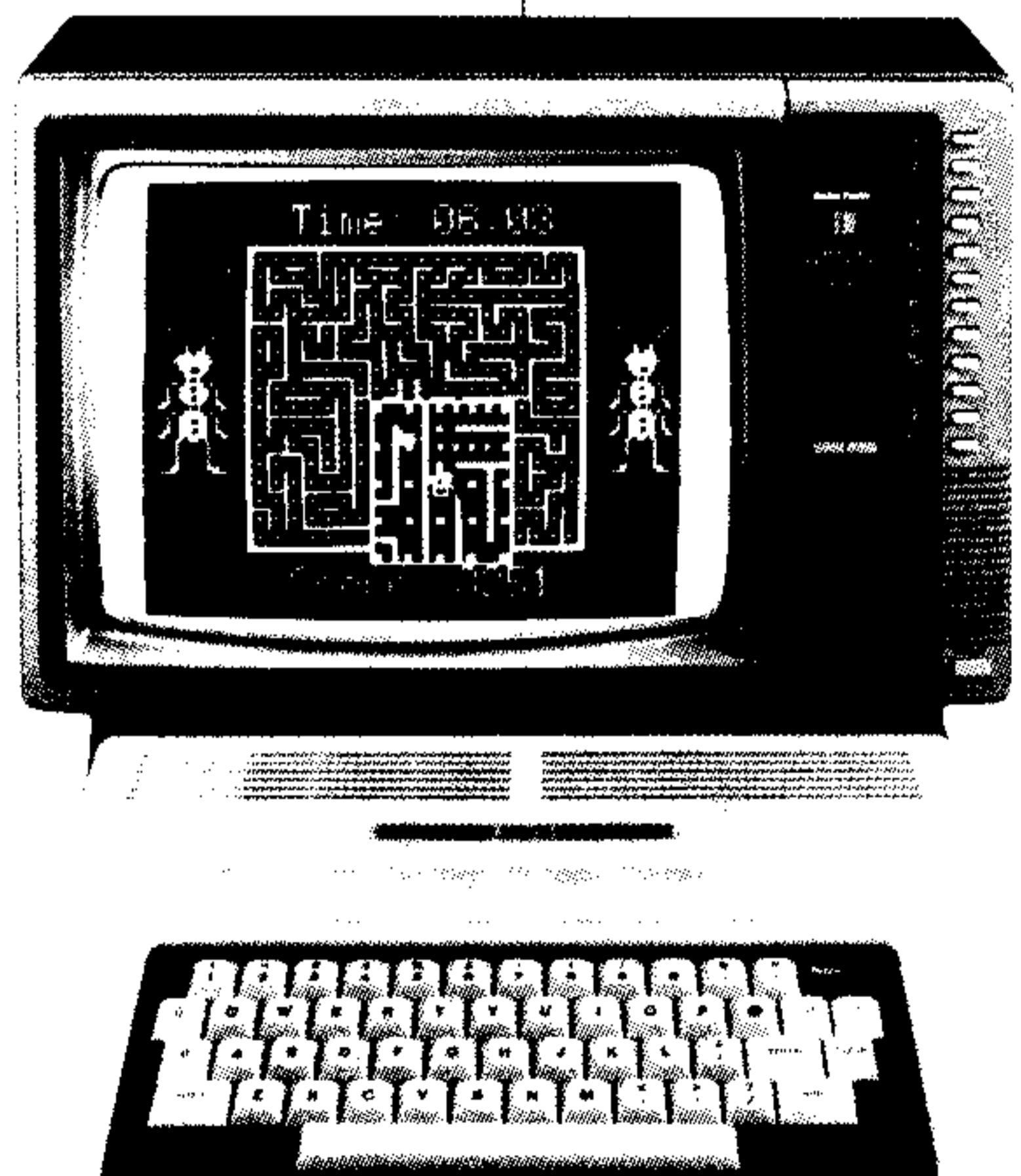**Microsoft** agrees to work with IBM

Ken Williams founds On-Line Systems

Doug and **Gary Carlston** found Broderbund

Personal Software introduces Zork
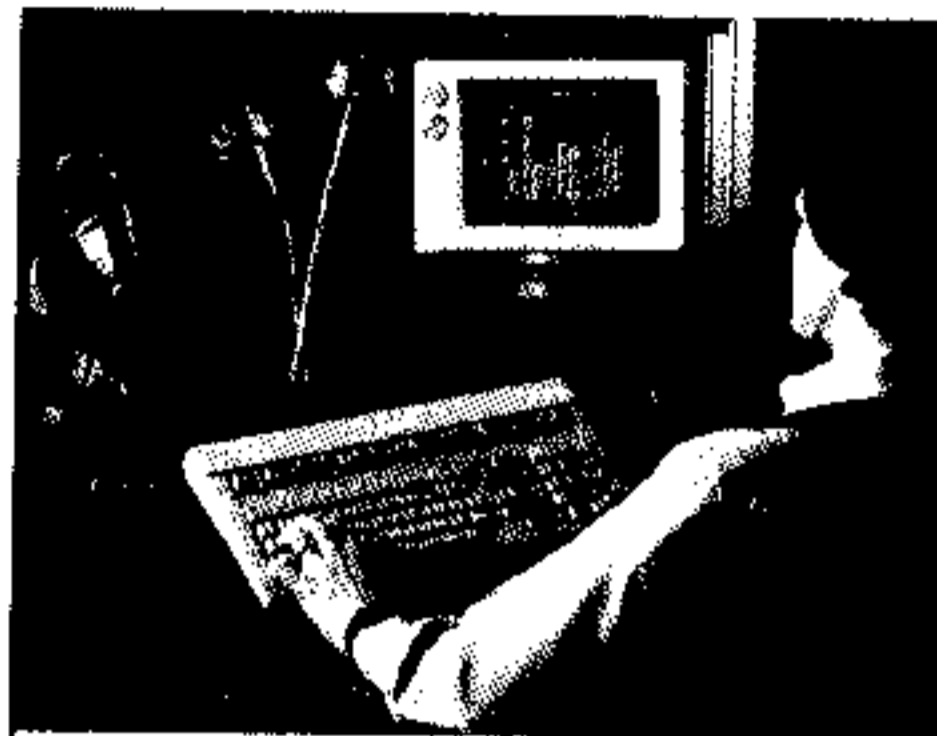
Xerox, DEC, and **Intel** announce Ethernet

Ascent

Near banishment from **NCC** for American Used Computer (for sandwich board signs) and *Creative Computing* (for taking subscriptions)
Creative Computing does giant 74-page April fool parody section

1981

Osborne introduces the first transportable computer
Commodore announces the Vic-20
IBM announces the PC
Microsoft produces MS-DOS (PC-DOS)
Bally computer acquired by Astrovision; re-introduced with Z-Grass
Okidata introduces Microline 82 printer
First color printers announced
Sirius Software founded
Big Five Software founded
Zork relinquished to game writers at **Infocom**; *Zork II* introduced

Logo finally licensed for commercial release by TI and others

1982

Commodore 64 announced
Epson announces HX-20, first notebook computer
Grid announces Grid Compass

Wang announces Professional Computer
DEC announces Rainbow 100, Professional 325 and 350 computers
Kaypro announced
Apple announces Lisa
Franklin introduces Apple compatible Ace 100
NEC announces 16-bit Advanced Personal Computer
Toshiba announces T-100 computer
Seven IBM "compatible" computers announced
More than 20 companies announce expansion boards and hard disks for IBM PC
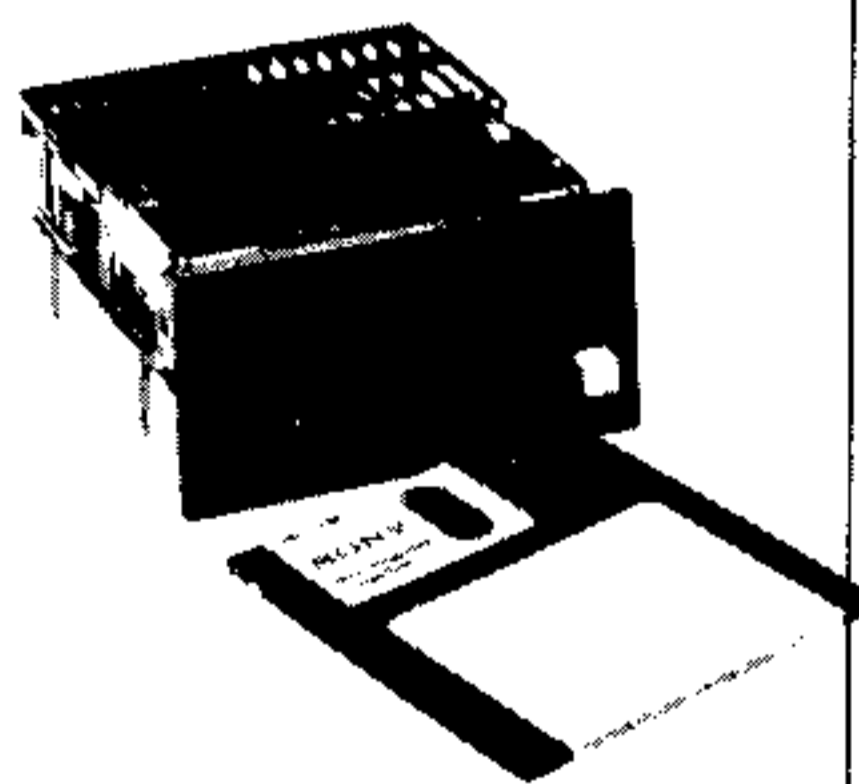**Teleram** announces first S-100 bubble memory systems

Sony announces 3½" microfloppy drive
Japanese Fifth Generation Project launched
Three colleges require students to have personal computers

Peak year for computer games—more than 300 introduced
Software Arts announces *TK!Solver*
First integrated software packages announced—*Context MBA* and *Lotus 1-2-3*

1983

IBM announces PCjr and PC XT
Radio Shack announces Model 100; **NEC** announces 8201
Sharp announces PC-5000
Epson announces QX-10 computer with Valdocs
ACT announces Apricot
Atari announces 600XL, 800XL, 1200XL, 1450XL computers
Coleco announces Adam
SpectraVideo announces 318, 328 computers
Mattel announces Aquarius computer
Timex announces Timex/Sinclair 2000; withdraws from market eight months later
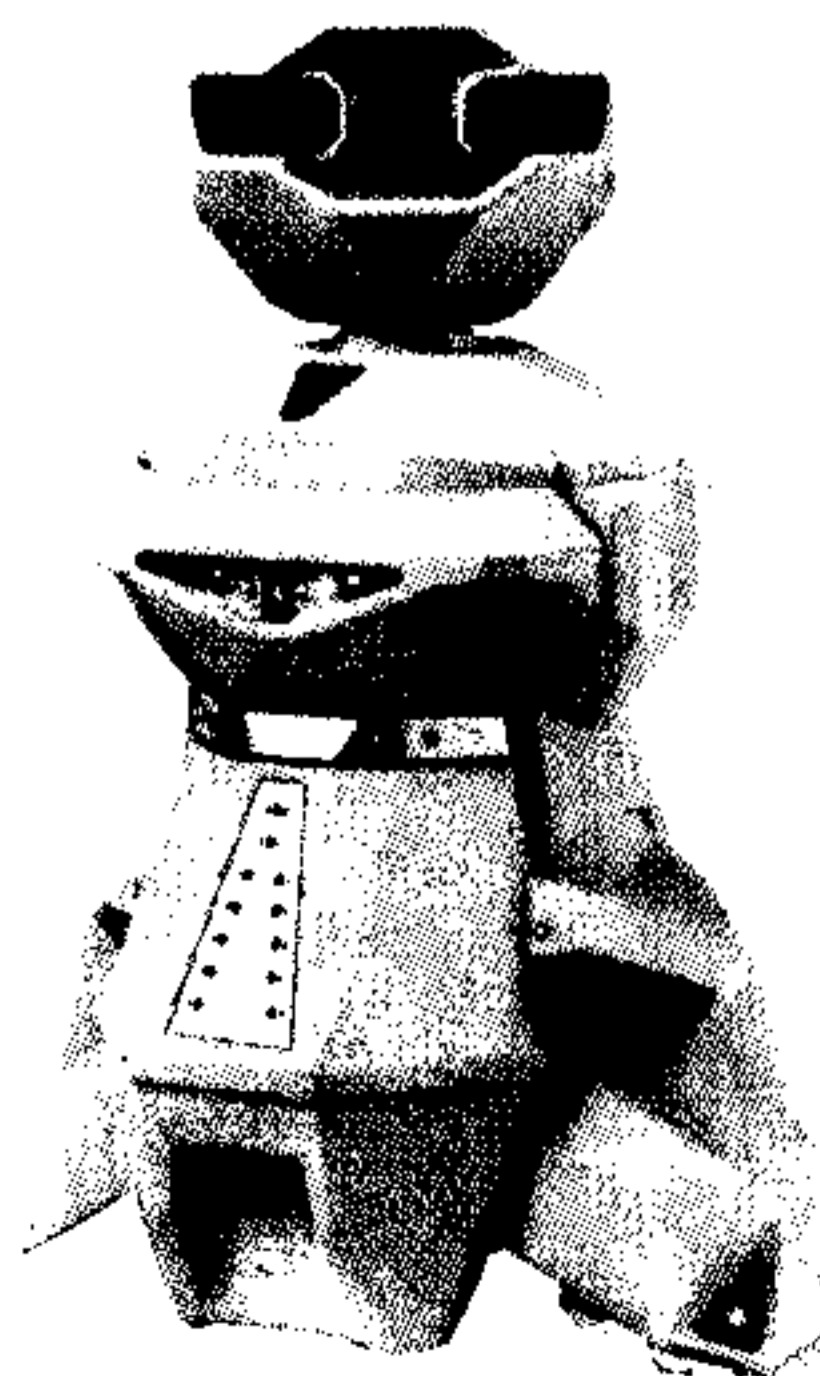**Androbot** announces four home robots

14 Japanese **MSX** standard computers introduced; none sold in U.S.
TI announces Professional Computer, CC-40 Portable
TI withdraws 99/4A
Osborne Computer files for Chapter 11
Four Atari VCS-to-computer conversion units announced; none successful
American Bell exhibits at West Coast Computer Faire
Number of personal computing magazines tops 150; starts to decline
PC publishes largest monthly magazine in history with 774 pages

1984

Apple announces Macintosh, Apple IIc
Hewlett Packard introduces Model 110 Portable
Commodore announces 264 (now the Plus 4)
ACT introduces first upward compatible line of seven computers
Amiga announces Lorraine
Mattel, Timex, Spectra-Video, Victor, Actrix, Computer Devices leave market or sell out
Warner sells Atari to Jack Tramiel
Electronic software distribution systems introduced
First national TV advertising for software (*Lotus Symphony* and Ashton-Tate *Framework*)
Human Edge Software introduces first psychological analysis packages
Peak year for educational software
Number of software manufacturers tops 500