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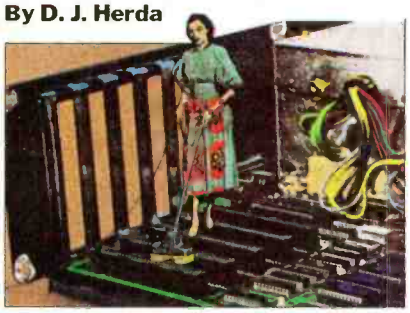

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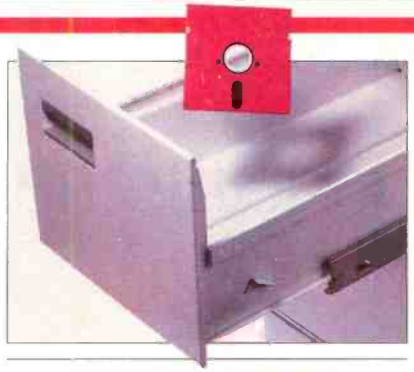

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 Computers & Electronics (ISSN 0032-4485) January 1985. Volume 23, Number 1. Published monthly by Ziff-Davis Publishing Co., at 3460 Wilshire Blvd., Los Angeles, CA 90010. Richard P. Friese, President; Selwyn Taubman, Treasurer; Bertram A. Abrams, Secretary. One year subscription rate for U.S. and Possessions, $16.97; Canada, $21.97; all other countries, $23.97 (cash orders only, payable in U.S. currency). Second Class Postage Paid at Los Angeles, CA 90052 and at additional mailing offices. Authorized as second class mail by the Post Office Dept., Ottawa, Canada, and for payment of postage in cash. POPULAR ELECTRONICS including ELECTRONICS WORLD trademark registered. Indexed in the Reader's Guide to Periodical Literature. Ziff-Davis also publishes Boating, Car and Driver, Cycle, Flying, Popular Photography, Skiing, Stereo Review, Electronic Experimenter's Handbook, and Tape Recording & Buying Guide. POSTMASTER: Send address changes to COMPUTERS & ELECTRONICS, Circulation Dept. P.O. Box 2774, Boulder, CO 80302. Please allow at least eight weeks for change of address, enclosing, if possible, an address label from a recent issue.

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SETH R. ALPERT
EDITORIAL
COMPUTER POWER

REMEMBER the saying, "Knowledge is power?" The early adapters of personal computers in business have re-established its validity and have changed it to "Computing is power."

Those early business users had a vision of the micro as a tool that would help them perform faster and better than their peers and thus provide a boost up the corporate ladder. True believers ahead of their time, they also had the courage to take the risks associated with spending company money on something new and unproven. Their success has created new standards of performance for so-called knowledge workers and fueled the dramatic growth of a whole new industry.

All that is well and good. In a world where success is envied and emulated, it is no surprise that personal computers have rapidly proliferated. As it happens so often with new ideas, society has adopted personal computing and taken it over from the pioneers. Instead of seeming like lunatic fringe behavior, using a personal computer in one's work is a sign of being trendy and with it.

Along with this acceptance has come the emergence of a new view of personal computers. Nonusers are incorrectly concluding that their more digitally inclined peers are succeeding because they own personal computers, rather than because they have learned how to use micros to boost their productivity. These newcomers seem to have construed the adage to be "*Having* a personal computer is power." They are wrong.

One fascinating side effect of this wrong-headed view of micros is that personal computers have become the latest, hippest symbols of corporate status and power. Now we can measure prestige within an organization not only by the size and location of the office, the thickness of the carpet, and the depth of the expense account, but also by whether the company has provided a computer, and if so, what kind. Powerful individuals require powerful computers, and, so the wisdom seems to go, people with powerful computers must themselves be powerful. What a boon to hardware manufacturers! The lonely few in corporations who have the temerity to question the appropriateness of personal computer acquisitions for executives are earning themselves little popularity.

Computer marketers are already responding to this new view of micros. We can expect to see more and more advertising copy that talks about the power that a particular personal computer bestows upon its owner. Like cars, micros will be marketed and purchased based not only upon their features, but also upon the image a brand conveys and the statement that a machine makes about its owner.

Try to imagine which of today's machines represent the market niche of the economical subcompact (lots of performance for the money), the reliable family sedan (a workhorse that can get all the jobs done), the luxury model (elegant and capable, for people who have truly "arrived"), and the sport coupe (the hell with utility and reliability, give me the thrill of all that power). It is surprisingly easy to group today's micros into categories like these.

This trend to image rather than substance in the microcomputer marketplace saddens me. Those who are putting fancy new computers on their desks should be aware that it is not the tool you have but how you use it that will prevail here. Getting that personal computer will not be enough to guarantee success; using it ably will. The good news for those with the pioneering spirit is that we have only just begun to learn how to take advantage of personal computers. A host of new uses is waiting out there to be discovered by the innovative and visionary. ◇

PHOTO BY STEVE BORNS

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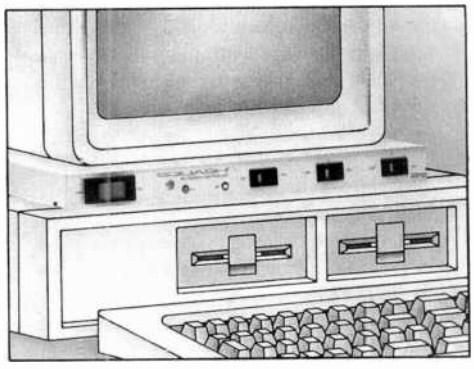

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LETTERS

Face-Off Held up to a Mirror

In response to your article "Face-Off: The Apple IIc vs IBM's New PC*jr*" (November), I would like to point out some misstatements and possible omissions. It was stated that the PC*jr* has only two colors in its high-resolution mode. Actually it has four foreground colors and 16 background, while the IIc is limited to black and white at a lower resolution. The PC*jr* also has 16 colors at 320 × 200 in medium mode, the same as the IIc's at 279 × 192. The PCjr also uses bit-mapped graphics, making its 16-color Color-Paint program much more fluid and natural than the IIc version.

You said that the disk drive capacity of the PC*jr* was 320K. Actually, it is 360K. And in the test you failed to mention the four-voice sound generator on the PC*jr*; the IIc has nothing that can be compared to this. You neglected to mention several facts about the PC*jr*'s monitor—such as the fact that it is in color, while the IIc's is monochrome.

If the PC*jr*'s manuals seem complex when compared to the IIc's it is only because the PC*jr* has so much more power and versatility than does the IIc.

—Tom Mason
York, NE

We apologize for any errors that crept into the piece. That's what happens when you get excited. As for the rest, chacun à son goût.—*Ed.*

On Compatibility

Your review of the Zenith Z-151 Computer (August) contains some misunderstandings about IBM PC compatibility. The author states that "almost all PC software not written in IBM's proprietary BASICA language will run on the Z-151" and "As expected, packages written in BASICA did not run." The fact is that BASICA will not run on anything other than an IBM PC because it relies not on ROM BIOS but on BASIC in ROM. However, the source code produced by BASICA is 100% compatible with the GWBASIC interpreter supplied by Zenith.

Complex graphics programs can be compiled using IBM's BASIC Compiler and the compiled code then moved to the Zenith, with flawless results. In a business environment we really don't consider BASIC programs on PCs unless the code is compiled. We have also used, out of the box, the following software configured specifically for the IBM PC: Peachtree Accounting, MultiPlan, WordStar, Word Perfect, and Palantir. The things that don't work on the Z-151 are some game programs with sophisticated copy protection schemes. For these, our best advice is to try them first—or get an Atari!

—Isaac A. Davadian
Fresno, CA

Valdocs and QX-10

Thanks to Les Solomon for his "Computer Hardware" column called "Bless This ABCDEFGH.DOC World" (August), where he described how the Epson QX-10 with Valdocs allows file names up to sixteen words long. That feature isn't half of the convenience offered by this great system. Valdocs will also display the file directory alphabetically, by date or indexed by any word in the file name you choose. What's more, the press of a key will send the directory to the printer so that you can stick a hard copy in the envelope with the disk. Solomon is right, why would anyone want to be stuck with trying to remember what those eight letter file names mean?

—Steve Max
New York, NY

MUMPS Is Good

You are to be congratulated on your inclusion of MicroMUMPS in your article on DBMS in the October issue ("Micro Data Managers Get Mainframe Power"). Developed over 10 years ago at the Laboratory of Computer Science, Harvard Medical School, MUMPS is a high-level, interactive, and very powerful system. I have been learning and programming in it for two years and have often wondered why the computing community in general is so ignorant of it. Although primarily aimed at the management of large text files, it can also handle everyday calculations.

It was recently shown in benchmark tests run for a large department store in Spain that MUMPS systems not only run fast but also require far less code; and files occupy much less disk space than for several other systems. My old (but reliable) Heath H-8 with two DSQD floppy drives can store literally years of tax data on a disk because of the storage efficiency of MicroMUMPS.

Finally, your readers should know that, in addition to public domain MUMPS, there are several public domain applications written in MUMPS that were developed by federal agencies. The VA File Manager, for instance, is a powerful "programmerless" data manager with built-in word processing and multikey search capabilities. It can be obtained from the U. C. Davis source mentioned in your article.

—Martin Mendelson
Sacramento, CA

Sanyo Schematics

A letter in your August issue indicated that the reader was having difficulty finding a set of schematics for the Sanyo MBC 550/555 computer. Sanyo Business Systems Corp., 51 Joseph St., Moonachie, NJ 07074, has excellent, clearly printed manuals for its equipment. The MBC-550/555 Parts List (Publication WM-10553) sells for $15 and contains "exploded" assembly drawings, a block diagram, a wiring diagram, and four foldout schematics, plus the pc board, component layout and schematic for the power unit. It also has a complete parts list and is available through Sanyo dealers.

I've had my Sanyo MBC 550 for a year and love it! The latest figures from Sanyo (July 1984) indicate well over 20,000 of these units are in the hands of users, with a US user base of 100,000 expected by year's end. Skeptics disbelieve this powerful "under $1000" MS-DOS is for real, while users find a rapidly enlarging circle of insiders supporting the machine.

Now that Sanyo has been licensed to manufacture Intel's 8088 chip and production is no longer limited by the scarcity of the chip, you can expect to see Sanyo taking a more aggressive marketing posture.

—Fred Blechman
Canoga Park, CA

Corrections

In "Advanced Matrix Printers" (November), the printer shown with the Star Micronics Radix print sample was actually the Epson LQ-1500.

In "The Computer Scientist—Random Numbers" (November), in Fig. 2, the IC for the 1-of-10 circuit should have been a 4017 instead of 4011.

In "Personal Investing: From Bits to Riches" (November), in the table on page 92, the telephone number for Iris Communications should be 714-720-0800. They do not have an 800 number.

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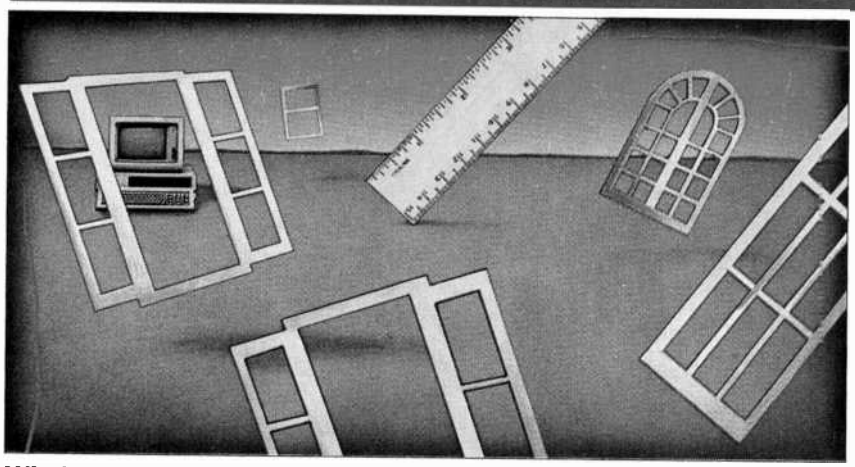


Windows & Integrated Packages

▶ The introduction of IBM's Topview windowing system (which we have mentioned before) is placing pressure on vendors of other windowing and integrated software packages. Whatever IBM does in the PC arena in effect establishes a *de facto* standard for the industry, and suppliers of application software work to conform to that "standard" rather than those of others. Actually, most sources cannnot afford to develop software for more than one system.

Since Topview allows different software packages from different suppliers to run concurrently and pass data back and forth, products such as Desq from Quarterdeck Systems, MS Windows from Microsoft, and Concurrent PC-DOS from Digital Research are expected to suffer most from IBM's introduction of Topview. In all likelihood, these suppliers, in order to compete with IBM, will enter into OEM arrangements with PC clone makers to furnish their software with the hardware. Although OEMs are expected to be the primary channel, Microsoft plans to retail MS Windows for $80 and, with a mouse, for $195, but delivery has been put back to this June. These prices are almost half those of IBM's Topview.

Also expected to suffer are suppliers (such as Lotus and Ashton-Tate) of integrated software packages like Symphony and Framework. Topview permits users to, in effect, roll their own integrated systems and packages (spreadsheets, word processors, database managers, etc.) from different suppliers. One vendor, Business Solutions (Jack2 package) has already closed up shop, and the much publicized Ovation introduction has been indefinitely postponed.

Lotus has reacted to the new competition by making available to software developers information on how to interface to Symphony, hoping that they will be encouraged to develop support software products.

Rumors persist that IBM may introduce its own operating system for the PC using a VM (Virtual Machine) architecture, with Topview being the first step in that direction. One thing is certain, IBM and the peripheral memory-board manufacturers are sure to profit as users need more memory (up to 3M bytes on the PC/AT) for Topview.

Big Squeeze in the PC Biz

▶ There is no doubt that last year was the year of the shakeout. Countless software and hardware vendors, computer stores and computer magazines closed their doors. I have reported on those closings on many occasions in this column. The predictions are that the squeeze will continue this year and will most likely intensify.

The industry cycles seem to be getting shorter and shorter. The computer mainframe dominated the industry for about 20 years. Minicomputers were "the thing" for about 12 years. The rapid growth of microcomputers, which appears to be ending now, lasted about 7 years. The home computer and computer game bubbles burst in less than 5 years. Therefore the next era, that of the supermicro, will most likely see rapid growth for only about 3 years before it tops out.

There is little doubt that the microcomputer industry has matured and the days of skyrocketing sales are largely over. The personal computer is becoming a commodity that is sold pretty much on price—like calculators, TVs and automobiles—with sales becoming seasonal and dependent on advertising, distribution and discounts.

Apples Are Falling

▶ It's said that Apple will soon announce another price reduction for the Macintosh—possibly dropping the list for the 128K machine to $1995. It was originally introduced at $2495 and dropped last September to $2195 when the 512K version was announced. Currently, the 128K Mac can be found discounted to $1795, with the 512K machine down to $2595 from its original $3195.

The 512K Mac is now only $300 less than the Lisa 2 with 512K. The Lisa is a fully expandable machine with lots of extras, so it appears to be a much better buy than the Mac. It is obvious that a lot of people realize this because Apple is backlogged with orders for the Lisa and not for the Mac. Of course Apple is not producing nearly as many Lisas as Macs.

In the meantime, Lotus 1-2-3 is still not available for the Mac—hope for next month! Users will need 512K of memory to run it. However, most Lotus users will also need a hard disk to store those large data files, and there is still no word on when Apple will release one for the Mac. When it does, the Mac will be stronger competition for the Lisa.

Bets & Bytes

▶ In a recent raid of a bookmaking establishment, New York city police found several personal computers (IBM PCs and Apples) being used to calculate odds and the layoff of bets. A layoff is the distribution of bets to other bookies made so that no establishment bears

ILLUSTRATIONS BY CARL WESLEY

more risk than it can handle. In large operations, these calculations can be relatively complex and sophisticated. Considering that many bettors are also using PCs to calculate the odds, it is becoming a contest of one computer program versus another.

Off in the Big Blue Yonder

▶ Dealers are reporting that sales of the PC*jr* have improved moderately as a result of the new keyboard and memory expansion and a massive advertising campaign. In an effort to promote the *jr* in the educational market, IBM is offering discounts approaching 50% to schools placing volume orders.

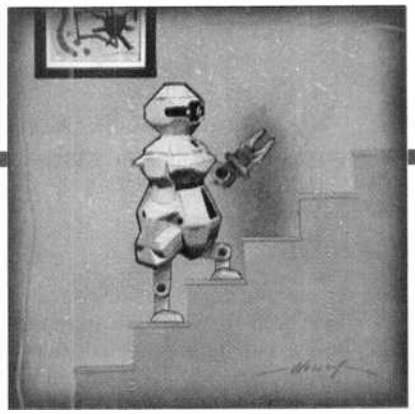
There are rumors that IBM will soon announce a replacement for the PC/XT that will have some of the features of the recently introduced PC/AT. Look for improved performance, a larger hard disk and built-in tape backup plus other options. In the meantime IBM is forced to allocate shipments of the PC/AT to dealers and will probably do so for several months until production capabilities are improved. Despite the short supply, some dealers are already discounting the PC/AT.

IBM may very soon introduce a portable lapsize version of the PC. However, the introduction of IBM's local area network is reported delayed due to problems with the Texas Instruments IC that is to handle the token passing protocols and bus interface. Could it be that TI has bitten off more than it can chew?

IBM says that researchers at its Yorktown Heights, NY, facility have developed an experimental computer with speech input that will take dictation. It has a 5000-word vocabulary, 90% accuracy (who needs more for business?) and can distinguish between homonyms by context (for example, to, too and two).

Robots Climbing Up

▶ Future Computing, a respected market research firm, predicts that the personal robot industry will grow more than 100% annually over the next six years. They say sales of personal robots from 17 companies generated about $15 million worth of business last year. With the field still in its infancy—like personal computing ten years ago—it is in the domain of experimentation. But the situation is changing as marketing and distribution take hold; and, by 1990, sales should reach $2.2 billion.



Currently, a personal robot with limited mobility, a sonar vision system, an arm, and a speech synthesizer costs about $6000. By 1990, says Future Computing, the price should drop to about $2500. They also expect that the 1990 model will be able to climb stairs and have two coordinated arms and speech recognition as well as speech generation.

Rumors & Gossip

▶ Although they deny it, IBM and Apple are rumored to be negotiating with several mass merchandising chains to distribute their entry systems. We may soon see the PC*jr* and Apple IIc next to the Commodore 64 on the shelves of K-Mart and Toys-R-Us. . . . As previously reported in this column, Commodore is developing three new 16-bit systems. Latest word is that its 8088-based IBM PC compatible will be announced this month and its Z8000-based Unix system will be announced in April. The 68000-based system using Amiga technology may be shown as early as the June Consumer Electronics Show. . . .

There are rumors that AT&T is seriously thinking of offering Microsoft's Xenix (a true Unix operating system) on its 6300 personal computer, which is IBM PC compatible. Such a step would put the unit in a much better position to compete with the new IBM PC/AT machine, which now has Xenix as an option. The problem is that Xenix is compatible with Unix System III and AT&T has announced that it will support only Unix System V. Microsoft is known to be working on making Xenix System V compatible. Probably when that happens AT&T will offer Xenix on the 6300. . . .

In the meantime AT&T seems concerned over Digital Research's slow progress in porting Unix System V to the Intel 80286. Presently it looks like the operating system may not become available until mid-summer at the earliest, by which time Microsoft will have had its 80286 version of Xenix out for almost a year. . . . Sharp is quietly showing a prototype portable with Unix. Hewlett-Packard might also be planning such a machine. . . . IBM, we hear, is working on separate optical disk drive development projects at its Boulder, Tucson, and San Jose facilities. . . . 64K RAM chips are now selling, in quantity, for as low as $1.85. Now it costs a manufacturer only $15 to put 64K of RAM in a system.

New portable possibilities include a Radio Shack upgrade. The company might increase the display of its popular Model 100 from 8 to 18 lines. Microsoft, they say, is considering an entry into the system business with a portable from Japan.

Epson seems to have begun to show, privately, prototypes of a very small flat-screen portable TV with word processing capability. . . .

Several Japanese manufacturers have optical disk storage subsystems to link to personal computers such as the IBM PC. These systems might reach the U.S. this summer. . . . And last, Apple Computer seems about to announce a new version of the venerable II+ based on the 65816. The latter is a true 16-bit processor with a mode compatible with the 6502 microprocessor used in the II+. Apple is also expected to sell for $50 a 65816 upgrade kit for the over one-million II+ units already in use.

Wafer Memory from Sinclair

▶ Sinclair Radionics, Cambridge U.K., the developer of the ZX80 and ZX81 personal computers, has disclosed that it will introduce a semiconductor memory device in the form of a wafer 1" square and 1" thick. It will be able to store 1M bytes and is intended to be used in place of a floppy disk on Sinclair's new 68000-based QL (Quantum Leap) computer. The QL is already on sale in the U.K. and should become available in the U.S. shortly.

The memory wafer will use NMOS semiconductor dynamic storage cells connected in a serial memory arrangement similar to that used on floppy disks. The wafer will contain a battery backup to provide data retention when the unit is unplugged from the computer or power is turned off.

The QL is expected to sell for $499 and provide features like those of the Apple Macintosh. The wafer memory should sell for under $250 and have an access time of 10 microseconds. ◇

FORREST M. MIMS III

THE COMPUTER SCIENTIST

COMPUTER ART

CREATING colorful images is an application for personal computers enjoyed by nearly all users. This month's column gives some examples of computer graphics and art, describes how to add sound to your artistic creations, and concludes with some tips for creating your own computer-driven laser light show.

Artists were among the first to realize computers could be highly creative and genuinely personal tools for self expression. In 1976, Creative Computing Press produced *Artist and Computer* (Harmony Books, New York), a wonderful book in which 35 artists describe their experiments in taking computer art far beyond computer graphics. After nearly a decade of advances in both hardware and software, computer artists have been able to extend their capabilities far beyond those available prior to 1976. Still, *Artist and Computer* remains a fascinating book, containing very personal accounts of the state of the computer art at the time MITS introduced the Altair 8800, the microcomputer that sparked the personal computer era.

Before the Altair, computer artists were dependent upon expensive machines ranging from minicomputers to large mainframe systems. Since few artists owned their own machines, they often depended upon the willingness of businesses and universities to provide them with computer time.

Today computer artists who are exploring the leading edge of their craft still rely upon the rapid speed and huge memory of very expensive industrial and research computers. Their sophisticated work has been displayed in museums and also used in motion pictures, television commercials and spacecraft animation sequences.

Although only a tiny number of computer artists have access to the powerful computers that make possible truly spectacular video imagery, almost any personal computer can function as an electronic paintbrush for would-be computer artists. Now that relatively inexpensive input peripherals like touch tablets, graphics pads and joysticks have become widely available, novice computer artists have available some of the tools used by professionals.

Most computer artists use only the cathode-ray tube as a display device, but many also employ various kinds of printers and plotters to make hard copies of their images. In addition, of course, an image on a CRT display can be photographed for a hard copy.

Kinds of Computer Art

Personal computers can be used to create visual images within several broad categories. The simplest are either regular or random patterns of color. A vast variety of colorful images can be created using either approach. Regular patterns have obvious design or symmetry. Often they are created by incorporating mathematical functions into software routines. Random patterns can be created by inserting into a driver program one or more random number algorithms or by calling a computer's built-in random number generator. Sometimes both methods are combined to produce a single image, as when the colors of a regular pattern are selected randomly.

A second broad category of computer art is the synthesis of recognizable images of people, faces, buildings, flowers, planets and other objects. If high-resolution and realistic images are essential, the professional artist with access to a powerful computer generally has an insurmountable advantage.

Do-It-Yourself Computer Art

The boundary between a simple mechanical drawing and a work of art can sometimes be very fuzzy. Figures 1 and 2, however, are clearly drawings and not art. Both could have been achieved by using such BASIC statements as CIRCLE and LINE, but the resulting programs would have been quite complicated. Instead, I used DRAW, a powerful Microsoft BASIC statement that is actually a self-contained graphics language. Here's the listing for the gear depicted in Fig. 1:

```
10 'GEAR
20 KEY OFF:CLS
30 SCREEN 1,0:COLOR 1
40 PSET (200,100)
50 FOR A=0 TO 360
   STEP 15
60 DRAW ''TA=A; U7;R7;
   U7;L7''
70 NEXT A
80 CIRCLE (137,90),5
90 LOCATE 23,16
100 PRINT ''GEAR'':
    GOTO 100
```

The buzz saw in Fig. 2 was created by modifying lines 60-100 of the preceding routine to read as follows:

```
10 'BUZZ SAW
.
.
.
60 DRAW ''TA=A;NU15;
   E15;L15''
70 NEXT A
80 CIRCLE (135,90),5
90 LOCATE 23,14
100 PRINT ''BUZZ SAW'':
    GOTO 100
```

Incidentally, the semicolons that sep-

Fig. 1. A gear drawn with the help of a DRAW statement.

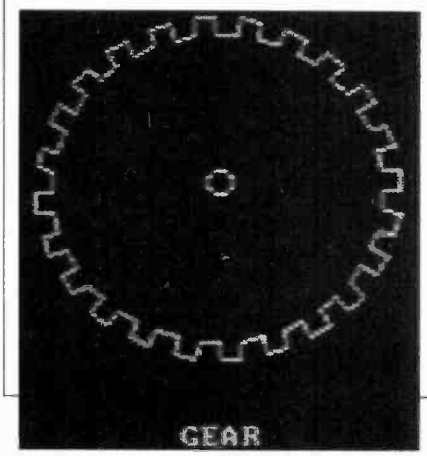
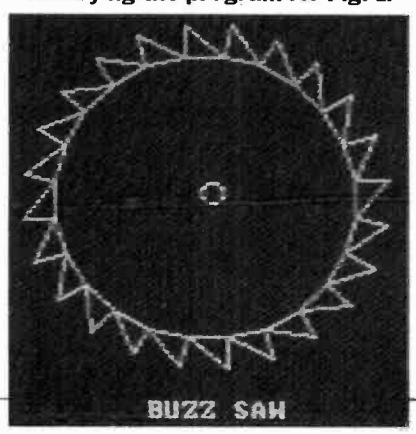


Fig. 2. A buzz saw drawn by modifying the program for Fig. 1.



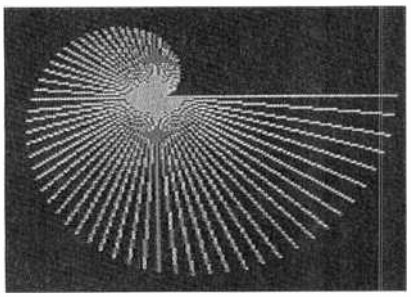


Fig. 3. A stylized snail created with a DRAW statement.

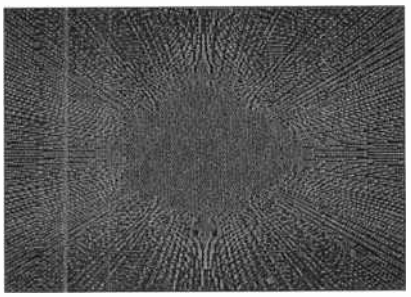


Fig. 4. A moire pattern formed by close spokes of a wheel.

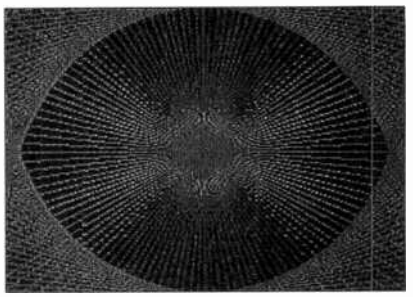


Fig. 5. "Cosmic egg," formed by LINE and DRAW statements.

arate U7, R7, U7 and L7 in line 60 of the first program and NU15, E15 and L15 of line 60 of the second program are optional and can be replaced by spaces.

The DRAW statement used in these two listings provides a means to generate many kinds of computer drawings and art. The format of the statement is DRAW "*string*," where *string* is a list of simple cursor control instructions such as U (up), D (down), L (left), and R (right), etc. Thus DRAW "R50 D50 L50 U50" draws a square on the monitor's screen measuring 50 units of each side. Placing an N before any of these commands causes the cursor to return to the original position after drawing the specified line.

TA (turn angle) is one of several advanced DRAW commands. It causes the direction of a line to be rotated by any angle from −360 to +360 degrees. Scale, color and paint commands are also available.

Figure 3 shows that the DRAW statements can be used in computer art applications. Here a stylized snail is created by increasing the lengths of successive spokes drawn from a common origin. Here's the listing:

```
10 'SNAIL
20 KEY OFF:CLS
30 SCREEN 1:COLOR 1,1
40 LOCATE 2,15
50 PRINT ''THE SNAIL''
60 FOR A=0 TO 360
   STEP 5
70 Q=Q+2
80 DRAW ''TA=A;NR=Q;''
90 NEXT A:GOTO 90
```

Line 70 controls the length of the spokes drawn by line 80. The listing can be modified to produce many different effects. It can also form the basis of a spiral generator.

The moire pattern in Fig. 4 was created by using the DRAW statement to create a wheel of closely spaced spokes extending over the entire face of the monitor. The pattern can be altered by reducing the number of spokes. Here's the listing:

```
10 'MOIRE PATTERN
20 KEY OFF:CLS
30 SCREEN 1:COLOR 1,1
40 FOR A=0 TO 360
50 DRAW ''TA=A;NR200''
60 NEXT A:GOTO 60
```

The particularly striking image in Fig. 5 combines the DRAW and LINE statements in a single program:

```
10 'COSMIC EGG
20 KEY OFF:CLS
30 SCREEN 1:COLOR 0,1
40 FOR S=0 TO 319
   STEP 5
50 LINE (S,0)
   -(0,199-S)
60 LINE (S,199)  -(0,S)
70 LINE (319-S,0)
   -(319,199-S)
80 LINE (319-S,199)
   -(319,S)
90 NEXT S
100 FOR Q=0 TO 360
    STEP 3
110 PSET (160,100)
120 DRAW ''TA=Q;NU200''
130 NEXT Q:GOTO 130
```

The LINE statements within the first FOR-NEXT loop weave a grid resembling string art around an empty, egg-shaped outline in the center of the screen. The second FOR-NEXT loop draws a spoked wheel in the center of the screen.

All the preceding programs were developed with a PC*jr* and should run with IBM look-alikes and other machines that understand Microsoft BASIC. It might be difficult to adapt them to machines that don't include the Microsoft DRAW statement or its approximate equivalent. The DRAW statement used in Apple BASIC is not compatible since it draws a predefined shape or outline at a specified coordinate.

These simple listings illustrate just a few of the thousands of ways any personal computer can be used as a tool of artistic expression. So many books about specific computers cover this subject, it's simply not feasible to list them here. If you're interested, your best option is to browse through the books at a computer store.

Adding Sound to Your Art

Virtually every personal computer is equipped with sound and tone functions. The capabilities of some machines are really quite impressive and can add a second dimension to your computer's artistic abilities.

For example, while developing the preceding program, I was reminded that watching a graphic image being painted on the screen of a monitor is often more fun than staring at the completed design. It's usually very easy to add sound effects to a graphics program so that the computer emits musical tones corresponding in some recognizable way to the activity on the screen.

Computer Scientist
(Continued from page 11)

The program that follows combines a siren-like sound with an on-screen triangular wave form. When the wave is drawn on the screen as a series of dots, a variable-frequency tone is emitted by a speaker connected to the computer. The frequency of the tone is inversely proportional to the height of the dots. In other words, as the wave descends, the frequency of the tone ascends. When the screen is filled with the wave pattern, the waves are erased and the cycle is repeated. Here's the program:

```
10 'SIREN
20 KEY OFF:CLS
30 SCREEN 1:COLOR 0,1
40 SOUND ON:BEEP OFF
50 FOR I=440 TO 100
   STEP 20
60 Y=(I-440)/2.8
```

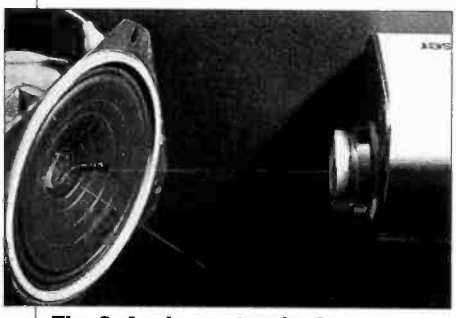


Fig. 6. A mirror attached to a speaker cone creates a laser light show.

```
70 X=X+1
80 PSET (X,Y)
90 SOUND I,.5,3,0
100 SOUND I,.5,6,1
110 SOUND I,.5,9,2
120 NEXT I
130 FOR I=1000 TO 440
    STEP -20
140 Y=(I-440)/2.8
150 X=X+1
160 PSET (X,Y)
170 SOUND I,.5,3,0
180 SOUND I,.5,6,1
190 SOUND I,.5,9,2
200 NEXT I
210 IF X>320 THEN CLS:
    IF X>320 THEN X=0
220 GOTO 50
```

This program is not particularly spectacular, and I'm afraid you'll grow quickly bored by its sound and visual effects. Nevertheless, it does show how both graphics and sound can be implemented within the same program. In particular, it illustrates how the variables that determine where points are plotted on the screen are used to control the frequency of the sound tones. Note how the program can be simplified by forming a subroutine of lines 60–110. Lines 140–190 could then be eliminated and the subroutine called in their place.

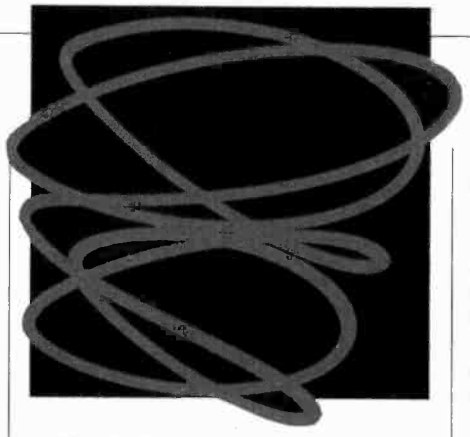


Fig. 7. A "snapshot" of a brief instant in a laser light show.

A Computerized Laser Light Show

The brilliant beam from a laser projected through the night sky or against a screen is a sight so spectacular that laser light shows are rapidly growing in popularity. They have been featured attractions at planetariums, museums and both indoor and outdoor concerts.

In the early 1970s I experimented with various ways to cause sound to control the screen position of the bright red beam from a low-power helium–neon gas laser. The simplest method was to attach a small mirror to the cone of an ordinary speaker and reflect the laser's beam from the mirror to the screen. When the speaker's cone vibrated in response to a sound-modulated electrical signal, the mirror vibrated in turn. This caused the laser's beam to trace an ever-changing, dynamic pattern across the screen.

The effect was quite captivating, and my son Eric, who was then four or five years old, and I spent hours watching classical music come to life in a manner never imagined by its composers. Once we carried our laser light show up on the roof of our house and projected its dancing beam onto the white wall of a nearby building. We stopped doing this light show when we noticed that traffic on the nearby street was slowing to a crawl and even coming to a dead stop as motorists noticed the spectacle on the wall.

Recently I've enjoyed using a personal computer as a sound source for a simple laser light show. All that's required is a helium–neon laser, a small mirror and an exposed speaker. The speaker is connected to the computer's audio port. In some cases, a small audio amplifier may be required.

The mirror is attached with double-sided tape at or near the center of the speaker's cone. The speaker is then installed on an adjustable support to which the laser is also attached so that the beam from the laser is reflected from the mirror to a white wall or screen. A program that generates music or sounds is then run.

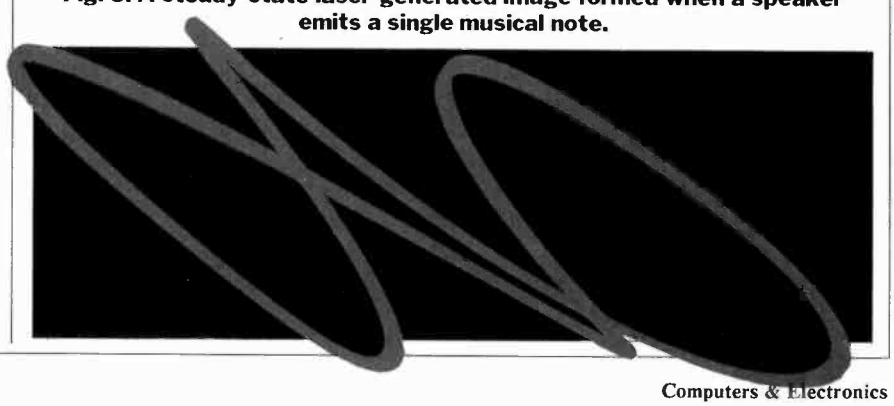
Figure 6 shows the general arrangement of the laser and speaker used to create a laser light show. Though for best results the speaker should be installed on an adjustable support, for preliminary tests or one-time experiments a chunk of modeling clay can be used. Insert one edge of the speaker's frame into the clay and move the speaker until the laser's beam is reflected in the desired direction.

The position of the mirror on the speaker's cone is crucial. If it is attached directly to the center of the speaker, the entire mirror will simply move back and forth. Instead, the mirror should be mounted just off-center, so that one side will move more than the other. The reflected beam will then sweep back and forth across a white wall or screen as the speaker cone moves.

Sweeping the beam across the screen in only one dimension isn't particularly interesting. Therefore, for best results, it's necessary to experiment with the exact placement of the mirror. I usually attach the upper edge of the mirror to the speaker's cone and allow one of its lower corners to touch the center of the speaker. By making slight changes in the position of the mirror, I can cause the reflect-

(Continued on page 84)

Fig. 8. A steady-state laser-generated image formed when a speaker emits a single musical note.



LES SOLOMON ON COMPUTER HARDWARE

RAY TRACING, PARTICLES, AND TEXTURE

LAST month, I presented a brief and simplified look at one form of state-of-the-art high-resolution graphics called *fractals*. I hope you had fun drawing triangles to create a realistic-looking rock or mountain. There is more to fractals than triangles, but we will cover that in a future column.

Because very high-resolution graphics seems to be increasingly popular these days, let us take a quick look at two other approaches to realistic graphics that you have probably seen as photographic special effects. Either or both of these two approaches—one is called *ray tracing* and the other *particle generation*—may well be in your computing future.

Ray Tracing

Ray tracing is based on the fact that everything we see is made visible by light that has been reflected from the objects in our field of view. Illumination radiates out from its source, strikes all the objects in its path, and is reflected from some objects to illuminate others. Finally, a small fraction of the original light eventually reaches the eye.

To generate graphics using this "real world" approach with a computer would be somewhat inefficient. Since we cannot use any light that doesn't reach our eyes, why include it in the program?

Therefore, as Fig. 1 shows, the computer algorithm used for ray tracing goes backward. It starts calculating the path of a single light ray starting at the eye, forms one pixel on the image plane (the CRT screen), and follows the light ray back toward the light source.

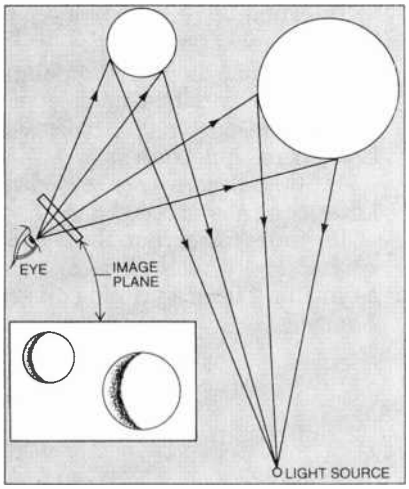


Fig. 1. Algorithm for ray tracing calculates path starting at eye.

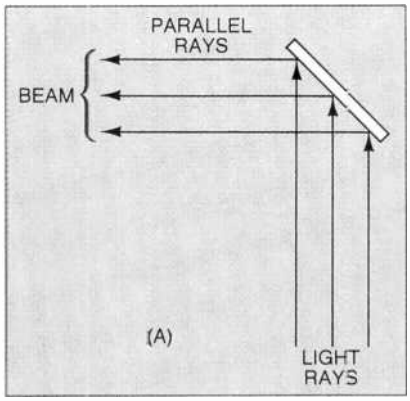


Fig. 2. Beams reflected from a flat surface are parallel rays.

The algorithm also takes into account that the brightness of reflected light depends on the reflectivity of the surface it bounces off. If, for example, a light ray strikes a shiny object, maximum reflection occurs; if it reaches "rough" texture, the amount of reflected light is contingent on the reflectivity of the texture; and if the surface is translucent, some light is transmitted through, depending on the degree of translucency.

Once the path of a ray has been determined, the algorithm calculates the illumination (and color) value of that particular pixel and stores the binary equivalent in memory. Then it calculates another ray.

Since calculating the paths of all possible light rays reaching the eye can be a computing nightmare, this particular approach, although capable of producing extremely real, almost photographic video images, may be difficult to implement.

There is a companion technique, called "beam tracing" that treats a cluster of rays following a similar parallel path as a single "beam." This method can greatly reduce computing time in some circumstances. Beam tracing is most efficiently applied to objects having flat surfaces, as in Fig. 2. Note that the reflected beam of light from the flat surface is composed of parallel rays, which can be treated collectively as a single "ray."

If you consider what happens when parallel rays meet curves (keeping in mind that the angle of reflection is equal to the angle of incidence), Fig. 3 can show you why curved surfaces are not good candidates for beam tracing.

Particle Generation

A vivid example of the second graphics approach—particle generation—was used in the movie *Star Trek II*. If you saw the "wall of fire" that engulfed the dead planet in the genesis bomb sequence, you were watching particle graphics in action.

Simply, the algorithm used produces a number of particle sources as required by the graphics, and each source is caused to "explode" like a Roman candle (Fig. 4). Like the individual "balls of fire" shooting out of the Roman candle, each of the light particles emitted by a single source "flies" along a prescribed curved trajectory, with its color changing with time—in this case, time is measured in movie frames.

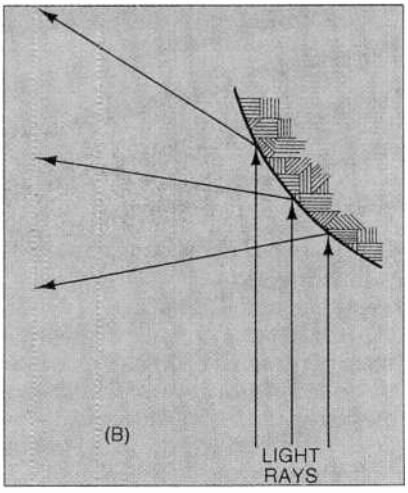


Fig. 3. With a curved surface, reflected beams are not parallel.

While light particles are arising, flying away and dying, other parts of the algorithm determine in which direction and how fast other particle sources are created and move.

(Continued on page 89)

The key word in that long, drawn-out headline is system.

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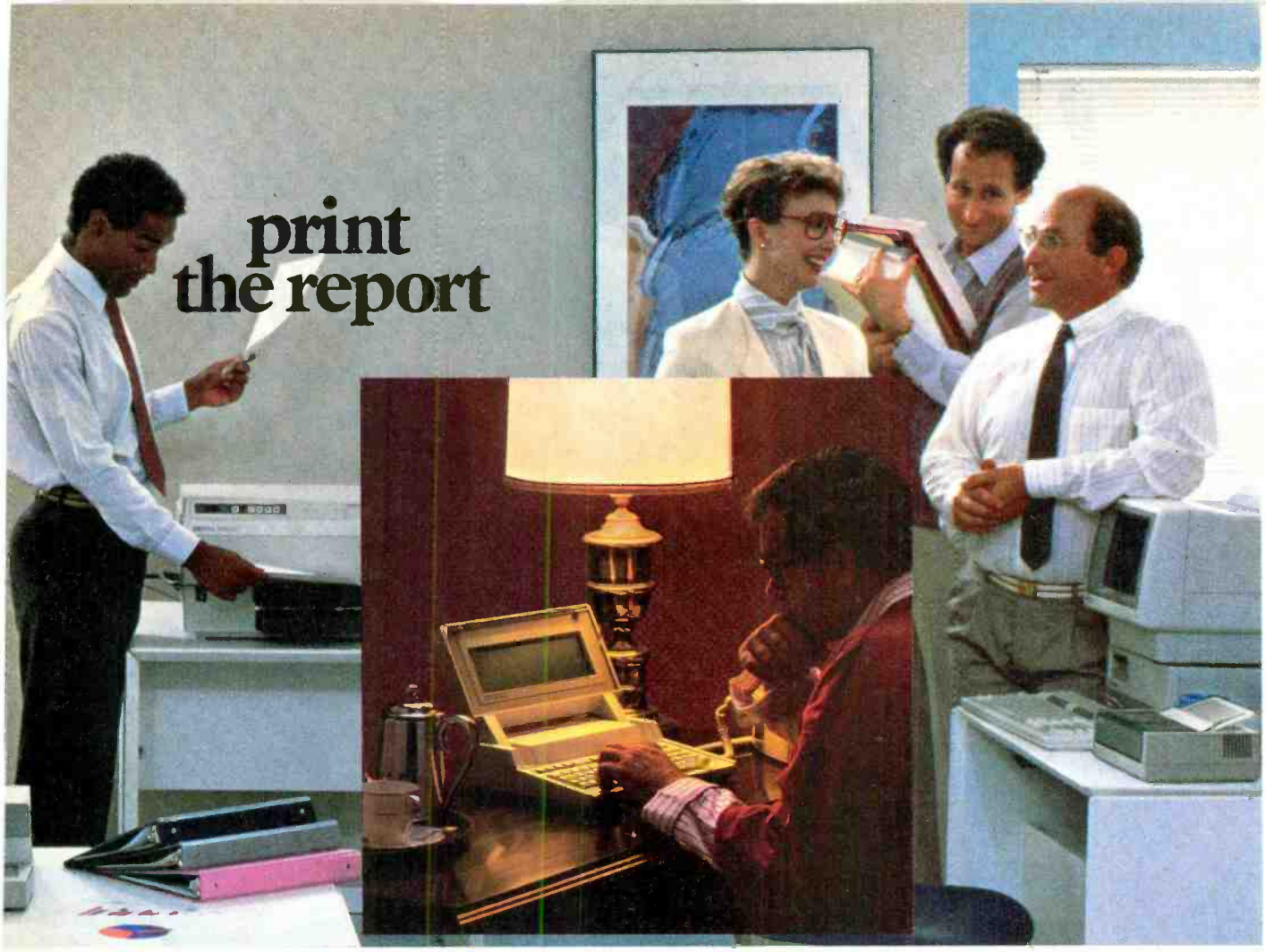
Ten times faster than the best daisy-wheel printers. Yet the image is as sharp as you'll get from a printing press. Amazing.

PG02502



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HEWLETT PACKARD

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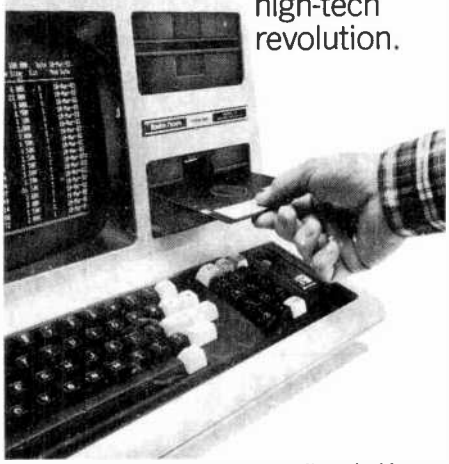

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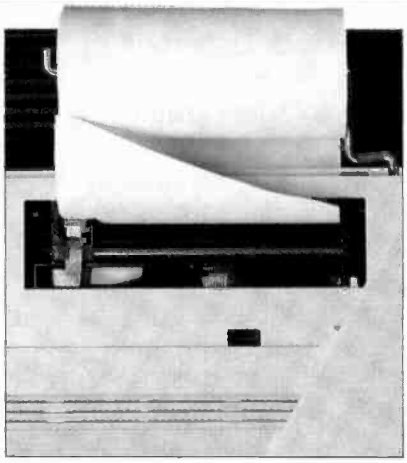

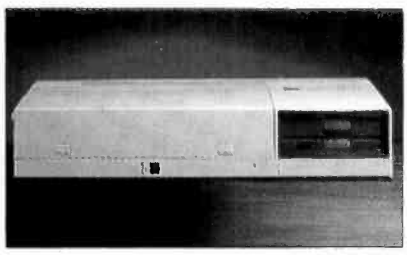

STM PORTABLE

Fast portable IBM compatible with 25-line LCD

BY MICHAEL K. GUTTMAN

Semi-Tech Microelectronics Corporation (STM) has introduced an IBM-PC-compatible portable. Although the market is overrun with IBM-PC compatibles, STM, previously known for its Z80-based Pied Piper microcomputer, has incorporated some unusual features into its STM PC.

First, the STM PC is built around the Intel 80186 microprocessor instead of the ubiquitous 8088 found in the IBM PC and many of its imitators. In addition, STM has packed its PC with a telephone amplifier, a 1200-baud modem, a 25 × 80 liquid-crystal display, an IBM-style keyboard, a built-in thermal printer, and two double-sided disk drives (quad- or double-density). Suggested retail price of the STM PC is $3499.

The STM PC is housed in a compact beige case 20"W × 11"D × 4"H that weighs only 18 lb. The design, however, is rather angular, and the weight is distributed unevenly, with the side containing the disk drives heavier, so the unit is a bit awkward to handle. STM does sell an optional carrying case (not reviewed) that may alleviate these problems.

We tested two STM PC units, one with quad-density disk drives and the other with regular IBM-PC-style dual-density drives.

With everything included in one package, installation is a snap. After removing the plastic cover, which the keyboard sits in for traveling, I plugged the keyboard cord into the front of the main unit, inserted the system disk, turned on the power, and was on my way. It was a pleasure to be free of cumbersome cabling and multiple power supplies.

The power switch is on the back panel of the STM, along with a gang of connectors, which are all labeled. For video there are two outputs, a nine-pin connector for RGB and an RCA jack for composite. There are a Centronics compatible printer port that uses a DB-25 female connector and two RS-232C ports that use DB-25 male connectors. For communications, a modular telephone jack connects to the on-board modem and telephone amplifier, and a five-pin DIN connector is available for an acoustic coupler. For adding hard disks to the system, the unit has an SCSI (small computer systems interface) connector. For expanding the STM, there is a connector that gives you access to the system bus. A reset button is also included on the back panel.

At the front right-hand side of the main unit are two one-third-height 5¼" disk drives. At the top left hand side is the LCD, which is inset into the unit at an angle of about 20 degrees. Two thumb-wheel controls above the display allow you to both set the contrast of the screen and provide an electroluminescent background for it. Between the drives and the display lie grated openings for the telephone amplifier as well as two LEDs that indicate "mute" and "off-hook" conditions. The keyboard has three LEDs, one to indicate power and the other two to indicate the currently selected drive. At the rear top of the STM is the thermal printer, the only sign of which is a slotted opening where the paper exits.

Inside the STM

The computer uses the 80186, which is a gamble for STM, since the chips are in relatively short supply. On the other hand, the 80186 operates at 8 MHz

PHOTOS BY WALTER JACKSON

(compared to 4.7 MHz for the 8088) and includes in its true 16-bit architecture a number of functions requiring an extra complement of components in 8088-based PCs. STM claims that the 80186 replaces as many as 20 chips otherwise needed to support the 8088. The system comes standard with 256K RAM, expandable to 512K (a dealer upgrade).

The main unit, lacking bus slots, offers the external bus connector on its rear panel for expansion. STM claims it is compatible with a standard IBM PC expansion chassis. We did not, however, test any hardware add-ons to their bus. Expansion slots will probably not be missed by most users, since the usual add-ons to an IBM PC are included with this system. The STM already includes serial and parallel ports, color graphics, disk controller, 1200-baud modem and telephone amplifier. Missing, however, are a system clock and a mouse or joystick port.

The Keyboard

STM has cleverly rearranged the IBM PC keyboard to reduce its size and retain nearly full compatibility. The most salient changes are that the function keys are in a horizontal row above the numeric keys with the backspace, number lock and scroll lock keys, while the "+" and "-" keys are directly above the numeric keypad. Also, the tilde/grave and backslash keys have been moved to allow for a larger, typewriter-style return key and a bigger shift key. These two changes correct two common complaints about the IBM PC.

Except for the possible incompatibility of keyboard overlay templates or some minor adjustments for touch typists, I can't see any real disadvantage to STM's modifications. The big advantage, of course, is that STM's keyboard packs neatly away into the main unit for easy storage and transport. Also, because the STM keyboard is considerably lighter and smaller, it is easier to fit it on and move it around the desk. I felt quite comfortable with the keyboard's feel and performance, although I wish STM had provided status lights for the CAPS LOCK and NUM LOCK keys.

The Video Display

The novelty of the built-in 25 × 80 LCD wore off after a short while. The unit has an adjustable backlight to improve readability, and it displays well-formed alphanumeric characters, but, in my opinion, LCDs are just not adequate for continuous viewing. In addition, the STM LCD is built right into the main unit at a fixed angle, and there's no way to change it.

STM claims that viewing angle problems are adequately handled by the unit's backlight and contrast controls, which electronically move the crystals to the desired viewing angle. While these are certainly helpful, I nonetheless found myself often craning my neck while using the LCD. In addition, the backlight generates a clearly audible hum, which some may find annoying. One other deficiency is that although the display has 25 lines, it is a condensed version of a normal display.

Specifications

Product: STM PC
Mfr: Semi-Tech Microelectronics Corp.
535 Middlefield Rd.,
Suite 25,
Menlo Park, CA 94025
Price: $3499.00
Hardware: Intel 80186 processor, 256K RAM, two double-sided quad- or dual-density disk drives; built-in phone, modem, thermal printer, and 25 x 80 LCD; two serial ports and one parallel port
Software: MS DOS with custom peripheral drivers; NewWord word processor

In general, these problems are not STM's fault, but are rather the result of the current limitations in this kind of display. Fortunately, it was very easy to hook up a monitor and, with a two-key command, move the display over to it. The RGB port will drive either an RGB color monitor or high-resolution monochrome monitor.

None of the ghosting or flickering that you get with the IBM PC in the monochrome mode occurs. I did experience difficulties when connecting a composite monitor to the STM—the horizontal positioning was way off.

Color graphics is a standard feature of the STM. In the medium-resolution mode (320 × 200) 16 colors are available for the foreground; in the high-resolution mode (620 × 200) one of four colors is available for the foreground and one of 16 for the background. The STM also has a high-resolution monochrome mode with a 720 × 348 pixel resolution.

The Printer

This diminutive device, which only handles rolled calculator-style thermal paper (about 4.5" wide), is probably not intended for normal printed output. Instead it can be a convenience for traveling. The printer is designed to print either in a straightforward 40-column horizontal format or an 80-column sideways one, which maps the the printout into 26-line pages separated by printed divider lines.

Mapping the printout sideways seems to consume a lot of processing power, so much so that it would be of no use in a production environment. However, I had no trouble whatsoever interfacing a letter-quality Diablo and dot matrix Epson printer to the output ports on the back of the STM PC. Both performed without difficulty.

The Disk Drives

STM's disk drives are among the quietest drives I have ever heard. The quad-density format (96 TPI, 720 bytes formatted) was a real convenience, allowing me to run software on one disk that normally requires two and to create and maintain much larger data files. If these drives could only write, as well as read, double-density format, they would get my unequivocal endorsement. The dual-density drives, while fully compatible, seemed slower than those on the IBM PC and much slower than those on the quad-density model.

The Telephone Amplifier and Modem

An intriguing component of the STM PC is its built-in telephone amplifier. When activated, the user can direct the computer to make a call and then carry out a conversation without the encumbrance of a handset.

The phone and built-in modem are accessed via special software supplied with the STM. The phone program is activated via a set of control keys, while the autodial setup program and the modem program are activated with the edit and modem programs. This means that the phone can be activated from the keyboard while the system is performing other work, but the configuration and modem programs can only be activated

(Continued on page 92)

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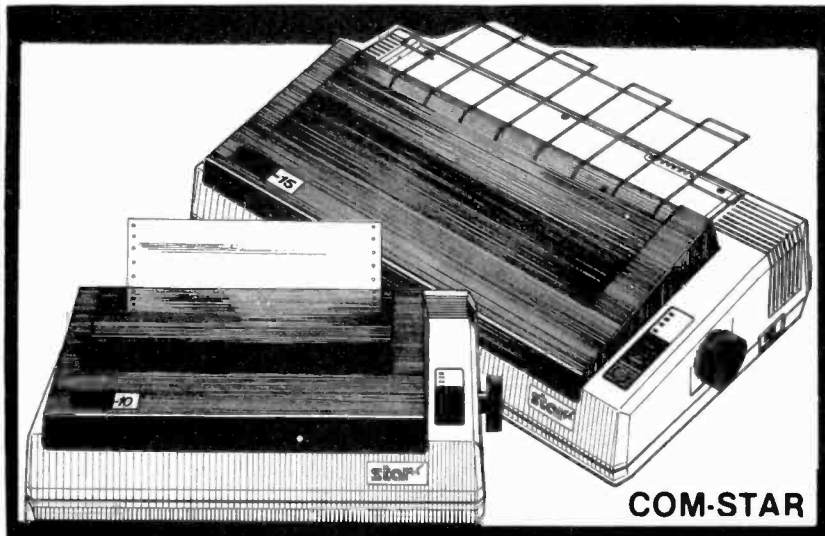

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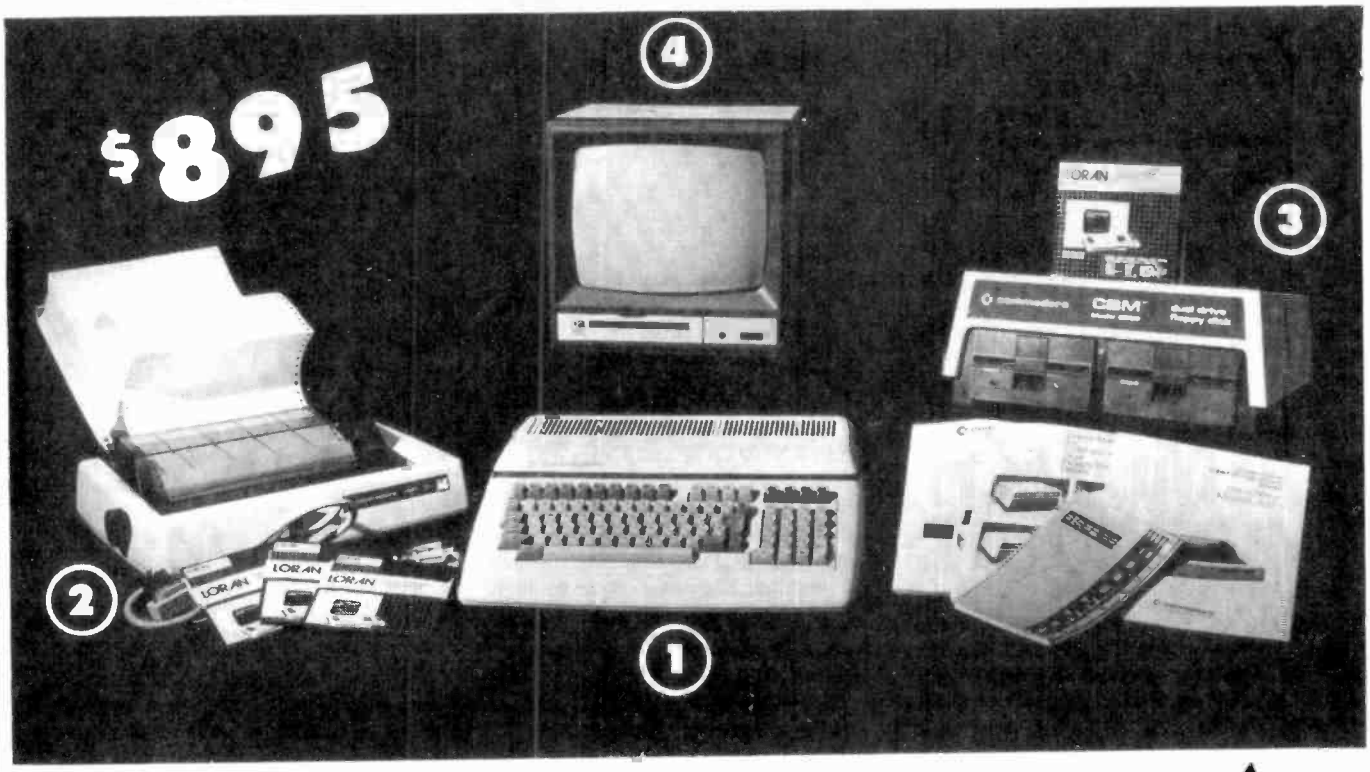

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Fig. 1. I/O sockets on rear (top). Fig. 2. Inside is room for memory expansion and communications board.

MEMOTECH MTX512

A Z80 computer runs CP/M and color graphics

BY CHARLES P. RUBENSTEIN

ALTHOUGH most manufacturers of new personal computer products boast of compatibility with the industry standard, some choose to go their own way. The latest independent is the Memotech Corporation, which recently introduced the MTX-FDX computer. You may recall that Memotech is the British company that probably extended the lives and popularities of the Sinclair ZX80/ZX81 and Timex TS1000 by designing a series of add-on memory, graphics, and interface "MemoPAKs" for the machines.

The MTX-FDX system, which sells for $1690 and is upward-expandable, is positioned with the small business in mind. Perhaps the first true Z80 system with CP/M and full color graphics, the FDX has also been aimed at small software houses needing to configure their offerings in a variety of 5¼" and 8" formats.

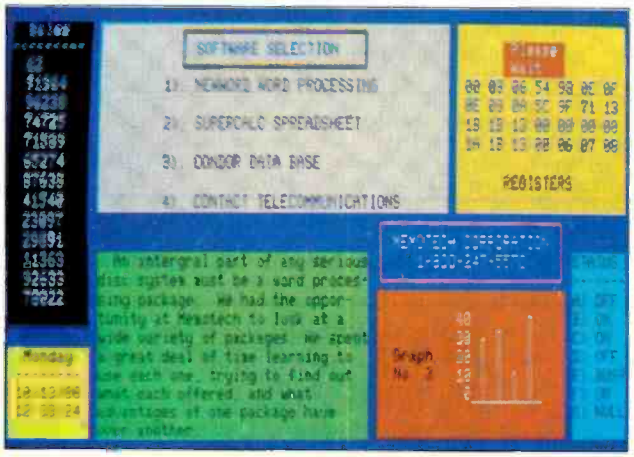
The MTX-512 Keyboard Console

The heart of the MTX-FDX is the MTX-512 cassette/TV system, which was designed as a modular, second computer for the Z80 enthusiast. The 512 can, in fact, be purchased (for $595) as a stand-alone cassette-based 40-column computer. The X in the designation MTX stands for the modular expandability built into the system console and the capability it has of accessing up to 512K bytes of bank-switched memory.

The MTX 79-key keyboard is superbly designed. It has a 12-key number pad/cursor pad, eight dual-function keys, and 57 full-travel keys in a layout that is nearly identical to the IBM Selectric's. Unfortunately, Memotech repositioned several of the shifted number keys—for example, double quotes over the 2, parentheses over the 8 and 9, and apostrophe over the 7—and made the LINEFEED key 20% larger than the RET key and thus much more likely to be hit. Finding and using the CTRL key—above the ALPHA LOCK key on the right side—is also problematic.

At the rear (Fig. 1) of the MTX-512 are two RS-232 (DB-25) connectors, a BNC connector and phono plug for color monitor video and audio outputs, a

The MTX/FDX computer can display up to eight windows on the screen.



A split screen allows debugging a program while watching the contents of the Z80 registers.

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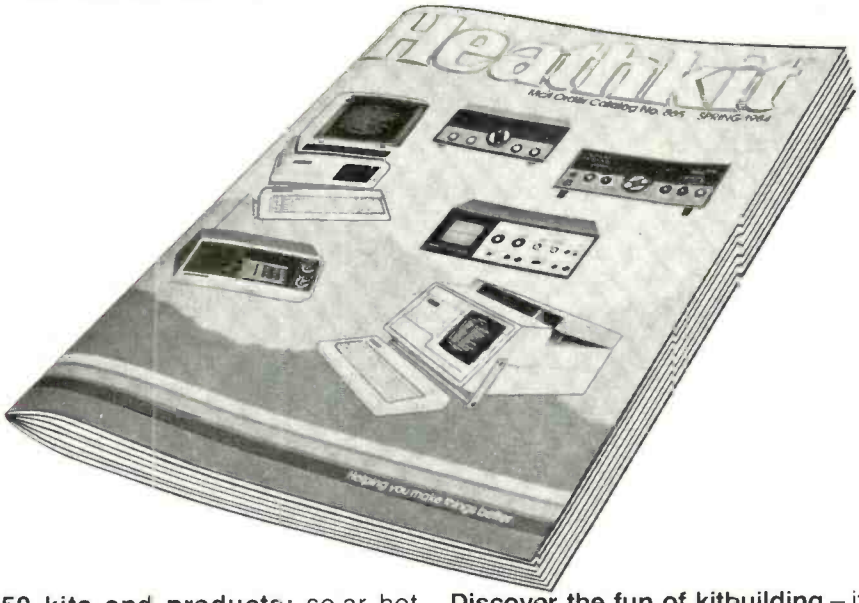

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six-pin DIN power input socket, a TV (r-f) output phono socket, a 34-pin header Centronics parallel printer port (a second uncommitted port is available internally), MIC/EAR sockets for a 2400-baud tape cassette, and a pair of Atari-compatible (DB-9) joystick sockets. (It's nice to see standard connectors rather than the hodge-podge of connectors used on the Apple IIc, IBM PC*jr*, etc.) On the left-hand side of the unit is a slot for external ROM cartridges.

Inside the MTX

Inside the console (Fig. 2) is room for a computer, RAM/ROM expansion, and RS-232/disk bus communications board. The Z80A (4-MHz) CPU board possesses 104K of memory: 64K RAM, MTX BASIC and a cassette operating system in a 24K ROM, and 16K of dedicated video RAM for the Texas Instruments TMS 9928 40-column color video graphics processor. On each of the circuit boards is a PAL programmed logic array circuit (personality module), which lets the processor know which board is which and which version of the system is in the ROM, etc.

Mindful that business users might want customized ROM cartridge programs inside the console, where they could not be removed, or additional RAM memory banks to expand upward to the 512K maximum. Memotech has made available RAM/ROM upgrade boards. These boards can be configured to add-on 32K, 64K ($150), 128K ($275), or even 256K of RAM or ROM. The maximum possible expansion is to 512K of bank-selected online memory.

Only 18 of the 74 integrated circuits that make up the MTX-512 (Z80A, TMS 9928 video processor, ROMs, PALs, and VLSI integrated circuits) are in sockets, with all RAM and support chips soldered in place. Normally this design is encouraged. However, Texas Instruments has just released an 80-column color video graphics processor that is pin-compatible with the 40-column TMS 9928. But swapping chips isn't sufficient: The present 16K video RAM needs to be increased to 32K. Since RAMs are soldered in, you will need a $75 Memotech (dealer) board swap/upgrade.

Memotech's Disk Drive System—the MTX-FDX

For serious machine language or BASIC program development, true word processing and the myriad of spreadsheet, database, and business application programs, you would undoubtedly need the FDX 1000 CP/M color business computer with dual 5¼" disk drives. There are two quiet, half-height drives labeled B and C in front. A 60-conductor ribbon cable is used to connect the MTX-512 console to the FDX. Ac power for both the FDX and the MTX-512 plugs into a very well identified rear panel on the FDX, which includes sockets for MTX power, an 80-column monitor, and an RGB color monitor, as well as three cutouts for chaining additional floppy and and hard disk units to the system. Also mounted on this panel is a rather noisy cooling fan, without which you probably wouldn't know the machine was on unless you looked at the lighted power switch in the front.

Inside, the layout of the FDX is rather good. Disk drives are on one side, power supplies underneath, and a card cage of electronics on the other side. (There would probably be enough room for a hard disk if the supplies were repositioned.) The card cage has room for up to seven boards although only four connectors are installed. Since it is a Z80-based machine, it would have been nice if Memotech had accommodated the S-100/IEEE 696 bus in the FDX design to allow for even greater flexibility in user hardware upgrades.

Specifications

Product: Memotech MTX-FDX
Mfr: Memotech Corp.
99 Cabot St.
Needham, MA 02914
Price: $1690
Dimensions: MTX-512: 19¼"W × 8"D × 1¼"H;
FDX-1000: 19¼"W × 11½"D × 6"H
Weight: MTX-512: 7 lb
FDX-1000: 21 lb
Operating System: CP/M
Hardware: Z80 CPU, two 5¼" floppy disk drives, 64K RAM, 24K ROM, 16K video RAM, two RS-232 ports, Centronics parallel port, parallel port
Software: NewWord, SuperCalc I, Condor Database

The standard system includes a bus interface/bootstrap ROM board, a Motorola MC6845-controlled 80-column color video board with 4K video RAM, and a Western Digital FD1791B disk controller board. A fourth connector is provided for an optional 256K-byte Silicon Disc Board ($695) that emulates a floppy at 50 times the access speed (often called a RAM disk). Using supplied programs (Sidisc and Sispool), the Silicon Disc can be configured either into a drive or into a full memory spooler. The MTX-512 console can handle four physical and four Silicon Disc (can be piggybacked into an 8M-byte single drive) drives. Thus you can assemble an impressive array of FDX-series single- and dual-drive 5¼" single/double/quad-density and 8" single/double-density floppy disk systems, as well as HDX-series 13M-, 24M-, or 32M-byte hard disk systems.

FDX BASIC

Memotech has achieved a high level of integration in its MTX BASIC software offering. Included, not only on disk, but in ROM as well, is their II-5 (interacting intelligence to the the fifth power) package, which includes BASIC, color graphics, the NODDY language, Z80 assembly language with PANEL, and local area networking through their Oxford Ring configuration.

FDX BASIC (and ROM-based MTX BASIC) contains a standard array of BASIC commands that can be abbreviated by one or two letters and a period (such as P. for print) and accepts both upper- and lower-case input. In addition to PLOT, LINE, CIRCLE, and DRAW commands, are INK and PAPER for coloring your graphics, GENPAT for creating your own character sets, CSR for cursor positioning, and ANGLE and ARC manipulations. There are also ASSEMBLER and DISASSEMBLER for generation and debugging of machine language programs.

These programs are immediately integrable into FDX/MTX BASIC without the usual hassles of defining USR but rather by declaring CODE from within the program. After the code is complete, the BASIC program recovers control of the action. Even better would have been a method of on-screen debugging. Memotech thought so too, and gives you VDEB (PANEL or ROM 1 in the MTX ROM), displaying a split screen wherein you can dynamically debug your program while watching the contents of each of the Z80's registers. You can poke around in the user memory area and even assemble a routine as you go.

Included within FDX BASIC is the NODDY language, which allows for user interaction with the display. Through NODDY you can ask a question, process it and move on to another display, create one of the eight virtual screens and have a layered look to your display.

Now add to all this Sprite graphics (up to 32 user-definable character sprites possible) for animation, and you get the ability to do, finally, real color graphics on a standard Z80-based microcomput-

(Continued on page 84)

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APRICOT XI

Stylish 8086-based IBM compatible uses 10-Mb 3¼" hard disk

BY WILLIAM S. BARDEN, JR.

LIKE a lightweight boxer, the new Apricot XI is compact and feisty. And it packs a solid repertoire of punches: a true 16-bit 8086 microprocessor, 256K of RAM, and 800- by 400-pixel monochrome graphics. It also has a hidden uppercut—a 10M-byte Winchester disk. Unfortunately, it must compete with heavyweights such as the IBM PC/XT and Compaq Plus. Does the Apricot XI stand a chance? A blow by blow account of the system should help you make a decision.

The basic ACT Apricot was reviewed in COMPUTERS & ELECTRONICS in April 1984. The hard-disk version is almost identical to the basic system, with the exception of an additional 5M or 10M bytes of storage. Let's recap what is in the basic system and then examine the hard-disk version and some special features of both systems that make the Apricot an interesting contender.

The Basic System

The basic Apricot system is about the size of an IBM PC*jr*. Were it not for the monitor, a separate system component, the Apricot would be much more transportable than an IBM PC Portable or Compaq—it's that light and compact. Even with the monitor, the system is still easy to carry around. The keyboard attaches to the main processor box, and the monitor, which weighs 9.1 lb, has a convenient carrying handle.

The keyboard of the Apricot is slightly smaller than the keyboard of the IBM PC. It has an excellent feel and full-travel keys. The keyboard layout is similar to the PC's. Some of the keys have "nonstandard" characters, such as a British pound sign where you would expect an American dollar sign (the dollar sign is there, but at a different location).

The Apricot uses 3½" Sony micro drives. In the basic Apricot, you can get either one or two drives, each containing 315K in 70 tracks; the XI contains one micro drive, on the right-hand side of the main processing unit and one built-in hard disk.

The micro drive is reliable, and the diskettes it uses are protected from dirt, dust, grime, and the vagaries of handling.

Inside the Apricot, you'll find an 8086 microprocessor operating at 5 MHz. The 8086 is a true 16-bit microprocessor, which is more efficient (faster) than the 8-bit 8088. Benchmark tests included in the previous review showed that the basic Apricot competes very well with the IBM PC and other PC compatibles in raw processing power, disk file operations, and other programming tasks.

In addition to the 8086, you'll find an 8089 microprocessor. This microprocessor handles input/output tasks such as keyboard communication and disk operations. The two microprocessors share a common bus structure. There's also an open socket for an 8087 numeric data processor, as there is in most IBM-compatible systems. The 8087 performs "floating-point" operations in hardware. Floating-point operations are very time-consuming in software, and the 8087 will dramatically increase the speed of numeric processing.

Included in the basic Apricot are a parallel printer port and a serial port. The parallel printer port is a standard Centronics; the serial port is identical in operation to the first IBM serial port—it can be used for connection to a serial printer but is more commonly used for an external modem.

RAM memory on the basic Apricot system is 256K. An expansion board can be added to the system internally to increase the RAM memory capacity to 768K.

The display shows a standard 80 characters per line by 25 lines per screen

PHOTOS BY BOB LORENZ

monochrome display in the text mode. The system provides 800 by 400 pixels in the graphics mode, in monochrome. As I mentioned in the review, the display is sharp and crisp. The monitor is green, with a long "persistence" (creating problems with light pen operation)—the image stays on the screen much longer than the image on a normal monitor, but not so much as to be distracting.

A unique feature of the Apricot is the *Microscreen*. The microscreen is a liquid crystal display of two lines of 40 characters each, located on the upper right of the keyboard. Below the microscreen are touch-sensitive function keys. The microscreen is used to display the current functions that can be invoked by touching the corresponding function keys. It is also used for such functions as displaying the current date and time. The keyboard contains a CMOS battery-powered "real time clock," which operates continuously, even when the system power is off.

In summation, the basic hardware of the Apricot is slick, well-designed, fast and efficient, and it includes as standard a number of options you'd ordinarily want in a system.

Software in the Basic System

The basic Apricot comes with "bundled" software. First, of course, is MS-DOS, the disk operating system that is virtually identical to the PC-DOS equivalent on the IBM PC. Also included is the MicroSoft BASIC interpreter. Applications software includes SuperCalc I, a spreadsheet applications program, and SuperPlanner, a data manager program. In addition, there are a number of utility programs, including an asynchronous communications package and other programs for data communications.

Other software in the Apricot system is integrated into the actual operation of the system. A Manager program allows the user to move a cursor on the screen or to press the touch-sensitive function keys below the microscreen to select functions. Each function has a subset of other functions, which in turn have subsets of subordinate functions, and so forth. Icons (pictures) are not used, but it's relatively easy to move from one function to another using only the cursor control or touch-sensitive keys and a minimum of typing. Also, limited use is made of "windowing" on certain functions.

The Apricot XI

The Apricot XI comes in either a 5M- or 10M-byte version, with the actual disk invisible in the innards of the machine. The 5M-byte version sells for $3995; the 10M-byte version, for $4495. In keeping with the Lilliputian dimensions of the system, the Apricot XI uses a 3½" Winchester hard disk made by a United Kingdom firm, Rodime. The disk appears to work just as well as larger hard-disk designs, although I did not exhaustively check its performance. The system, by the way, "boots up" from the hard disk (drive A:), just as hard-disk versions of IBM compatibles and the IBM PC/XT do. Owing to its small size, the electronics of the Apricot XI is densely packed. About one-third of the space is taken up by a compact power supply and fan; another one-third is taken up by the two drives; the remaining space is occupied by a motherboard as wide and deep as the main processor chassis.

The motherboard includes two expansion slots. Normally, these would be used for additional memory boards or for such components as a color display board or an internal modem. In the case of the XI, however, one of the slots is used for a disk controller board, which leaves only one slot for other options. Having a single available slot is a decided detriment if you want to add additional memory *and* another option, but is probably adequate for most systems.

Specifications

Product: ACT Apricot XI
Manufacturer: ACT (North America) Inc.
3375 Scott Blvd.
Suite 336
Santa Clara, CA 95051
Suggested Retail Price: $4495
Dimensions: 16.5"W x 12.5"D x 4"H
Weight: 14.2 lb
Operating Systems: MS-DOS 2.0, Concurrent CP/M-86
Other Features: 8086 CPU, 256K RAM, RS-232 serial, Centronics parallel, 9" monochrome monitor, 3½" microfloppy disk drive, 3½" 10M-byte hard disk, BASIC, SuperCalc, SuperPlanner

With hard-disk systems, of course, you don't usually have to worry about "interfacing" to the hard disk—the operating system does it automatically. You just go along, creating different types of files at will and selecting either drive A: (hard disk) or drive B: (micro drive), as you would with two floppy drives. One problem that you do have with any hard-disk system is backup and maintenance of the hard-disk files. However, with the micro drive available as drive B: and some good habits, you'll find periodic backups of new files are not very time consuming.

Special Features of the Apricot System

The high-resolution screen is a feature of both the Apricot and the Apricot XI that I have mixed feelings about. A resolution of 800 by 400 is about 2½ times the number of pixels in a standard IBM PC system—quite an improvement. As I mentioned, the monitor that comes with the system is quite sharp, and the graphics look very nice. However, its BASIC does not include commands to take advantage of the graphics, as in the PC and compatibles. There is no Line command to draw lines or boxes, and no Circle to draw circles, ellipses, or arcs. You can utilize the graphics in BASIC only by doing Peeks and Pokes to a "memory-mapped" screen area. With the Digital Research GSX Graphics Package included with the system, however, the package allows you to implement graphics, but with a great deal of work compared to what you would need to do with built-in BASIC commands.

Three other unique features of the Apricot are the Font, Logo, and Keys functions that run under the system Manager.

The excellent Font program allows you to create additional character fonts for display on the screen. It gives you an enlarged layout area of 16 by 16 pixels on which you can draw a character by moving around a cursor and performing other editing functions. As you are creating the character in the enlarged layout area, you can see the actual character elsewhere on the screen. The 16-by-16 matrix for each character allows you to create nearly any character set you'd like, from Japanese *Kanjei* to German script. You can store the resulting character set as a disk file and invoke it at any time to replace the normal set of characters. The entire operation uses several windows to show the source and target files, the layout area, and other data.

The Logo program under the Manager is similar to the Font program, except that in this case you can create and edit a "screen logo" 3 lines by 20 characters. The default logo is the "apricot" display that appears on the upper right of the screen. The Logo feature is primarily a tool for OEMs (Original Equipment Manufacturers) who would use their own logos in a "value added" system.

(Continued on page 91)

SOFTWARE REVIEWS

DESK ACCESSORY PROGRAMS

New products that will keep you from reaching for your calculator, calendar, and phone book while using your pc

BY BARBARA E. AND JOHN F. McMULLEN

THE year 1984 may well be remembered in the personal computer world as "The Year of the Accessory." Several significant accessory programs, including The Desk Organizer from Warner Software, Sidekick from Borland International, and Spotlight from Software Arts, were introduced in 1984. Products like these did not exist until last year. Furthermore, their development makes the personal computer a much more complete tool.

What is an accessory? Essentially, it provides a personal computer user the ability to interrupt the activity being performed and carry out another task such as note-taking, using a calculator, checking or updating an appointment calendar, looking up a telephone number and calling a person, or formatting a disk.

We've found accessory products tremendous enhancements to the power of our systems. In our judgment, no computer should be without one of them.

Two that we think are worth considering are reviewed below: Sidekick and Spotlight.

SIDEKICK

BY MICHAEL K. GUTTMAN

If your desk looks anything like mine, it's probably cluttered with notepads, scraps of paper, various pens and pencils (some work, some don't), a battered Rolodex, a dog-eared calendar and, buried somewhere, a calculator. Although my desk mess is often the object of muttered expletives, rarely has it occurred to me that it might be possible to live without it.

Not, that is, until I was introduced to Sidekick, the latest offering from Borland International, which also makes another notable software product, Turbo-Pascal. The new one, Sidekick, at $49.95, combines a calculator, a notepad, an appointment calendar, an auto dialer and an ASCII table, all organized in a convenient windowing environment that can be invoked by a few keystrokes from any running application.

Getting Started

Sidekick is very easy to use. After being loaded, it returns control to the operating system (or batch file), and all subsequent programs run under it in memory, as if it were a memory-resident extension of DOS. This arrangement means, of course, that Sidekick needs RAM, about 73K for the full system. Borland supplies several abbreviated versions, each excluding one or more of Sidekick's functions, that monopolize less memory.

Once Sidekick is resident, it can be invoked at any time, regardless of what's currently running, when the CTRL and ALT (or both shift keys) are pressed simultaneously. Immediately, the Sidekick menu window is superimposed on the screen, and a status line appears at the bottom.

PHOTO BY STEVE BORNS

Functions and Windows

From the main menu, each of Sidekick's functions can be accessed by typing a single function key or by holding down ALT and an appropriate letter (N for notebook, C for calculator, D for dialer, etc.). The user can also invoke one function while running another by using this ALT/letter combination. Each function appears as a window, and all functions may be opened simultaneously. The active window holds the cursor and controls the line at the bottom of the screen.

The F1 key summons explanatory text, which appears in its own window. This help is context-sensitive—that is, the explanation that appears is appropriate to the current activity—and obviates the use of the manual.

The Notepad

The most sophisticated function in Sidekick is the Notepad. For the most part, the Notepad is a subset of WordStar, and anyone familiar with WordStar commands and terminology will be breezing along in no time—within limits. The notepad is not a full-blown word processor. Word wrap, right justification, paragraph reformatting, margins, and tabs are missing. You can, however, do cursor moves, block operations, and string search-and-replace.

The Notepad also contains some useful features not found in WordStar. It has an auto-indent mode that begins a new line at the same point as the line above—very useful for programmers. It also has a "sort block" operation that could be very handy for maintaining simple lists. The Notebook also has a command for retrieving the date and time for insertion in the current document. In addition, the Notepad can print a "block" without leaving the document.

The most powerful Notepad feature, however, is its ability to "import" data from any part of the screen. With an application running, the user invokes Sidekick, calls the Notepad, then simply presses F4. The Notepad window temporarily disappears, the user marks a screen area using standard WordStar block commands (^KB and ^KK), the Notepad reappears, and the user can then copy this block anywhere into the Notepad text (using ^KC) and return to the principal application, which will resume processing exactly where it left off!

It's hard to emphasize how useful this one feature is. Consider these examples: A programmer testing a new program can halt execution, enter the Notepad, and capture any portion of the screen, add additional comments and log the time, then return immediately to program execution. An application user can

(Continued on page 90)

SPOTLIGHT

BY BARBARA E. AND JOHN F. McMULLEN

HAVE you ever considered how often you drop what you are doing and reach for a pad to jot down a number? Or stop everything to look up an address or telephone number or to grab a calculator for some quick computation? These interruptions could be eased with a software accessory called Spotlight.

Spotlight, from Software Arts, the developer of VisiCalc and TK!Solver (see COMPUTERS & ELECTRONICS, August 1984), comes as six individual accessory programs: an Appointment Book, a Calculator, a DOS Filer, an Index Card File, a Note Pad and a Phone Book. These programs are all "buried under DOS" when the computer system is initially booted and are accessible at any time in any program that runs under MS- or PC-DOS 2.0 (or higher). You access individual accessories by simultaneously depressing the SHIFT, ALT and, depending on the accessory you want, one of the following keys:

A—Appointment Book
C—Calculator
F—DOS Filer
I—Index Card File
N—Note Pad
P—Phone List

A SHIFT, ALT, H command activates the Spotlight Help facility, which explains the various functions of the system.

When you call in one of the accessories, the program being executed (such as 1-2-3, dBase II, or WordStar) is interrupted and the accessory window pops up on the screen. When you are finished with the accessory, you're returned to where you were in the program that was interrupted. From some of the accessories, such as the Calculator and Filer, you can paste information developed into the application being run.

The accessory windows contain three areas: the menu/prompt area, the top two lines of the window, where commands for the accessory are displayed; the contents area, where entries are displayed, added, changed or deleted; and the name and date/time area, where appear the time and date and the name of the accessory being used. Depending on the accessory in use, the image for it and the display of the contents area vary. (For example, the Calculator is a representation of a numeric pad on a calculator; the Appointment Book shows a desk calendar; the Note Pad, a blank sheet of paper, etc.) In no case does the accessory window take up the whole screen. You can move the window (the move mode is toggled with the SCROLL LOCK key, and the window is repositioned with the directional arrows on the keypad) in order to see what was displayed by the interrupted application program.

Six Accessory Programs

The Calculator. When the Calculator is activated (by SHIFT, ALT, C), the NUM LOCK feature automatically turns on and the numeric keypad becomes the calculator. (Other keys, such as ENTER, left and right bracket, apostrophe, and backspace become function calls, supplementing the numeric pad.) The Calculator has a 12-digit display, memory storage and recall, and constants. The calculated result may be stored directly in the application program that was interrupted. Once you become familiar with the structure of the key pad, you'll find the Calculator both easy to use and extremely useful.

The DOS Filer. When you invoke (SHIFT, ALT, F) the DOS filer, you are presented with a directory of all the files in the current disk drive or subdirectory, sorted alphabetically by file name.

Powerful commands allow you to view and manage the files and directories on disks: VIEW, which shows the contents of any directory or file on the system; UP, which displays the parent directory of the one shown in the window; SORT, which reorders the directory currently viewed by date and time (descending from most recent) or by extension,

size (descending), or file name.

Other commands include INFO, which displays the volume label of the disk, the number of subdirectories and files in the directory currently being viewed, the amount of space taken up by the directory and the amount of space left on the disk; and MKDIR, which creates a new directory. You can also change directories; format a disk; and delete, rename, or copy a file. Another command, called PASTE, inserts a file specification into the interrupted application.

The DOS Filer is one of the most useful components of Spotlight. Because of it, you don't have to exit an application program (and possibly lose data) to format a new disk or delete a file to make room for storing data. The only enhancement we would like to see in it is the ability to use DOS wild-card characters (*) to show only TXT files, for instance, or to allow copying of all BAK files.

The Note Pad. Pressing SHIFT, ALT, N brings up a diagram of a blank piece of paper. The module can keep up to eight pages of notes active at any time and can also print or save the notes to a file for permanent storage.

We found this accessory particularly useful when we were reviewing a software product and wished to take notes on it. We found it convenient, too, when we were in the middle of an activity and had to take a telephone message.

The Appointment Book. This accessory (activated by SHIFT, ALT, A) is an electronic desk calendar that lets you keep track of meetings, appointments and other activities. It can alert you of forthcoming meetings by sounding an alarm, even repeated weekly meetings, which, once entered, the system will store in the proper time slots for every week. Each day's schedule may also be printed out for reference.

This accessory, while providing the basic calendar operations, does not have the functionality of some of the stand-alone calendar programs, such as IBM's Time Manager (which can print the entire calendar for a range of dates and will notify a user of each occurrence of regular monthly meetings). However, by operating as a pop-up accessory, it provides an ease of use that the stand-alone systems do not have. Having used stand-alone systems for a number of years, we find the Spotlight approach considerably more appealing.

Specifications

Product: Spotlight
Mfr: Software Arts
27 Mica Lane
Wellesley, MA 02181
617-237-4000
Price: $149.95 (copy-proteced)
Requirements: IBM PC or compatible, 128K, DOS 2.x

"Spotlight" shines as a desk accessory

Phone List. This accessory (called by SHIFT, ALT, P) allows you to maintain and search alphabetical lists of names, phone numbers and related information (such as company name, address, or your remarks). Up to 36 separate lists of up to 500 entries each are possible. You enter names, numbers and other information into an index-card format. The program then alphabetizes the names and allows you to search for a specific name, go to a specific place in the file, view the file in a format similar to a standard telephone book, view individual "index cards," print either a specific card or the entire file, switch to another phone list, file the information in a separate text file (for a word processor or other program), or delete a specific record.

While the Phone List operates very rapidly and is quite easy to use, it can only look up names; it cannot dial them automatically, as some other telephone accessories can.

Index Card File. Invoked with SHIFT, ALT, I, this accessory provides the user with an electronic "wheeldex," actually a general purpose version of the Phone List. It performs the same type of input, search and display functions, maintaining up to 36 files of up to 500 "cards" each.

Like its companion accessory, Phone List, the Indexer operates very rapidly. On the other hand, it comes up short in functionality when compared with some of the better stand-alone systems of this type, such as Link Systems' DataFax (which provides extensive "keyword" search capabilities and much greater individual card size). We felt that the convenience of this pop-up accessory was outweighed by its diminished capability. We feel that in an index-card application, being able to search for key words is a major feature and, if possible, ought to be the next addition to this system.

Each of Spotlight's six modules is functional enough to stand on its own. The quality of the modules range from adequate—the Indexer—to superior—the Filer. When we viewed the system as a whole, Spotlight's quality was most apparent. We strongly recommend Spotlight to your attention. ◇

Note: Since this review was completed, Software Arts announced an upgraded version of Spotlight that includes an automatic telephone dialer, the ability to print the appointment calendar across ranges of dates, IBM AT and Compaq DeskPro compatibility and the use of color for various functions. Users of the initial version will be able to upgrade without loss of any information stored in Spotlight files.

ANOTHER USE FOR SPOTLIGHT

IT IS easy, once one familiarizes oneself with Spotlight, to envision the benefits that the system provides. We asked Dr. William A. Merlino, a Mays Landing, NJ, physician to use it to see whether it could help in his medical practice.

Dr. Merlino is no stranger to computers. He founded one of the early independent computer dealers on the East Coast ("Jonathan's Apple" of Marlton, NJ) and is the author of a gourmet cookbook program and a computer store management and billing system. After a short time he was ecstatic about Spotlight.

Long a proponent of computers in the management of medical practice, Dr. Merlino found that, by integrating Spotlight into his networked Compaq system, he was able to dramatically increase his office's efficiency. His receptionist, with minimum interruption of the VersaForm-based client billing and insurance-form processing system, manages the Spotlight-based appointment book and takes notes relating to client calls. Dr. Merlino accesses the calendar and notes and uses the indexer to maintain patient diagnostic notes. In fact, the accessory has outstripped its original purpose and has become the heart of the system.

DISPLAY-WRITE 2

IBM's full-featured word processing entry

BY JON PEPPER

REPORTS of the death of dedicated word processors, like that of Mark Twain in another day, may be greatly exaggerated, but these creatures are getting crowded out by new word processing software. These high-end, full-featured programs, manufacturers claim, can tame a PC so it behaves like a big, expensive stand-alone word processor.

IBM has entered the increasingly full market with its own word processing software, DisplayWrite 2, which is based on IBM's DisplayWriter system of dedicated machines. Ads for DisplayWrite 2 claim that it gives you many of the features of a dedicated word processor. I found that, while it does deliver on that promise, there are some tradeoffs.

DisplayWrite 2 contains all of the basic features and most of the more advanced features that one would want from a word processor: math capability, extensive column formatting, phrase library, address merging and a spelling checker. If IBM had introduced DisplayWrite 2 a few years ago, it would have stood out as a leading full-featured word processor. Today, any number of products can perform all the same functions—or more—and many are much easier to use than DisplayWrite 2, although some cost more.

Installation

The product comes with two slip-cased binders: a hefty procedures guide and a slimmer reference manual. IBM's documentation is clear and complete, with sections aimed at both beginning and advanced users. It includes some of the best explanations of DOS functions I have read anywhere, with a section on DOS directories and paths particularly well done. There are also a keyboard template and a quick reference card. The software itself comes on two diskettes.

I found DisplayWrite 2 to be cumbersome to install. In order to prepare a working copy of the software, you need three diskettes (in addition to your copy of DOS and a formatted diskette to hold data files). Even so, installation directions are not hard to follow. You simply load your copy of the operating system in drive A and the first DW2 distribution disk in drive B and type "B:Setup." A series of screen prompts leads the user through all of the necessary steps, including formatting disks and transferring the necessary DOS files. Someone with hardly any knowledge of MS-DOS can install the product.

Unfortunately, using the product does not go as smoothly. Two of the three working diskettes are required just to boot the program. And certain programs (like the spelling checker) require disk exchanges. There would be no such annoyance on a hard-disk machine, of course.

Opening Menu

After booting the program with your first DW2 disk and swapping it for your second DW2 working disk, you can choose from an opening menu that includes the commands CREATE, REVISE, PAGINATE, PRINT, EXIT TO DOS. If you choose to create or revise a document, you are led to a submenu with choices for setting up or altering the format and page numbering before you reach the insert-mode screen.

A status/ruler line at the top of the screen indicates the mode of operation, position of the cursor on the screen, the document name, the print pitch and other information. The line also has a cursor block that moves along as you type, which seems like an attempt to make the word processor seem like a typewriter. While I found it rather distracting, I suppose it can be useful.

Specifications

Product: DisplayWrite 2 Word Processor
Mfr: International Business Machines
PO Box 1328
Boca Raton, FL 33432
Price: $299 (not protected)
Requirements: IBM PC, XT, Portable PC, or compatible; 192K RAM; two disk drives; PC-DOS

Entering and revising text is straightforward. DisplayWrite 2 uses a "hot" keyboard: The delete key on the PC keyboard deletes characters while you are in insert mode. Block moves (copy, delete, move) are fairly easy to perform. Striking F4 brings up MOVE, COPY, DELETE, or OVERSTRIKE as choices on the bottom of the screen. Typing the first letter of your choice (or moving a highlight bar with the cursor keys and hitting enter) puts you in the corresponding mode. You then define the range of your block by positioning the cursor and hitting ENTER.

Some functions, such as centering and underscoring, were overly complicated to use. Underscoring requires nine steps (that's right); centering text is not much better. A dedicated center key would have been nice.

Advanced Functions

The program does have some clever touches. The FIND command (CTRL +

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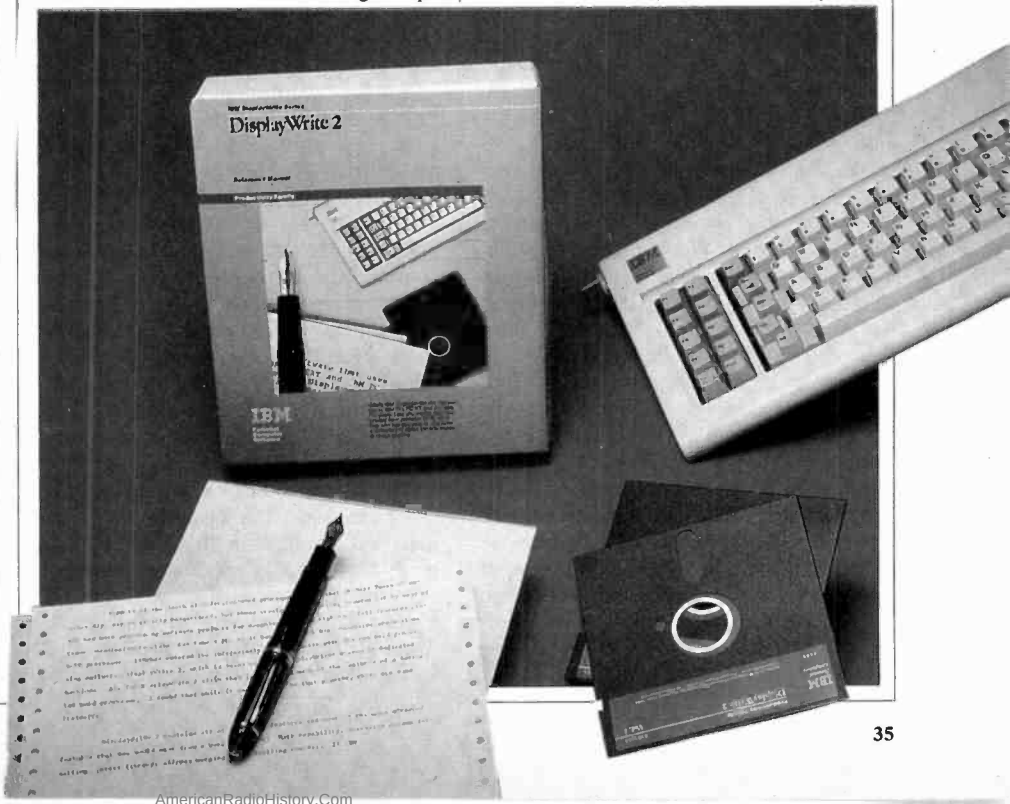

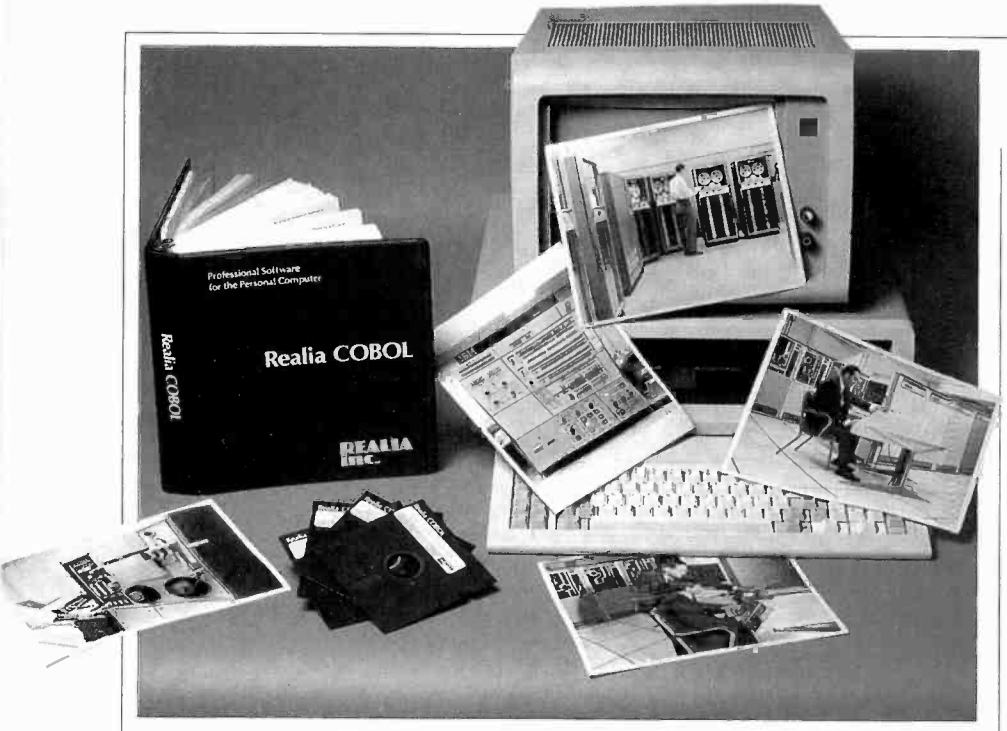

REALIA COBOL

Mainframe-quality Cobol for the IBM PC

BY BILL BARRETT

Realia, Incorporated, has developed a fast, new COBOL compiler for the IBM PC to compile mainframe programs and develop new applications for the PC or mainframe.

Realia COBOL is more than just another PC COBOL compiler. It is highly compatible with IBM's VS COBOL, it's fast, and it can compile large programs. This compiler uses all of the PC's address space, allowing 1M-byte Data Divisions and up to 6M-byte Procedure Divisions, with overlays. Equally impressive is the professional implementation of the language to the ANSI 74 standard, and its many VS COBOL extensions. It can compile and run COBOL applications developed on a mainframe; programs written in Realia COBOL can operate on bigger machines.

Realia COBOL compiles about 1000 lines of source code per minute with no errors. When errors occur, the compile process is cut short, so that 5000 lines of code with errors can finish in 3 minutes. Realia's compiler can handle source programs up to the size of the disk storage device. Speed and high IBM VS COBOL compatibility of this product mean the mainframe programmer can be productive on the PC immediately. And, because mini and mainframe computers can be freed for other tasks, overall shop productivity is enhanced.

COBOL: Some Background

COBOL (COmmon Business Oriented Language) is a popular minicomputer and mainframe language because it has been used for a long time. It is designed for business applications (inventory, accounts receivable, payroll, etc.).

New programmers generally don't choose COBOL for micros because the language is verbose, it is highly structured, and it may be very rigid in its file handling. The compile process frequently is cumbersome and may take a lot of memory and require large external storage space. Additionally, COBOL programs usually require large memory space to run, even after they're compiled.

That's the bad news. The good news is that COBOL programs are self-documenting and predictable. With the source code, a programmer can modify old programs relatively easily. Because they're compiled, COBOL programs execute pretty quickly, even on micros. COBOL is nearly machine independent: Applications written in a standard version of COBOL for one computer probably will run just fine on any other machine with the same or a similar COBOL compiler. Most big machine programmers are familiar with COBOL, and many thousands of applications have already been written in it.

And now, with micros joining mainframes in many shops, a product that will convert popular applications from the big machines to the little ones is worth its weight in megabit RAM chips. With the right compiler, programmers can use the micro to develop new applications or to run the ones they already have.

Realia COBOL and the ANSI 74 Standard

Unlike BASIC, COBOL has evolved under a set of nationally recognized and generally accepted guidelines from the American National Standards Institute (ANSI). This group, using input from various sectors of the industry, periodically updates the standards for COBOL. Probably the most popular COBOL standard is the *ANSI 1974 Standard*, even though many implementations of COBOL go far beyond it. It is highly desirable for a COBOL compiler to handle all or most of the features and commands that this standard sets.

ANSI COBOL defines a nucleus, which contains 11 component modules. If a module performs to the full requirements of the standard, it is said to have level 2 compliance. A level 1 rating indicates a basic implementation. The objective of Realia COBOL designers was to obtain a level 2 rating for all implemented modules. While some modules go beyond level 2 support, the sort/merge, report writer and communications modules are not supported.

The Realia compiler has some notable features. It supports COMP and COMP-3 mainframe data structures to the same 64-bit precision and byte alignment, for one thing. As a result, the PC can handle mainframe binary or packed decimal data without conversion.

With Realia, the programmer may specify condition testing before or after the PERFORM procedure. And there is full MS-DOS interface to enable programmers to use DOS features from within COBOL applications. Screen addressing and color selection with the ANSI.SYS device driver would be available to COBOL programs, for example. Subdirectories and the DOS PATH command are supported via the library module. Using such PC-specific routines would, of course, mean the application probably wouldn't run on a mainframe.

And, Realia has developed an interactive debugging package called "Follow The Source." While this facility doesn't use the standard's exact operating statements, it performs even better than the standard. You can trace a program while it runs and make interactive changes to the source code. Single-step and range execution modes also are available.

(Continued on page 87)

PHOTOS BY STEVE BORNS

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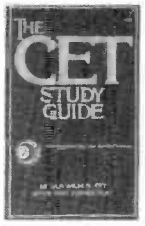

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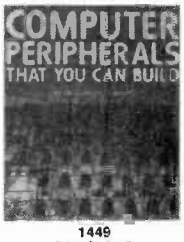

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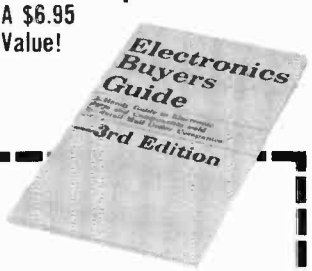

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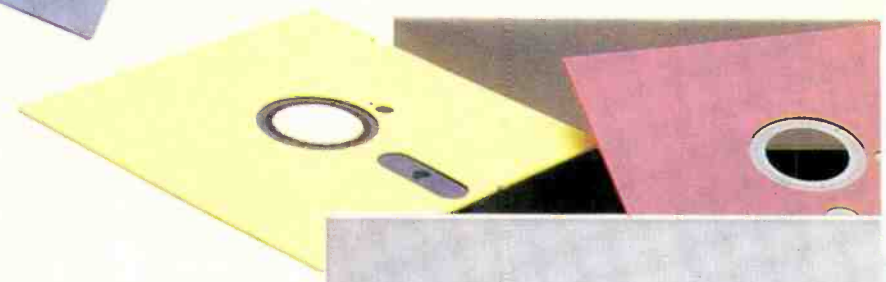
ADVANCED DATA MANAGERS

Command-driven software for building serious databased applications

BY MICHAEL K. GUTTMAN



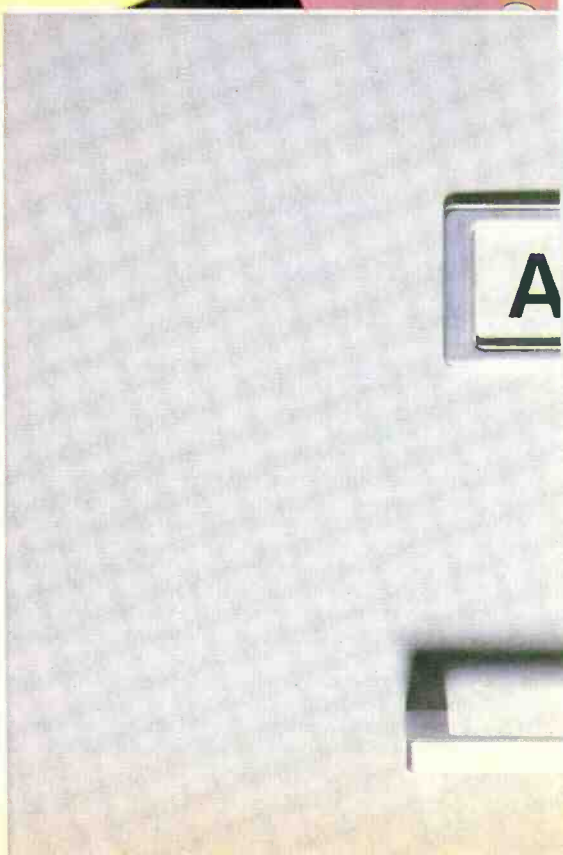


PHOTO BY MICHEL TCHEREVKOFF
Disks courtesy Cenna Technology
File cabinet courtesy Sam Flax

NEWSPAPER and magazine articles often compare word processing with typing. They also liken using an electronic spreadsheet to using a calculator. Similarly, running a database manager is like inserting and removing information from a file cabinet. What is not said about these "big three" general-purpose software applications—word processing, spreadsheets, and database managers—is that the advanced capabilities of database managers are probably the hardest to learn and understand.

At the high end of the spectrum are the true database management systems (DBMS), derived from software used on mainframe computers. These high-performance products are designed to handle complex problems and interrelationships of corporate-wide databases. Although they may contain some functions to allow managers and professionals to gain easier access to the company database, they are still generally the province of data processing specialists.

At the other end are the file or list managers, which allow the user to manipulate simple sets of data, such as mailing addresses, phone numbers, personal inventories, and appointments. These file managers can be a great help in keeping personal information on file, but are extremely limited otherwise. Generally speaking, such products have little or no capacity for interrelating different forms of data, operating logically or arithmetically on data, printing specialized reports, or reorganizing data to create new data files.

Other products fall in between. They are simple enough to be used by nontechnical people and yet sophisticated enough to satisfy the needs of an increasingly knowledgeable audience. They are generally aimed at a single user but may allow growth to multi-user or networked environments. Using their advanced features requires some training and experience with data structures and the logic of data processing, but never the need to master computer hardware, operating systems, or the cryptic intricacies of traditional computer languages.

Michael K. Guttman is a general partner of Professional Computer Technologies in Chico, CA.

The Data Manager Archetype

The best known example of this genre is probably Ashton-Tate's dBaseII. It is really two products, crudely but effectively integrated. The front end of dBaseII is

very much like a simple file manager (with some very useful extensions). It can easily be mastered by a novice in a few sessions. The "back end" is a much more sophisticated command language that allows the more experienced user to manipulate the input, output and processing of data in a variety of ways.

Although dBaseII has been joined and largely surpassed by competitors (including dBaseIII), many new data managers are based on a similar file manager/command language structure. Because of this, a new user can start immediately with the file manager features, later progressing to the more powerful features of the command language without having to change products or reenter existing data.

Using the Front End

With typical front end functions, the user can quickly create new files. (Files are collections of records, which, in turn are collections of fields, which are individual data elements.) The user enters records, usually with a standard screen template that moves automatically from field to field. After data entry, the user can recall individual records by number or contents for perusal or editing and browse through the file by groups of consecutive records.

Additional features may allow a search for all records that meet some defined criterion (for example, [CITY = NEW YORK] or [BALANCE > 0]). One can also sort a file by the contents of various fields or create a new file from selected records in the file. And finally, printed reports can be generated using one or more standard formats.

Examples from an archetypal data manager. A simple command file called "Reports" (below left) could be invoked by typing DO REPORTS. The manager would then "read" the command file, executing each line. Below right: When invoked (DO REPORTS CHOICE), the ENTER statement prompts the user for a report type and stores the result under the label CHOICE. When one of the following IF statements is true, the data manager will execute the statements between it and the next ENDIF statement. Statements between the other IF/ENDIF statement pairs that are not true will not be executed. This automation yields reports easily and is ideal for novices.

```
REPORT

Use time file
Sort on activity
   Report activity, employee, time, date, subtotalling time by
activity
Sort on employee
   Report employee, activity, time, subtotalling time by
employee
Sort on date
   Report date, activity, time, subtotalling time by date
Sort by project and activity
   Report project, activity, time, subtotalling time by activity and
project
```

```
REPORT CHOICE
Display "enter type of report (employee, activity, or project)"
Accept type
If type = "employee"
   Sort on employee
   Report employee, time subtotalling time by employee
End if
If type = "activity"
   Sort on activity
   Report activity, time subtotalling time by activity
End if
If type = "project"
   Sort on project
   Report project, time subtotalling time by project
End if
```

PHOTO BY BOB LORENZ

Even these fairly simple functions give the program tremendous utility. For example, let's suppose that we're managing a typical office and want to know which activities occupy the bulk of the employees' time. Let's say that the employees are already filling out time sheets with an entry for each activity showing the date, activity type (report preparation, meetings, telephone calls, etc.), and the elapsed time.

Using a typical data manager, we can quickly create a file with fields for employee name, activity type, date and time. We might type CREATE TIMEFILE, after which the manager would prompt us for the name, length, and data type of each data field. The data manager typically uses this information to allocate disk space and to create an input screen automatically.

We can then sort the file by any field or combination of fields. For example, we might say SORT ON EMPLOYEE+ACTIVITY to reorder the file for more convenient examination of various employees' activities. We can also list out selected records. For example, to list all telephone calls lasting more than five minutes we might say LIST FOR ACTIVITY=TELEPHONE AND TIME > 5. Finally, we can produce reports showing the total time logged by employee, activity, or date for all or selected records. For example, we might list and total all meetings lasting over one hour for every employee by typing REPORT EMPLOYEE, TIME SUBTOTALLING BY EMPLOYEE FOR ACTIVITY=MEETING AND TIME > 60.

As with a spreadsheet, we can fiddle with the data, creating different lists and reports experimentally, until we have the data tabulated and ordered to suit our purposes. In addition, we can get reports on the fly to meet special requirements. Therefore, we now have far greater control over this information than anything that could be generated by hand or from any set of standard printed reports from the corporate computer.

The Command Language

As useful as these front end features are, they pale beside the possibilities offered by the command language. Using the command language, the user can break out of the standard formats (and logic) of the database manager to create custom input and output screens and specialized reports. It's also possible to control the kind of data to be entered, generate timely messages, and update not just one but possibly several data files concurrently. In addition, these processes can be automated so that they can be used by others who may have only a passing familiarity with the operation of a data manager.

Using Simple Command Structures

The simplest function of a command language allows the user to take the file management commands commonly used and store them in a command file. Whenever the name of this file is invoked, the database manager executes all the commands as though they had been typed from the keyboard.

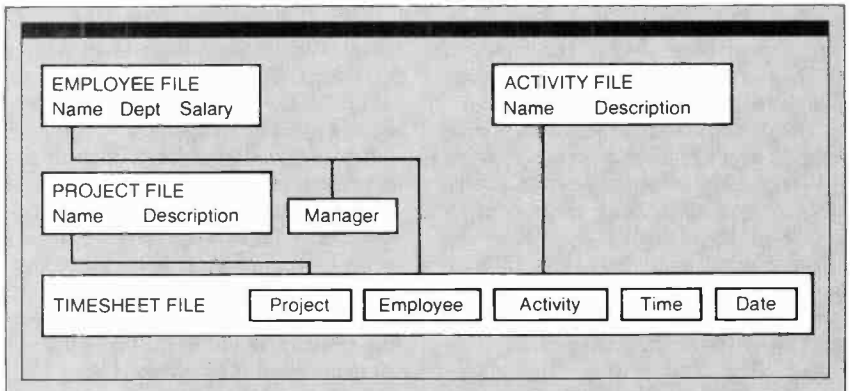
For example, suppose we decided on a series of reports we wished to run each week based on the time-analysis file we discussed earlier. We might construct a simple command file called "reports." Once we created this file, we might invoke it by typing DO REPORTS. The manager would then read the command file and execute each line. Obviously, we could save the time ordinarily used to type in each command every week. In addition, the task could now be handed over to a subordinate who could generate the reports as required—without any knowledge of the data manager.

If we wanted to make it easy for a subordinate to get a specific report, we could fashion the data manager so that it asks a human in plain English for information and executes instructions conditional to the response.

Thinking Like a Data Manager

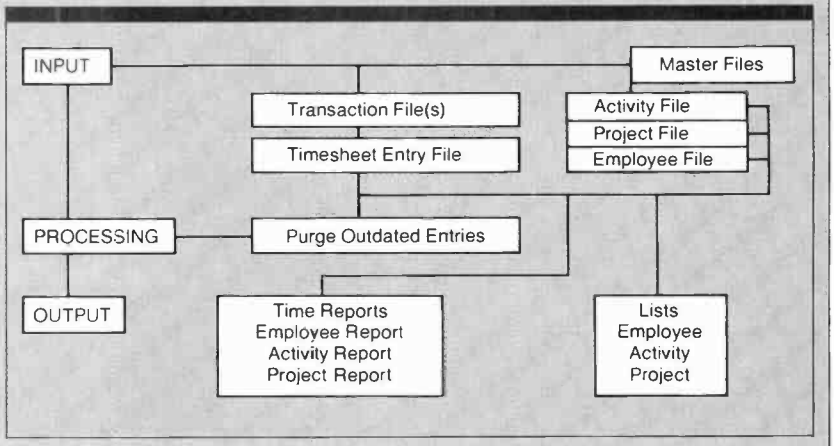
In order to get the most from your

(Continued on page 79)



"RELATIONAL" DATA MODEL

The object of this structure is to minimize the collection of redundant data and increase the flexibility of reporting. For example, to report on how many hours of travel have been accumulated for projects under the direction of a particular manager, the user need only add a Manager field to eah record in the project file, not to each record in the timesheet file. Since there are far fewer records in the project file than in the timesheet file, this can save both time and file space. Once the data structure is defined, it is necessary to detail the flow of data through the system. This includes not only the input and output processes, but also any maintenance procedures—for instance, to purge the file periodically (see below). In this case, we might run a command file procedure every month that purges all timesheet entries more than six months old for all completed projects.



USING DATABASE MANAGEMENT SYSTEMS

The advent of capable data managers on micros has streamlined the way many Americans are doing business

BY MARTIN PORTER

LIKE cars that used to run on regular and high-octane gasoline, microcomputers once primarily ran two types of software, word processors and spreadsheets. More and more, a third kind of software is fueling personal computers: the database manager.

The database software market, now at slightly over $1 billion a year, is growing 40% annually, according to the Cupertino, CA, consulting firm, Infocorp. In a recent survey of smaller companies ($5 million or less in annual sales), 42% reported that database management programs were among their two most important software applications.

Data on the Batter

One company benefitting from a DBMS is Dilettante Chocolate of Seattle. Although the company is only seven years old, the recipes for its truffles have been passed on for generations and won it awards. However, as a company, Dilettante is strictly high-tech, thanks to Brian Davenport and a DBMS package called R:base Series 4000 from Microrim.

"I've applied a very straightforward business school approach to managing this business," says MBA-holder Davenport. "We use the program for accounting and inventory control."

R:base is a derivative of a relational database product called RIM that Davenport first encountered while in business school. He says the product is easily worth four employees. It's used on four stand-alone Victor machines, which will soon be linked in a local area network. The system was put to the test when the company applied for a bank loan.

"The loan officer, looking over the way we handled things, said he'd have been surprised to find so much data control from a company ten times our size," Davenport reports, proud of his business management skills that could apply as easily to running an automobile assembly line as cooking gourmet chocolates.

Game Computers

Database management met greater challenges at last summer's Olympic Games in Los Angeles. The Los Angeles Police Department, for one, faced an information nightmare trying to keep track of the various events throughout the city.

To handle the task, ten Columbia computers distributed to command posts thoughout the city used a program written in dBase II to track the information necessary for the 55,000 job assignments that were handled daily by an augmented Los Angeles police force.

According to Sergeant Terry Pratt, automation supervisor for the Olympic Planning Committee, dBase II was used to generate the printouts for the daily job deployments throughout the city. The printouts specified every job assignment in each of the 22 divisions of the police force. For each assignment, division officers filled in names that were filed at the central command post.

ART BY TOM LULEVITCH

Since the Olympic Committee reimbursed the L.A.P.D., job assignments were coded by the officer's rank or the short term employee's salary and were printed out in a daily auditing report. Officers' personal histories were downloaded via an IRMA board from the L.A.P.D. mainframe. Furthermore, personal histories of 250 volunteers were accumulated so the assigning officers would know each volunteer's skills and thus know where they could be used most appropriately.

In addition to job assignments, dBase II was used to keep a running police journal of the entire Olympics. Every incident that occurred in the city or at the game sites was fed into a central database so the duty officer could assess the information in a variety of formats. For instance, with a few keystrokes, the officer in charge could see a printout of all the events at the L.A. Coliseum or a summary of all the arrests in the previous 12 hours.

Furthermore, Pratt and company used his program to keep track of the entire inventory of L.A.P.D. equipment dispersed throughout the city. "We had to know what equipment was located where. If we needed a special vehicle we had to know where it was and whom to contact," Pratt explains.

He adds that since the Olympics, "requests have been pouring in" from the various L.A.P.D. divisions for desktop databases to handle routine workloads.

"We primarily had a mainframe mentality in this police department," he says. "We have since discovered that the table-top stuff can be pretty effective."

A similar revelation came from another traditional mainframe user, Coca-Cola, which utilized the PC/Focus database program to control its ticket allocations for the Olympic Games. The Coke division that has the reponsibility of caring for the needs of the company's leading clients had the task of managing files of nearly 8000 guests and allocating more than 41,000 tickets for the Olympic festivities.

Bill Conner, Coke's Olympic Systems Manager, explains that he set up four different databases for the assignment, with separate records for customers' names and addresses, housing, transportation, and ticketing. The sales staff received daily printouts of where its clients were staying and when they were arriving in and departing from L.A. Meanwhile, the staff also received reports of the clients' tickets allocations, subdivided by price, row, seat and aisle number for each of the 500 different events.

"We knew where everyone was and where he was going," Conner claims, adding that his only other options were to use the Coca Cola mainframe in Atlanta or to handle the chore manually. "We wanted control of the procedure at the source. If the system went down in Atlanta, we would have been in big trouble. We even looked into the possibility of using a time-sharing service, but the answer kept coming back to using a local DBMS."

The hardware consisted of several IBM PCs equipped with 10M-byte Winchester drives. Without them, Conner adds, "we would have had to hire a lot of people with pencils—and then we would have had to hope that they kept their inventory codes correctly."

Hacking Down Trees

While big business and even big sports officials are being drawn to the possibilities of desktop database management systems, it has been the smaller (and less visible) entrepreneurs who have led the way.

Steve Seeberg runs a company called Emerald Tree in northern Michigan. His is not the kind of business that makes the cover of the *Wall Street Journal,* but without it Christmas would never be the same.

Emerald Tree is the second largest supplier of Christmas trees in the U.S. It owns nearly 8000 acres of pines, spruces and Douglas firs. The trees grow for eight to fifteen years before they are cut and sold to wholesalers or bought by mail order or through retailers.

In the next few years, however, a shakeout will be taking place in the Christmas tree industry. An abundant planting eight years ago yielded a massive tree crop for Christmas 1984. Competition promised to be fierce, and Seeberg, who has an accounting background, knew that a computer could help him in these tough times.

He purchased three IBM PCs with 30M-byte hard disks and a PC/Focus DBMS package to keep a file on each

(Continued on page 80)

Martin Porter is a free-lance author who contributes to various periodicals and magazines on computer-related subjects.

BUYER'S GUIDE TO ADVANCED DATA MANAGERS

THE chart on pages 48 and 49 lists database managers that have procedural languages. These DBMS systems let you develop extensive new applications and fine-tune databases. You can control the kind of data you enter, generate timely messages, and update not just one but several files concurrently. Because these processes can be automated, they can be executed by novices.

All the programs listed allow a user to check data on input, design custom input screens, and import and export files in another format. Each has a formatter and online help screens. Additional features, such as tutorials, color, and copy protection, are important only in certain situations, should you want, for example, to minimize the operator's training or to back up the system conveniently.

File sizes are given to indicate the relative capacities of the programs. In ordinary practice, most office applications will not reach upper limits. A figure that is sometimes more significant is maximum field size. For instance, if you want to record a product description or a note to yourself, you might find a field of restricted size filled quickly.

All the procedural, or command, languages have the capabilities of the idealized command structure discussed in the accompanying article.

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Condor Computer Corp.
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Data Access Corp.
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Miami, FL 33156
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Mountain View, CA 94043
800-227-6621

Metafile
Sensor-Based Systems
401 16th St. SE
Rochester, MN 55904
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Probase Group
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Microrim
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Bellevue
WA 98007
206-641-6619

Revelation
Cosmos, Inc.
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Seattle, WA 98188
206-824-9942

Savvy PC
Excalibur Technologies Corp.
PO Box 26448
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Product	Maker	System(s)	Price ($)	Max. Chars./ Field	Max. Chars./ Record	Max. Fields/ Record
Condor 3	Condor Computer Corp.	MS-, PC-DOS; TURBODOS; CP/M; MP/M	650	127	1024	127
Dataflex	Data Access Corp.	IBM PC, XT, AT, compatibles	995 (1)	255	4000	255
dBaseII	Ashton-Tate	MS-, PC-DOS; CP/M	495	254	1000	32
dBaseIII	Ashton-Tate	IBM PC, XT, compatibles	695	254	4000	128
Formula IV	Dynamic Microprocessor Assocs.	MS-, PC-DOS; CP/M86	695	127	1024	200
Informix	Relational Database Systems	MS-DOS; Unix multi-user	795 (2)	2048	2048	2048
Knowledgeman	Micro Data Base Systems	MS-, PC-DOS; CP/M86	500	65,535	65,535	65,535
Manager	Manager Software	IBM PC, XT, AT, compatibles	195	1024	2048	50
Metafile	Sensor-Based Systems	IBM PC, XT, AT, compatibles	995	250	1000	250
Optimum	Uveon Computer Systems	MS-, PC-DOS; CP/M86; TURBODOS; CP/M	595	255	12,750	50
PC/Focus	Information Builders	MS-, PC-DOS	1595	256	4096	250
Probase	Probase Group	MS-, PC-DOS; CP/M86	300 (3)	64	1024	64
R:base 4000	Microrim	IBM PC, XT, compatibles	495	1530	1530	400
Revelation	Cosmos	IBM PC, XT, AT, compatibles	950	64,000	64,000	64,000
Savvy PC	Excalibur Technologies Corp.	IBM PC, XT, AT, compatibles	395	1000	256,000	255
The Sensible Solution	O'Hanlon Computer Systems	MS-, PC-DOS; TURBODOS; CP/M; MP/M	695 (4)	55	55,000	1000

(1) 16 bit: $995, multi-user: $1250; 8-bit: $750, multi-user: $995
(2) Multi-user prices start at $1600
(3) Single-user: $300; network: $900
(4) Multi-user: $995

Max. Records/ File	Structure	Multi-user/ Networking?	Tutorial Available?	Support Color?	Copy Protected?	Read/Write Across Drives?	Command Language
65,534	Relational	No	Yes	Yes	No	Yes	44 Commands; English-like
65,000	Relational	No	Yes	No	No	Yes	Dataflex; high-level structured
65,535	Relational	Yes	No	Yes	Yes	Yes	Flexible programming
Limited by disk	Relational	No	Yes	Yes	Yes	Yes	Flexible programming
Limited by disk	Relational	Yes	Yes	Yes	Yes	Yes	English-like query language; free format
Limited by disk	Relational	Yes	No	No	No	Yes	High-level English-like
65,535	Relational	Yes	Yes	Yes	No	Yes	Similar to Pascal; highly structured and interpreted
32,767	Relational	Yes	Yes	Yes	No	Yes	Auto-programming supplies text; allows comments
64,000/ database	Relational	Yes	Yes	Yes	No	Yes	Procedural language based on assembly language
Limited by disk	Relational	Yes	Yes	No	No	No	Directly programmable or used to auto-program
Limited by disk	Relational	No	No	No	Yes	Yes	Nonprocedural; command order immaterial
65,500	Relational	Yes	Yes	Yes	Yes	Yes	Powerful macro language
Limited by disk[e]	Relational	No	Yes	No	No	Yes	English-like; query has no formal syntax
Limited by disk	Variable	No	Yes	Yes	No	Yes	Flexible natural language
60,000	Relational	No	Yes	Yes	No	Yes	Natural context-addressable; 150-phrase vocabulary
Limited by disk	Relational	Yes	Yes	No	No	No	English-like query language

IBM'S NEW QUIETWRITER

Unique thermal ribbon achieves letter quality without noise

BY JOSEF BERNARD

IBM, as any longtime typist knows, manufactures more than computers. It has been a leader in typewriting technology ever since 1935, when it introduced the first electric typewriter that became a commercial success in the U.S. A generation later, in 1961, it began marketing a new industry standard, the Selectric typewriter. With its revolutionary "golf ball," the Selectric gave typewriters interchangeable print elements and stationary carriages.

Now it seems IBM has broken new ground, this time introducing a computer printer called the Quietwriter. What makes this printer unique is how it forms characters on paper. While in technical terms it is a "non-impact dot matrix thermal printer," the Quietwriter is unlike any other printer of that description.

Josef Bernard is Technical Editor of COMPUTERS & ELECTRONICS.

How It Works

The Quietwriter doesn't work like other thermal printers. It prints on ordinary paper by transferring ink to it from a special ribbon cartridge. What makes the Quietwriter particularly interesting is the way in which the ink is transferred.

IBM uses the phrase "resistive ribbon technology" to describe its new method of printing. It is unlike other thermal printing mechanisms, because its process does not use a heated printhead. Instead the printhead contains 40 tiny electrodes that apply an electric current to the ribbon. The heat that releases the ink is generated within the ribbon itself.

The figure at right shows how the four-layer resistive ribbon is constructed. The first layer is made from an electrically resistive polymer that generates heat when an electric current is passed through it. This heat is transferred to a metallic heat-conducting layer, which in turn transfers it to an easily melted layer that permits the ink (the fourth layer) to be released.

When a character is to be printed, the print mechanism presses the ribbon against the paper. The electrodes in the printhead make contact with the resistive layer and apply the small electrical currents that create heat that, through the process described above, melt tiny

PHOTOS BY DAVID ARKY

areas in the release layer and "paint" the ink onto the paper.

There is a version of the Quietwriter with a keyboard, the Quietwriter 7, that is intended for use as a typewriter. It has the same print technology, but a slightly different ribbon. Corrections are made by applying a smaller current than is used for printing to the printhead. Instead of melting, the release layer simply becomes sticky, and the ink is lifted by it from the page. Since the printing is accomplished without impact, corrections are all but undetectable.

Ribbons are rated for approximately 160,000 characters, depending on the type font and pitch used. Replacements are priced at $12. IBM also supplies a special cleaning ribbon with the printer to remove particular buildup from the printhead. Fresh cleaning ribbons are available for $5.55. Despite its innovative technology, the Quietwriter should not be any more expensive to operate than other printers yielding output of similar quality.

More Innovations

While the Quietwriter's resistive ribbon technology certainly makes it unique, the printer has a lot more to recommend it.

Character generation is accomplished through a matchbook-size ROM cartridge that plugs into a compartment under the cover of the printer. Each cartridge, called by IBM an "Electronic Font," contains a set of 252 characters. Since there are two compartments, two sets of type fonts are available simultaneously under software control.

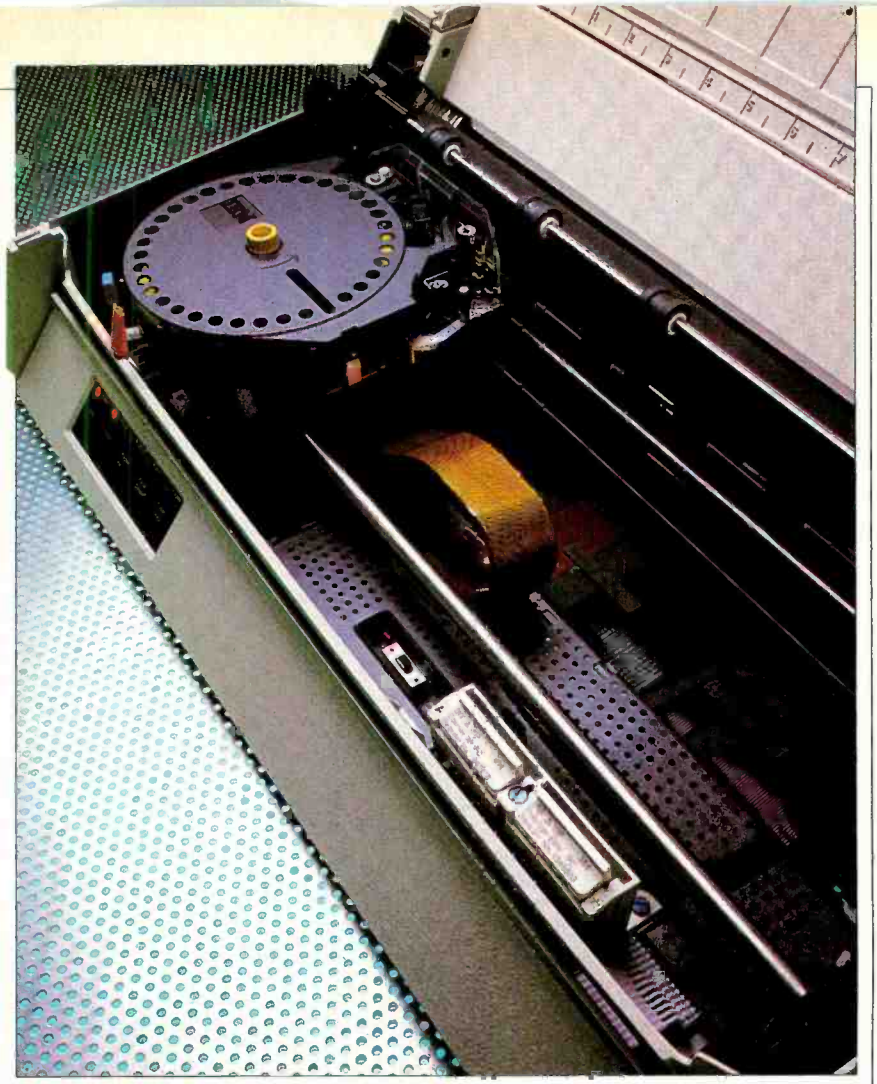
While the Quietwriter is not a graphics printer, its Electronic Fonts support the entire IBM PC character set, which includes some graphics characters as well as a number of foreign language characters. In addition to its four "PC" fonts, the Quietwriter can also accept any of the 14 (as of this writing) Electronic Fonts intended for the typewriter version of the printer. Each costs $50.

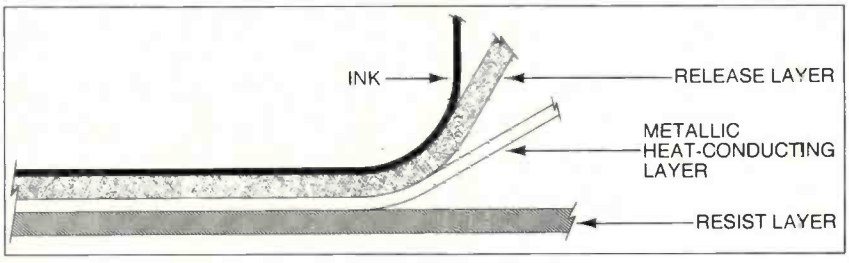
The print quality is extraordinary—as you might expect from a printhead having the electrical equivalent of 40 wires stacked vertically. As you can see from the enlargement below, it is next to impossible to tell that the characters are formed in a matrix process and not by a formed-character print element. Print density is 240 dots/inch vertically and 350 dots/inch horizontally.

The printhead, incidentally, is rated in excess of 4,000,000 impressions, and can easily be replaced. A new unit costs $20.

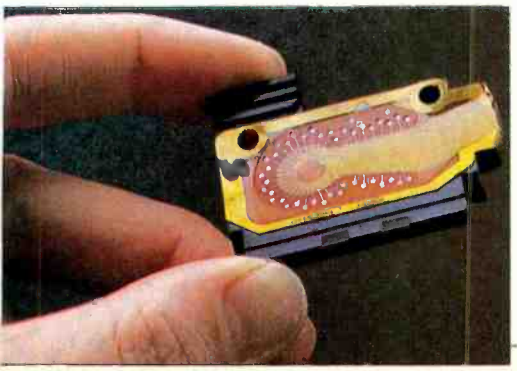
The Quietwriter has no manual mechanism for paper feed or advance—there are no knobs to turn. Paper movement is controlled entirely by membrane switches on the front of the printer or by software. In addition to line feed and form feed controls, the unit has a provision to

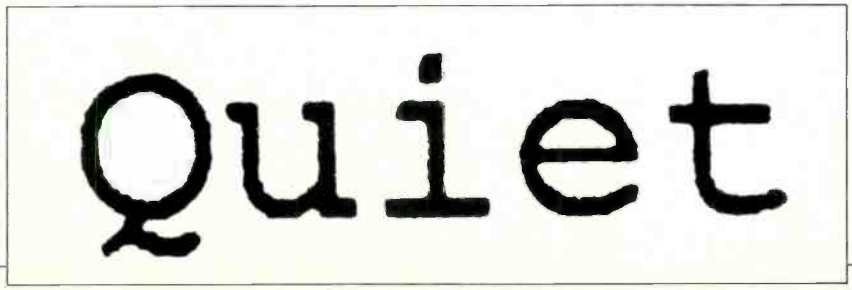
(Continued on page 88)

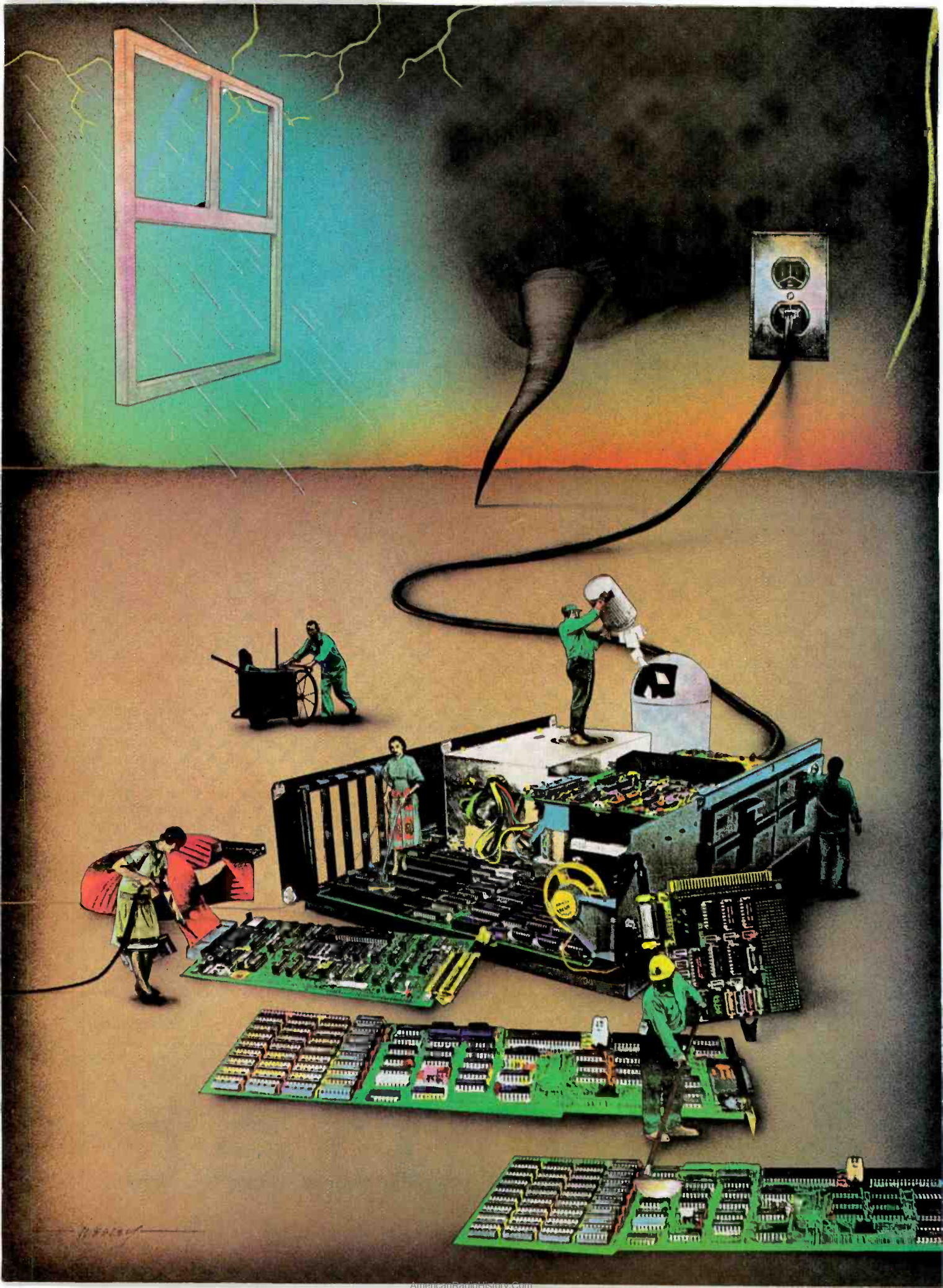




Construction of resistive ribbon is shown at right, 40-electrode printhead below. 8X magnification of output (below, right) shows virtually no evidence that characters are matrix-generated.







HOW TO MAINTAIN YOUR MICRO

What you need to know to keep your micro in tune

BY D.J. HERDA

HAVE you ever:

- Left your microcomputer uncovered while you were not using it?
- Smoked a cigarette, cigar, or pipe as you sat at your computer?
- Used your micro more than four or five hours at a time?
- Turned your micro on during a sweltering hot day?
- Taken a telephone call while working at your computer?
- Walked around the room before touching the computer keyboard?
- Turned your system on during an electrical storm?
- Temporarily placed a disk on top of your CPU or video display?

If you're like most micro users, your reply to at least one of the above is, "Certainly. Who hasn't?" The answer: people who have the least trouble with their systems.

Notice I said the *least* trouble. The painful truth is, no matter what you do, sooner or later something will go wrong. Of course, there are some things you can do to reduce computer malfunctions and costly downtime—either from normal attrition or user abuse. And that means holding costly repairs down, too.

Down to Basics

Most people think of a computer as the keyboard and the electronic circuitry: the central processing unit (CPU), RAM and ROM. But these are probably the components least likely to malfunction. According to several recent independent service studies, the weak links in a typical micro system are the electronic media on which programs and data are placed, cassette tapes and floppy disks. (Winchester-type hard disks and ROM chips built into cartridges, called "firmware," are sealed and less susceptible to damage.) Once media are damaged, it's difficult to distinguish software malfunctions from hardware problems. The key to avoiding disasters is to minimize the possibility of media failure.

Magnetic media defects can be caused by many things. If you've ever tried playing a kinked magnetic tape on an audio tape recorder, you know about physical media problems. Besides producing a "skip" at the location of the kink, the tape is weakened at that spot and may eventually break.

The same holds true with magnetic media used for data storage. You can damage a disk by bending it while inserting or removing it from a disk drive or by writing on the label of a disk with a pencil or a ballpoint pen. Always write on labels *before* affixing them to disks. If you must write on a label already attached to a disk, use a soft, felt-tipped marker and press gently.

Dust, dirt, grease, and various airborne contaminants (such as the residue from hair spray; cigarette, pipe, and cigar smoke; etc.) may settle on exposed tapes and disks and interfere with the drive head's ability to read or write information. Certain caustic substances can eat through oxide coatings permanently, destroying the medium along with any data stored there.

The solution? Keep all magnetic media in your micro's disk drive or in a sealed storage container. And never touch exposed magnetic media surfaces. The oil naturally present on the skin is bad news for a disk's oxide coating.

As an extra precaution, periodically clean your disk drive with a commercially available product to remove random debris that accumulates. Radio Shack and other manufacturers make a simple-to-use cleaning kit that helps extend disk and head life and prevent data loss. At about a dollar a cleaning, it's cheap insurance.

Squeaky Clean

Dirt and pollutants damage more than magnetic media. They can also injure your computer. In an office, airborne particulates are bad enough. In a home, they're even worse: cooking grease, human and pet hairs, cleaning chemicals, miscellaneous aerosol spray residues, in addition to run-of-the-mill dust and dirt. Even though your computer is sealed in a case, it's not airtight. All electronic and mechanical components create heat that must be dissipated via circulating air, the same air carrying all the dirt and pollutants so deadly to computers.

Of course, the external symptoms of dirt and pollutants are easy enough to spot and eliminate. When your video display screen gets dusty, gritty, or greasy, the culprit is a thin coating of grime. Many products are made for cleaning CRT screens. Four that seem to work especially well are Innovative Computer Products, PerfectData Cleaning Kit; Inmac's Cleans Cycle Master Cleaning Kit and Texwipe's lint-free Cotton Cloths and Clearview Terminal Wipes. Companies like Nortronics and Discwasher offer a range of cleaning and care products for your computer. Nortronics has head cleaners for 5¼" and 3½" disk drives, and a 5¼" disk drive

D. J. Herda is a free-lance writer and columnist, and is the author of several books on computers.

ILLUSTRATION BY CARL WESLEY

THE DAWN OF A NEW ERA

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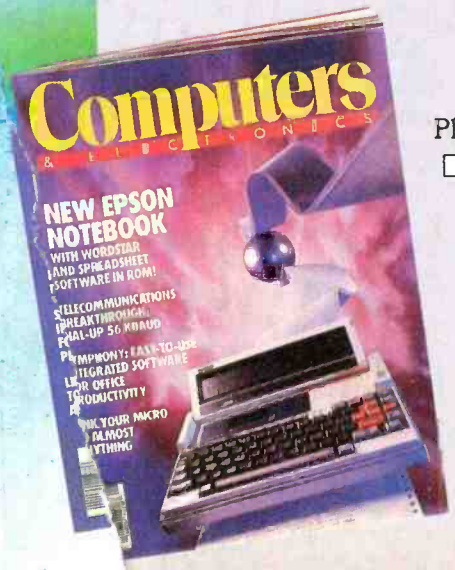

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Grounding mats protect computer and data from possible damage due to static electricity.

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analyzer to find speed problems and other malfunctions. Discwasher supplies a "Clean Runner" package for 5¼" or 8" disk drive cleaning.

Never use commercial degreasing products on your display screen. They may eat away at the surface of the screen, making it difficult to read.

Unfortunately, by the time you notice dirt on the *external* parts of your computer system, internal damage has already begun. Trapped dust, dirt, and various contaminants have started to corrode sensitive electrical contacts and short delicate circuits.

A monthly cleaning regimen can help avoid some of these internal problems. Turn your micro off, unplug the unit from its power source, and remove the cover so that you can check all computer air vents and intake ports. If your operator's manual doesn't tell you how, check with the manufacturer.

Carefully examine all ventilation slots, filters, and fan housing (if any) for dirt, dust, and grime. Check your manufacturer's recommendations for filter replacements. On permanent screens and foam filters, use a vacuum cleaner to remove as much dirt as possible. (Several battery-powered mini-vacs not much larger than small flashlights are available to reach into tight spots.) If the screens and filters are removable, take them out and clean them under clear, warm, running water. Don't use deter-

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Dallas, TX 75234
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Discwasher
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Columbia, MO 65201
314-449-0941

Fidelity Products Co.
5601 International Pky.
Minneapolis, MN 55440
800-328-3034

Inmac (Perfect Data Products)
2465 Augustine Dr.
Santa Clara, CA 95051
408-727-1970

Misco
PO Box 399
Holmdel, NJ 07733
800-631-2227

NEBS
12 South St.
Townsend, MA 01469
800-225-9550

Nortronics
8101 Tenth Ave.
Minneapolis, MN 55427
612-545-0401

Radio Shack
Tandy Center
Fort Worth, TX 76102
(and local stores)

Specialized Products Co.
2324 Shorecrest Dr.
Dallas, TX 75235
214-257-3535

POWER LINE PROTECTION

Electronic Protection Devices
5 Central Ave.
Waltham, MA 02154
800-343-1813

Electronic Specialists, Inc.
171 S. Main St.
Natick, MA 01760
800-225-4876

Electro Systems Research, Inc.
PO Box 1268
Temecula, CA 92390
714-676-5699

Indus-Tool
Dept. CC
325 W. Huron
Chicago, IL 60610
312-642-6871
800-662-5021

Networx
203 Harrison Pl.
Brooklyn, NY 11237
718-821-7555

CHEMICALS, CLEANING SUPPLIES, STATIC PROTECTION

Chemtronics, Inc.
681 Old Willets Path
Hauppauge, NY 11788
516-582-3322
800-645-5244

Texwipe Co.
PO Box 575
Upper Saddle River, NJ 07458
201-327-5577

3M Company
Static Systems
2111 W. Braker Lane
Austin, TX 78769
800-328-1368

TOP LEFT AND BOTTOM RIGHT PHOTOS BY BOB LORENZ

gents, which can leave behind caustic residues. Allow the filters and screens to dry thoroughly before you reinstall them. Wet filters inside your micro can create problems.

Also, each time you examine filters and screens, check for signs of damage. If there are any holes or if the filters are clogged beyond cleaning, replace them as soon as possible.

At least twice a year, check as much of your computer as possible for miscellaneous dirt and pollutants. First, turn all power off and unplug all power cords. Wait a minimum of 20 minutes (or as long as your manufacturer recommends) to allow for the discharge of electricity held in any of the large capacitors commonly used in computers. Then remove all protective cases and scout around inside for hair, "dust bunnies," and other garbage. To remove *internal* debris, don't use a vacuum cleaner, which could damage some of the delicate micro components. Instead, rely on fingers, long tweezers, and clean pressurized air for blowing out dirt and dust. Texwipe's Micro Duster is a pressurized can of laboratory-clean gas that's nontoxic, nonflammable, and noncorrosive, designed for use with delicate computer components. You may also use one of the clean-air sprays sold in photo stores for cleaning cameras and photographic equipment. Falcon's Dust-Off II and Beseler's Dust Gun are two such products. Many of these come with extenders and nozzles for getting into tight spaces. Just be sure that you're not simply moving debris from one corner of the case to another.

While your micro system is opened for inspection, check all mechanical components for wear. Look for worn spots (which will appear dull or severely scratched) on all moving parts and on the fixed rails on which your printer's printhead rides.

If your impact printer uses fabric ribbon, examine the printing elements for buildup of ink, ribbon fibers, and paper scraps. To get the highest quality printing from your element, clean it at least monthly with one of the commercially available products (available at computer and typewriter stores). If you have a dot matrix printer, check to see that all the dot patterns are in good shape by printing a sample page using all the characters on your micro's keyboard or using the printers self-test feature. Examine each character for defects. Deterioration in the patterns means the printhead may need to be replaced.

One word of caution. Although most micros are designed to allow fairly easy access to their internal mechanisms, a few are not. Called "sealed" units (like the Atari, Apple IIc, Macintosh, and several other models), they may require trips to the shop for regular servicing. Although that's more expensive than if you could do the job yourself, having it done regularly will save you time and money over the long run.

Keeping Cool

Even though computers are designed to operate within a certain temperature range, the continuous output of heat from any micro can be damaging if it's not allowed to dissipate according to design specifications. Since safe operating ranges vary from one brand and model micro to another, it's wise to check your manual for your own micro's range. Here are some typical ambient (room) temperature ranges recommended by manufacturers.

Epson QX-10:
50°F to 95°F
IBM Personal Computer:
50°F to 110°F
Osborne 1 Computer:
32°F to 85°F

(Continued on page 78)

For every part of a computer that needs to be cleaned or tested, there's a product to do the job. Below are just a few of them.

THE TENTH ANNIVERSARY OF THE ALTAIR 8800

Popular accounts of the invention of the personal computer are fraught with error, ego, and eccentricity. To tell the story behind *the story,* COMPUTERS & ELECTRONICS *asked Forrest Mims to review the history of the microcomputer. Mims is one of the founders of MITS (Micro Instrumentation and Telemetry Systems), the company that produced the Altair, the first successful personal computer. In the articles in this issue, Mims chronicles the development of the micro and talks with H. Edward Roberts, the "father" of the Altair.*

RICHARD PIPES

SETTING THE RECORD STRAIGHT

BY FORREST M. MIMS III

Few major inventions have uncontested ancestries. Consider, for example, the controversies over who invented the telephone, the incandescent lamp and, more recently, the digital computer. Now, the invention of the personal computer is being written about in magazine articles and books, and some of these accounts contain glaring errors and omissions. That should trouble those of us who use personal computers, for we are the first generation to have at our fingertips the means to extend intellectual and creative abilities once available only to a few.

Two facts about the history of personal computing are indisputable. One is that the introduction of the Altair 8800 through the pages of *Popular Electronics* exactly ten years ago sparked the personal computer revolution. The other is that both individuals and small companies were building small computers long before the Altair arrived in 1975.

As a high school student in 1959, I, among others, began building simple analog machines that performed basic arithmetic. By 1961 these early machines culminated in an analog computer that translated 20 words of Russian into English. The key circuit of this machine, which I still have, was a memory consisting of 20 miniature trimmer resistors that were automatically scanned by a mechanical sequencer made from a modified electric music box mechanism.

Ed Roberts also began building both analog and digital computing devices in 1959. Even before Ed Roberts, Stan Cagle, Bob Zaller and I formed MITS in 1969, Ed and I used to discuss the homebrew analog computers we had built a decade earlier. In the summer of 1970, we discussed designing and selling, through an article in *Popular Electronics*, a kit analog computer that would use operational amplifiers. Had not Ed become interested in designing the 816 digital calculator featured on the cover of the November 1971 issue of *Popular*

On opposite page: the garage in New Mexico where it all started. From top to bottom: Altair 8800 was introduced to the world in the January 1975 issue of Popular Electronics (predecessor of COMPUTERS & ELECTRONICS). Altair 8800 in the flesh. One of the original sites occupied by MITS. Ed Roberts.

RICHARD PIPES

FORREST M. MIMS III

PHOTO TINTING BY LINDA M. EKLUND

Electronics, MITS might have developed an analog machine.

Sol Libes, who writes the "Bits & Bytes" column for this magazine, is particularly knowledgeable about the pre-Altair era of personal computing. He has written about the formation of the Amateur Computer Society by Steven Gray in 1966 and several discrete logic and microprocessor-based machines built prior to the Altair.

Among the most important commercially available pre-Altair machines was the Scelbi-8H, a product of Scelbi Computer Consulting Company. This machine used the 8008 microprocessor, Intel's first 8-bit microprocessor.

Jonathan Titus' Mark-8, which was featured on the cover of the July 1974 issue of *Radio-Electronics* and which also used the 8008, soon became more widely known than the Scelbi. Titus' article listed a source for circuit boards for the machine, but hobbyists who wanted to build a Mark-8 had to locate the components on their own. Nevertheless, according to Libes, more than 500 Mark-8's were eventually assembled by experimenters.

To say Scelbi, Titus or Roberts invented the personal computer would be manifestly unfair to Marcian Hoff, Stan Mazor, Federico Faggin and the other engineers at Intel who conceived and designed the first microprocessors in the early 1970s. The architecture of the first microprocessors was itself based upon concepts developed decades earlier. The personal computer was then a logical culmination of more than a quarter of a century of digital developments, and everyone involved rightfully deserves credit for the roles they played. If you want to find out more about the early days of digital computing, the classic work is *The Origins of Digital Computers* (Springer-Verlag, 1982), a collection of early papers in the field compiled and edited by Brian Randell.

The Henry Ford of Personal Computing

Though Henry Ford didn't invent the automobile, his role in the early automobile industry was unsurpassed. Similarly, while the invention of the personal computer cannot be attributed to a single individual, credit for fathering today's multi-billion-dollar personal computer industry rightfully belongs to one man, H. Edward Roberts.

Ed's Altair 8800 was a major advance over its predecessors because it used Intel's new 8080 microprocessor, a more powerful version of the 8008 that required fewer support chips. Computer

hobbyists knew about the 8080 before the Altair. They could obtain from Intel "From CPU to Software," a 47-page booklet that described in great detail the 8080, its instruction set and its support chips. The booklet even included two system block diagrams. But because the 8080 sold for $360 in single quantities, few people could afford it. Ed Roberts bought the chips in large quantities and was able to get a substantial discount, allowing him to sell his Altair in kit form for only $40 more than the cost of a single 8080. This helped account for the incredible response to the two Altair articles that appeared ten years ago in *Popular Electronics*.

Of course Ed Roberts and MITS did far more than design the Altair; they set the stage for the personal computer industry as we know it today. In addition to hardware peripherals and software, MITS pioneered personal computer conferences, clubs, stores, users' groups, software exchanges and company newsletters. By the time Ed sold MITS to Pertec in May 1977, MITS was often called the IBM of personal computers.

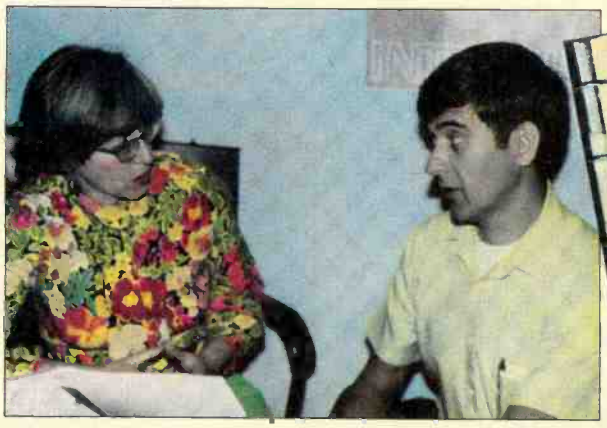
Today, comparatively few people have heard of MITS and the Altair 8800, much less of Ed Roberts. And to make matters worse, some of the new generation of computer journalists have written books and articles containing errors about the origins of personal computing. A recurrent theme in many articles and books about computers is that personal computing was born in California, either among members of the Homebrew Computer Club, in Steven Wozniak's garage or in Silicon Valley itself. Even while preparing this article, I happened across still another perpetuation of the persistent California myth in an otherwise interesting piece by Steven Levy in the November issue of *Popular Computing*. Levy described how Wozniak and others brought circuit boards to Homebrew meetings and concluded that: "Those ridiculous boards attached to boxes with blinking lights turned out to be the spark of the modern personal computer industry."

Many members of the Homebrew Computer Club can point with justifiable pride to their accomplishments. Stephen Wozniak, for example, co-founded Apple Computer, one of the most spectacular success stories in American business. But the fact of the matter is that the modern personal computer industry was sparked by the Altair 8800. Indeed, the Homebrew Computer Club, which first met in March 1975, was itself sparked by the arrival of the Altair. Wozniak himself recalls in *Digital Deli* (Workman Publishing, 1984) that when the Homebrew Computer Club was formed, "There was just one personal computer then, the Altair 8800. . . "

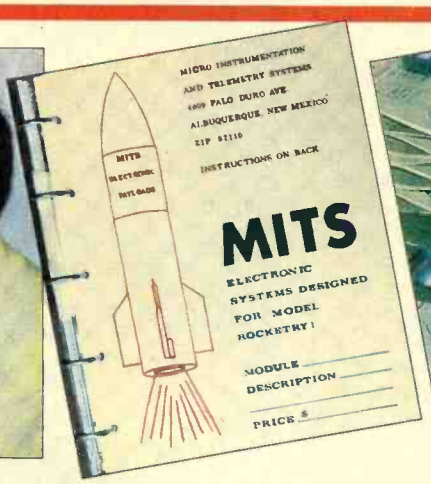
Rewriting History

By far the most important book yet published on the early days of personal computing is *Fire in the Valley* (Osborne-McGraw-Hill, 1984) by Paul Freiberger and Michael Swaine. This fact-filled book contains a wonderful

(Continued on page 81)



MINNIE MIMS



FORREST M. MIMS III

MIMS AND MITS

WHEN he helped form MITS, Inc., in 1969, Forrest Mims had no idea the company would eventually start the personal computer revolution. After he left MITS 18 months later to become a professional writer, Mims continued working part-time for MITS and wrote the operating manuals for the firm's first digital calculator and the Altair 8800.

From 1969 to 1976, Mims accumulated dozens of early MITS papers, photos, catalogs, ads, fliers, data sheets, and operating manuals. He also saved the carbon copy of the original draft of the Altair operating manual and 12 issues of *Computer Notes*, the post-Altair tabloid published by MITS.

As for hardware, Mims has dozens of the model rocket telemetry modules that were MITS's first products and the 816 calculator he built while writing the machine's assembly manual. He also has an Altair, which still runs and is in excellent condition, given him by Ed Roberts in return for writing the machine's operating manual. Mims's Altair lacks a serial number because it was one of several preproduction test machines.

Last summer Mims's collection of MITS memorabilia came to the attention of Dr. Uta C. Merzbach, curator of the Division of Mathematics at the Smithsonian Institution's National Museum of American History. While Dr. Merzbach was visiting Mims's home in Texas to review the material in person, Mims suggested a conference on the history of the development of the personal computer to be held at the Smithsonian. He believes such a conference could help put an end to many of the widely believed myths now being published as facts in computer books and magazines.

Dr. Merzbach agreed to consider Mims's conference idea. She also asked him if he would donate to the Smithsonian his collection of MITS material and a language-translating analog computer he built when a high school student in 1961. Mims has agreed to donate the material as soon as he can find time to prepare an inventory and make copies of some of the papers. ◇

Left: Dr. Uta C. Merzback, of the Smithsonian Institution, with Forrest Mims. Center and right: Some of the materials that will be donated.


FORREST M. MIMS III


ERIC MIMS


FORREST M. MIMS II


CHARLOTTE WILKES

A CONVERSATION BETWEEN ED ROBERTS AND FORREST MIMS III

If one person deserves to be known as the "Father of Personal Computing," it's H. Edward Roberts. After graduating from Oklahoma State University with an electrical engineering degree in 1968, Ed Roberts was commissioned a second lieutenant in the United States Air Force. He was then assigned to the Air Force Weapons Laboratory in Albuquerque, NM. There he met Forrest M. Mims, III, who was a research and development officer interested in lasers, model rockets and analog computers. Mims had been assigned to the Weapons Lab after service in Vietnam as an intelligence officer.

Both Roberts and Mims worked on a variety of sophisticated projects at the Weapons Lab's Laser Division. They soon developed a friendship that culminated in the formation of a company to build instruments for model rockets. The original partners included two other electrical engineers: Bob Zaller, who stayed with the company for only several months, and Stan Cagle. They named their company Micro Instrumentation and Telemetry Systems, or MITS.

In November 1970, *Popular Electronics,* as this magazine was then called, published articles describing how to build the Opticom, an infrared voice communicator developed and sold in kit form by MITS. Sales were poor, so Roberts shifted his interest to developing a kit calculator. Concerned that the calculator market would attract too much competition, Mims and Cagle sold their stock to Roberts.

Cagle eventually moved to Arkansas to become an electronics instructor in a community college in Fort Smith. Mims became a full-time free-lance writer. He has written 47 books and more than 500 articles for 30 magazines. Since October, 1975, his columns have appeared in each issue of this magazine.

Roberts stayed with MITS until 1977, and developed the first digital calculator kit, the first kit programming unit for a calculator, digital clock kits, and, of course, the Altair 8800, the first successful, commercially available hobby computer. Others had previously used TTL logic and early microprocessors like Intel's 8008 to make working microcomputers, and some of these machines were sold as complete or partial kits. But when the Altair 8800 was featured on the cover of the January 1975 issue of *Popular Electronics*, the personal computer revolution took off.

Roberts hoped to sell at least a few hundred Altairs to rescue his company from possible bankruptcy brought on by crushing competition in the calculator market. He was as surprised as anyone by the reaction to the Altair article and the fact that MITS eventually sold thousands of the machines.

In just two years, MITS pioneered the first personal computer users' group, the first company newspaper, a software exchange, the first company-sponsored personal computer conference, Altair BASIC, and scores of hardware and software products. In May 1977, Roberts sold MITS to Pertec Computer Corporation and the following summer moved his family to a 900-acre farm in Georgia. Today, at 43, Roberts is attending Mercer School of Medicine, thereby fulfilling a lifelong ambition of becoming a medical doctor. He also heads Georgia Medical Electronics, a company that develops novel computer-supported medical devices.

Over the years, Roberts and Mims have maintained their friendship. Even after Mims left MITS, he wrote the first assembly and operating manuals for the company's first calculators. After the Altair was developed, Roberts gave

Clockwise: Ed Roberts and friend at launch site. Forrest Mims. Second generation Altair 8800B. Ed Roberts today.

Mims an assembled computer in exchange for writing the machine's operating manual.

Concerned by erroneous accounts about the early days at MITS that have been published in various books and magazine, Mims has included several chapters about the historic company in *Siliconnections,* a book he has written that describes the many electronic adventures he's experienced since first experimenting with transistors as a twelve-year-old in 1956. (*Siliconnections* will be published by McGraw-Hill later this year.)

The following is a question-and-answer session between Forrest Mims and H. Edward Roberts, co-founders of MITS.

Mims: Ed, how does it feel to be known as the father of the personal computer?
Roberts: I don't think I'm known as the father of the personal computer. I don't think there are more than a dozen people in the whole world who really know that—maybe a few dozen, actually.

M: Like people with Altairs in their closets. Ten years ago did you have any idea the industry would be the size it is now?
R: I don't think anyone did. But I've been very disappointed in the speed of the technology. When we sold MITS to Pertec, you could have bought an Altair that would have done essentially anything that can be done today. It's a little disappointing that the technology hasn't moved any further than that.

M: Do you have any regrets about selling MITS?
R: No, not really.

M: How would you advise a budding entrepreneur with a good idea but no money?
R: That's a good question. The whole trick to being an entrepreneur is to be unconventional. I think the only way you make money is by getting involved in something you enjoy doing. If it turns out to be lucrative, great; and, if it doesn't, that's OK. If you get knocked down, you've got to get right back up and keep going. I think that bulldog tenacity is probably the single most important thing.

M. From my experience at MITS, the most creative times at an entrepreneurship occur when it's still a garage operation. I'm still a garage operation and I'm going to be a garage operation forever. Everytime I start a new circuit or program it's the most exciting thing I'm doing.
R: What I'm doing right now is probably the most interesting thing I've done in electronics in the last ten years. I'm the only engineer here. I'm doing all the electrical engineering and all the software; and we're extremely well funded. I've got all brand new CAD and logic development systems from Hewlett-Packard and the best scopes that Tektronix makes. It's really a fantastic laboratory.

M: Sounds like you're satisfied running a company much smaller than MITS was.
R: To put some perspective on that, after the Altair became a real product, Bill Yates (who helped develop the Altair) became really badly motivated, particularly after Pertec took over. It had been building before that; he used to tell me all the time, "Ed, MITS isn't fun anymore." And he was right. I couldn't really argue with him. It wasn't any fun for me anymore. It got to where we weren't doing anything very creative, and I was spending my whole life solving soap operas. Somebody would find out someone else was making 3 cents an hour more than he was and there would be a big panic on the production line, with everybody threatening to string up the production supervisor. I was wasting all my time with crazy stuff like that.

M: Well, like I've told you, once I had to go through a receptionist to see Ed Roberts, MITS wasn't fun anymore. After the Altair explosion people were falling all over each other to get in to see you.

Changing the subject slightly, the new generation of computer journalists is beginning to take a big interest in the history of personal computing. Some of their books have contained glaring errors about MITS.
R: In my experience with the press—and I use that term very loosely—you're better off ignoring those guys. They're going to win no matter what you do.

M: What did you think about *Fire in the Valley,* by Paul Freiberger and Michael Swain (Osborne-McGraw-Hill, 1984).
R: Well, obviously the bottom line of that book was to try to move the origins of personal computing from Albuquerque to Silicon Valley. I don't think it was as much an attack on MITS as it was an attempt to rewrite history.

One of the things that really strikes me about all this—and it means nothing to anybody now—is the hours and days I agonized over things like using BASIC. That seems like a totally logical answer right now, but BASIC was a relatively unknown language in 1974. It had only been invented in 1968. Boy, for a year I took a lot of heat that it should have been FORTRAN or APL. Nobody remembers any of that.

I could just go on and on and on with decisions I made that right now have major impacts on the direction that personal computing took. And all those decisions, that in retrospect I think were pretty good—it's as if I had nothing to do with them. The only decision I found in that whole book was that we were the first company to use 4K dynamic memories. That's a little exasperating.

M: Some well-known people are now claiming they helped you develop the Altair. I hope my new book will help set the record straight.
R: I don't know if it's recoverable now. I'm frustrated. On occasion, I go someplace like Radio Shack and, just to get the salesman to leave me alone, I say I'm the one that really started personal computing. He looks at me like I'm crazy and says, "Oh no you're not! It was some guy at Apple or somewhere else." I've gotten to where I don't tell anyone anymore.

M: Years ago I quit telling people I was a MITS founder because they always asked, "What's MITS?" Speaking of that, what one thing would you have done differently if you could do it all over again?
R: Lots of things, with 20-20 hindsight. Probably the single biggest mistake was to build Microsoft at MITS instead of building our own internal software capability. I thought we were building a software capability, but it turned out we were building Microsoft. So I would control the software more personally.

M: Everytime I sit down at my IBM computer, I'm using Altair BASIC.
R: Right.

M: And nobody knows that.
R: Right. Microsoft BASIC was developed and popularized because of the Altair. The reason it exists and the reason it's the standard is because of the Altair and not because of anything else.

M: How would you assess the status of software today?
R: What hurts the industry right now is that the software is developed independently of the hardware to a large extent. And until software is integrated into the

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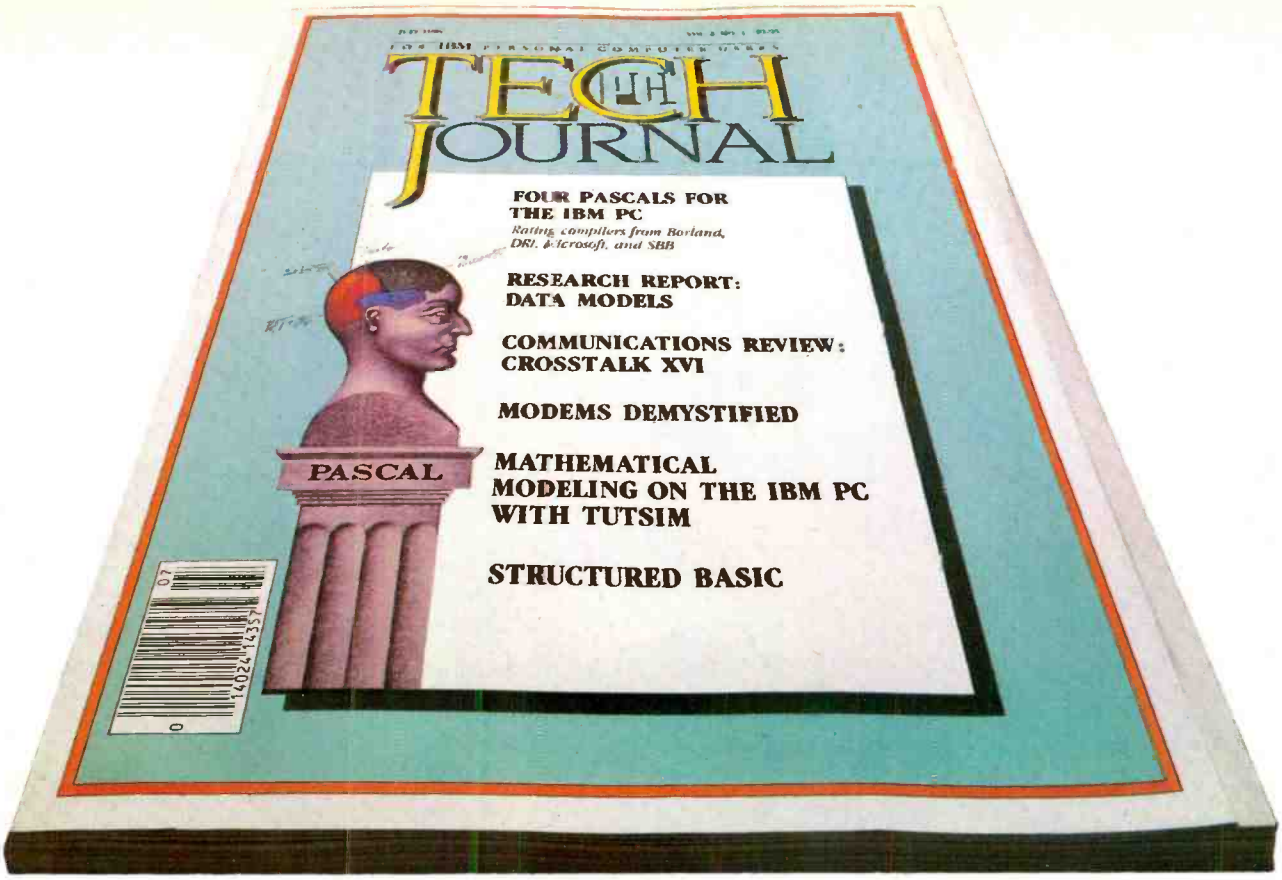

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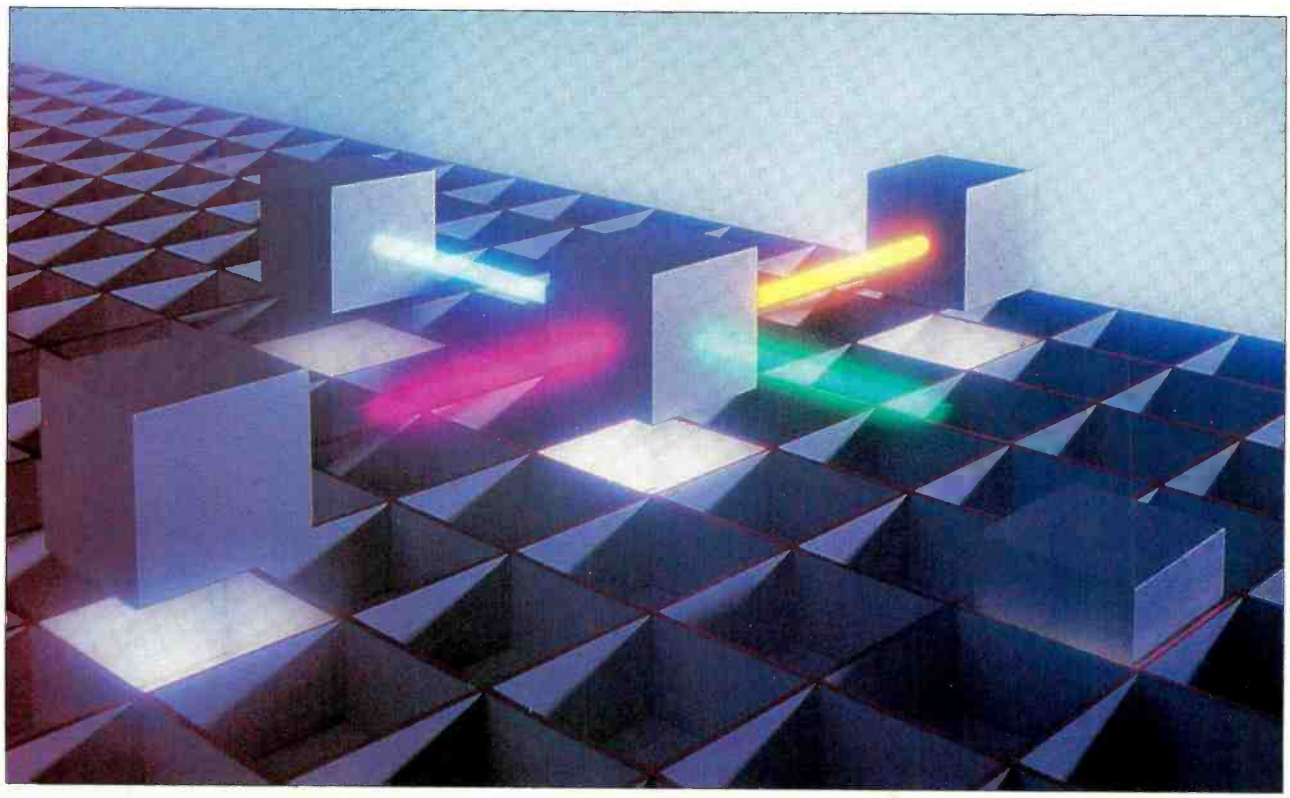


OPTICAL COMPUTING

Little-known technology that outperforms digital computing for special applications

BY JEFF HECHT

BEFORE science fiction movies adopted their raucous shoot-em-up style, they typically set advanced civilizations against shimmering crystalline backdrops. In the world of the future, Hollywood predicted, power would flow from some mystical control of light.

This luminous vision of the future was probably exaggerated, but the power of artificial light is here today, in fiber optic communications—and now in computers. Passing light through lenses or other optical devices is yielding analog or digital computing results.

Optical computing will not make digital electronics obsolete because the two technologies have very different strengths. Electronic computing excels at obtaining precise results from series of digital logic operations performed on a single stream of input data. Optics can process many parallel data streams simultaneously and interrelate the data. Thus optics can achieve incredible speed by electronics standards, but at a cost in precision and flexibility.

Optical computers, so far, are dedicated machines—designed to perform specific tasks. Unlike electronic computers, which can be reprogrammed easily, they are not suited for general-purpose use. Jobs that require precision, such as bookkeeping, or flexibility will remain in the digital electronics lane.

As with electronic computing, there are two principal means of computing optically: analog and digital. Each has its advantages and disadvantages. Analog optical computing can be used to process vast quantities of information rapidly when fast response is more important than precision. But a new family of "bistable" digital optical devices is opening up possibilities for optical logic and optical switching of signals in fiber-optic communication networks.

Jeff Hecht is a free-lance author who writes frequently on optics and computer applications.

PHOTO BY MICHEL TCHERENKOFF

Analog Optical Signal Processing

The first optical processor was an outgrowth of classified radar research conducted at the University of Michigan's Willow Run Laboratory in Ann Arbor during the 1950s. Military engineers wanted to increase the resolution of airborne surveillance radar by increasing antenna size, but the radar dishes were threatening to become larger than the planes they were attached to. The Michigan lab overcame that problem by having the planes continuously record data as they flew. In effect, their flight paths defined "synthetic apertures" much larger than any airborne dish could be.

The raw data collected by the radar, however, were not intelligible. To generate images of the scenes viewed by the radar, Emmett N. Leith and coworkers at

Michigan recorded the raw radar traces from cathode-ray tubes onto photographic film, moving the film slightly between traces. After developing the film, they passed it through an optical system that turned the seemingly meaningless raw data into an image of the scene viewed by the radar. That first optical processor was so successful that the Pentagon kept details classified for a decade.

The concept also foreshadowed another breakthrough by Leith and Juris Upatnieks—the first use of lasers to record holograms in 1963. Lasers made holography practical, and Leith and others at Michigan used holographic concepts in a second-generation optical processor for synthetic-aperture radar, which remains in widespread use today.

The dramatic success of analog optical computing for synthetic-aperture radar led to extensive research in the 1960s. A goal was to take advantage of the way a lens transforms a coherent-light (or laser) image, in which the waves are all in phase with each other. Passing a coherent-light image through a lens generates a Fourier transform on the other side of the image.

Mathematically speaking, the Fourier transform results from double integration of a two-variable function across the entire plane. The task is complex, cumbersome and time-consuming for a digital electronic computer, but as easy as passing light through a lens for optics. What's more, the Fourier transform reveals patterns of varying intensity that are useful for recognizing images.

In developing the technique for pattern recognition, however, researchers ran head-on into such unexpected practical problems as sensitivity to image size and orientation, which made their task much harder than they had counted on. Work progresses, but, as one optical-computing expert said, "I think we're where I thought we were 20 years ago."

Other types of analog optical computers are being used for signal processing by military and intelligence agencies. One of the commonest is the acousto-optic spectrum analyzer, which relies on the interaction of light with acoustic waves in certain acousto-optic materials. In this kind of device, a broad-spectrum radio signal, applied to the acousto-optic cell, generates high-frequency acoustic waves that travel through the cell. As the acoustic waves pass through the material, they change its refractive index, in effect, forming a diffraction grating that scatters light passing through the material. The angles at which light is scattered depend on the frequencies in the input signal, so measuring the scattered light can reveal what frequencies are present. Frequency identification is important to the military, because it singles out radar and communication signals, allowing for countermeasures and eavesdropping.

This technique can also be used in other types of analog optical computing. For example, correlation, or comparing reflected radar signals with those returned by known objects, is an essential task in sorting hostile targets from friendly forces on the battlefield.

Analog optical computing has not been able to match the rapid development of digital electronics during the past two decades. Nonetheless, its tremendous possibilities for parallel activity give it a speed advantage in many operations that are complex digitally. Analog optics holds out the promise of compact, inexpensive, and very reliable devices that consume little power.

Digital Optical Computing

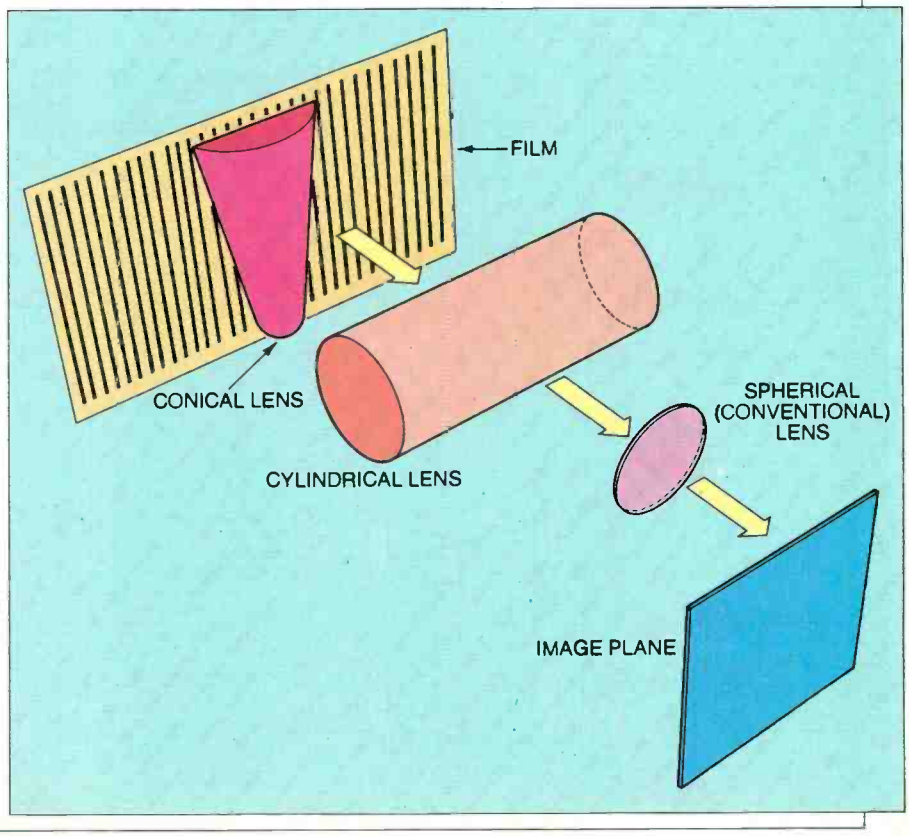
The past few years have seen rapid developments in digital optical computing aimed at combining the strengths of optical parallel processing with the precision of digital techniques. At least some operations, researchers hope, will run much faster than they would on conventional electronic computers. Ironically, this hyperspeed may require slowing down the optics, which in some cases can be so fast that input and output become fatal bottlenecks.

The greatest effort in digital optical computing has been in linear algebra, where the major problem is matrix manipulation. The matrix, a two-dimensional array of numbers, is an unwieldy beast that nonetheless is useful for representing many physical processes and mathematical problems, for example, simulation of cloud physics and fusion reactions.

When two matrices are multiplied, each number in the resultant matrix is found by summing the products of numbers from the corresponding columns of the two matrices. Textbook examples normally stop at matrices with three rows and three columns, but matrices developed in real life are much larger.

Matrix multiplication, at least at first, looks as though it could be performed

An optical processor originally used for synthetic-aperture radar. The input is a roll of photographic film on which are recorded a series of lines (oscilloscope traces of return signals from the radar). Passage of light through the film and the conical and cylindrical lenses converts the signal so it can be focused by an ordinary spherical lens, generating an image of the scene on the image plane.



rapidly by a machine because each entry can be calculated independently of the others. However, present electronic computers aren't built that way—they do one calculation at a time. Researchers are looking at alternatives involving parallel calculations. For electronic computers, H. T. Kung of Carnegie-Mellon University and S. Y. Kung of the University of Southern California proposed a "systolic array" design in which elements of the input matrices would systematically pass through an array of electronic multipliers and adders. That idea was adapted for optical computing by H. John Caulfield, principal scientist at Aerodyne Research in Billerica, MA, William Rhodes, a professor at the Georgia Institute of Technology, and others. They aimed much of their initial work at multiplication of a matrix by a vector, essentially a matrix containing only a single row or column of numbers.

Optical systolic arrays are designed so the data from the two input matrices enter in separate ways. Data from one matrix are used to modulate the intensity of a row of light sources, such as LEDs, which are focused onto an acousto-optic device, with the fraction of the incident light diffracted by the acoustic wave dependent on acoustic-wave intensity. (In this way the acousto-optic device is acting as a modulator of light intensity, and the interest is not in the angle at which the light is diffracted but in the light intensity reaching a certain point beyond the acousto-optic device.) The product of the light intensity from the source and the degree of modulation by the acousto-optic device gives one of the products that has to be summed to give the final matrix element. To calculate the sum, the light is focused onto an array of "integrating" detectors, which store a record of the total light intensity that has reached them.

Caulfield and Rhodes estimate that an optical systolic array could multiply a 100-component vector by a 100-element square matrix in about 10 microseconds, faster than a digital electronic supercomputer. Another optical technique, suggested earlier by Stanford University professor Joseph W. Goodman, could do the same job in just 0.02 microseconds, with a method so fast that existing techniques for data input and output would be inadequate.

At first the optical systolic array was seen as another analog form of optical computer. However, developers later began devising ingenious algorithms that make it possible to combine optical speed with digital precision. By using multichannel acousto-optic devices, performing multiplications in binary form, and doing additions in a nonbinary form, Peter S. Guilfoyle, president of GuilTech Research in Sunnyvale, CA, has devised an approach with 32-bit precision. He has performed some initial concept demonstrations, and his start-up company is now trying to develop the technology commercially. A likely application is as an add-on matrix-arithmetic unit for a mainframe computer.

The small community of optical-computing researchers is excited about systolic arrays. So far most of the excitement is at a theoretical level—very little hardware has been built. Most of the research has aimed toward finding computer architectures best matched to the systolic array concept.

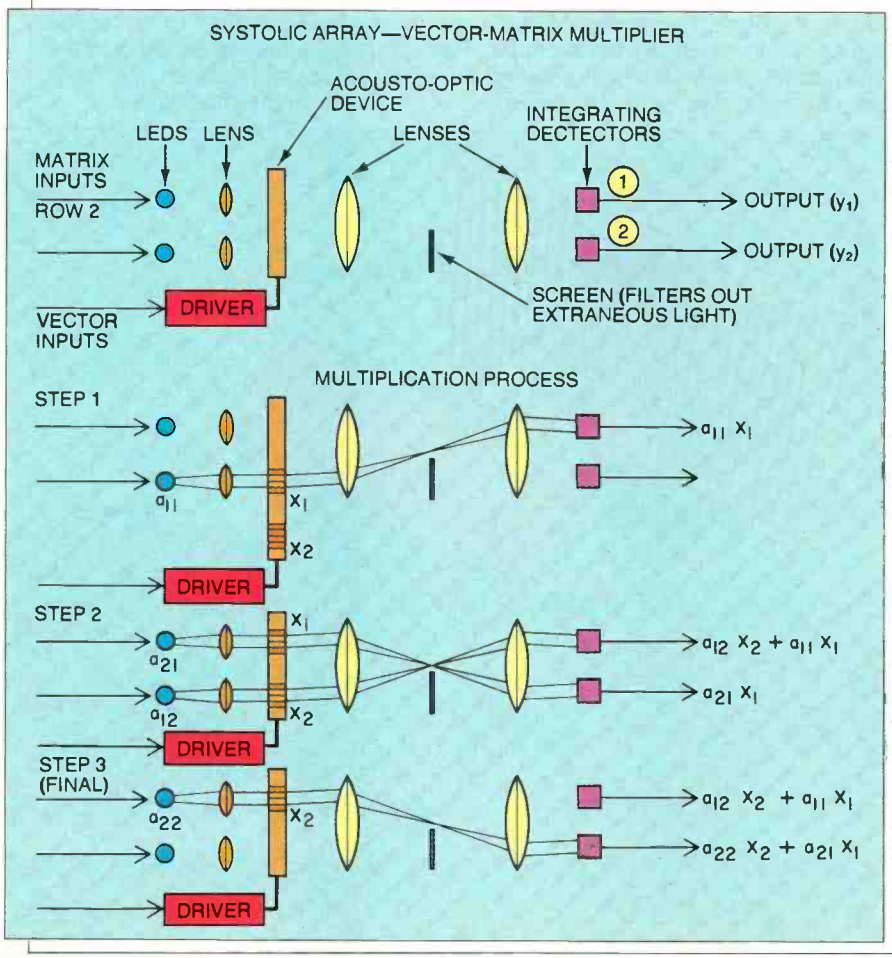
Optical-computing researchers are already looking beyond systolic arrays. Both Caulfield and Rhodes see optical

Multiplying a Matrix

Problem: Multiply a four-element matrix by a two-element vector to produce a two-element vector. This is the classic textbook solution:

$$\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \times \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} y_1 \\ y_2 \end{pmatrix}$$

The diagram shows how the problem is solved using an optical systolic array, which is made up of LEDs and an acousto-optical device. Values that make up elements of the matrix are entered as signals driving the LED light sources, while the two vector elements are entered as acoustic signals through the acousto-optic device. The optical signals produced by the array are detected by integrating detectors, which accumulate an electrical charge proportional to the total amount of light detected during the entire operation. The products are summed to get the solution vector. Developers of systolic arrays envision using such devices for much more complex tasks, such as multiplying a 100-element square matrix by a 100-element vector.



systolic arrays as an intermediate step to an ultimate optical computer that neither claims to have a clear vision of. Rhodes says the "if optics is going to be a major driving force in supercomputers, it will involve bistable optics and binary logic," new possibilities that have also emerged in recent years.

Moreover, systolic arrays are far from the only optical approach to matrix manipulation. For example, the Naval Research Laboratory in Washington is sponsoring work on a 128-element-square vector-matrix multiplier using lenses and a fixed mask to process the data.

Optical Bistability and Switching

At the same time optical systolic arrays have been evolving on paper, optical bistability has been evolving in the laboratory. A bistable optical device is stable under two different sets of conditions. It transmits either a small, or a large, fraction of incident light. That is, it's either opaque or transparent. The jump between the two states is typically triggered by light.

In effect, a bistable optical device is an optical digital switch. The shift between transparent and opaque states is comparable to a transistor's "on" and "off" states. That similarity has led to concepts for optical logic and switching devices. It has also led to near-ecstatic press releases making some claims that could stand a liberal dousing of cold water. Billions of dollars have been spent on developing semiconductor electronics, and that technology is decades ahead of bistable optics. There is no reason to switch to optics for a job that electronics can do as well or better. To be successful, optics must offer some special advantage.

Where bistable optics could prove valuable is in memory or storage cells for optical computers or in performing logic operations on data already in optical form. A sooner likelihood is in the humble job of switching telecommunications signals.

Interest in optical switching comes from the rapid growth of fiber-optic communications, which is beginning to handle a large share of this country's telephone traffic. Virtually all existing fiber-optic systems are point-to-point links, carrying signals along a single path between two points—generally multiple telephone conversations between two telephone switching offices. Switching now must be done electronically, so the optical signals in a fiber-optic link must be converted into electronic form at switches. Optical switches could be used to interconnect fiber-optic links and might serve as building blocks in a completely fiber-optic communication network.

Some optical switches have been built, but many are simply electro-mechanical devices that redirect signals by moving an optical fiber. Bistable devices seem more attractive for optical switching—in much the same way that transistors and integrated circuits are better electronic switches than relays.

Switching of signals between optical fibers using bistable devices has already been demonstrated by a team from Bell Communications Research, AT&T Bell Laboratories, and the University of Arizona's Optical Sciences Center. They've directed input from two optical fibers into a specially made bistable device with about 200 alternating layers of gallium arsenide and gallium aluminum arsenide. Light from one of the fibers switched the device from one state to another, blocking or transmitting light from the other fiber. Thus light from the first input fiber controlled switching of light into the output fiber.

Much work remains to be done on bistable optics. Operating power and switching threshold power need to be reduced, and other performance characteristics need to be improved. But developers are excited and making rapid progress.

Looking to the Future

More new technology and new ideas are in the offing for optical computing. Researchers are working on projects ranging from integrated optical circuits to new computing algorithms that would be suitable for optical hardware. Sometimes the hardware is hard to build

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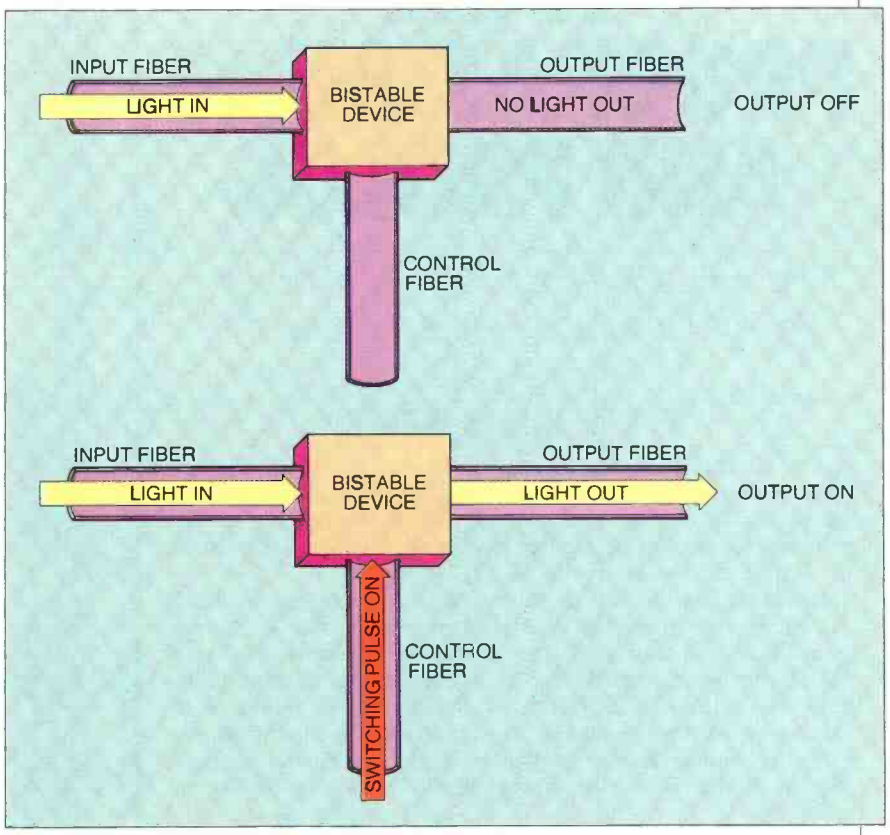
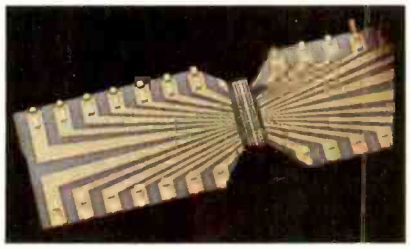


A bistable optics switch transmits very little light when there is no light input to a control region (through the control fiber). However, when a switching pulse enters the device, light transmission increases and an output pulse emerges through the output fiber.

Integrated optical circuit used to switch lightwaves



COURTESY, AT&T BELL LABORATORIES

LOGIC PROGRAMMING AND PROLOG

The language that Japan has chosen for its Fifth Generation Project is based on mathematical logic

BY DR. JAMES WEINER

IT'S our ability to reason that sets our species apart as *Homo sapiens.* No parallel capacity, at least right now, exists in our most sophisticated machine—the computer. But a growing number of researchers believe that a computer may one day at least mimic human thought.

One of the latest tools in the quest to develop a machine capable of performing an intelligent task is a language called Prolog. Recently, it gained prominence because Japanese researchers chose it for their Fifth Generation Computer Project, which aims at producing a computer with artificial intelligence. In fact, one Japanese team recently announced a Prolog-based processor, which is expected to process "knowledge information." It will take a step toward handling such intelligent tasks as voice recognition, natural-language processing and reasoning.

Prolog was developed at the University of Marseilles by a group of scientists headed by Alain Colmerauer. It was initially used to implement a natural-language processing system. From those beginnings, Colmerauer and colleagues, including Robert Kowalski and Phillipe Roussel, nurtured the ideas of using logic to specify programs and using logical inference as a form of computation.

Many versions of Prolog succeeded the initial one at Marseilles. The most influential work came from a group headed by David H. D. Warren at the University of Edinburgh. Warren's Prolog included both an interpreter and the first Prolog compiler as well as a sophisticated debugging package. Warren currently heads Quintus Computer, a Palo Alto company that is developing Prolog applications and systems.

How Prolog Functions

Computer languages, like Prolog, that can manipulate symbols are often called "symbolic programming" languages. In Prolog the symbols (words)—for example "toaster," "pick up" and "appliance" used, respectively, to represent a toaster, the concept of obtaining an item, and a category of objects, of which a toaster is one—are called "atoms."

Of course, all knowledge cannot be represented by single symbols. For example, the statement, "milk can be purchased at a supermarket," requires a combination of symbols, called a "symbolic expression." A symbolic expression represents a relationship between objects.

Prolog also uses "rules," to infer new facts. For example, if we know that broccoli and cauliflower are vegetables, a rule that states that all vegetables are purchased at a supermarket allows us to infer that broccoli and cauliflower can be bought at a supermarket. Using this rule minimizes the need to keep track of facts that indicate where an individual vegetable can be purchased.

James L. Weiner teaches computer science at the Unviersity of New Hampshire and is currently working on a book about Prolog.

Original 19th century Japanese woodblock print by Kuniyoshi, with some help by COMPUTERS & ELECTRONICS.

PROLOG LISP

5TH GENERATION

PROLOG FOR MICROS

UNH Prolog
University of New Hampshire
Computer Science Dept.
Kingsbury Hall
Durham, NH 03820
603-862-1234

Quintus Prolog
(For 68000 Unix-based supermicros)
Quintus Computer Systems, Inc.
2345 Yale St.
Palo Alto, CA 94306
474-494-3612

Microprolog
Programming Logic Systems
31 Crescent Dr.
Milford, CT 06460
203-877-7988

Mprolog
Logicware, Inc.
1000 Finch Ave. West
Toronto, Canada M3J 2V5
416-655-0022

Prolog includes a database of facts and rules, from which it can draw conclusions. A program in Prolog is a set of facts and rules with the same name and number of arguments stated in a restricted form of logic. For example, the following is a program made up of facts describing various objects that are vegetables:

```
vegetable(broccoli).
vegetable(cauliflower).
vegetable(carrots).
vegetable(cucumber).
```

Once Prolog has been invoked, we can ask "Is a cucumber a vegetable?":

```
?- vegetable(cucumber)
yes
```

The "yes" response indicates that the program has concluded that "a cucumber is a vegetable." Prolog can also be used to ask "What are vegetables?":

```
?- vegetable(Vegetable)
Vegetable=broccoli;
Vegetable=cauliflower;
Vegetable=carrots;
Vegetable=cucumber;
no
```

In Prolog, any word starting with a capital letter is a variable. Thus, "Vegetable" is a variable whose value is set to the different vegetables that are known in its database. The semicolon is actually a user response that asks Prolog to find another vegetable. Note that in Prolog, a value can be a parameter, as in "vegetable(cucumber)," or a variable can be a parameter, as in "vegetable (Vegetable)." Since programs in Prolog are "predicates," that is, statements that are either true or false, input and output are effected by passing the appropriate parameters.

From the foregoing, one might conclude that Prolog is little more than a database language. The difference is that Prolog contains rules as well as facts. Moreover, the Prolog interpreter is a program that proves theorems; Prolog is called a "logic programming" language because it is based on a form of logic. What further distinguishes Prolog is its ability to prove theorems relatively efficiently.

Here's another demonstration of Prolog's facility: Suppose you wish to save time by doing several errands in one trip. Suppose you're traveling between home and office. Suppose further that at some time during the day you have to get a toaster and some broccoli. Obviously, you can save time if you pick up these items at stores on your way to the office.

To accomplish this goal you must know which stores carry the items you want and whether there is a path from your house that runs to the stores and ends at the office. The question becomes:

```
Is there a store where I can
    pick up a toaster
and a store where I can pick
    up some broccoli
and is there a path from my
    home to the store
    selling toasters
and a path from that store
    to the store selling
    broccoli
and a path from that store
    to my office?
```

or in Prolog:

```
?- pickup(toaster,
    StoreT),
pickup(broccoli,
    StoreB),
path(house,StoreT),
path(StoreT,StoreB),
path(StoreB,office).
```

To answer this question, Prolog needs to know that "broccoli is a vegetable" and "a toaster is an appliance," thus:

```
vegetable(broccoli).
appliance(toaster).
```

and that vegetables are picked up at a supermarket and toasters are picked up at a department store:

```
pickup(Item,Store):-
vegetable(Item),
supermarket(Store).
pickup(Item,Store):-
appliance(Item),
department(Store).
```

Note that this knowledge is represented as rules. The symbol ":-" is read "if." The first rule is read, "an item is picked up at some store if that item is a vegetable and that store is a supermarket." These two rules make up the "pickup" procedure or program. Suppose that the only place to pick up a bagel is the "Bagelry." That fact could be added to the database:

```
pickup(bagel,bagelry).
```

in which case it would also be part of the "pickup" procedure. So if the program is asked:

```
?- pickup(bagel, Store).
```

Prolog would respond correspondingly:

```
Store=bagelry.
```

To complete the database, the program also needs to know which stores are supermarkets and which are department stores, and that there are possible paths between them. Given this information, Prolog is able to respond with names of stores with the desired items that are located on the path to the office. Note that to do this, Prolog has to try all possible alternatives. That is, it might find a store that sells broccoli and another store that sells toasters only to find that there is no path from home to the stores to the office. In that case, it must find another set of stores to try. Prolog will—automatically—try all possible alternatives until one, if any, meets the constraints expressed in the original query.

This is the key point in understanding Prolog. In a Prolog program one doesn't have to specify how to find the solution—Prolog will find it if there is one. Accordingly, Prolog programs can be comparatively simple: They don't need any form of control, such as "for loops" or "gotos."

Prolog Applications

One major application has been the development of expert systems, including programs that diagnosis heart arrhythmias, troubleshoot telephone cable repairs and configure computer systems. Prolog has also been used as a natural language interface to a database, for discrete simulation, graphics, computer-aided architectural design and compilers.

Clearly, most of these applications of Prolog don't fit on a personal computer. But some do, mostly applications that don't require a large knowledge base. For example, Prolog on a micro could sift through electronic mail, looking for important and timely messages.

Prolog could also be used to interface with such devices as modems. It could not only look up a number and dial it, but also know about alternative numbers. It might know that on Tuesdays between 12 p.m. and 2 p.m., your friend Robert hangs out at Chez Louis RAM, a purveyor of haute cuisine and computer products with a particular modem line.

Prolog can handle much of the information found in the home and the office in a straightforward manner. Given the current surge of interest in artificial intelligence and the number of new companies developing micro-based artificial intelligence products, the use of Prolog on microcomputers is probably just beginning. ◇

LISP VERSUS PROLOG

BY ALVIN BARKOVSKY

```
(def defun
   (macro (l)
      (prog (name type arglist body specind specnam)
         (setq name (cadr l) l (cddr l))
         (cond ((dtpr name)
                (cond ((memq (cadr name) '(macro expr fexpr lexpr))
                       (setq l (cons (cadr name) l)
```

```
potray(entry(Id,Type,function(_))) :-
  print(Id),print(:),print(Type).
pr_parms([]).
pr_parms([Entry]) :-
  print(Entry).
pr_parms([Entry,Entries]) :-
  print(Entry),print(','),pr_parms(Entries).
```

Samples of Lisp (top) and Prolog programs give a idea of the two different approaches.

PROLOG is not the only artificial intelligence development language. In fact, until recently, Lisp, a list-processing language, had been the standard. Since its inception 26 years ago, AI researchers have used Lisp for symbolic processing—notably in expert systems and natural-language processors.

However, after Prolog was developed, especially after Japanese scientists selected it as the language for their Fifth Generation Computer Project, some AI researchers began questioning the dominance of Lisp.

Lisp was initially accepted by the AI community because of its usefulness. While standard high-level languages such as PL/1 and Pascal are effective at number crunching and digit manipulation, Lisp excels at symbol manipulation, where lists of symbols (such as words) must be evaluated and processed.

With Lisp, a programmer is able to write programs that use symbols combined in lists and defined as functions, which can then be related to other functions. This ability is useful in processing natural languages (such as English), a central goal of machine intelligence.

Because the language has been widely used, a lot of specialized Lisp software exists. Some of it combines the power of Lisp with the practical properties found in conventional computer languages.

Unlike one in Lisp, a Prolog program consists of a series of English-language statements written in a form of logic. Both programs and data become unified as facts and rules. Thus, it's a simple task to form relationships between words and incorporate these relationships into the program. In Lisp, on the other hand, before such relationships can be computed, a function must first be defined and a means must be devised for storage.

Prolog is much better than Lisp when interfacing with relational databases, mainly because there is a strong correlation between pure Prolog goals and relational database queries.

Prolog is also very portable. While language extensions and machines have made development work easier for Lisp programmers, the numerous Lisp extensions tend to hinder the portability of software written with it. And Prolog is so machine-independent and easy to implement that specialized hardware is not required for rapid software development. Lisp-optimized machines, on the other hand, are expensive, costing anywhere from $50,000 to $100,000.

Though many computer scientists elsewhere favor Prolog as the ideal AI development tool, in the U. S. the habits and individual perspectives of many programmers keep Lisp in use. Most programmers with strong backgrounds in Lisp have developed a respect for the language, and are hesitant to switch.

You could compare the Prolog vs. Lisp argument to the programming polemics that occurred when high-level languages first emerged. Then, many programmers using assembly language thought the ease of use, debugging, and functional power of high-level languages were no incentive to abandon the speed and nuts-and-bolts control of low-level code. To some programmers who have used both Lisp and Prolog, Lisp is the assembly language of AI, while Prolog is its Pascal.

The controversy will continue. As AI research makes strides toward the simulation of intelligence, substantial achievements will be made with both Lisp and Prolog. The ultimate choice of an AI language will reflect the tastes of individual computer scientists. ◇

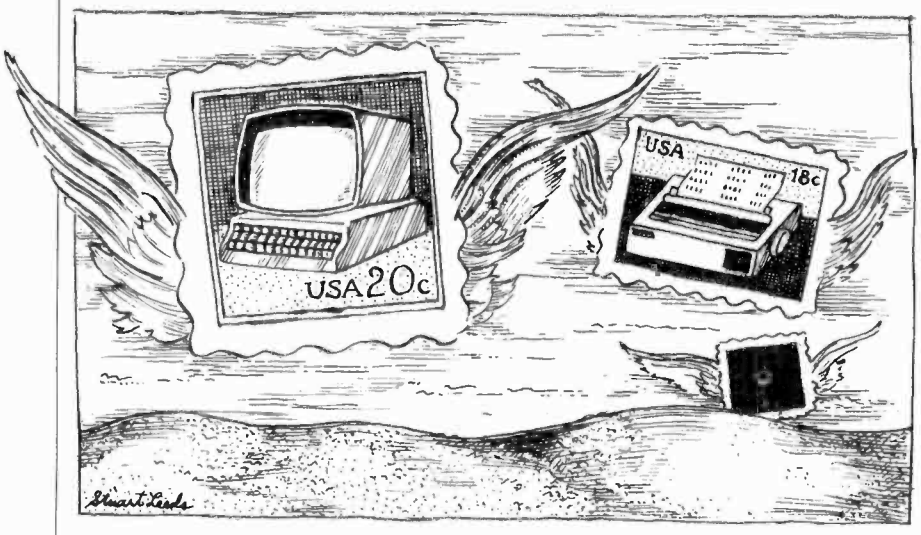
Alvin Barkovsky is vice president of marketing at Silogic, Inc., Los Angeles, CA.

GUEST COLUMN

CONFESSIONS OF A MAIL-ORDER JUNKIE

Buying computers by mail can save you money but getting service may not be just a mailbox away

BY DEXTER R. HART



THERE are two reasons for ordering computer hardware or software by mail: to save money or to obtain items not available locally.

Yet the very phrase, "mail order dealer" sounds negative, especially when uttered by a retail dealer.

One reason is that there *are* risks in ordering by mail. There have been well-publicized incidents of companies collecting money but never shipping a product (which also happens with noncomputer merchandise, of course). In the long run, the firm that operates this illegal way will go out of business. In the short run, it can separate you from some bucks. While the likelihood of your being taken is small, so is the chance that your house will burn down—but you still carry insurance. What protection do we have for mail order items? Is the risk worth the gain?

How to Buy by Mail Order

• Know what you are buying. That sounds like an easy rule, but is often violated. Reach a conclusion by using the product at a friend's place or at a user-group meeting or by carefully reading magazines or manufacturer's literature.

• Try to get questions answered by calling the manufacturer. Spend a little, if you're trying to save a lot. Explain you're about to buy the product and ask some essential questions. Don't expect to receive extensive product information—although you might reasonably expect confirmation of compatibility and equipment requirements. (Get the name of whomever you are talking to, and write it down. If there is a problem, you will want someone at the company to take responsibility.) Measure the quality of response as an indicator of the kind of support you're likely to get *after* you make the buy.

• We call it mail order, but don't use the mail—use the phone (and for delivery use United Parcel).

• Is the item in stock? If it's not and you order anyway, make sure your credit card will not be billed until the item is shipped.

• Nail down shipping charges, exactly or at least to a ceiling amount. Otherwise you will often be billed a few dollars more than you expect.

• Write down the exact final dollar amounts—product, shipping, total. It is the *total* you compare with other firms' prices. Make sure you understand the company's return/refund procedures. The whole idea is to avoid surprises later.

• Have the order taker repeat your name, address, and credit card number. If there are extra charges (or a discount foregone) for credit card use, document the amounts (you may still want to use the plastic, even if it costs more, as you'll see later).

• The shipping charges should have tipped you off in case your package has a weight problem. UPS will not handle packages over 50 lb. Four years ago when I bought my all-in-one Superbrain CP/M system and NEC Spinwriter printer, *each* package was over 50 lb., and my airfreight bill was $52—not bad for two packages, Rhode Island to Miami, totaling 123 lb. Even so, if you're breaking the 50-lb barrier, consider the separate packages. Most items today are "component" style, separate keyboard and so on. No single package *need* be overweight. Most printers today, even daisy-wheel types, are much lighter than top-of-the-line heavyweights.

• Note that UPS delivery, always quite reasonable, does not protect you from high charges. "Shipping and handling" can be another source of profit for the shipper. I paid $65 for UPS delivery of three packages from New York, an IBM system unit, keyboard, and Amdek monitor—much lighter in total weight than my earlier Superbrain/Spinwriter shipment. Overcharge? Sure, but I knew it and signed up to it.

• Ask if you can use their toll-free number (if they have one) for checking on your order or arranging for return of a defective item. Some firms limit toll-free talk to order taking.

• Order from a firm whose advertisements you have seen for at least a few months. Continuity is one thing a rip-off operation is not likely to acquire.

• Use a credit card if at all possible. You can enlist the credit card company on your side if you have not received the merchandise. If you ordered from within your own state or within 100 miles of your home, the protection is spelled out more specifically (this is not very useful, however, because one of the appeals of mail-order buying is the avoidance of state sales taxes by out-of-state purchasing).

DRAWING BY STUART LEEDS

• If you can't use a credit card, have the item shipped UPS collect. The small collect charge is minor because you don't pay it unless they deliver *something* to your door. Sending checks off with the order is an act of faith.

Case Histories

I ordered my first system in 1980. I thought I was clever in buying the computer and the printer from the same source, which also supplied a cable. The dealer knew nothing about why I couldn't print. Only after three agonizing days and $85 worth of calls to South Carolina, Atlanta and Houston, was I up and running.

Consider me a slow learner. In June of 1984 I bought my second system, an IBM PC, from a New York dealer known mostly (until recently) as a purveyor of cameras and video equipment. In retrospect, I feel I should have paid the extra $150 and bought locally. PC mail order discounts have been modest compared to those available with other systems, but since supply has caught up with demand, the savings have become larger.

You get no IBM warranty when you buy from an unauthorized dealer. The company I bought from claimed a 90-day *on-site* warranty. It turned out I needed it, because there was a defect on the system board; that is unusual, but even IBM's normally good quality control missed this one. It worked fine with the original 64K, but one socket on the first empty memory bank, visibly tilted, turned out to be the problem. The service contractor was Sorbus. I had indicated the probable defect on the phone and told the service person I had switched my 27 new chips every which way and then put in 64K from a friend's *operating* PC just to be doubly sure. I wanted to make sure he was prepared for the worst.

The service man arrived, stuck in *his* nine-chip set and confirmed my diagnosis. He replaced the system board with the spare he had brought, and I was up and running once more. All my chips were OK. Sorbus did a good job, and the private warranty arrangement worked fine. But again, I had a few days of uneasiness. If you are constitutionally unable to withstand such uncertainty, think long and hard before buying full systems via the mail. It's so nice to just dump it back on your local dealer and say "fix it." It may be worth the money.

My problems with this firm have still not been resolved. My system is running all right, but the mono and drive boards are non-IBM. The catalog sheet from which I ordered said "IBM Mono-Chrome Card & Printer Adaptor." I suggested they send me what I paid for—for resale value, quality control and as a matter of principle—and got this response: "Since the adapter and monochrome card is (sic) working properly we don't see why you wish to have them exchanged." I guess I'm lucky the *system* unit was IBM.

The firm did finally offer to make the exchange, but wanted me to return my boards first. I suggested I didn't need another long system-down delay. (They originally sent me the wrong color monitor, which caused me three weeks of down-time.) I pointed out they had my credit card number and could charge me for the IBM boards if they didn't have them within two weeks. It seemed fair to me, but I haven't heard from this company since.

I've ordered lots of other equipment by mail—software, ribbons, modem, memory chips, multipurpose board for the PC. Sometimes I've had to wait as items that were claimed to be in stock were not. While I never got cheated, some people have. How do you minimize the possibility? What do you do if it does happen?

In Case of Fire, Break Glass

Most firms are legitimate and want you to be a satisfied customer. Try to reason with the seller. Don't get abusive or make threats even after all negotiations fail. But if things look hopeless, you can still fight.

• If you're a member of a user group, try sending a letter on group stationery.

• Write to the magazine (if you ordered from an ad) and describe your complaint and ask for their help in the resolution of the problem (copy to the seller). Don't expect a lot, because magazines are not in the complaint business. Still, magazines want happy subscribers and it is in their best interest to minimize mail-order incidents resulting in unhappy readers.

• Also write to all magazines in which the firm has advertised. Always send a copy to the firm with which you have had the disagreement. Most reputable firms will try to keep their names clean. Magazines do pay attention to documented and well-reasoned complaints, and advertisers know it.

• Keep writing, to the Better Business Bureau of the mail-order firm's city (don't expect a lot), to the state Attorney General's office, and especially to your and the firm's local newspaper and TV "help" services (Action Line, Contact 10, etc). Write carefully but briefly. If you can interest one of these services, you will almost always get effective help.

• Contacting an attorney should be your last resort. Even small claims courts are not much help, although they are more effective if your problem is with a firm in your state. Getting a favorable judgement in small claims court is relatively easy; collecting any money is not.

The Plastic Plus

If you used plastic, write to the credit card firm, giving your name, account number, the dollar value and date of transaction along with a description of what went wrong. If you didn't receive or accept the merchandise, ask them to void the transaction in accordance with the Fair Credit Billing Act—use the words "billing error" and specifically state that you won't pay for goods you do not have. Make sure you write to the credit card issuer within 60 days of the statement mailing date.

If you received the merchandise but it is completely unsatisfactory, you may be able to claim that the seller failed to live up to the "implied warranty of fitness," meaning the merchant's or manufacturer's promise, specific or implied, that the product would meet your expressed need. An example might be software or a peripheral that won't work with your system. Don't be put off by the don't-expect-anything-from-this-product printed "warranty" that came with the product. Printed warranties these days, especially for software, are more disclaimer than warranty.

Give details about why the product is unfit and ask the credit card company to withhold payment and investigate your claim. If the card issuer agrees with you, it will remove the charge (but the seller may still take legal action against you). If the card issuer *disagrees* with you, your only recourse is legal action against the seller, rarely cost-effective for the amounts typically at issue. Save the printed material your credit card bank sends you periodically; there's some help available there, but it may not be easy reading. Still, it's clear that you have more protection when you order with plastic, even if it's something less than total.

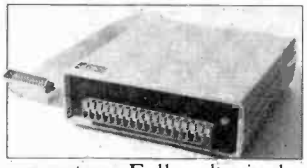
Mail-Order Dealers Are People Too

The vast majority of mail-order firms are legitimate and will try very hard to treat you fairly. They live on repeat business, not just on new customers. Your word-of-mouth references are important to them. But don't have unrealistic expectations about the support they will give you. ◇

NEW PRODUCTS

ANALOG/DIGITAL CONVERTER SYSTEM

Ozark Peripherals' analog/digital converter subsystem for laboratory, educational, industrial, and experimental environments, the Model AO-6, is an 8-bit, 8-channel device for use in applications requiring low-frequency analog conversion such as temperature, pressure, and voltage measurements. System accuracy is ±1 least significant bit and it is interfaced to a host computer through the RS-232 port available on most



computers. Full-scale single-ended voltages can range from 2.5 to 5.0 V dc (adjustable), which is compatible with a wide variety of commercially available transducers and transducer assemblies. Features of the AD-1: solderless/lugless connector for convenient transducer connection; DIP switch-selectable baud rate, 300-19.2K (input sample rate 15-960 Hz); internal expansion interface for digital and relay output circuit cards; prototype area on board with an op amp that can be configured by the user for signal conditioning or other uses. The AD-1 comes complete with power supply, user's manual, drive software for IBM, Apple and most other computers and a 90-day warranty. $189.95.

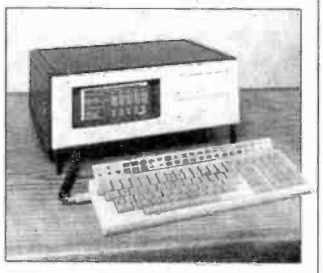
Circle No. 71 on Free Information Card

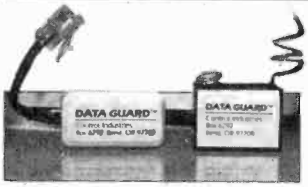
PORTABLE COMPUTER

The Execuport XL Series of IBM PC compatible computers from Computer Transceiver Systems includes both desktop and portable models ranging from a basic Z80 system through a 16-bit 80186 system. The keyboard incorporates all the keys necessary to duplicate the functions of the IBM PC keyboard and has been arranged in an easier-to-use layout. There are 22 function keys with 44 functions, and easily replaceable color-coded placards can be inserted to describe the functions.

The screen can display 25 lines of text, and graphics to 960 × 288 pixels is provided. The systems can read and write IBM PC format diskettes, and coprocessing (Z80 plus a 16-bit device) allows increased speed and efficiency. The units support CP/M-80, CP/M-86, MS-DOS 2.11 (PC-DOS compatible), and Oasis. Dual RS-232C parallel and video interfaces to an external video monitor are also provided. The systems run Lotus 1-2-3, Multiplan, WordStar, and other software.

Circle No. 72 on Free Information Card





MODEM PRIORITY DEVICE

Control Industries' Dataguard allows a logged-on modem to have priority on that line so that there are no more data losses or tripped communications connections caused by someone accidentally or intentionally picking up another phone on the same line. No external power or switch is required. Two models: in-phone version and a model with a 12' snap-in cord that replaces the present phone cord. $39.95.

Circle No. 73 on Free Information Card

COLOR GRAPHICS SYSTEM

The Ultratek Model 6848 Color Graphics System (12"W × 12"D × 3"H) contains a Z80A microprocessor, a power supply, 192K of RAM, 12K of EPROM, and RS-232 serial and parallel printer ports. It can be used as a stand-alone unit, an ASCII terminal, or a 192K printer buffer. The 6848 can drive most any RGB monitor and has RS-170 composite video output. In its graphics mode, it will display 8 of 16 colors in 640 × 480, 640 × 400, or 640 × 240 format. Built-in graphics commands include DRAW, DOT, DRAW LINE, DRAW CIRCLE/ARC, PAINT, IMAGE SAVE/DUMP. The 6848 emulates the Televideo 920 terminal's protocol and displays up to 30 lines of 80 characters. It includes blink, graphic characters, underline, and reverse video.

Circle No. 74 on Free Information Card

SOFTWARE SOURCES

Flowchart Sketcher. A quick and easy way to draw flowcharts—and revise them—comes from Patton and Patton. The program, called Flow Charting, creates organizational charts with standard flowcharting symbols. You can use two text fonts and three line styles and send the output to a dot matrix printer. Flow Charting runs on an IBM PC with 128K RAM (or PC/XT), color graphics board, color monitor and one disk drive. $167. Address: Patton & Patton, 340 Lassenpark Circle, San Jose, CA 95136.

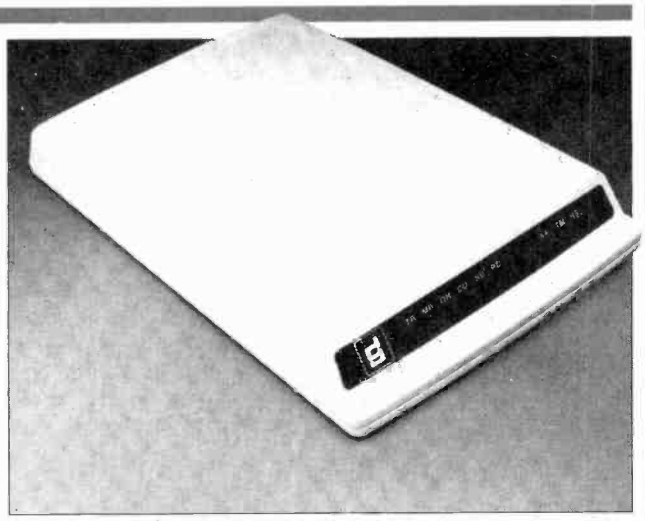
Writer's Aid. In almost any nonfiction work (especially computer and software documentation) an index is indispensable. But preparing one is one of the most tedious jobs of writing. Textpro is designed to help with the job. It works with ASCII files and can index every word in a 200-page document in less than 15 minutes, claims its publisher. What's more, it doubles as a spelling checker, with a 20,000-word dictionary that can be updated. The program is compatible with most text processors, including Microsoft Word, EasyWriter and WordStar. $199.

Circle No. 83 on Free Information Card

COMMODORE COOLING FAN

MiraCool-64 and MiraCool-20 from CR Technologies are cooling cartridges that plug into the user ports on the Commodore 64 and VIC-20. The one-piece fan units draw power from the computer and require no switch or cord. Rated life is 10,000 hr and internal operating temperature in the RFI shielded enclosure is said to be lowered to below 100°F. $52, plus $2.50 s/h.

Circle No. 75 on Free Information Card



1200-BAUD MODEM

The General DataComm 1200 modem operates at 300 or 1200 baud full and half duplex. High quality is said to be due to special circuits with automatic adaptive equalization. This means that the modem continually monitors the phone line conditions and automatically adjusts for degradations. Software provided will be updated by a subscription service. Up to 36 different phrases can be sent with two-key commands and there is a file transfer function. Other features include touch-tone or pulse dial, auto-disconnect, auto-programmable log-on and auto answer, indicator lights to monitor operations, audible alarm for wrong numbers and busy signals, and complete diagnostics. $699.

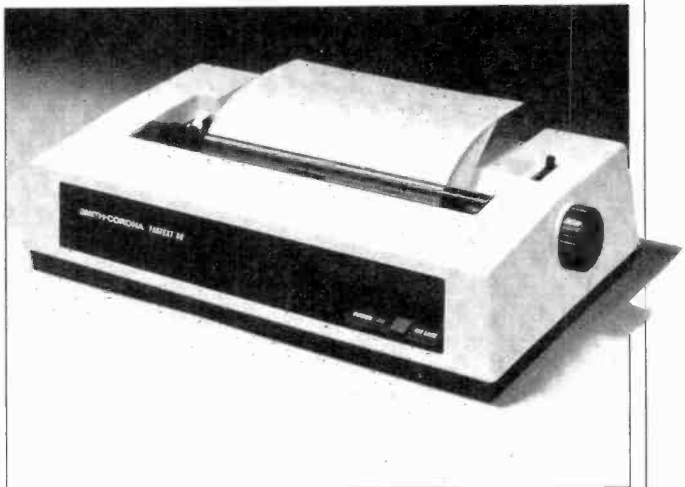
Circle No. 76 on Free Information Card

SOFTWARE SOURCES

Cross-Referencer. When writing a long program in BASIC, it sometimes gets difficult to keep track of all the program's variables. One way to solve that problem is to use a cross-referencer, such at C-REF from Jagware. To run the program, you select options from a menu, for example, the destination of the output (printer, screen, disk), then enter the path name of the file to be cross-referenced. Less than 15 seconds later, Jagware says, the output begins, sorted with 16-place accuracy. C-REF runs on Apple computers under ProDOS. $30. Address: Jagware, 127 Albany Ave. S.E., Orange City, IA 51041.

Menu-Driven Graphics Developer. ChartStar, the recent addition to Micropro's line (which began with WordStar), builds charts and other forms of presentation graphics. The user simply fills in blanks in a form on the screen. You can make pie charts, bar charts, line charts, scatter charts, Gantt or organization charts and write labels in up to nine fonts. The program lets you string a series of charts together to create a sequence on a monitor, much like a slide show, except you see the output on a monitor instead of a movie screen. ChartStar can use data from such other programs as Micropro's InfoStar+, CalcStar or PlanStar as well as 1-2-3, VisiCalc, SuperCalc, and Multiplan. It requires PC DOS 1.1 or 2.0, two disk drives, 192K RAM and a graphics printer such as the Epson FX series, or a plotter such as HP's two-pen model 7470. $395.

Circle No. 85 on Free Information Card



LOW-PRICED DOT MATRIX PRINTER

The Fastex-80 dot matrix printer from Smith-Corona runs at 80 cps and has an 80-character print line at 10 characters/inch. Six pitches are provided: 10, 12, and 16.7 characters per inch; plus enlarged printing at 5, 6, and 8.3 characters per inch. Character matrix is 9 × 8 (standard) and 10 × 8 (elongated). Horizontal resolution is 60 or 72 dots per inch and vertical resolution is 72 dots per inch. Also has a full line buffer, a 96-character ASCII set including seven foreign languages, bidirectional printing, Centronics parallel interface, friction feed, and self test. $259.

Circle No. 77 on Free Information Card

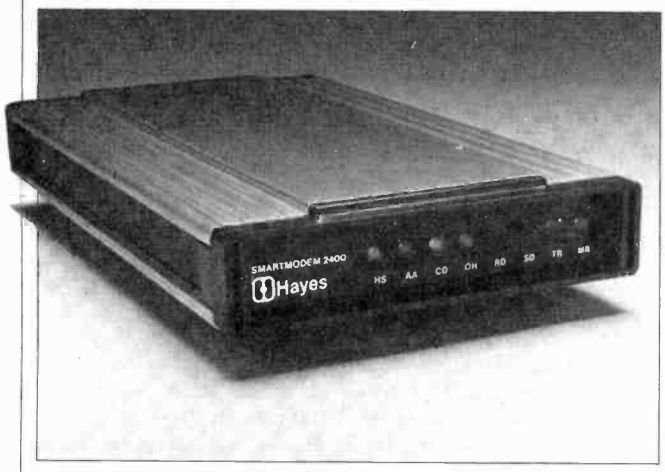
NEW PRODUCTS

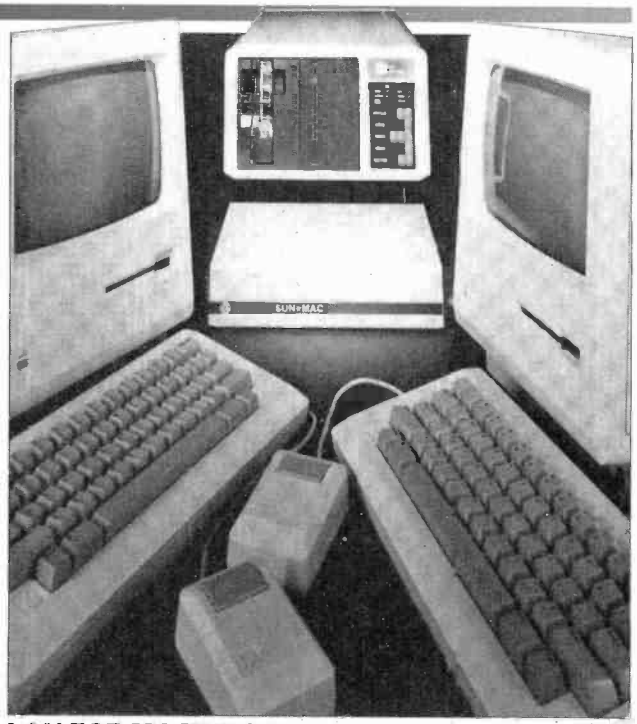
2400-BAUD MODEM

The Smartmodem 2400 from Hayes Microcomputer Products can operate over ordinary voice-grade phone lines at speeds up to 2400 baud. Supports asynchronous communications at 2400, 1200, 600, and 0–300 baud and synchronous at 2400, 1200, and 600 baud. It can be operated in either Bell 103 and 212A modes or in the international CCITT V.22 mode.

Has no DIP switches to set; all operating parameters are set using Hayes "AT" commands. Features call-progress monitoring, auto redial, and ability to take into account pauses that sometimes occur in ROLM phones and many PBXs. Under software control, the modem can be switched between Voice and Data modes. Smartmodem 2400 uses a signal-quality detector to reduce transmission errors so the user can set allowable number of errors at various baud rates. $899.

Circle No. 78 on Free Information Card





LAN FOR MACINTOSH

Sun*Mac from Sunol Systems uses the Macintosh RS-422 port and allows up to 32 Macintosh computers to interconnect and share a Sunol Sun*Disk through a single twisted-pair cable up to 1000' long. Has usable storage capacities of 8, 16, 25, 40, 65, and 92 Mb per hard disk. Up to seven different operating systems can be used at the same time and data transfer rate is 230,000 bps. Handles queuing of drive requests from up to eight Applebus users simultaneously. All utilities use conventional Macintosh pull-down menus and dialog windows.

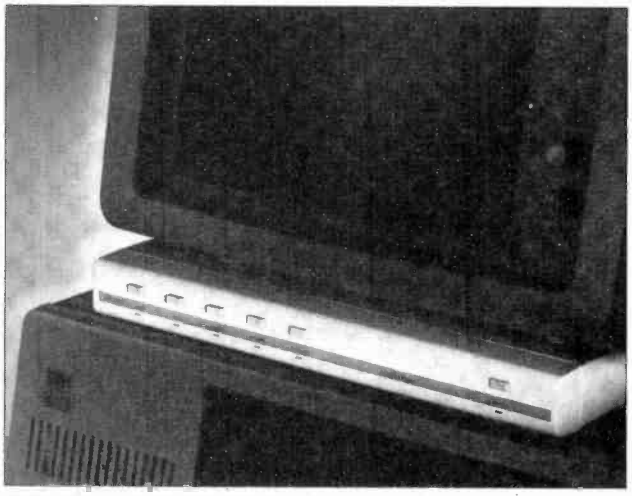
Circle No. 79 on Free Information Card

SOFTWARE SOURCES

Impact Text And Graphics. ConvertaBuffer II with GT Merge, from von Leivendyke Enterprises, lets you print letter-quality text and graphics on the same page. The system includes a plug-in card that translates Epson graphics output from programs such as Lotus 1-2-3 into a format that can used by a daisy-wheel printer, using the period symbol as the basic element. Graphics can be positioned anywhere on the page, and the image can be cropped, rotated, or printed in negative image. $249. Address: von Leivendyke Enterprises, Silvermine Ave., Norwalk, CT 06850.

Cost Estimator. In planning a building, an early cost estimate is an obvious asset. The Design Estimator, from McGraw-Hill, includes prices for 4000 building components as well as wage rates for various construction trades automatically adjusted by zip code. Using such parameters as project location, material to be used and structure size, the program computes a cost estimate. If the plan changes during the design, new data can be entered, and a revised cost estimate can be calculated. The program comes on two disks, and has material and labor costs for any one of 10 regions in the country. Updates are available semiannually. It runs on IBM PC with two disk drives, 128K RAM, and on the Apple II series, 48K RAM. $795; updates are $300 annually.

Circle No. 86 on Free Information Card



IBM PC ACCESSORY

The Master Piece from Kensington Microware is a multifunction accessory for the IBM PC, XT, AT and *jr*; Compaq; and similar computers. It acts as a swivel mount for the videomonitor, functions as a power control center, and provides five individually switched power outlets with on/off switch. It protects the computer from power surges and spikes and static charges. $139.95.

Circle No. 80 on Free Information Card

NEW PRODUCTS

MEMORY EXPANSION AND SPOOLER FOR IBM PC

The Datatron 2megaboard for IBM PC and compatibles allow memory expansion to 2 Mb on one expansion board. Using either 64K or 256K memory ICs or a combination of both, the user can begin with 64K chips and expand to 512K. For more memory, 64K chips can be swapped with 256K versions to give 2.2 Mb (assuming 256K on system board).

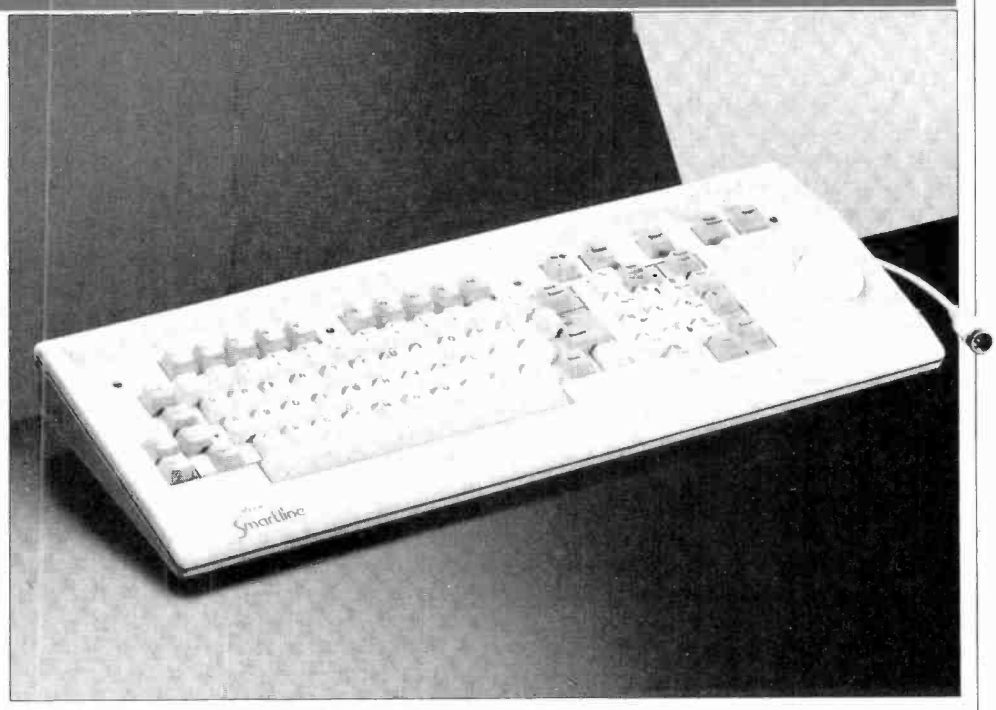
The MegaCache software allows higher speed by using a cache instead of a disk. Size of cache is created dynamically as data is accessed. The MegaSpool allows printing while continuing another application. Without RAM chips, but with MegaCache and MegaSpool, $295; with 64K of RAM, $375.

Circle No. 81 on Free Information Card

LAP-COMPUTER UPLOADING

TransDoc from Software Plus allows one-step upload of document files on the Radio Shack Model 100 or NEC PC-8201A lap computers directly into any word processor operating on the IBM PC. No modification of the word processor is required. Using a special connector, the lap computer and IBM PC keyboard are connected in parallel and the cable can be left in place. The TransDoc software is also available for multi-user systems with RS-232C terminal links such as Fortune 32:16 and VAX. $79.95.

Circle No. 82 on Free Information Card



KEYBOARD/ TRACKBALL

The Smartboard from Wico Corp., an intelligent keyboard/trackball peripheral for the IBM PC and Apple II, II+, and IIe, incorporates a trackball capable of all standard trackball commands and mouse emulation. It is user programmable and allocates up to 256 bytes to the 10 horizontally positioned function keys according to need. Any single function key can be programmed to contain up to 126 characters including alphanumerics, control characters, spaces, and returns. The trackball can be programmed with up to eight characters in either of the four primary directions. User programming is stored with a battery-backup system, and the factory programming can be easily restored. Keyboard comes with either QWERTY or Dvorak key layout. Has a RESET key to restore an IBM PC or compatible to its cold-boot mode. BASIC key provides 26 commands for the Apple and enhances the similar IBM BASICA program. $399.95.

Circle No. 83 on Free Information Card

LIGHTWEIGHT PRINTER

The 5025 Printer from Amdek is a lightweight letter-quality, daisy-wheel printer that uses either an RS-232C serial or Centronics/IBM parallel interface. It operates at 25 characters/second, has a 2K or 8K buffer, and has a 50-dB noise level. It can print in both directions with adjustable character spacing (10, 12, or 15 cpi) and can handle paper to 15" wide. $899.

Circle No. 84 on Free Information Card

SOFTWARE SOURCES

Code Generator III. The best-selling database manager, dBase III, has a new companion program generator called Quickcode III. It lets the user create data files that are eight times the size of normal files—up to 1000 fields and 32,000 bytes per record. It also writes application programs automatically, does on-screen field calculations, lets you create a report library for sorted reports and comes with an online help facility. Quickcode III joins dGraph III and dUtil III, graph and programming utilities for dBase III. It runs on the IBM PC or XT under MS/PC-DOS 2.0. $295.

Circle No. 87 on Free Information Card

T/Maker Integrator. The latest version of T/Maker integrated software adds a relational database, a 55,000-word spelling checker, online help, and a command menu to T/Maker III's standard word processing, spreadsheet, graphics and data transfer functions. Every command and function of the program, even the spreadsheet, is accessible through the word processor. You can string commands together and execute them automatically. It runs on most CP/M (64K) or MS- or PC-DOS (128K) machines. $450.

Circle No. 88 on Free Information Card

Maintain Your Micro
(Continued from page 57)

Sanyo MBC 1000 Computer:
50°F to 95°F

All Charged Up

Even if you operate your micro within these temperature ranges, your equipment may get dangerously hot. *Internal* temperatures for a fully equipped Apple II+, for example, have been known to reach 120°F. It won't take you long at a temperature like that to "fry" a system, ruining both software and hardware. (See COMPUTERS & ELECTRONICS October 1984, page 88 for complete discussion of keeping your computer cool to avoid heat damage.)

Even though magnets are useful and intriguing, the fields they generate are hazardous to your system's health. In addition to turning data stored on tapes or disks into gibberish, they can interfere with computer operations, change the data being entered or processed, and even erase data stored in your micro's internal memory.

The moment you plug your comptuer into the socket and turn the power on, you create a strong electromagnetic field. That's because all electric motors operate via electromagnetism. Moreover, metallic objects near electromagnets can become magnetized, and potential sources of trouble.

It's difficult to say how severely stray magnetic fields affect computer systems. They may show up as disk-drive failures, memory losses, incorrectly processed data, haywire video displays, or any number of things. Worst of all, they *can* cause the erasure of magnetically stored data, which is an excellent reason to copy all important data onto backup disks kept in safe areas free from magnetic fields.

Here are some common sources of stray magnetic fields.

Telephones. Every telephone contains a powerful electromagnet. Store your disks next to the phone, and you may damage or destroy data.

Stereo speakers. These too contain powerful permanent and electromagnets used to drive the speaker cones. They may affect such things as disks, tapes, memory contents, and input/output operations. Keep computers and disks at least 3-4′ from all sources of magnetism.

Electric typewriters, calculators, televisions, and radios. Keep them clear of both hardware and media. Even television sets used as computer monitors should be at least 3′ from your processing unit and disk drives. And never set disks on top of the computer or on your CRT, even temporarily.

Scissors, staplers, paper clips, screw drivers, and metallic pens. Metallic objects kept too near electromagnetic fields can become temporarily magnetized. Passing disks or tapes too near them could result in erasures or glitches.

Remember, if it contains a motor or a permanent or electromagnet, keep it clear of your micro system.

Zapping Out

Everyone has been bothered by static electricity from time to time, but no one has been affected more—negatively—than computer users. The 3M Company, which has been investigating the effects of static electricity on high-tech devices, describes it this way:

"In scientific terms, it is an imbalance of electrons on the surface of a material. Whenever two materials that are in contact are separated, an imbalance of electrons occurs on each surface, resulting in a positive charge (deficiency of electrons) on one surface and a negative charge (overabundance of electrons) on the other. Because this charged state is 'unnatural,' each surface makes an effort to discharge or return to its neutral state. A typical example is a person walking across a floor (generating a charge) and then getting a shock (discharging) as a doorknob is touched."

Research at Western Electric Co. has shown that a person walking across a carpeted floor usually builds up about 12,000 V. In some cases, the amount of electricity generated reached a whopping 39,000 V!

And people walking across *uncarpeted* floors aren't immune from static charges. The same research showed that walking across a vinyl tile floor commonly created 4000 V of electricity; and in a maximum case, 13,000 V.

On the average, when you feel a static shock, at least 2500 V is involved, a level high enough to cause malfunctions of electric equipment. In fact, since charges well below 2500 V can cause equipment failures, the fact that you don't feel static shock doesn't mean that some kind of static protection is not necessary.

Electric equipment such as computer chips can be affected by static discharges containing as few as 10 V. Even "protected" computer components that are encased can't usually withstand a charge of more than 500 V.

Typically, static discharges striking internal computer components can alter or erase internal memory, blank a CRT monitor, and cause a printer to go haywire. They could also make a disk drive read or write erroneously, blow power fuses, and burn out circuit chips or even entire boards. A static discharge to a magnetic disk or tape can also destroy the data stored there and possibly damage the medium irreparably.

Play It Safe

How can you protect your equipment and media from static electricity? Here are a few rules.

- Make sure all your micro components are electrically grounded. Three-prong power plugs fit into three-slot outlets. *Never* bypass grounding by breaking off the ground prong on a plug or by forcing a grounded plug into a two-slot extension cord or adapter.
- Check with an electrician to make sure your house is properly grounded. Many older houses, especially, are not. Grounding protects the computer and peripherals from static and *you* from electrical shock in the event of an electronic malfunction.
- Remove rugs and carpeting, especially those made of artificial fibers such as nylon, from the computer room. Purchase an anti-static floor mat to place under your chair at your computer station. Several companies, including 3M, manufacture such mats, which are connected by a wire to an electrical ground, usually the center screw of a grounded wall receptacle.
- Avoid unneccessary fidgeting while sitting at your computer station. Shuffling feet across the floor can create a static buildup that may be discharged to your micro.
- Avoid wearing rubber-soled or other insulating shoes. They allow a charge to build up while you walk around, without letting it dissipate. That happens only when you touch something conductive—like your computer. Leather-soled shoes hold less static charge.
- Install a room or furnace humidifier to raise the relative humidity in your computer room, especially during low-humidity winter months. High relative humidity in the computer room reduces but does not eliminate charges by allowing them to dissipate through surface and airborne moisture.
- Use anti-static products on the floor and work surfaces near your computer components. Innovative Computer Products' Anti-Static kit, which contains three bottles of anti-static solution, works well. The kit also contains an anti-static cloth for wiping the video screen, leaving a conductive film on the screen to discharge static electricity before it has a chance to build up to damaging levels.

A few words of caution: Keep overspray from anti-static chemicals away

from your magnetic media. Also, since some chemicals are toxic, use them with care. Even those that are not may be irritating to your eyes and to the mucous membranes in your nose and throat. If any irritation or other adverse reaction appears to be occuring, stop using the chemicals at once.

Who Pulled the Plug?

Obviously, no full-sized computer will work unless it's plugged in. But what about other sources of power interruption? Electric-company power failures, power surges (spikes), and brownouts, sudden reductions of line voltage, can hinder performance. So can "chatter," or line noise, caused by electrical interference, usually from appliance motors or other electrical devices on the same line as your micro. A little chatter won't hurt anything, but substantial noise can cause glitches, printing or display errors, and other garbage.

Most computers don't have electrical protection beyond extremely basic anti-noise guards. Even those with more protection aren't safe from other forms of power interruption.

Few buildings wired for 110 V actually deliver 110 V. Due to a number of variables, some houses may have 95 V; others, 130 V. The IBM PC specifies a nominal operating power of 120 V ac, with a maximum of 127 V ac and a minimum of 104 V ac. Anything outside that range is sure to cause problems. Operating ranges for other micros vary widely.

Further, there's always the possibility of someone in your home overloading a circuit and blowing a fuse or tripping a circuit breaker. Should power to your micro fail, printing and disk-drive mechanisms can jam and cause mechanical damage.

Read/write heads on disk drives can crash onto disk surfaces, damaging heads, disks, or both. Even if heads don't crash, the data you were processing when the power stopped might be lost . . . perhaps along with the other files on the disk. With some micro systems, when a single file error occurs anywhere on the disk, the remaining files can't be retrieved.

At the minimum, you should protect your micro from power spikes and noise with a "surge protector," which may cost anywhere from $25 to $200 or more. For lower prices, you'll find devices such as the Panamax SS-120/4 and the SS-120/2, geared to protect micros in residential areas. Higher-protected devices include the ISO-17 Magnum Isolator, built to offer heavy-duty protection suitable even for industrial use.

If your micro is subject to frequent power outages, consider a standby power device. (See COMPUTERS & ELECTRONICS, Oct. 1984, page 84)

Wear and Tear

Even if you do everything perfectly, you'll still have micro problems. The reason is everyday wear and tear. Anytime two moving parts rub against one another—like a bearing against a disk inside your micro—your system is being subjected to wear.

Wear isn't the only source of mechanical malfunction. If you place enough stress on an object, sooner or later it will break. Buildings have collapsed; jet plane wings have snapped; and drive shafts in letter-quality printers have sheared off due to stress.

While you can't actually prevent wear and tear, you can avoid costly downtime and unnecessarily high repair bills through anticipation. Notice a key that requires a second or third strike before registering, an on-off switch that fails to make contact the first time it's thrown, printer characters that are sharp and crisp on one side and blurred on the other. All these are signs of a gradual decline in your system's performance due to wear.

Here are some steps that will minimize the seriousness of mechanical malfunctions.

- Keep your equipment clean. This reduces unnecessary friction and prolongs the life of moving parts.
- Keep it cool. As parts get warmer, they tend to expand, increasing the likelihood of premature wear.
- Lubricate your system regularly, in accordance with the manufacturer's suggestions. Lubrication reduces friction and lets components last longer. Use only the recommended lubricants, though. Don't use grease when a lightweight oil is called for and don't ever substitute a general lubricant for a specific one. Do *not* lubricate those parts not meant to receive lubrication. The guide rails that control the position of a disk drive's read/write head are rarely lubricated, for example, because they would attract dirt that would interfere with the smooth functioning of the head.
- When the inevitable breakage occurs, don't play service technician. Even if you think you know how to fix it, without the proper diagnostic equipment and tools, you're likely to do more harm than good. Take the hardware to an authorized service rep, secure in the knowledge that, by being diligent in your approach to caring for your system, you've held repair costs to a minimum. ◇

Advanced DBM

(Continued from page 43)

data manager, it's important to understand how it "thinks." Of course, it doesn't really "think" at all, but is merely preprogrammed to perform such tasks as inputting, filing, listing, and reporting.

Most developers try to make their command language structures resemble English and have the ability to catch obvious errors in logic or spelling. However, no program tells you that you forgot to include an important data element in your file definition or that your report format is virtually impossible to read. Unlike you or your co-workers, neither the software nor the computer has any stake in or opinion about the value of the system you've created.

Fortunately, much of the technique of designing viable systems is just common sense. The most important thing is to define beforehand what information you want to report and to make sure it's the same as you plan to input. Once you know all the data elements to be managed, you must define how and when each is to be input and how and where it's to be reported.

Going through this process generally resolves most of the ambiguities and contradictions that might otherwise creep into a system. The process may also suggest other useful information that could be generated from the data.

The next step is organizing the data to be collected in a concise series of logically related but separate files. In our example of a time accounting system, it might make sense to keep a file of employees, a file of projects, a file of activity types, and, finally, a file of all timesheet entries. The first three files might be called "master" or "reference" files, since the data in them change very rarely and they are generally used for reference purposes only. The timesheet file can be viewed as a "transaction" or "activity" file, since it is constantly being updated.

This model of database organization is generally called "relational." Its object is to minimize the collection of redundant data and increase the flexibility of reporting. For example, if we wish to report on how many hours of travel have been accumulated for projects under the direction of a particular manager, we need to add a "manager" field. Using a relational model, the manager field need only be added to each record in the project file, not to each record in the timesheet file. This is because this system will automatically relate the project and time sheet file to the associated manager in the project file. Since there are probably far fewer records in the project file than in the timesheet file, we save

Advanced DBM

both time and space.

Another advantage of this structure is that we can use it to check the validity of "transaction" information as it is being entered.

Many data managers have features that allow automatic checking of transaction data against reference files. If, for example, we entered "Jonse" instead of "Jones" for an employee name on a timesheet entry, the manager would catch the mistake because no "Jonse" is listed in the employee master file.

Once the data structure is defined, the flow of data through the system must be detailed: not only the input and output processes, but also any maintenance procedures required to keep the database up-to-date and manageable. For example, we certainly wouldn't want to keep all the timesheet records in the activity file forever. Therefore a procedure to purge the file periodically has to be devised. In this case, we might run a command file procedure every month that purges all timesheet entries more that are more than six months old for all completed projects.

Towards the Automated Office

As a user's data management applications grow in number and sophistication, the logical outgrowth is an integrated, office-wide information system. To support it effectively, access to information cannot remain limited to a single PC. Fortunately, many data managers now allow expansion beyond the single-user PC to multi-user and networked computers.

At the simplest level, data managers need to recognize that there may be more than one user of the system active at any given time and that multiple users may be simultaneously accessing some of the same files. Memos, reports, and data files therefore can be sent to or shared among users without the need for creating printouts or duplicate disks. All information would remain timely. At a more advanced level, applications can be created in which users share a common file, each making changes that may immediately affect the others.

Such office-wide systems are not simple to implement, but they offer tremendous potential for productively integrating information, coordinating activities, and improving inter-office communications within a large organization. As data managers and their users evolve in sophistication, we can expect to see more applications that contribute not only to the productivity of each individual, but also to the productivity of whole organizations. ◇

Using DBMS

(Continued from page 45)

tree and on his mail orders. He had handled all his computer work through a third-party mainframe before realizing that "a computer with software would cost about what I would spend during the busy season for online costs alone."

Like other integrated DBMS packages, PC/Focus offers more than just a database. It is billed as an "information management system" that is identical in design to Focus, a product commonly used on IBM and compatible mainframes. Its facilities include both a database manager with shared-relational database files and a full-screen editor. It also carries its own financial modeling language, a text editor, and graphics; has the ability to build PC applications and menu-driven procedures; and offers the potential to link-up via an asynchronous bus to Focus-driven mainframes.

The file system Seeberg designed includes a plantation inventory that keeps a history of all his trees. Because the fields are maintained by independent contractors who get paid by the tree, Seeberg previously had no way to keep records of how productive each worker was. If something went wrong—if trees didn't carry the luster that would turn them into Christmastime earners—he could only guess the cause.

People are just now discovering the overall power of what the right software can do.

But with his new inventory control, he can track everything that had ever been done to a given tree: "Maybe I would have just had a hunch before, but now we have control over what we are doing. So, when I see the printout—even if I had the right instinct to start with—it makes me feel a lot better."

Likewise, the DBMS has given him control of the mail-order business that has earned him growing profits. The file system keeps all customer names, addresses, and order history accessible for annual marketing drives. The system even prints out the shipping labels and manifests for every tree and creates credit card authorization slips that will be sent to the bank.

"It's obviously made a difference," Seeberg says. "We're expanding now, and the database has surely given us the confidence to go ahead."

Even the Heavyweights

With assets in excess of $6.5 billion, the Bank of New England certainly ranks as a financial heavyweight. Like many large companies, it has separate divisions that, while pursuing "small" projects, sometimes place untimely demands on the data processing managers guarding the corporate mainframe.

So, in order to manage a branch sales incentive campaign recently, the bank employed Powerbase, a menu-driven DBMS. The program includes a "data-zoom" feature that provides instant access to designated files.

In the case of the incentive drive, the bank's management was eager to promote savings products such as IRAs. As a result, all sales personnel throughout the bank's 15 branch offices were granted points for every IRA sale. Whoever made the most sales and gathered the most points during the course of the campaign was eligible for a grand prize.

"It would have been a real nightmare any other way," explains Frank Chiacchieri, office systems analysis manager. "We wanted running tallies, and we wanted the results immediately. We needed a central way of inputting the sales information. The DBMS was a huge success."

The Bank of New England is now making extensive use of the Powerbase package throughout the company. For instance, Chiacchieri uses the software to keep track of the bank's 125 micros, as well as their applications and hardware configurations. He foresees the development being taken up by the smaller affiliate banks that generally don't receive the kind of mainframe support they require.

As a result, Chiacchieri considers the spread of DBMS packages throughout his company as the "third software wave." First came the company's Wang word processing, followed by extensive use of Lotus 1-2-3 spreadsheets on IBM PCs; now come local database management packages.

"You'd be surprised at what people have traditionally done by hand—even in a bank this size," Chiacchieri explains. "But technology is quickly taking hold. It wasn't so long ago that we were first introduced to spreadsheets; now we're moving to databases. People are just now discovering the overall power of what the right software can do." ◇

Tenth Anniversary
(Continued from page 60)

collection of stories and anecdotes about the people, programs and products of MITS, IMSAI, Processor Technology, Apple and many other early companies. Even though its title reinforces the Silicon Valley myth, *Fire in the Valley* is must reading, especially for those who entered the world of personal computing before 1978.

Unfortunately, however, *Fire in the Valley* includes several major errors about the history of MITS. Among the most curious are the claims that a *Popular Electronics* technical editor, Leslie Solomon, flew to New Mexico and along with " . . . Roberts spent many nights in Albuquerque hashing out the exact components of [the Altair]" and that David Bunnell and Ed Roberts " . . . worked long hours in the workshop on their computer." The latter claim was recently supported in a subscription appeal for a computer magazine that included a note from David Bunnell that began, "When I helped develop the first personal computer in the 70's, I didn't realize that the industry would exceed $6 billion by 1983."

Ed, who has read *Fire in the Valley*, is baffled by these assertions. He has always expressed gratitude that *Popular Electronics* was willing to publish the Altair articles. But as for receiving technical help from the magazine, Ed recently told me, "No such thing ever happened." David Bunnell was a technical writer at MITS, not an engineer. According to Ed, "He did some fantastically creative ads and the World Altair Computer Conference was his idea. But Dave never had any involvement with product design at MITS."

So who really designed the Altair? I visited MITS when the first Altair was being designed and built, and I wrote the original operator's manual for the machine. To the best of my knowledge, Ed Roberts alone deserves full credit for the decisions to build the computer and to incorporate the expansion bus. Ed also designed the circuitry, specified the bus lines, selected the 8080 and specified the various front panel switches and status indicators. As reported in *Fire in the Valley*, Bill Yates spent many hours planning most of the circuit boards and the bus terminations. A couple of times when I visited MITS late at night, Bill was hard at work laying out the double-sided Altair boards with colorful strips of red and blue tape. In addition, Ed reports that Jim Bybe made numerous suggestions that were incorporated into the final Altair design.

Fire in the Valley also claims "No one at MITS had *ever* built a computer." Actually, as I mentioned earlier, Ed had begun building simple analog and relay computers in 1959. When Ed and I first became friends at the Laser Division of the Air Force Weapons Laboratory in 1968, he often talked about building a full scale digital computer. As I observed above, at MITS in 1970, we seriously discussed building a kit analog computer. From 1971 to 1974 Ed designed and manufactured many different kinds of digital calculators and programming units that used large-scale integrated sequential logic circuits and memory chips almost identical in operation to those used in digital computers. Moreover, Ed had worked extensively with minicomputers, both at the Weapons Lab and at MITS. In short, Ed had extensive knowledge of computers when he designed the Altair.

Although *Fire in the Valley* falls short in its account of MITS, the book is filled with fascinating anecdotes about the early days of personal computing. Moreover, its authors have presented the best summary yet published of the role played by Ed Roberts' company. "It would be hard to overestimate," they wrote, "the importance of MITS and the Altair. The company did more than create an industry. It introduced the first affordable computer, of course, but it also pioneered computer shows, computer retailing, computer company magazines, users' groups, software exchanges and many hardware and software products. Without intending to, MITS made software piracy a widespread phenomenon. Started when microcomputing seemed wildly impractical, MITS pioneered a billion-dollar industry."

Silicon Valley Fever (Basic Books, 1984) by Everett M. Rogers and Judith K. Larsen is another widely publicized book that perpetuates the California myth. Though old timers will find this book dull, too long and overly simplistic, I can recommend its nonfiction content for novices interested in the high-tech culture.

As for fiction, *Silicon Valley Fever* parrots in a matter-of-fact fashion "mythinformation," such as that Apple "launched the microcomputer industry"; "Silicon Valley is the birthplace of pocket calculators [and] home computers. . . . "; the first personal computers

"were all kits"; Apple was first to offer a disk drive; and so on. MITS, which is misnamed in the text and isn't even listed in the index, is allotted a 1" footnote in small print on page 277 at the end of the book. In short, the typical reader will come away from *Silicon Valley Fever* convinced that were it not for California geniuses the personal computer would still be a twinkle in the eye of some science fiction writer.

After reading *Silicon Valley Fever*, I sent its authors a three page letter listing some of the errors in their book. I'm happy to report Everett Rogers responded that they would include corrections in the book's second printing. He also wrote " . . . we agree with you completely that [MITS] was *the* pioneer in microcomputers."

We owe future generations a complete and accurate record

Getting the Facts Together

While the men who pioneered personal computing are still with us, it is essential that they begin recording for history their recollections about the roles they played. I've asked Ed Roberts and Bill Yates to write down everything they can remember about the Altair project, and those who worked at other early companies might want to do the same.

In our lifetime there may never be another invention which will have the intellectual impact of the personal computer. Therefore, we owe future generations a complete and accurate record of the development of the personal computer. Finally, those who rightfully deserve credit as pioneers should be properly recognized, even if their contribution had its origins in a garage in New Mexico instead of California. ◇

Mims and Edwards

(Continued from page 62)

hardware, we're not going to see any major breakthroughs.

M: Tell me about the lap computer you developed at MITS in the summer of 1977 after Pertec bought you out.
R: It would fit in a briefcase. There were two versions, one that plugged in and one that was battery-powered. Neither used CMOS because CMOS was just becoming available, so they had fairly high power consumption. I think the battery-powered machine would run, maybe, 3 or 4 hours. The basic system had 16K of user RAM, a 32-character LED display, and a standard-size keyboard. Our materials cost was in the ballpark of $150, which would have meant the asssembled system would have probably been $450 or $500.

M: What happened to this machine? Did Pertec kill it?
R: They didn't actually kill it. I gave them the drawings and we had the industrial design finished; but, after I left, they just let it die. It got caught up in the NIH (not invented here) thing within Pertec, where the engineering department was doing regular product development and felt threatened by it. I think that's kind of what killed it. There were some comments made later by some of the key people at Pertec that there was no market for such a product.

M: Was any hardware built?
R: Oh, yeah. It was built and checked, tested, and run.

M: You mean an actual prototype was built?
R: Sure. When I say prototype, it was not a full-up manufacturing prototype. It was a working prototype.

It got caught up in the "Not Invented Here" thing within Pertec

M: Did the lap computer use the 8080?
R: Z80. At that time I was really interested in the Z80 because it was a hot chip that had just come out.

M: Radio Shack picked it for the TRS-80 Model I.
R: Yeah. It was fast—roughly two or three times faster than the 8080—and had a little more sophisticated instruction set.

M: Since the 8080 microprocessor was available in 1974, it was inevitable that someone would have eventually developed a successful personal computer with or without MITS. How much of a lead did the Altair give the industry?
R: We didn't see any serious competition in terms of new mainframes for about two years. People like Processor Technology began providing add-on cards for our system within 6 or 8 months after the Altair was introduced, and IMSAI may have started shipping copies of the original Altair 18 months later. But as far as anybody doing anything fairly original, I think it would have been probably close to 2 years later. ◇

Optical Computing

(Continued from page 67)

and the theories hard to grasp; yet progress and optimism are apparent in conversations with key people in the small community of researchers.

No one believes that optical computers will replace general-purpose electronic computers. Analog optical processors seem destined for specialized niches, where they can do certain jobs better than anything else.

Digital optical computing is in its infancy. If the systolic-array approach works out, optical matrix-handling modules might someday plug into supercomputers, permitting simulations far more detailed than possible today. Optical techniques might help supercomputer designers bypass the interconnection problems that restrict design of very large scale integrated circuits.

Might optical processing, with its potential for parallel processing and its inherently analog nature, match the tricky and still undefined requirements of artificial intelligence? It will be a long time before the answer is known, but the question clearly seems worth asking. ◇

DisplayWrite 2

(Continued from page 35)

HOME) will let you search for any word *or location* in the text. The search and replace feature is quite powerful, allowing you to conduct up to three separate searches at the same time throughout a document. Each change can be a string up to 60 characters long. The search process is quite fast, and a message at the bottom of the screen indicates how many phrases have been replaced.

DW2 has full formatting features, which are menu-driven, as are most other functions of the software. The page format menu includes such niceties as setting first typing lines differently for the opening and following pages of a document, and a choice of various envelope and paper sizes for printing. There are also decimal and colon tabs and full-featured headers and footers.

Although there is an option for automatic or discretionary hyphenation, the automatic hyphenation requires the use of the dictionary disk, which means another disk swap.

Printers, Bells and Whistles

Most word processing programs I have used offer extensive printer support. DW2 falls a little short in this category. There is only support for four families of printers: The IBM matrix printer (or Epson or compatible driver), the IBM (Epson) graphics printer, the IBM 5218 and the NEC 3550 (or compatible driver).

DW2 does offer a lot of features. The column formatting and editing functions, which are unusual, work very well, and column manipulation is a big plus for scriptwriters and others who do a lot of work with columns of text (and/or numbers). The math and mail merge features also performed as advertised.

The built-in spelling checker works in an interactive or batch mode, but either way, you still have to correct the words manually. There is no automatic correction facility, not even a "look up" function.

Mixed Emotions

In preparing this review I used DisplayWrite 2 as my primary word processor, which left me with mixed feelings. The product does more or less perform as advertised. It's certainly complete and offers many of the features of a dedicated word processor. However, some of these features are so unwieldy that they are annoying.

A successful word processor is nearly invisible. It let's you perform all of your important editing and formatting functions quickly and easily. It doesn't require disk swapping on a two-drive machine. For me DisplayWrite 2 doesn't quite measure up.

However, since evaluating a word processor is somewhat of a subjective matter, it could be different for you. And the price is certainly attractive (the suggested retail price, $299, includes all of the features listed).

The DisplayWrite 2 system seems reliable and can produce good-looking documents. Even so, there are competitive programs of a similar type that may make you happier. I'll put it this way: On a scale of 1 to 100, I give it an 80—it's got a good beat and you can dance to it, but it probably won't make the big best-seller chart. ◇

Memotech MTX512
(Continued from page 26)

er. (I must admit that I spent 10-15 minutes trying to see where they hid an extra 64K ROM to do all this. I couldn't find it—amazing power in only 24K of ROM, or even 34K of disk!)

To assist you in learning about all these wonderful commands and possibilities is an MTX BASIC Tutorial and Reference Guide. I found it very thorough in its introductory presentation of each topic but flawed in the way it bounces from primer to advanced discussions of the techniques. To its credit, Memotech has not only included schematics of all its circuitry, but has also gone and explained how the video processor works. Now that's upgrade-friendly.

The Oxford Ring

Local area networking has got to be one of the hottest topics under discussion for microcomputers these days. Soon to be integrated into FDX BASIC will be the Memotech Oxford Ring software, which currently exists only as a separate program, in conjunction with an external NODE ROM cartridge ($100 each, about $75 in dozen quantities, and $20 if you want a full 256-unit system). The Ring is expandable to up to 256 nodes (individual computers), and is very simple to operate and use—merely plug a DB-25 connector into the RS-232 port on each computer in the ring, plug in the ROM cartridge, and run the Electronic Mail program.

Once the ring is established, the "master" can set the operating parameters and priority level of each node. Using the ring, you can share a mass storage device connected to any node among the ring members, with programs, data, messages, and mail movable through the ring. The linkage itself uses a serial rather than a parallel bus for connecting systems. Unfortunately, you need active RS-232 connectors with built-in relays that short out pins 2 and 3 when a computer is turned off. Otherwise the ring will fail if any node turns off.

CP/M and Utility Programs

Not satisfied with supplying only the standard Digital Research CP/M-80 version 2.2 utilities, Memotech has added a dozen of its own. These include the Silicon Disc handlers Sidisc and Sispool mentioned above, a program (Rcheck) which checks disks for both hard and soft errors, a way to ENTER a string of commands (i.e., DIR, STAT, and begin a program) on a single line, a second version of the Enter program called Startup that stores initial commands directly onto the disk for execution each time you turn the system on, a program to set the RS-232 port baud rates (Baud), a means to configure your system to be aware of which disk formats are being supported (Config), and a pair of Submit-type programs called Batch and Sub. There is also a program, Eraq, that allows you to erase common disk files with a query on each one.

NewWord Word Processor

The standard NewWord program was reviewed in an earlier issue (June 1984). However, on the FDX 1000 it comes alive in 16 simultaneously displayed (user-defined) colors signifying the various word processing functions, such as underline, bold type, sub- and superscript. I did notice that when I used the full help level I saw an appreciable amount of disk access for menu updating, which slowed the editing quite a bit.

If speed is more important to you than color, you might want to check out color NewWord before you depend on it for your word processing. Also be aware that although monochrome NewWord files can be typed out on Memotech's DMX-80 dot-matrix printer, many embedded control characters in the color version will cause strange fonts to be printed and even turn the printer offline if not printed through the program. You might encounter some difficulties if you need to transfer your color NewWord files between color and noncolor machines.

The Jaguar of CP/M Computers?

Breaking with the traditions of bland, beige, plastic cases, the Memotech "Black Knights," with their metal armor, are very impressive. But businesses don't really care about a machine whose beauty is only skin deep. As a cassette-based system, even with MTX BASIC and the NewWord ROM, the MTX-512 is unsatisfactory.

The dual disk drive FDX 1000 color business computer has the legacy of the 70s: CP/M-80, with hundreds of monochrome, nongraphic 8080/Z80 programs written for various versions of it. Another plus is the ability to use both the monitor and RGB video outputs simultaneously when using the VDEB or PANEL debugging utilities. Unlike standard BASICs, the FDX BASIC is interactive. It allows 16-color graphics, sprites, assembly language, and text manipulation, which suggests future color, graphic, and animation offerings such as the color NewWord. It's hard to tell if NewWord is so slow because of the color enhancements or because of the overabundance of user-friendly menuing, but just imagine a spreadsheet in color with figures in black and red ink where necessary. The designs for internal and external ROM/RAM packs and a wide variety of physical and superfast Silicon Disc drive configurations have got to be considered a plus. Others are the user-friendly error messages and startup/enter utilities.

I still can't believe how much raw power is built into the MTX system, the first of the color CP/M computer systems. All-in-all I feel that it is an exceptional CP/M development system that can be used effectively for small business applications and software development. It truly brings the 8-bit system into the 1980s and could spark a new wave of 8-bit systems. A Jag? Until the NewWord is speeded up and the Ring is made failsafe, I can't rate the MTX system in that class. But I do think it has the potential to get there. ◇

Computer Scientist
(Continued from page 12)

ed beam to move in two dimensions and create a complex and rapidly changing pattern of loops, swirls, convoluted circles and other fantastic shapes.

For preliminary tests, you can drive your laser light show with a speaker connected to an ordinary transistor radio or cassette recorder. Select a talk show or music having lots of bass for best results. After the system is operating well, you can then connect the speaker to your computer. (Figs. 7 and 8).

Professional laser light shows often use powerful argon, krypton, helium–neon and other lasers that emit beams with a range of discrete wavelengths or colors (blue, green, red, etc.). Many of these lasers cost well over $10,000, and some require special maintenance. Most of those bright enough for professional light shows emit beams that can damage unprotected eyes.

Helium–neon gas lasers are best suited for do-it-yourself light shows. Even a very-low-power unit emitting less than a milliwatt of optical power, considerably less than the power in a flashlight beam, can produce a striking red pattern on a wall or screen in a darkened room.

More than a dozen companies manu-

facture helium–neon lasers, some of which sell for less than several hundred dollars. For several years I've used an ML810 helium–neon laser made by Metrologic Instruments (143 Harding Ave., Bellmawr, NJ 08031). This compact laser, which now sells for $339, includes a built-in power supply powered by ordinary household current.

Many other lasers are also available, and complete lists of manufacturers and the lasers they make are given in such trade catalogs as the *Laser Focus Buyers' Guide* (PennWell Publishing Company, 199 Russell St., Littleton, MA 01460) and the *Lasers & Applications Designers' Handbook & Product Directory* (3220 W. Sepulveda Blvd., Suite E, Torrance, CA 90505).

Laser Operating Precautions

The U.S. Bureau of Radiological Health has established safety standards for most kinds of lasers. A low-power helium–neon laser considered a Class II laser so long as the power in its beam is less than 1 mW. Class II lasers must have pilot lights that indicate the laser is switched on and mechanical shutters to block the beam.

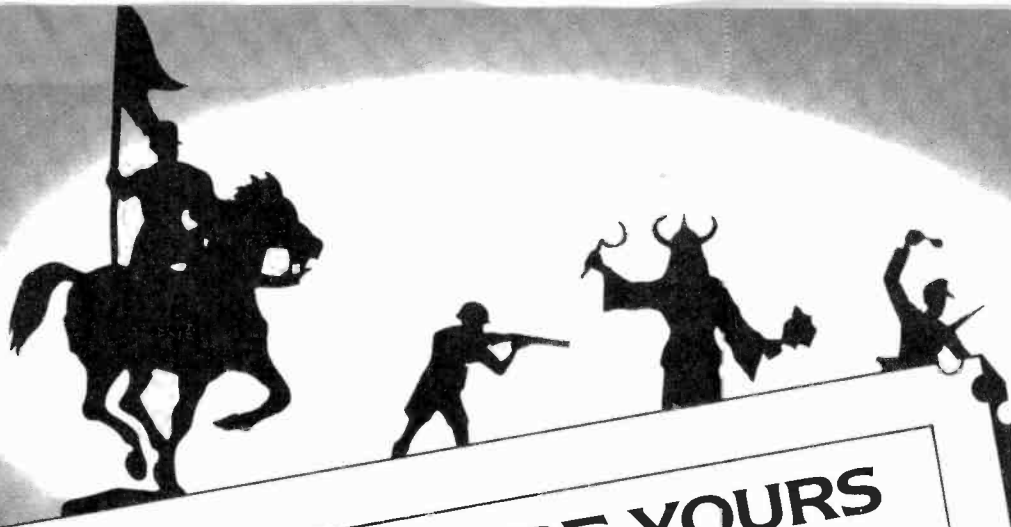
Having worked with powerful argon lasers that emit beams that can quickly ignite paper or cloth, I'm well aware of the need for safety when working with lasers. Even though Class II helium–neon units appear to emit less light than two-cell penlight, their beams are so narrow and concentrated that you should never stare into the beam or point it at another person. Always be sure your laser light show apparatus is working properly before inviting friends over for a look.

If you've never before worked with a laser, try your system with a bright flashlight or slide projector first. Though the reflected light pattern will not have the striking beauty of that produced by a laser, you will gain valuable experience aligning your system.

Novice laser users should also read any safety laser precautions supplied with the laser they plan to use. For additional information, see *ANSI Z-136.1-1980, ANSI Standard for the Safe Use of Lasers* (American National Standard Institute, 1430 Broadway, New York, NY 10018).

Going Further

I hope this column has stimulated your interest in computer art. For more information, visit the book displays at local computer stores. If all else fails, have a look at your computer's operator's manual. ◇



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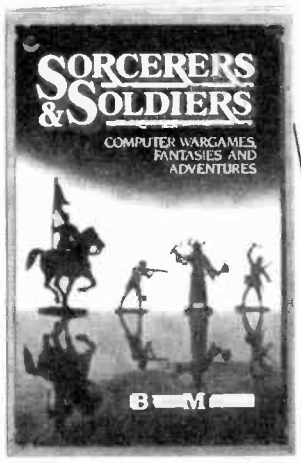

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Realia COBOL

(Continued from page 36)

Using the Compiler

Using the Realia COBOL compiler requires the source code to be prepared in one of two formats: The standard .COB with source starting in column 8, or .CBL-type files with code starting in column 2. Realia supplies a full-screen editor with the compiler for users who don't already have one. The Realia editor is an excellent program development tool with the usual text editing functions. It is relatively fast, provides good on-screen help, and will edit files of any size. The editor stores text in standard ASCII format, so the files it creates can be accessed by virtually any other program. It is a good tool for developing BASIC or other programs.

A complete set of compile time switches and source code directives is available to customize the operation of the compiler. Some directives can enhance the error checking of the run time execution module while others speed up the compile.

The .LST file generated by the compiler can contain the following elements, depending on compile time switches:

- Source listing—source program as compiled
- Cross-reference listing—data and procedure names
- Error listing—standard level E, C, or W messages
- Condensed code listing—similar to IBM CLIST
- Generated code listing—assembler and object code
- Segment table—description of program segments and PMAP size
- Version listing—signature of the compiler modules
- Compilation directives—listing of directives and switches in effect

The compiler produces files compatible with the DOS linker. The linkage editor must be invoked after each compile to obtain run-time routines from the Realia run-time library. Other compatible modules may be linked at the same time. The result is a stand-alone .EXE module that executes in a fast and efficient manner.

Some compilers require large amounts of memory and disk space. The Realia COBOL compiler, however, will perform admirably with two floppies and 160K of RAM. If additional RAM is available, it is used as a cache to improve compilation speed.

The Realia Difference

The Realia COBOL compiler was written to get the maximum possible performance from the PC: Data Divisions up to 1M byte and Procedure Divisions up to 6M bytes, for example. The use of CALL and RET instructions during PERFORM statements can be selected with a compiler option. The indexed access method uses a compressed key, to speed disk performance. Small binary fields are operated upon by single instructions instead of large subroutines. These factors and others combine to produce speedy compilations and compact, efficient object modules.

User Observations

Realia delivers its promise of speed advantages over other compilers. Using an IBM XT with 512K of memory, 3000 lines of source can be compiled in 3 minutes. This rate is at least four times faster than any other compiler I have tested. Realia object modules run at least four times faster than the same program compiled with other products; sometimes they are as much as 20 times faster.

Realia COBOL

(Continued from page 87)

Using the Realia compiler to maintain or develop mainframe programs appears to work as advertised with some minor hitches. During four months' use I observed several minor bugs, which I reported to Realia, which fixed them, typically in one day.

During my testing of Realia, I downloaded a 15-year-old order processing program to the PC. This program has 5000 lines of source and has been modified by many programmers. The Realia compiler took 3 minutes to compile the program, flagging a few statements it shouldn't have. It seems there are a couple of areas where IBM strayed from the standard, causing the Realia compiler to generate some E-level diagnostics on source statements that pass through the IBM compiler. Realia realizes the need to be compatible with IBM VS COBOL and is working to add syntax checking as close to IBM's as possible.

Indeed, the "standard" for this compiler seems to be as much IBM's VS COBOL as the ANSI standard. The Realia COBOL manual provides a brief overview of the product and lists differences between the Realia and IBM compilers. For additional information on this COBOL implementation, the user is referred to the IBM VS COBOL manual.

Final Comments

Choosing a COBOL compiler can be complicated. Each compiler on the market has some strong points that may make it the suitable choice. Some compilers may have special extensions, for example; others have more complete implementations of the standard. Performance and ease of use should be weighed heavily in making a final decision.

Specifications

Product: Realia COBOL compiler
Mfr: Realia
10 S. Riverside Plaza
Chicago, IL 60606
Price: $995
Requirements: IBM PC, XT, and compatibles 160K RAM, two disk drives

Realia COBOL, while a new product, performs well. The OP-TEC sort/merge and VSI screen manager can be linked to Realia object modules to enhance the performance.

Those interested in a fast compiler that can use all of the PC's memory and function with mainframe compatibility should take a close look at Realia's new offering. ◇

Quietwriter

(Continued from page 51)

"jog" the paper up or down in increments of 1/96".

A semi-automatic single-sheet feeder is built in. After a piece of paper is inserted, pulling out the bail lever automatically brings it into the correct position for printing. Available as options are a pin feed mechanism ($75) for continuous-form paper and a fully automatic cut-sheet feeder ($350).

Other Features

Printing without impact, the Quietwriter is, as its name implies, quiet. IBM claims that the noise level is 53 dBA. The loudest noise it makes occurs when the printhead returns from the right end of its travel across the paper to the left.

Specifications

Product: Quietwriter printer
Mfr: IBM
Weight: 22 lb
Dimensions: 8.5"H x 21.3"W x 14.4"D
Speed: 40 cps (10 pitch), 48 cps (12 pitch), 60 cps (15 pitch), 40–60 cps (proportional)
Resolution: 240 dots/inch (V), 360 dots/inch (H)
Character set: Determined by Electronic Font cartridge

It's also fast. In its proportional spacing mode it operates at between 40 and 60 characters per second, and the output is truly letter quality. Its slowest speed is 40 cps, when it's in its 10-pitch mode. (There are also 12- and 15-pitch modes when the appropriate Electronic Fonts are used.)

Connection to a computer is made through a Centronics-type parallel interface.

IBM is to be complimented on its manual. It is thorough (to the point of devoting 21 pages to unpacking and setup) and explicit. A large portion of it describes how the printer can be controlled from a computer.

One somewhat disconcerting aspect of the Quietwriter is that while its output looks as if it had come from an impact printer, it has none of the slight depressions or bumps that such a printer would have left in the paper. This smoothness, however, seems to be the general trend in hard copy today—laser printers don't dent the paper either. If the trend continues, we may not be able to tell the originals from the originals!

Based on first impressions, it looks like IBM has a winner. While the Quietwriter's inability to produce hard copy of bit-mapped screen images may be a drawback to some, its speed, silence, ease of use, and the quality of its output will easily make it the printer of choice for many. ◇

Computer Hardware
(Continued from page 13)

Thus, it becomes possible to produce continuously expanding multiple rings of particle "explosions." If the particle color selected is associated with the changing colors of a flame, the result resembles a moving "wall of fire."

Bump Mapping

In the column that discussed fractals, I mentioned the use of Lambert's law of cosines, which states that the amount of light reflected from any surface is proportional to the cosine of the angle between the light source and the "normal" perpendicular to the surface being illuminated.

The surfaces of almost all the things we see have some texture. Even "clean" surfaces may have slight cracks, dust particles, fingerprints, rust, or other forms of contaminant. By writing algorithms that slightly alter the amount of light reflected from different points on a given surface, it is possible to simulate bumps and depressions and thus create any texture. By making slight changes in the algorithm, almost any surface can be simulated. The approach is usually called *bump mapping*.

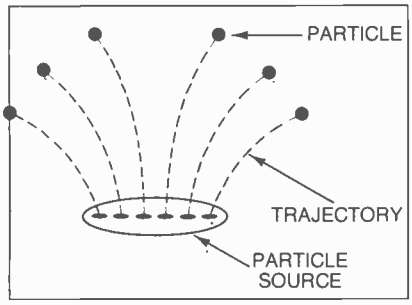

Fig. 4. In particle generation, sources explode like Roman candles.

Computing Power

Unfortunately, all of these complex graphics algorithms are extremely time-consuming (if not impossible) to run on a typical microcomputer. Just one graphics frame might require extremely long periods of time (possibly months), even if the microcomputer had enough memory and operated 24 hours a day.

A Cray X-MP supercomputer (which costs $12 million), performing some 400 million mathematical operations per second, must operate day and night for several months to create enough high-resolution graphic frames for a typical movie. A fast minicomputer, on the other hand, also running day and night might turn out only some 2.5 minutes of similar movie film per year!

But what about microcomputers? At the moment, the graphics techniques used on mainframes are not available. Before too long, however, advances in software and semiconductor technology will bring new "goodies." What will these new systems be like?

To cut down on processing time, the new high-resolution graphic approaches will probably use multi-CPUs (parallel processing) running with "partitioned" software. Each memory plane will have one or more 32-bit CPUs running at or close to its maximum rate, and each board will contain its own copious memory. The amount of time needed per frame will be reduced. But, for the moment, don't plan on making any high-resolution computer-animated movies.

Why not? A relatively low-resolution image—512 by 512 pixels by only 4 bits deep—would require over 1 megabit of memory, while a more reasonable image—1024 by 1024 pixels by 4 bits deep—would require over 4 megabits of memory to produce only 16 shades of brightness. If this sounds like a lot of memory, consider that a typical computer-derived movie frame can be 4000 by 6000 by 24 bits deep. This comes out to 576 megabits per frame. At some 24 frames per second, just 1 minute of film requires 2.3 gigabits of storage!

But don't despair. The cost of memory is coming down, surface mounting will reduce board prices, and extremely high-density optical storage devices will soon make their appearances.

Moreover, CPUs are getting faster and more powerful. For example, the new 32-bit Motorola 68020 or the National Semiconductor Series 32000 CPUs can directly address 4 gigabytes of memory and run at clock rates greater than 14 MHz.

Now consider what may be in store for us only 5 years from now. In laboratories today, experimental gallium arsenide devices are operating at speeds far faster than those of the semiconductors we use today. It may soon be possible to create semiconductor logic devices to operate at clock rates of several hundred MHz.

Because of the increasing interest in high-resolution graphics, we feel that, more than likely, specialized 32- and even 64-bit graphics processors will appear. These will probably be supported by various graphic algorithms in some form of ROM and will have sufficient RAM to fill a CRT screen or two. When several of these specialized devices are coupled, limited animation will be possible.

Yes, it appears that we will have a very high-resolution future. ◇

Sidekick
(Continued from page 33)

capture specific data items from any screen to a file for later inclusion in a report, without disrupting current processing. The Notebook will even import data from Sidekick's own Calculator, Calendar, and other functions.

The Notepad does not support the reverse operation, a direct "export" of its contents to the running program. That's because there is no clean way for Sidekick to know where to put the data or even what the main application is currently processing. However, if the application itself has a way to "import" ASCII-type files, it can read files created and saved under the Notepad. For example, I was able to go through various software packages, take notes on the fly with the Notepad, and reassemble them using the Read File (^KR) command in WordStar.

Sidekick may slow down some I/O operations

The Calculator

Sidekick's Calculator pops up as a picture of a calculator with a "totals" line that responds to the computer's numeric keypad, arithmetic operators, and various one-key commands. The most useful features of the Calculator include switching between binary, hex, and decimal arithmetic and performing the Boolean operations AND, OR and XOR, all very handy for assembly language programmers.

In general, however, the Calculator seems the weakest part of Sidekick and deserves some sprucing up. It would help if it could raise to a power, do trig and log functions, do transformation to any base, and have more than the one level of memory that is currently provided. Other useful features would be the ability to add a column of numbers extracted from the Notepad or the screen, and maybe some limited programmability, for example, the ability to evaluate expressions stored in the Notepad. As it is, Sidekick's virtual Calculator is not quite good enough to make me throw away my real one.

The Autodialer, Calendar and ASCII Table

Sidekick also contains a telephone autodialer that works with the Hayes Smartmodem or compatibles. The phone list can be in any format. To dial you simply bring the phone number up anywhere on the screen, invoke the Autodialer window, point to the number, and hit the return key.

If you maintain your list as lines in an ASCII-type file, the Autodialer can search for the correct entry on any match, and allow you to scroll through the matching entries to find the right number. Autodialer phone numbers can be any combination of numbers, parentheses, dashes, or "@" signs, where an "@" indicates a pause for a dial tone.

Sidekick also has a Calendar that displays a monthly calendar and allows the user to schedule appointments. This feature is thoughtfully conceived and well-executed, but, unless you make appointments only at your desk, it will probably never replace your paper appointment book.

A final convenience, aimed mostly at programmers, is the ASCII Table. It shows an extended ASCII character set with numerical values in decimal and hex. It can save time otherwise wasted on fumbling around looking for a printed table.

You can easily learn Sidekick without the documentation, which is more than adequate as a reference, should you need it. One chapter gives an overview of the program and its functions; subsequent chapters detail every feature clearly and provide numerous examples.

Slowing Down

Because Sidekick performs essentially a DOS I/O call that checks every byte for input of a CTRL/ALT sequence, it may slow down some I/O functions while it's resident. For example, I noticed a marked degradation in the performance of the DOS Print command. If you run Prokey with Sidekick resident, there may be some interference, notably if you use Prokey's one-finger option—the menu flashes on and off after the CTRL/ALT sequence.

In general, however, I was impressed with Sidekick's performance, utility, and ease-of-use. At $49.95, I find it easy to recommend. ◇

Specifications

Product: Sidekick
Mfr: Borland International
4113 Scotts Valley Dr.
Scotts Valley, CA 95066
800-227-2400 ext. 953
(CA 800-772-2666 ext. 953)
Price: $49.95; $79.95 not protected
Requirements: IBM PC, XT, or compatibles; 128K, one disk drive

Apricot XI

(Continued from page 31)

The Keys program allows you to redefine any keyboard key to produce a string of up to 79 characters when it is pressed. This feature is handy for dedicated applications programs, such as word processing. One limitation of Keys, though, is that you cannot "overlay" the keyboard with new key legends, a shortcoming that does not prevent it from being quite a useful program.

Another interesting feature of the Apricot is a built-in sound generator. As in other systems, the chip used here is a TI SN76489 Sound Generator, which provides noise sources, volume control, and three channels of sound. Again, as in the case of graphics, some BASIC commands that would make use of the sound capability would have been welcome. About the only way to utilize the sound chip is with an assembly language, not an alternative for the casual user of the system.

Consider the Apricot XI if you want high-capacity storage with just a few dedicated applications

A "mouse port" is included on the Apricot and is compatible with the Microsoft mouse. The connector is the same one used by the keyboard.

Software products available include UCSD Pascal, WordStar, dBase II, a SuperCalc II or III upgrade, and a Macro Assembler. Since ACT is the largest British personal computer company, you can expect software manufacturers to modify many of the products you'd find on an IBM PC to run on the Apricot configuration.

The Apricot has a number of other products available from either ACT or from independent manufacturers. Whether these products will be made available in the U.S., what prices they will be offered at, and other particulars are unclear. The most intriguing of these products is a color graphics board that is 768 by 576 pixels by 16 lines by IO Research, Ltd., of the U.K. This board, presumably available now, would be a powerful supplement to the monochrome graphics.

Documentation

Documentation for the Apricot is similar to that of other MS-DOS machines—little of it approaches the IBM standard. The Apricot includes an adequate MS-DOS/BASIC User Guide, a barely adequate SuperCalc/SuperPlanner Guide, an inadequate Configurator Guide that describes how to use the Manager utilities such as Font, Logo, and Keys, and a glossy but short Owners' Handbook. Also available is a Technical Reference Manual, which is fairly well done but does leave some gaps in technical information.

Summation

At $4495 for the 10M-byte version, the Apricot is competitive with other 10M-byte IBM compatibles. Its features are certainly well designed and bundled together in a compact package. The disk drives are dependable and reliable.

However, the Apricot is simply not compatible enough with the IBM PC to be a serious contender for its share of the MS-DOS market at this point. The biggest factor contributing to its incompatibility is the 3½" micro drive. Incorporation of the drive makes for a nice neat package, but doesn't allow you to run IBM software directly from 5¼" diskettes. Even if you could get the software onto the 3½" medium, you'd still have conflicts in the BIOS in regard to disk, screen, and other operations. I don't feel the typical user wants to wait, hat in hand, for either the manufacturer or a secondary company to provide appropriately tailored software to run on the Apricot or on any other machine. Only systems that are very compatible with the IBM PC or PC/XT, such as the Compaq series, have been able to compete head-to-head with IBM. Even some of those companies are having tough times with recent price cuts by Big Blue.

The Apricot, with "20,000 to 30,000" world-wide sales, is simply not a popular enough system to spend $4500 on. There is neither a wide base of software nor enough innovation in the system to warrant its purchase for the average user.

Although the Apricot remains a feisty contender, it is not a serious challenge to the IBM PC/XT and probably not much of a threat to other hard-disk PC compatibles, either.

My recommendation on the Apricot XI must be similar to my recommendation on the basic Apricot in the previous review—consider this system seriously only if you want a high-capacity storage system in a compact package and want to run just a few dedicated applications. It might make a good system for an OEM that has specialized requirements for character fonts and redefinable keys. ◇

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Required by 39 U.S.C. 3685)

1. Title of publication: Computers & Electronics
   a. Publication No. 0745-1458
2. Date of filing: October 1, 1984
3. Frequency of issue: Monthly
   a. No. of issues published annually: 12
   b. Annual subscription price: $16.97.
4. Location of known office of publication: 3460 Wilshire Blvd, Los Angeles, CA 90010
5. Location of the headquarters or general business offices of the publishers: One Park Avenue, New York, New York 10016.
6. Names and complete addresses of publisher, editor, and managing editor: Publisher: William S. David, One Park Avenue, New York, New York 10016; Editor: Seth R. Alpert, One Park Avenue, New York, New York 10016; Managing Editor: John R. Riggs, One Park Avenue, New York, New York 10016.
7. Owner: Ziff-Davis Publishing Company, One Park Avenue, New York, N.Y. 10016; Ziff Corporation, One Park Avenue, New York, N.Y. 10016.
8. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities: None.
10. Extent and Nature of Circulation:

	Average No. Copies Each Issue During Preceding 12 months	Actual No. Copies of Single Issue Published Nearest to Filing Date
A. Total No. Copies Printed (net press run)	752,174	771,171
B. Paid circulation		
1. Sales through dealers and carriers, street vendors and counter sales	101,407	121,000
2. Mail subscriptions	479,571	474,100
C. Total Paid Circulation (sum of 10B1 and 10B2)	580,978	595,100
D. Free distribution by mail, carrier or other means, samples, complimentary, and other free copies	21,811	43,650
E. Total distribution (sum of C and D)	602,789	638,750
F. Copies not distributed		
1. Office use, left over, unaccounted, spoiled after printing	1,985	2,221
2. Returns from news agents	147,400	130,200
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11. I certify that the statements made by me above are correct and complete.

WILLIAM L. PHILLIPS, Vice President

STM PC
(Continued from page 21)

from the operating system level when no other program is running. The modem can be set up for autodialing and will adjust itself to operate at 300, 600, or 1200 baud.

While in the phone mode, I was able to interrupt any program with one key stroke and dial out (from my private telephone directory when applicable), and then return to the program where I had left off, even while I was still talking! Similarly, the built-in phone generated a warning tone when I received a call, after which a couple of keystrokes established a voice connection. I could then adjust the volume, using function keys, as indicated at the bottom of the display screen.

Unfortunately, several people I talked to over the STM phone said I sounded like I was strangling inside a tin box and I had to talk very loudly and clearly to be properly heard. This is, however, characteristic of many telephone amplifiers. Given the poor audio quality of the transmissions, I prefer to stick to my own phone rather than use the STM.

The modem program functioned well, and I succeeded in sending off several articles using it. The STM software covers most of the bases of modem support, including autodial (with a handy telephone directory) and autoanswer, file sending and receiving, and parameter setting for various communication protocols. You can store up to 20 phone numbers and there is an auto-redial feature. If you are communicating with another STM, there is additional support for handshaking, error checking, and sending and receiving remote commands.

Compatibility

My first impulse was to run the STM PC through some compatibility tests. Although the unit comes with the NewWord word processor, a WordStar clone, I decided to try WordStar anyway and encountered no apparent problems. Multiplan also worked flawlessly, as did Lotus 1-2-3. All three programs showed a substantial increase in performance due to the speed of the 80186.

STM claims that its PC runs most standard IBM PC programs right out of the box, and I found no contradictory evidence during my tests. Memory expansion on the STM PC is limited to 512K, not a serious problem for most programs. However, it should be noted that the custom drivers provided by STM for the on-board printer, phone, and display take up memory and may prevent you from running some programs designed to take up a particular memory size on the IBM PC.

The STM with double-density drives read and copied without difficulty all of my double-density PC-DOS and MS-DOS disks, but the quad-density version can only write in its own format. As a result, without some form of communications link, work done in the field with a quad-density STM cannot be downloaded to the office PC. The dual-density disk drives are, however, completely compatible with the IBM PC.

Documentation

The STM documentation is well laid out in a convenient binder with attractive printing, chapter tabs, and an adequate index. The early sections that describe the system and deal with installation are clear and well illustrated. However, the manual does a less effective job of explaining more difficult sub-

jects, such as installing printer drivers for the thermal printer or operating the communications programs. Almost no real technical information is provided on hardware expansion or interfacing.

Reliability and Service

While I am always reluctant to draw conclusions about reliability from one or two test units, I feel I owe readers a full description of problems I encountered. The first unit I received had a bad habit of hanging up during booting, which got worse until the unit ceased booting altogether. It also had a very loud hum from the LCD backlight. STM replaced this unit, but the replacement contained a defective lower disk drive. Normally I return defective units, but pressed for time, I checked into the problem and discovered the drive to be improperly mounted and secured. Once I had corrected this, the drive functioned without further problem.

Minor problems like this excepted, the absence of any real technical documentation, the high level of hardware integration and the use of some relatively unfamiliar components in the STM PC will generally make its owners more dependent on their dealer and STM for service than they would be with other, more familiar PCs.

Conclusion

Is the STM PC the computer for you? If you do a lot of traveling and need a full-featured, IBM PC compatible computer wherever you go, the STM PC provides one of the most convenient solutions around. Though the LCD takes some getting used to, the STM's full-size 25 × 80 display is clearly superior to the more abbreviated displays of other portables and far lighter than the many CRT-based luggables. Similarly, the thermal printer, though limited in performance, could prove useful on the road. In addition, the built-in modem and IBM-compatible disk drives allow for maximum flexibility in data exchange from the field to other office-based computers.

On a desktop, the STM PC has the advantages of a small footprint and profile, the higher performance of its 8-MHz processor, and its easy integration with IBM-PC-compatible monitors, printers, and other peripherals. Whether these offset a relatively high price and possible problems with service and reliability, I leave the reader to judge. I grew quite fond of the STM and, despite some problems, I would gladly recommend it to anyone whose needs and pocketbook would be fit by it. ◇

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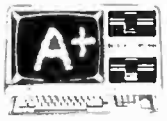

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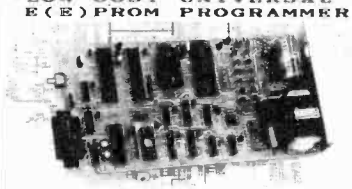

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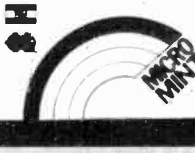

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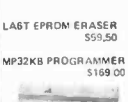

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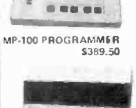

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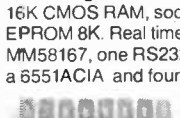

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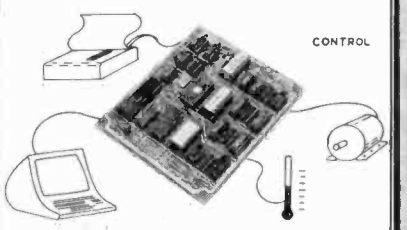

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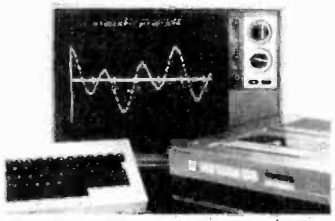

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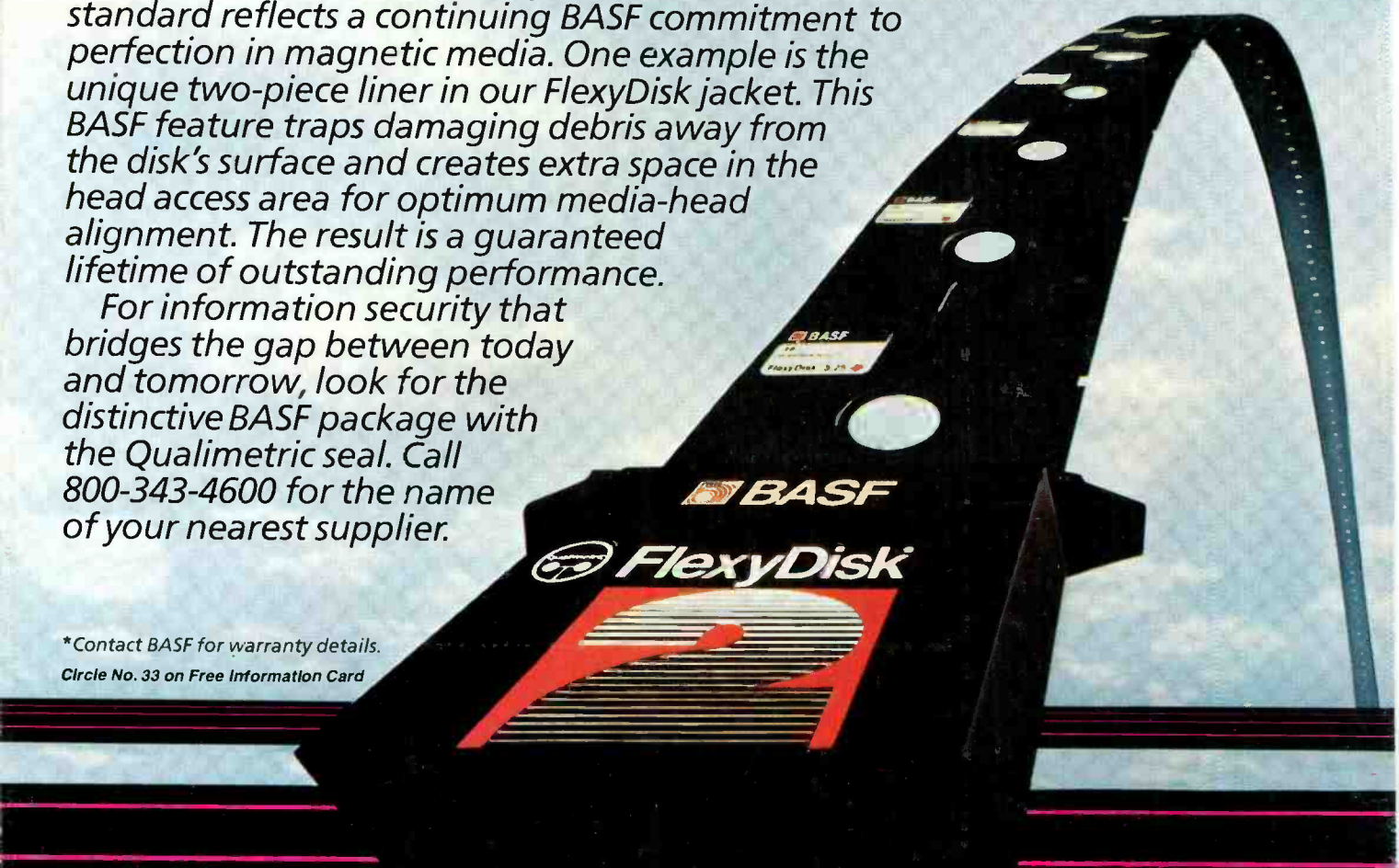

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