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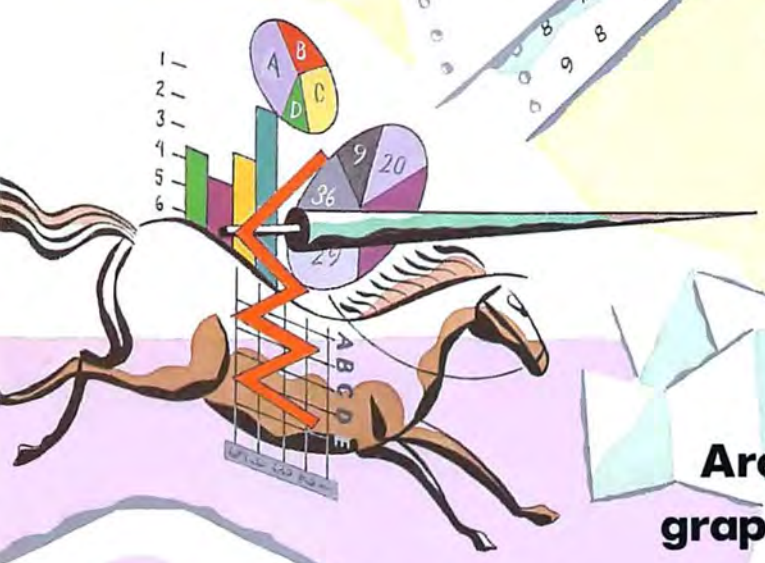

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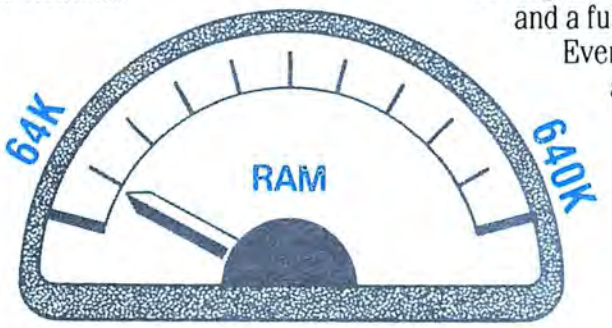

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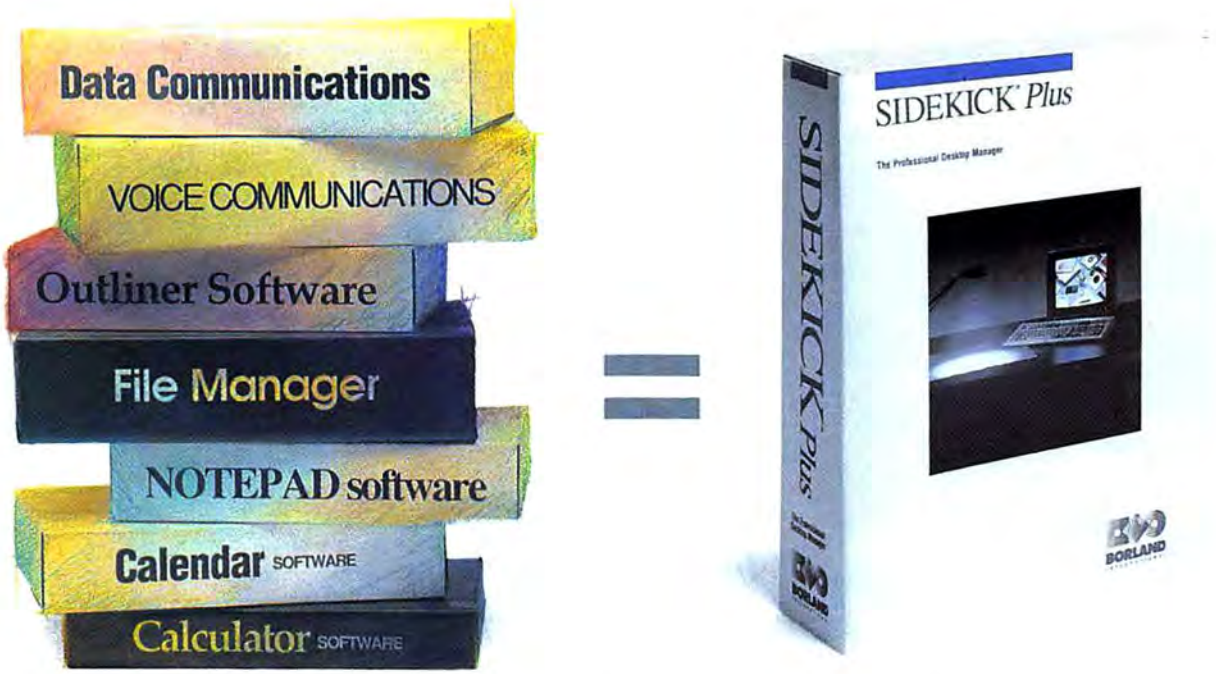

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Behind the Screens

JOHN HARDING

Associate Editor Anita Amirrezvani

Sometimes a review reveals as much about the company that created the product as it does about the particular hardware or software under review.

Take William Urschel's "Quattro Goes 1-2-3 Better." Associate Editor Anita Amirrezvani supervised the review of Borland's well-publicized entry in the spreadsheet derby. The bottom line? *Quattro* is a serviceable alternative to *1-2-3* release 2.01—easier to use, highly compatible, and certainly cheaper. It also has a few bugs, hardly unusual in a complex product's first release. But that's not the end of the story.

As editor of *Consumer Watch*, Amirrezvani deals with sacks full of consumer complaints every month. She found Borland's attitude toward user problems refreshing. While researching and editing the review, Amirrezvani logged on to Borland's user forum on CompuServe and read uncensored opinions, questions, criticisms, and bug reports from *Quattro* users. According to Amirrezvani, "Borland is really being open about the product by having a public forum. Anyone monitoring the forum would find a tremendous amount of useful information."

Similarly, Senior Editor Robert Luhn got a chance to assess the Microsoft product philosophy while writing "Still Waiting for Windows/386." No stranger to either the company or the operating environment, Luhn was invited to Microsoft headquarters way back in 1983 for a sneak preview of *Windows*—the program that would change the way we look at PCs. He expected a hands-on session with a multitasking, graphics-oriented environment. What he saw instead was a semifunctional copy of the *Windows* notepad.

Five years later, Luhn reports, the *Windows* family still promises far more than it delivers. "But give Microsoft credit for trying to go beyond what everyone else has been doing," Luhn says. "*Windows* is an operating environment that was designed ahead of the hardware. That's a real switch for the industry."

Also in this issue: Contributing Editor Eric Brown ("Five Tools for Team Writing") takes the measure of a handful of network word processors. Senior Editor Eric Knorr ("Getting the Feel of OS/2") takes DOS users on a guided tour of OS/2 and finds that it's not such unfamiliar territory after all. Charles Ryan ("Measure the Costs of PC Ownership") shows you how to use *1-2-3* to unearth the hidden costs of computing. And, of course, *PC World* offers exclusive test reports from National Software Testing Laboratories in Philadelphia. ●

Ed Bott

Ed Bott
Managing Editor

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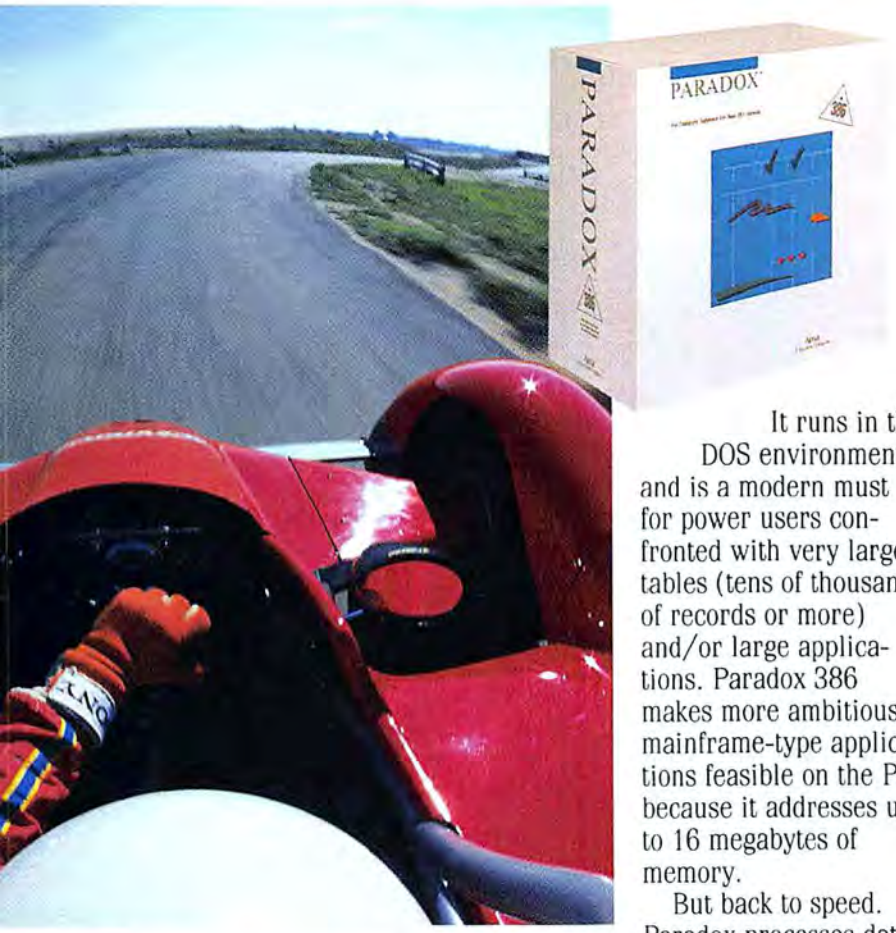

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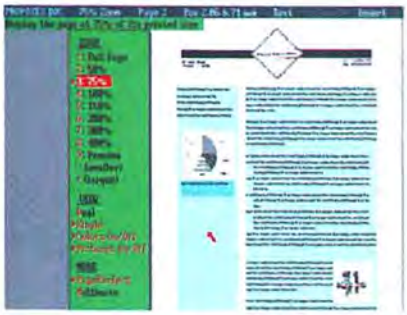

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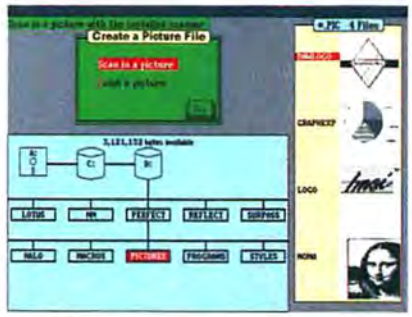

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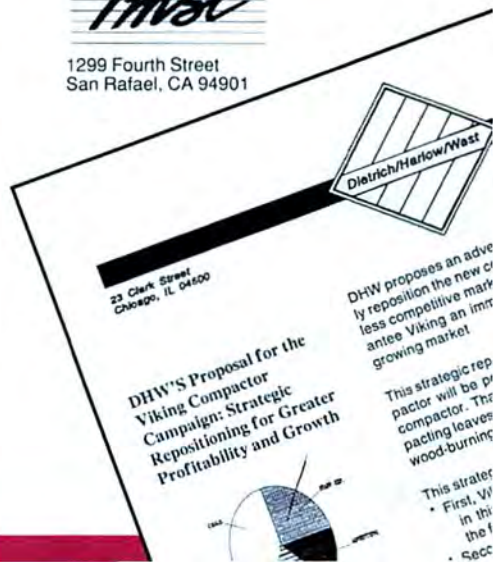

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Circle 97 on reader service card

"The Breakthru 286 performed flawlessly with every application we handed it, including copy-protected programs and nine memory-resident utilities at once."
Stephen Manes, PC Magazine

"...the Breakthru 286 was the card of choice."
PC BusinesSoftwareview (Rated #1)

"...Breakthru 286 is a good value and a quality product backed by effective support."
Dan A. Griffin
The Newsletter of the AutoCAD User's Group

"The PCSG Breakthru 286 achieved the best performance results of the caching boards tested."
Ted Mirecki, PC Tech Journal (Rated #1)

"The 12-MHz Breakthru 286-12 speedup board is the fastest of those tested, but not the most expensive. On a dollar per-horsepower basis, it could be called the cheapest boost available for an XT."
Mark Welch, InfoWorld (Rated #1)

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Make Your IBM PC Faster Than an AT in Just 5 Minutes!

Accelerator Cards: Speed and Value

Speed figures are consolidated results from 10 tests of CPU performance (See Accelerator Boards Special Report, December 1, 1986.)

		Increase in speed over the Intel 8088	Cost per percentage increase in speed
☐ Microspeed Fast 88	$149	65%	$2.29
☐ Microsoft Mach 10	$395	78%	$4.97
☐ Univation Dream Board	$512	131%	$3.91
☐ Orchid Turbo EGA	$945	202%	$4.68
☐ ST&D Standard 286	$995	237%	$4.20
☐ Classic Speedpack	$995	280%	$3.55
☐ Orchid PC-Turbo 286e	$1,195	321%	$3.72
☐ **Breakthru 286-12**	**$595**	333%	$1.78

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Breakthru 286-8MHz-$395
Breakthru 286-12MHz-$595

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Best of 86 review

Loads with the DOS - always ready as a background program to accelerate disk access. You do nothing - everything is automatic. Programs that frequently access the disk (hard or floppy) are made instantly up to 2 to 4 times faster. Uses a principle greatly enhanced from mainframe technology called caching. Fully exploits Above Board memory.

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PC MAGAZINE EDITORS' CHOICE BEST of 1986

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Second, they are advanced. The BREAKTHRU 286 replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. Has a 80287 math coprocessor slot for numeric intensive applications. A 16K cache memory provides zero-wait-access to the most recently used code and data. Speed switching software allows you to drop back to a lower speed on the fly for timing sensitive applications.

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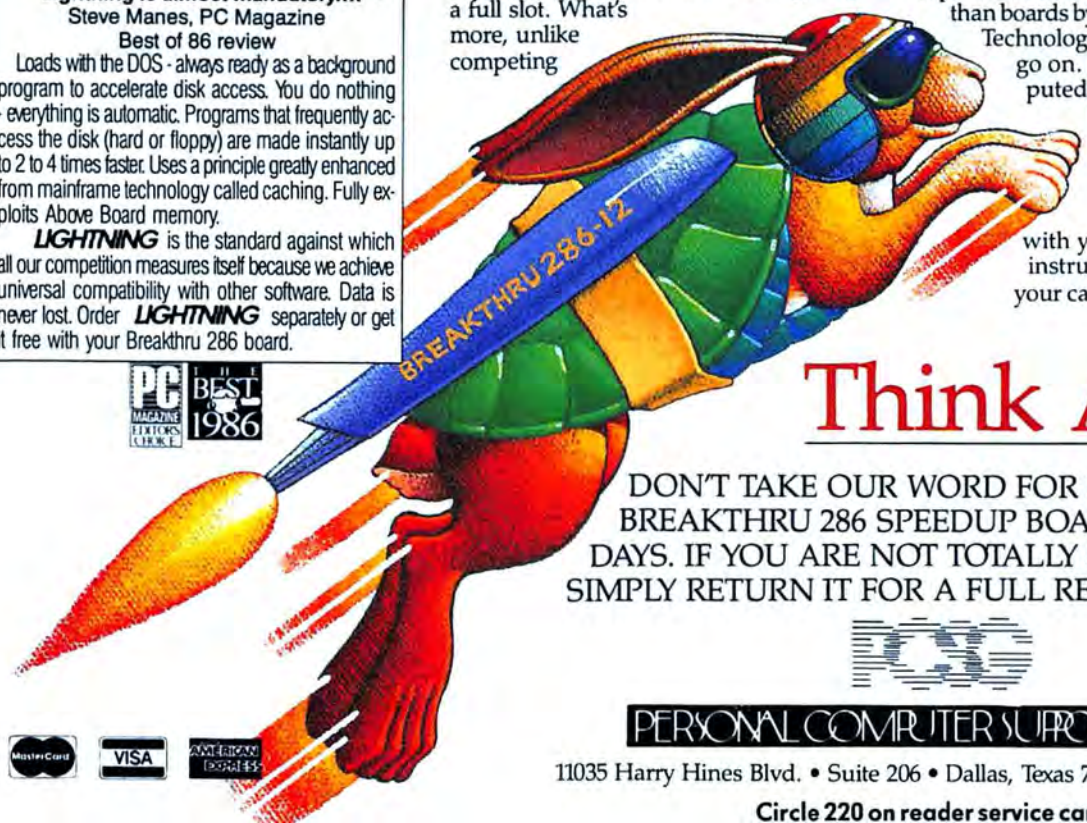
Fourth, these are the best. There are several other boards on the speedup market. We at PCSG have compared them all, but there simply is no comparison. Many cards offer only a marginal speedup in spite of their claims and others are just poorly engineered.

We are really excited about these products. PCSG makes the unabashed statement that the BREAKTHRU 286 card represents more advanced technology than boards by Orchid, Quadram, P.C. Technologies, Phoenix...we could go on. Breakthru 286 is undisputedly the turbo board with the biggest bang for the buck. And we include FREE the $89.95 acclaimed Lightning software. Call today with your credit card or COD instructions and we will ship your card the very next day.



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Circle 220 on reader service card

CSS Labs Releases Fast Graphics Controller

CSS Laboratories has developed a PostScript-compatible printer controller that can churn out a full page of graphics in less than 2 seconds—much faster than the almost 2 minutes the Apple LaserWriter controller would take to format the same page. The Generic Raster Image Processor (GRIP) controller is based on a 32-bit INMOS T800 "transputer" processor that has its own math coprocessor and runs at 15 million instructions per second. In May, CSS of Irvine, California, will begin selling the controller as a $1500 PC add-in board compatible with popular laser printers; CSS will also bundle the GRIP with five printers of its own. The 300-dpi Indy Series ranges from a $3000 printer with a 5-ppm engine to a $15,000, 22-ppm model. Additionally, CSS will release a Grand Prix 300-dpi thermal color printer that will sell for about $1000. Eventually, says CSS product manager David Whitt, the $10 million company hopes to bundle its controller with 40-ppm, 60-ppm, and 90-ppm engines offering pixel resolutions as high as 1000 dpi. The GRIP controller includes the company's own emulation of Adobe's PostScript language as well as emulations of the Hewlett-Packard LaserJet Plus, Hewlett Packard's HPGL language, and the Epson FX-80.

Ansa Pares Down Paradox

Bare-bones engine will run Turbo-language programs

In June, Ansa Corporation will release a version of its *Paradox* data base stripped down to only the data processing engine and the Query by Example (QBE) module. Using the *Paradox* engine, millions of programmers who favor Borland International's Turbo Pascal, Turbo C, and Turbo BASIC can design applications in those languages rather than the lesser-known Paradox Application Language. Advanced users can create compiled .EXE applications for use by work-group members who lack a copy of the $725 *Paradox*. These executable files will run faster than the interpreted *Paradox* for functions like scanning a table and will prevent novice users from accidentally changing application program code. Turbo programmers can also create applications using the more plentiful and powerful *Paradox* functions, including its multiuser capabilities. Programmers can combine new routines with those already written via the DOS LINK command. A typical application might join a communications routine to the QBE program generator, which could write the necessary code to query a mainframe data base. By midyear, the *Paradox* engine should include Structured Query Language (SQL) support, which will be transparent to the end user, promises Vice President of Software Development Robert Shostak. The 200K engine is less than half the size of the full *Paradox* package. Still unnamed, the *Paradox* engine will be priced in line with current *dBASE* compilers, says Shostak.

Living Videotext Launches Lotus Agenda Competitor

Three views of personal information management

Symantec subsidiary Living Videotext is challenging Lotus's *Agenda* in the burgeoning personal information management category. The $295 *GrandView*, expected to ship in April, will include Outline, Document, and Category views. Names, dates, phone numbers, and other text strings can be randomly entered in the Outline view, and then relationships can be created between them in the Category view. The user has the option of creating categories by using *GrandView*'s pulldown menus, a mouse, or keyboard commands. The Outline view has much of the look and feel of Living Videotext's *ThinkTank* outliner but with many more functions, such as the ability to maintain outlines in up to nine tiled windows at once. Each subhead in the Outline view may relate to documents of up to 64K in length, which can be created with the full-function word processor of the Document view. All relationships are dynamic; changes made in one view are updated in all. Under development for two years, the stand-alone program is intended as a personal data base and project-tracking tool for managers. *GrandView* runs in as little as 256K of memory and has a soft interface, enabling the user to reconfigure the keyboard to recognize the commands of another word processor.

Lotus Outlines Lotus/ DBMS Specifications

Graphics user interface and SQL are included

Lotus Development has provided more details on *Lotus/DBMS*, a fully relational data base with a graphics user interface and close links to both *1-2-3* and mainframe data bases. *Lotus/DBMS* will include a data base processing engine, SQL support, and a set of point-and-click graphics tools for performing data base functions without resorting to programming. The tools conform to the Presentation Manager environment of OS/2 Standard Edition 1.1. The data base package is scheduled to ship in the first quarter of 1989, following both Standard Edition 1.1 and *1-2-3/G*, which will also employ the Presentation Manager's graphics user interface. *Lotus/DBMS* users will be able to access the data base functions from any *1-2-3* version (release 2.01 and later) and to make mainframe data base queries via SQL. Data in *Lotus/DBMS* will be tightly integrated with *1-2-3* release 3 and future versions through Lotus's new application program interface. In addition, Lotus will offer an SQL data base server for OS/2 networks called *Lotus/DBMS Server*, which is being developed jointly with Gupta Technologies of Menlo Park, California. Unlike the Microsoft/Ashton-Tate/Sybase *SQL/Server*, the Lotus server will be optimized for performing analysis rather than recording transactions. Later releases of *Lotus/DBMS* will include a proprietary technology that accesses data base products from other vendors.

Traveling Software Links PCs and Macs

High-speed serial transfers between environments

Traveling Software has begun shipping a serial transfer software/cable bundle for high-speed file exchanges between IBM PCs and Apple Macintoshes. *Lap-Link Mac* operates on the same principle as the firm's portable-to-desktop interchange package, *Lap-Link*, which has sold more than 50,000 copies since its February 1987 introduction. "But more than 40 percent of our customers don't own a laptop," reports President Mark Eppley. "They use *Lap-Link* to switch programs and files between incompatible media or as a high-speed gateway into a network." The $139.95 *Lap-Link Mac* transfers files between Macs and PCs at 57,600 bps (about half as fast as *Lap-Link* PC-to-PC transfers). During the process, both computers display a split screen, each with a tree directory of the PC's files on one side and the Mac's file cabinet/folder directory on the other. A menu gives conversion options for the types of files to be sent or for transmission speed. *Lap-Link Mac* automatically converts transferred files to ASCII, unless they are from programs written for both environments. *Lap-Link Mac* works under Mac's MultiFinder as well as with the TOPS and AppleTalk networks. On the IBM side, it's compatible with the 3Com 3+, IBM Token-Ring, and Novell networks.

Tapestry II to Link Incompatible Networks

LAN system management from any node

Torus Systems is expected to release in April a wide area network companion to its icon-based local area network system software. *Tapestry II* reportedly will break the 100-node barrier of *Tapestry* version 1.4, accommodating an unlimited number of users over wide area networks whose local nets can run LAN system software from other vendors. Those local nets can be linked either by cable or through wide area X.25 gateways; users can manage them from any station using *Tapestry II*'s advanced LAN management software. *Tapestry II* will accommodate any application running on IBM-compatible networks, including IBM's OS/2 LAN Server and Microsoft's OS/2 LAN Manager when those become available. Implicit in the product's design is the belief that OS/2 will be the standard for complex networks—not Novell's best-selling *Netware*, which dominates the under-50-node network market. Network vendors also say that OS/2 will provide a more capable platform than DOS and will result in a long-awaited spurt of growth in companywide networks, whose sales have lagged behind analysts' projections. Torus executives would neither confirm nor comment on the new product. The company has a worldwide installed base of 30,000 networks.

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9/18 MHz 21 MHz Throughput

Intel 32 Bit 80386 CPU (18 MHz) 9/18 MHz software (keyboard) switchable clock • Norton SI (Ver 3.0): 23 (processor speed) •CMOS memory, 16 channel Interrupt, 7 DMA channels • 512K interleaved 32 bit RAM on board • RAM can be expanded to 16 MB of 32 bit high speed interleaved memory • 2–32 bit, 4–16 bit and 2–8 bit expansion slots • Supports 80387 Math co-processor • Award BIOS • (Phoenix BIOS optional) • Plus basic system features.

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Stanford 386–16

Same configuration as in system 386–18 except: socket for 80287 math co-processor • Plus basic system features.

$1999

Stanford 286–16

8/12 MHz – 16 MHz Throughput

Intel 80286–12 cpu, 8/12 MHz software (keyboard) switchable clock • Award BIOS, Norton SI (Ver 3.0): 15.8 • DRAM can be expanded to 1 MB on M/B • Selectable between 0 wait state or one wait state • 8 expansion slots (5–16 bits, 3–8 bits) • Socket for 80287 math co-processor • Plus basic system features.

$1119*

Stanford 286–12

6/8/10/12 MHz 1 Wait State

Same configuration as in 286/16 except: Intel 80286–10 CPU, 6/8/10/12 MHz software (keyboard). Switchable clock • Plus basic system features.

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*System price does not include memory (DRAMS).

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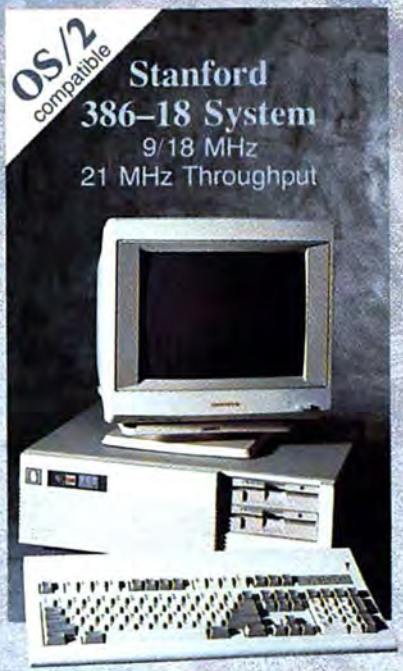

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Circle 64 on reader service card

Flat-File Data Base Publishers Go Relational

Will maintain low prices and user requirements

Flat-file data base publishers are readying versions that narrow the gap between their products and fully relational data base managers. One such program, just released, is an upgrade of *Q&A*, Symantec's popular data base/word processor. *Q&A 3.0* includes an XLookup function that lets the user search on a field across multiple files in up to seven data bases, pulling the information into a file or report. Symantec calls this "multifile capability," but only one file can be open at a time. However, *Q&A 3.0* can search for several fields across multiple files a field at a time. Additionally, *Q&A*'s customized menu can add programming statements to forms. This summer, Alpha Software will offer fully relational capabilities in a new member of its data base line, currently topped by *Alpha/three*. But neither developer plans to add a programming language for users to write applications that transfer data back and forth between linked data bases. Neither envisions its product evolving into a high-end package such as *dBASE* or *Paradox* in power and breadth. Flat-file users say they want the new *Q&A*'s quasi-relational capability, explains Symantec marketing director David Watkins, but without the higher prices, memory overhead, and more difficult interface that characterize its fully relational cousins.

Amway Signs Volume Purchasing Agreement With Tandy

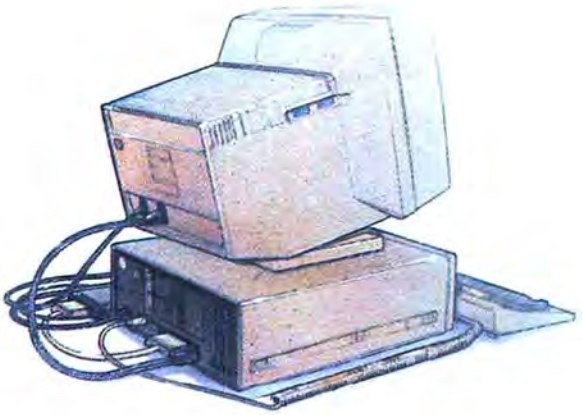
The companies consider a joint distribution agreement

Tandy Corporation has cut a volume purchase agreement with home product marketer Amway Corporation that eventually could lead to door-to-door computer sales. The home-sales firm has arranged to offer Tandy products and its own $199 integrated software package, *Amware*, to the 700,000 U.S. Amway distributors for their own use. This group can buy Tandy computers at discounts of 5 to 15 percent from Amway, with installation and warranty fulfillment available from any of the 490 Radio Shack Computer Centers. Neither company wants to disclose the terms of the agreement, but based on the size and sophistication of early shipments, Radio Shack vice president of business products Bob Myers estimates that the deal could turn into the largest single agreement that his company has ever signed, including volume sales to the armed forces. In addition, Amway and Radio Shack have discussed the possibility of Amway distributors actually reselling Tandy PCs to the millions of established Amway customers. But both sides emphasize that several concerns, including legal issues, must be addressed first. "We are looking at it and will continue to look at it, but we have to be careful not to create pricing confusion among our customers," says Myers. In addition to Amway's 300 home and personal care items, the $1.5 billion corporation has been very successful selling insurance, water treatment, MCI's long-distance telephone service, and even automobiles door-to-door.

Computers Tune Into Satellite TV

TV signals for downloading to computers

Satellite disk-equipped PC users can now pull news, sports scores, and stock market quotes out of the air with a computer peripheral that links home satellite TV systems to personal computers. General Instrument of San Diego is shipping InfoCipher 1500R, a data de-encrypter/transmission rate modulator that translates satellite broadcasts much as a modem handles telephone transmissions. The $349 peripheral connects between a satellite TV system's signal receiver/descrambler and the computer's serial port. It comes with a cable, interface software, and a four-month subscription to X*PRESS Information Services' X*Change and X*Press Executive data broadcast services. X*Change provides stock quotations from all major exchanges, as well as Sports Ticker scores and statistics, Zephyr Weather Transmission Services, and major news wire services. X*Press Executive is an expanded version of X*Change designed for investors and business executives. According to a Turner Broadcasting System survey, approximately one-quarter of the nation's 1.5 million satellite dishes are installed outside homes and businesses that contain personal computers. ●



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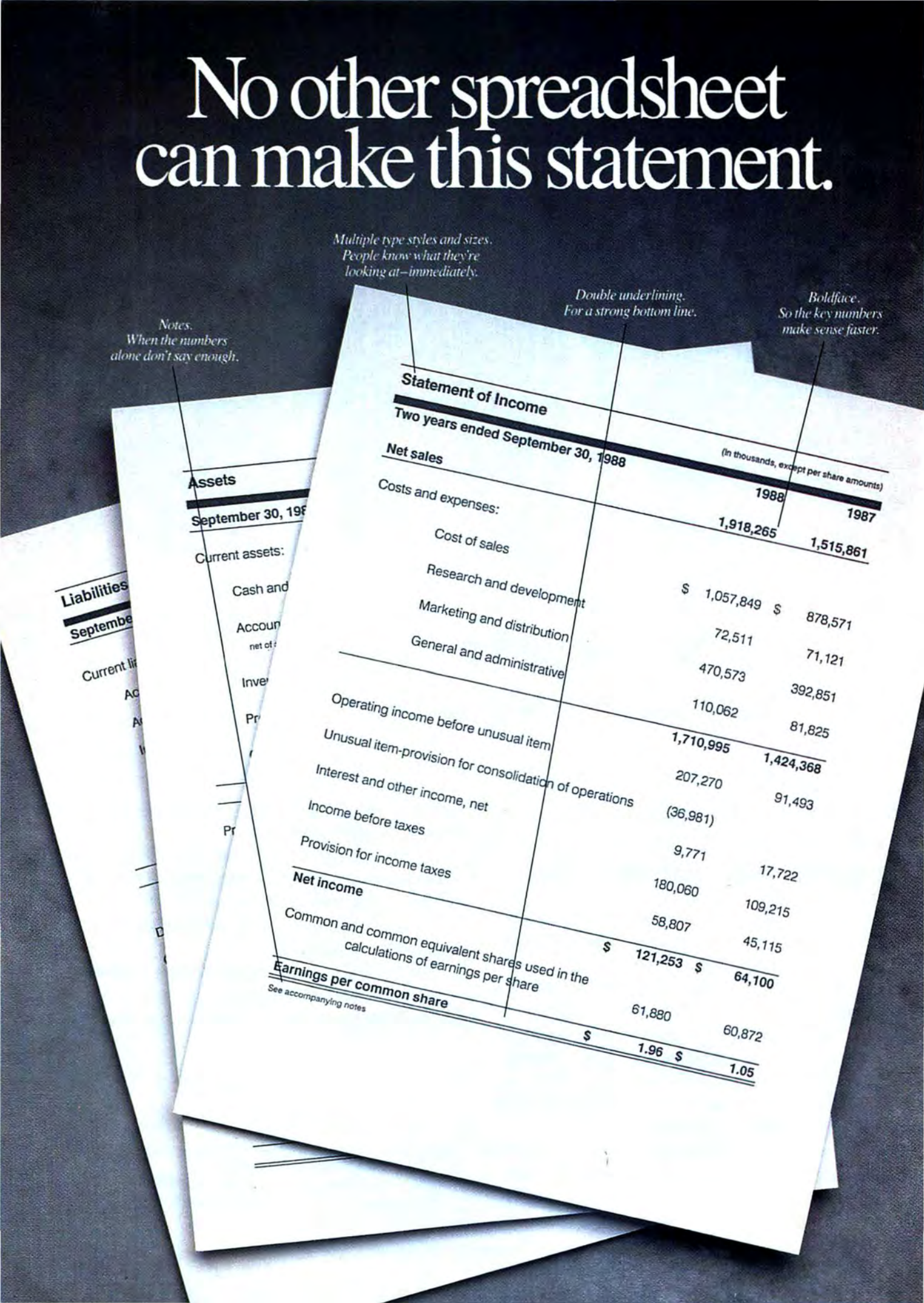

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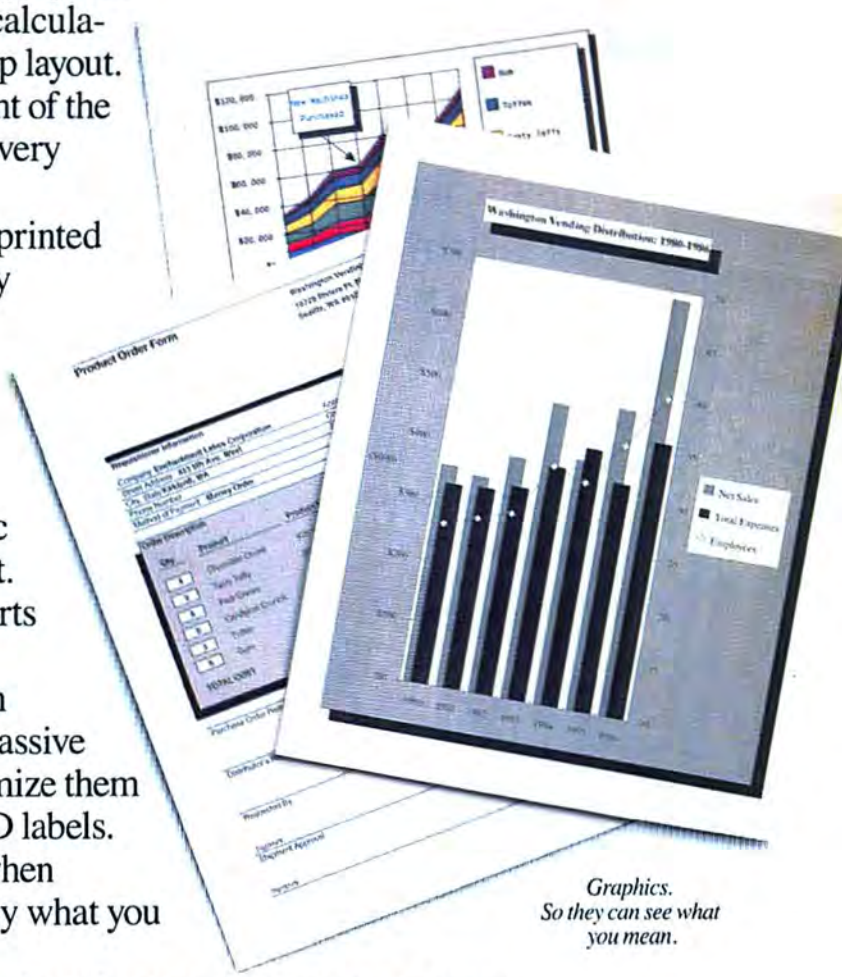

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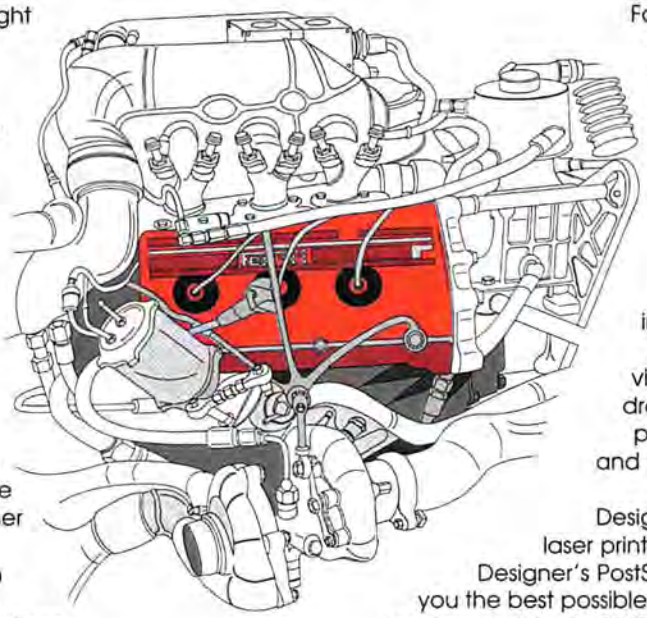

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The Interface Race

A host of graphics interface developers are fighting for their share of one big guest list.

Which environment will prove the most inviting—and who's throwing the best party?

David Bunnell

The competition among graphics user interfaces in the personal computer world is intensifying. Recently, we've heard about IBM's Presentation Manager, Hewlett-Packard's *New Wave*, Xerox's *Viewpoint*, Tandy's *Professional Deskmate*, Digital Research's *GEM*, and Commodore's *Intuition*. Of course, the acknowledged leader they're all pursuing is Apple's *Finder*. Some of these interfaces are already here; others are still in development or even more vaporous states.

So far Apple has more on the ball than IBM or other rivals. It's got a base of 1.5 million hard-core users who are hooked on the Mac interface. It's got the software now—not tomorrow—and it's captured the imagination of the most talented software developers. Clearly, Apple has the momentum in the graphics user interface market.

In a recent issue of his biweekly *P.C. Letter*, Stewart Alsop wrote an open letter to Bill Lowe, president of IBM's Entry Systems Division; he also addressed the heads of Compaq, AST Research, and PC's Limited, along with "anybody else that builds a high-performance, high-end computer like the PS/2 Model 80 or the Compaq Deskpro 386/20." Alsop noted a curious trend among the leading software gurus, to wit: Many of them no longer use IBM or IBM-compatible machines for their personal computing.

That's right. Lotus founder Mitch Kapor, Ashton-Tate's Ed Esber, Borland International's Philippe Kahn, Symantec's Gordon Eubanks, and Living Videotex's Dave Winer all favor the Macintosh II for their own work.

You don't have to be a latter-day Nostradamus to see the writing on the wall. All those DOS tycoons made their megafortunes developing hit software programs for the IBM line—*1-2-3*, *dBASE*, Turbo Pascal, *ThinkTank*, and *Q&A*, to name a few. So why the gravitational pull of the bit-mapped screen?

After all, even though the Mac II may be a state-of-the-art 32-bit machine, the PS/2 Model 80 is no slouch. Feature for feature—speed, memory, and technical pizzazz—it keeps pace with the Mac II.

As Alsop notes, it's not really the hardware that lures PC kingpins over to the Mac. Those guys want to develop hits for all the major PC players. They're working overtime to come up with the next *1-2-3*, or the next *WordPerfect*, or the next *dBASE*

(continues)

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II. But the fact is, the best new applications—like *HyperCard*—are showing up on the Mac and may never appear on an IBM machine. There's more breakthrough wizardry and fun on the Mac to keep those industry heads of state agog. As their personal preferences reveal, they're simply not married to the IBM standard.

Not surprisingly, Big Blue is suffering from a bad case of Macintosh-itis. It certainly has a major fixation on the Mac interface. Sometimes it's hard to remember that just a few years ago, IBM was firmly ensconced in the industry's driver's seat.

In his keynote address at a recent Information Center Manager's Association (ICMA) meeting, Michael Maples, IBM's director of software strategy, showed an unexpected flair for Mac evangelism. He went so far as to cite the Macintosh's success as an indication that the OS/2 and SAA (Systems Application Architecture) will eliminate many corporate PC training costs.

As he noted, a consistent user interface allows people to learn applications more easily. They'll also be more likely to use nonstandard applications and to make better use of their computers.

Maples cited studies revealing that the average PC user in a large company uses the computer less than an hour a day and works with only one or two applications. PC users tend to know their way around single programs—a spreadsheet, a data base, or a word processor. They don't stray from their beaten path. Conversely, my company's research indicates

(continues)

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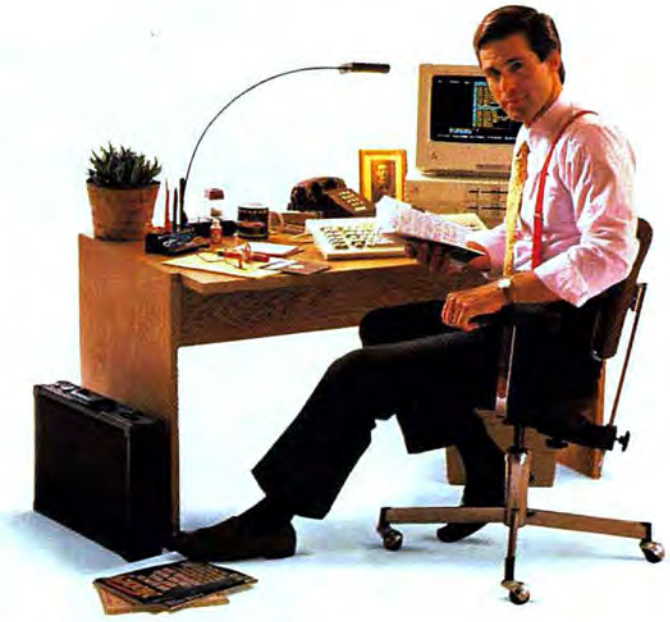

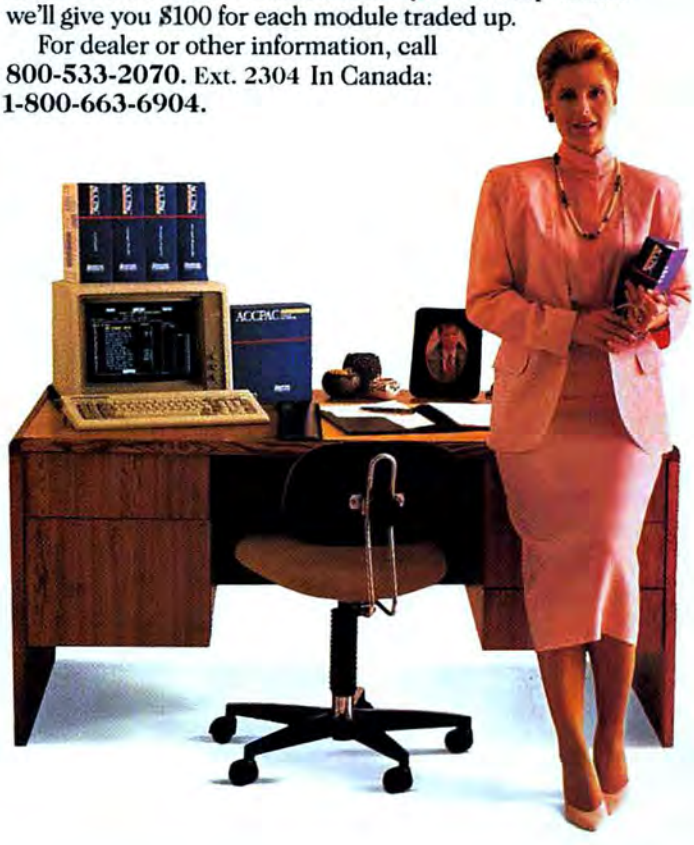

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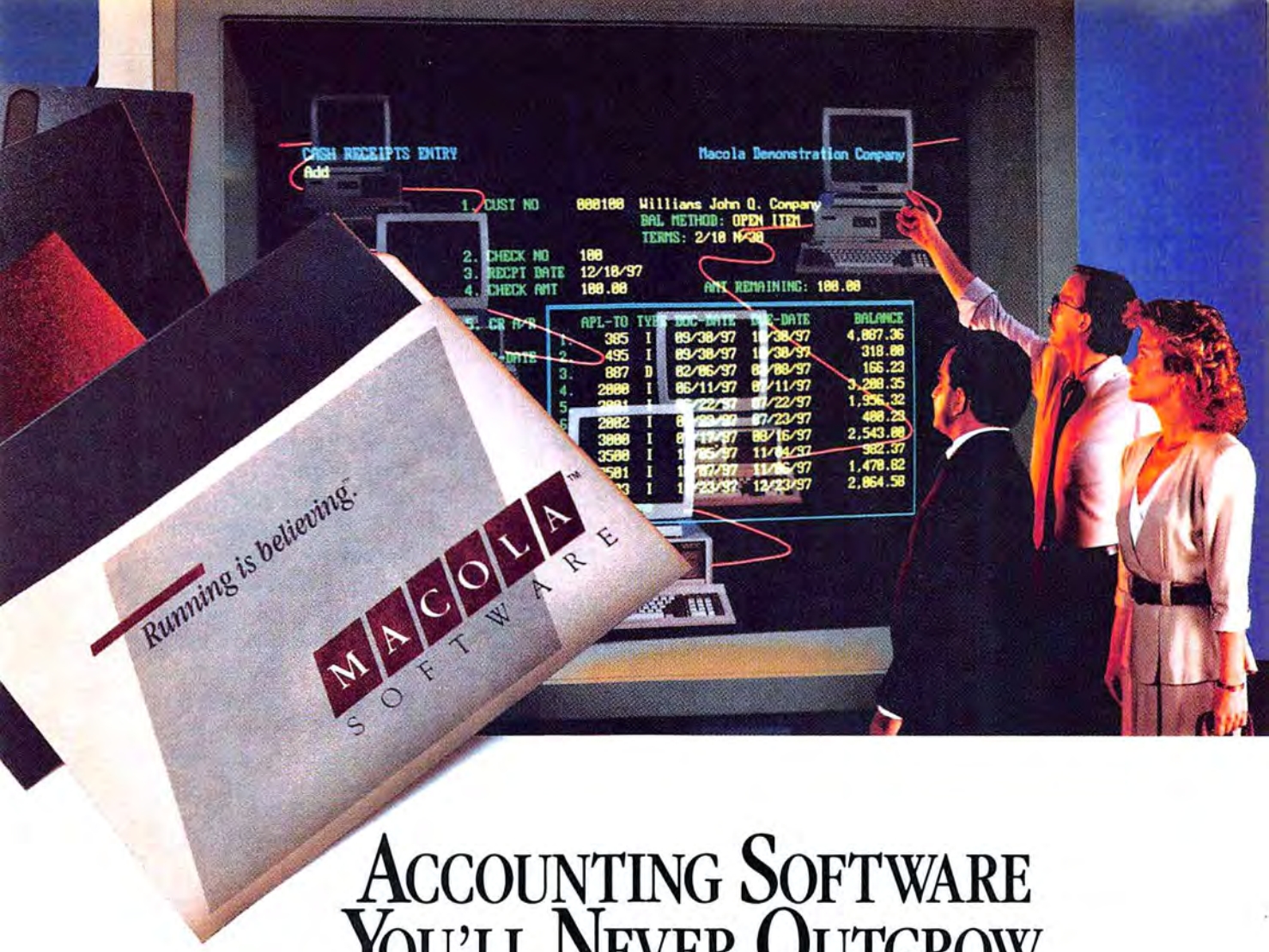

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that the average Mac user regularly uses five or six different programs.

Why the applications gap? The difficulty of learning a different interface for each application discourages exploration in the IBM world.

IBM spokesman Maples' concession rang true to me. In 1984 when I founded *Macworld* magazine (two years after launching *PC World*), I was certain the Macintosh would become a hot machine because it offered a standardized user interface for software. This feature has turned out to have greater implications than I anticipated. For one thing, PC training has become a huge corporate expense. The cost of using a PC can range from $18,000 to $30,000 over the life of the machine (as Maples himself admitted)—and a sizable portion of that amount goes to training and support.

The clincher at the ICMA meeting came when many of the corporate managers present confessed they would choose a Mac over an IBM if company policy didn't prevent their doing so.

I think the graphics user interface is the key to the computer's future. The development of both *Windows* and the Presentation Manager is absolutely vital to IBM. If IBM cannot introduce the latter by year-end as promised, the Macintosh will have won the interface contest. How ironic! Only a couple of years ago, the Macintosh was on the endangered PCs list.

But while we all await the outcome of the rivalry between IBM and Apple, I wonder if some developer might not turn the tables

(continues)

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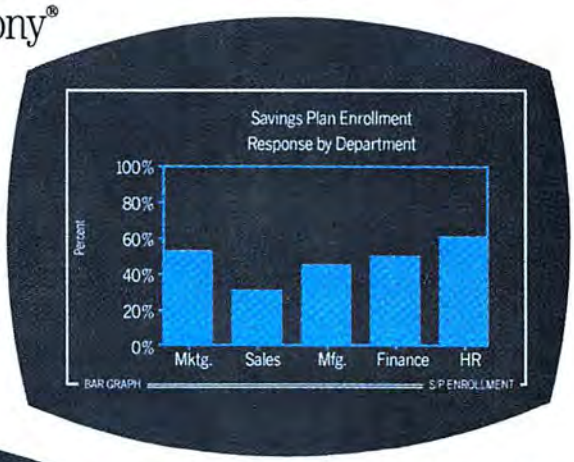

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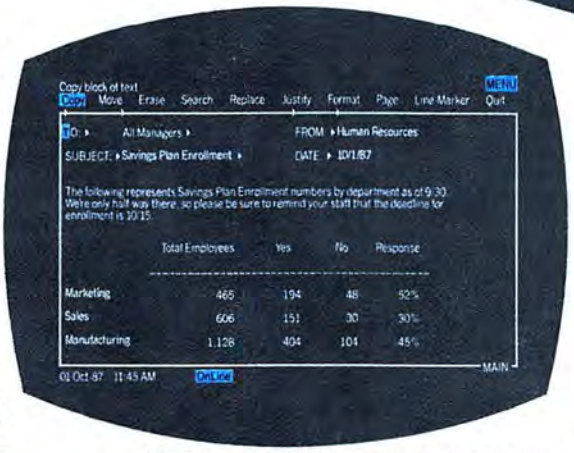

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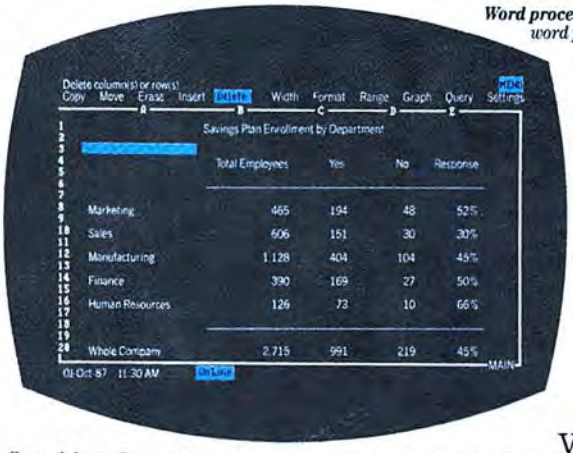

Spreadsheet. *Create a table in a spreadsheet that will automatically calculate formulas, allowing for what-if analyses.*

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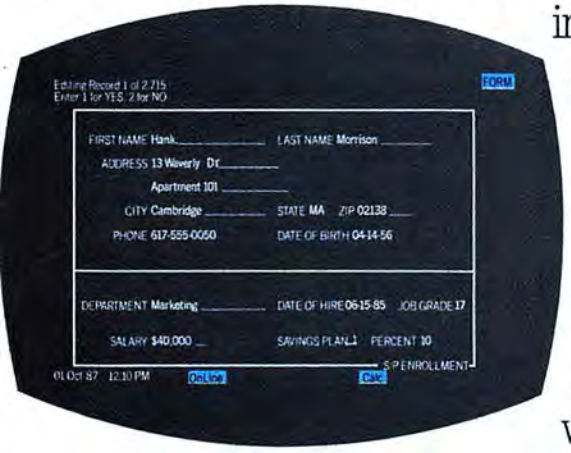

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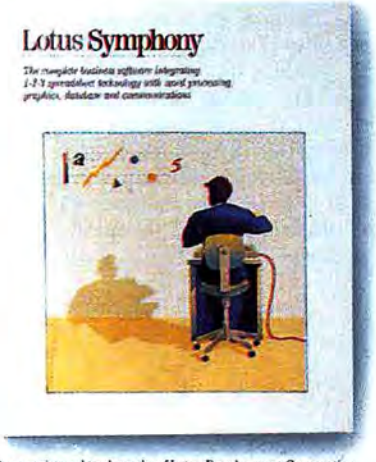

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on the main contenders and produce another, even better interface.

An interface is not just windows management, after all. It determines how the user deals with the software and hardware, with networks and data connections—with everything that gives the system its intrinsic value. The interface creates the user's environment. It's the host of the party.

And the dynamo behind the original Macintosh, Steve Jobs, may surprise us again. The man who revolutionized the personal computer has started a little company called NeXT. He's busy creating another wonderful new interface, which will sit on top of UNIX. This very powerful operating system features true multitasking capabilities.

Apple's own operating system, of course, does not have multitasking. That is its real, acknowledged weakness.

So as IBM vies with Apple and attempts to add multitasking to its OS/2 operating system—while trying to build in a friendly and consistent user interface—Steve Jobs is creating something that far surpasses his earlier creation.

By the time OS/2 catches up to the Macintosh front end, the whole interface rivalry may be eclipsed by a new kind of relationship with UNIX. This development will ultimately be in personal computer users' best interest, because UNIX has the ability to link Macs, IBMs, and workstations everywhere. It could become the standard operating system that unites all systems. Wouldn't it be great if all of us could go to the same party? ●

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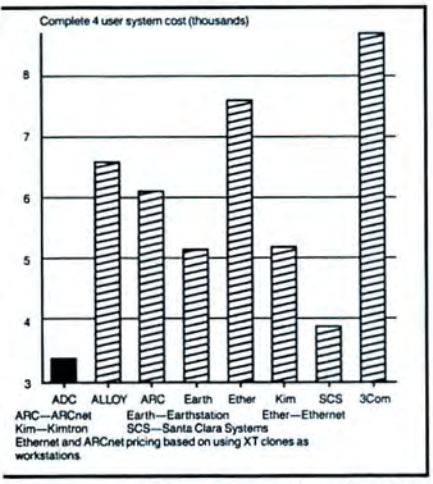

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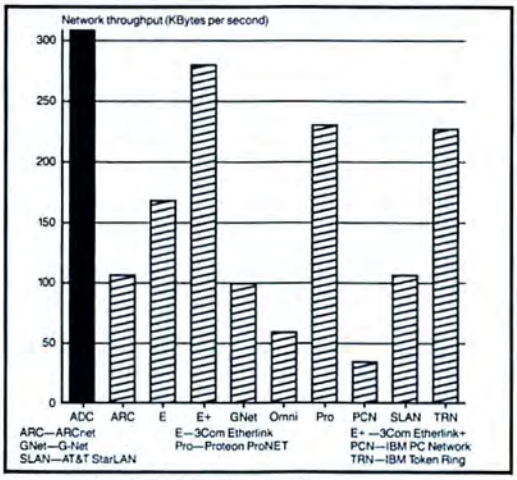

Test results are based on Novell's independent LAN Evaluation Report using their PERFORM™ program. Results were obtained using an 8 MHz IBM AT file server with 6 MHz IBM ATs as workstations. Six Personal Network Stations were used for the ADC test. If tests were conducted on PC workstations, other networks would test up to 70% slower. All prices are based on manufacturers' suggested retail prices.

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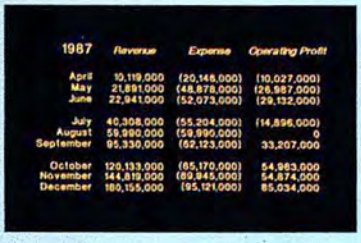

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May	21,891,000	(48,878,000)	(26,987,000)
June	22,941,000	(52,073,000)	(29,132,000)
July	40,308,000	(55,204,000)	(14,896,000)
August	59,990,000	(59,990,000)	0
September	85,330,000	(52,123,000)	33,207,000
October	120,133,000	(65,170,000)	54,963,000
November	144,819,000	(89,945,000)	54,874,000
December	180,155,000	(95,121,000)	85,034,000

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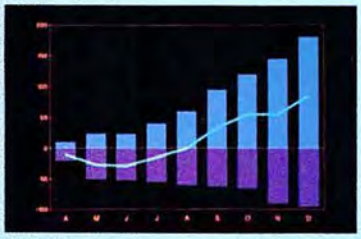

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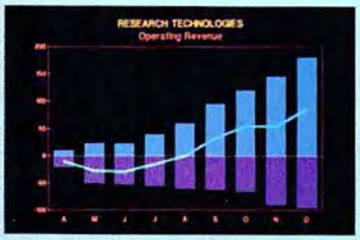

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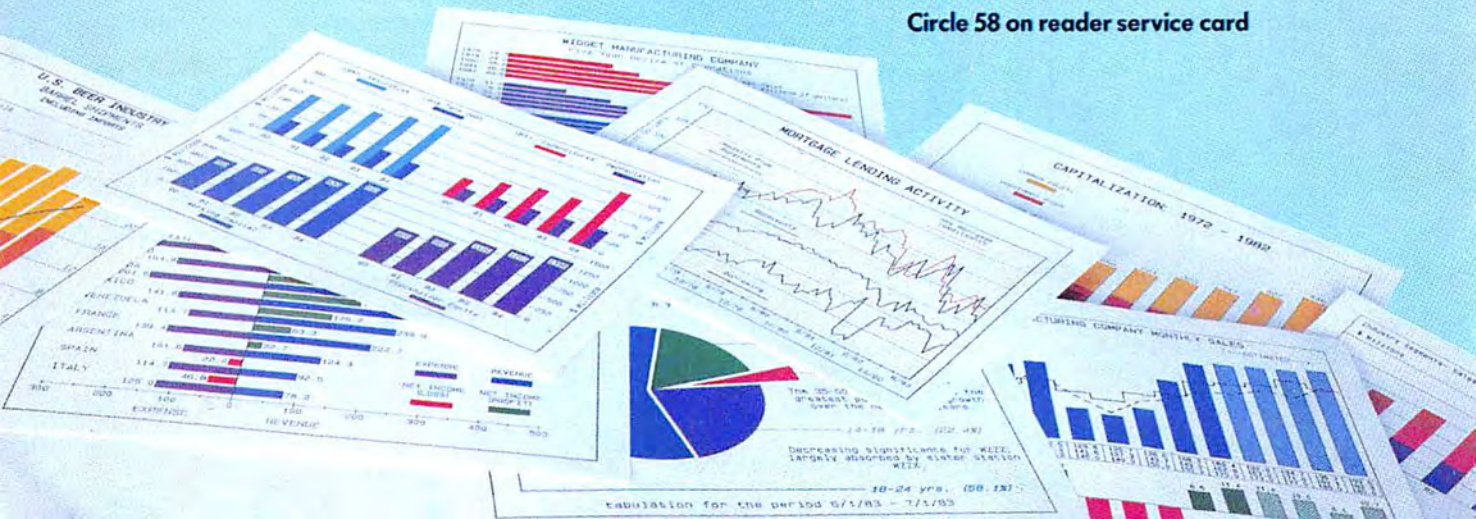

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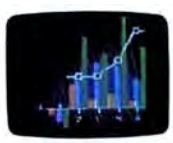

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LETTERS

Reactions and responses from the PC World community

The Price of Freedom

I agree with David Bunnell's editorial advocating participatory democracy via the PC ["The Participatory PC," *PCW*, December 1987], but he failed to mention the most crucial factor behind the lack of computerized social action: cost.

The majority of my friends who are computer literate and also have a serious desire to change society can't afford the exorbitant on-line charges of CompuServe or The Source. Worse, many on-line vendors require customers to subscribe with a credit card, shutting out those who don't play the credit game.

The personal computer has increased our opportunities to work together for social change, but the current high cost of on-line conferencing makes it just another yuppie sport.

M. E. Karns
Princeton, New Jersey

Apostate's Testimonial

I liked Mr. Bunnell's December column, and I agree that personal computers are helping to set the world free. No state can censor a population with unlimited access to information and to each other. Mikhail Gorbachev is smart to support *glasnost* before it becomes inevitable.

I'm one of Mr. Bunnell's "conservatives . . . bordering on libertarianism," but I think PCs have changed the world enough that I am now busy selling "Glasnost-Gorbachev" T-shirts.

Allen Stoltzfus
Harrisonburg, Virginia

Personally Unconvinced

In your December issue David Bunnell says, "I'm casting my vote for the universal personal computer user." I have used a PC since 1982 and was surprised to read that the "original vision of the PC" was "that it would set the human race free" and that "desktop democracy for everyone . . . was our Holy Grail." What drivel!

Despite widespread functional illiteracy, mind-numbing television "infotainment," and advertising hype, our country is still a participatory democracy. If citizens choose not to exercise their right to participate, giving them a computer won't change anything.

George R. Lehan
Williston Park, New York

Feeling the Pinch

We at Practical Peripherals were disappointed by Judy Getts' modem review ["Penny-Pinching Modems," *PCW*, December 1987]. We work very hard to produce a line of reliable, Hayes-compatible modems at a price end users can

(continues)

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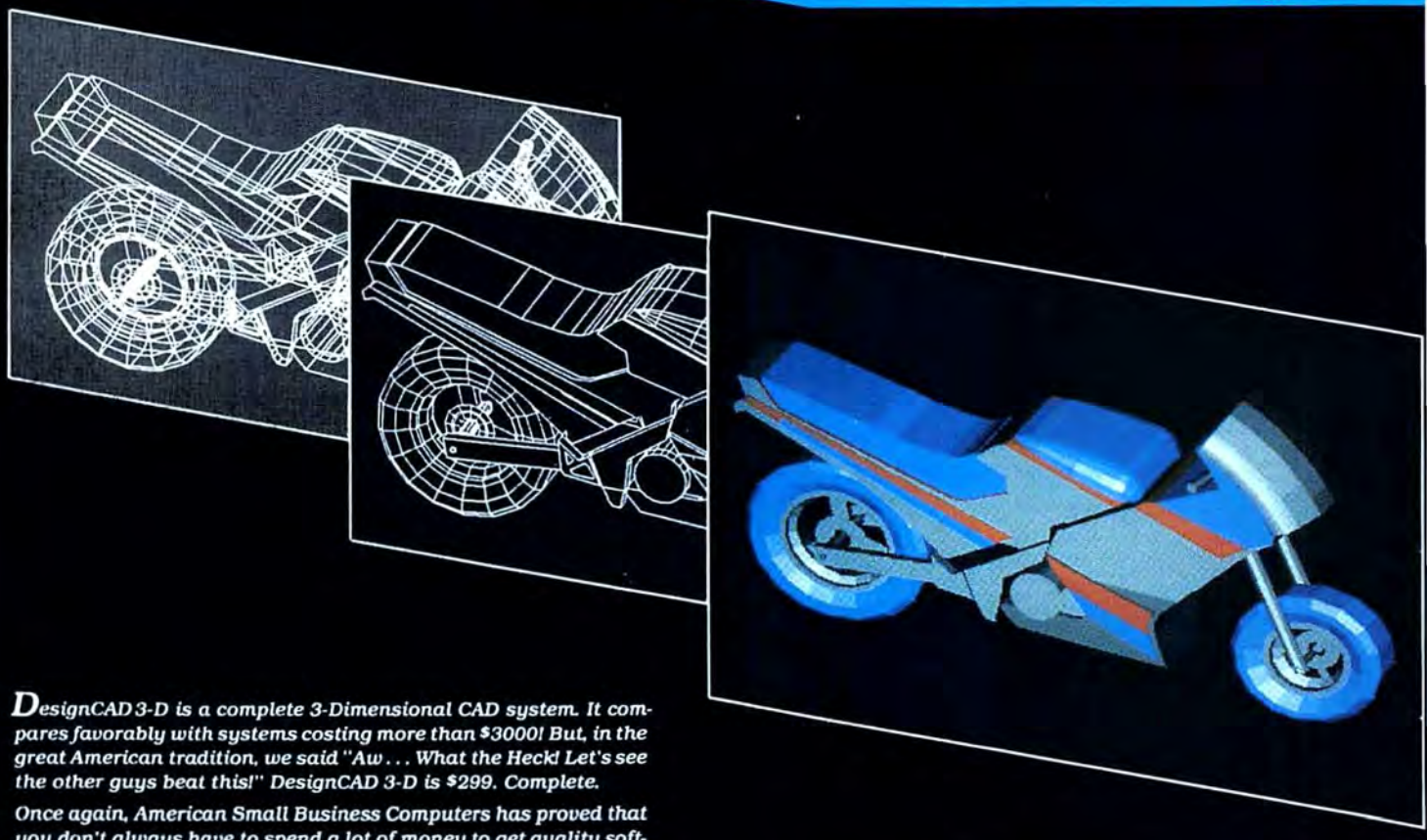

DesignCAD 3-D is a complete 3-Dimensional CAD system. It compares favorably with systems costing more than $3000! But, in the great American tradition, we said "Aw . . . What the Heck! Let's see the other guys beat this!" DesignCAD 3-D is $299. Complete.

Once again, American Small Business Computers has proved that you don't always have to spend a lot of money to get quality software. DesignCAD 3-D provides features such as Shading, Hidden Line Removal, Printer and Plotter support, and extensive file transfer capability, all for $299! No other 3-Dimensional CAD system can come close to providing the price/performance of DesignCAD 3-D.

There is a very important reason to buy DesignCAD 3-D other than price: PERFORMANCE. DesignCAD 3-D provides complete 3-Dimensional drawing capabilities. It's not a "warmed-over" 2-D program. DesignCAD 3-D allows you to draw any entity in 3-D space. This means, for example, that you can draw a curve in the shape of a spring. You can draw a circle or arc at ANY angle on ANY plane.

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DesignCAD 3-D almost certainly is compatible with the computer system you now own. DesignCAD 3-D supports more than 200 dot matrix printers, at high resolution. DesignCAD 3-D supports more than 80 plotters, and most digitizers and graphics adapters available for "PC Compatible" systems. Shaded and wireframe models can be output to the printer or plotter YOU own.

DesignCAD 3-D does not require expensive graphics adapters and monitors - even shading can be done on ordinary displays such as the Enhanced Graphics Adapter (EGA), Color Graphics Adapter, or Hercules monochrome adapter.

However, the best reason to buy DesignCAD 3-D is not the low price. It's not the outstanding performance. It's not the extensive hardware compatibility. The best reason to buy DesignCAD 3-D is for its amazing ease of use!

DesignCAD 3-D provides powerful commands you can use to produce professional 3-Dimensional drawings in less time than you thought possible! DesignCAD 3-D commands can be selected from the menu or entered as fast, single keystroke commands. We have found DesignCAD 3-D to be easier to learn and easier to use than any 3-Dimensional CAD system for the IBM PC, at any price!

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afford. Contrary to Ms. Getts' opinion, I believe we have done that with the Practical 1200SA.

Besides the fact that the article gives the wrong price for the modem (list price is $159, not $199), it is difficult to reconcile Ms. Getts' statement that "the Hayes Smartmodem 1200 can take a lickin'—and dish it out to its no-name competitors" with the data in the chart on pages 196 and 197. In the signal-to-noise tests, the Practical 1200SA equals or betters the performance of the Smartmodem 1200, while in the phase jitter test the Hayes modem isn't even in the running with our product's performance.

It's hard to conclude that Ms. Getts' misleading statements were not made intentionally, and I think you have an obligation to your readers and to the maligned manufacturers to publish a correction.

Michael Seedman
President
Practical Peripherals
Westlake Village, California

Rest easy, my statements were made intentionally. A Practical Peripherals spokesperson quoted the $199 price over the phone to PC World *right before the review went to press. But Mr. Seedman's point about the inaccuracy of the PC World Evaluation caption is well taken—if readers look only at the simulator tests, they'll find that the Practical 1200SA and the Hayes Smartmodem 1200 performed comparably. However, benchmarks tell just part of the story.*

My analysis of the Practical 1200SA was based on long-term, day-to-day use as well as on test data. And, as noted in the review, the modem had some distinct flaws. It had trouble with a simple dialing string like <ATDT>, wouldn't connect to some major on-line services like MCI Mail (despite dozens of tries), and couldn't connect to some electronic bulletin board systems unless I dialed the number manually with a phone and then forced the modem to pick up the line. In the course of three months of testing, I encountered all of these problems, and more, with the Practical 1200SA. It's a part of the story readers shouldn't forget.
—Judy Getts

Stick to Your Clones

Stewart Alsop's column ["Why You Shouldn't Buy 80286 Machines Anymore," *PCW*, December 1987] is honest and seems to be based on a solid framework of careful thought. For many users, especially corporate ones, his logic is sound. Nevertheless, I can think of many reasons why an 80286-based machine is precisely the computer many users should buy.

Buy an inexpensive clone before cheap chips vanish from the pipeline, and use it either with DOS or OS/2. Don't worry about the future, because your upgrade options are numerous. Intel's rumored 80388, basically an 80386 that plugs into the 80286's socket, is a clone owner's dream, but it makes so much sense that there's a chance Intel won't go through with it. You could also swap your 286 motherboard for a 386 one and continue using the same drives, display, and other peripherals, or you could buy a 386 add-in card that plugs into one of your computer's slots and takes over for the 286.

The important thing is to buy a cheap clone now and upgrade later when prices are certain to be lower. If computer costs continue their sharp decline, you may even be able to buy a 286 machine now *and* a 386 later, both for the price of a 386 now.

Robert J. Spear
Accokeek, Maryland

A Momentary Lapse

Robert Luhn's report on the Hauppauge 386 Motherboard [*The Upgrade Path*, *PCW*, November 1987] was worth my subscription price many times over. It is a wonderful product and the ideal solution to my computer's growing pains.

I purchased Quarterdeck's *Desqview* along with its expanded memory manager *QEMM-386* on the strength of another *PC World* article ["Multitasking Now!" *PCW*, December 1987] by Craig Stinson. I thought both Mr. Luhn and Mr. Stinson would be interested to know that the Hauppauge system crashes when used with *QEMM*. After talking to Hauppauge and Quarterdeck, I am convinced that both companies would like to solve the problem, but getting them to talk to each other isn't easy.

Ron Lockhart
New York, New York

Calls to Hauppauge and Quarterdeck revealed an incompatibility between QEMM *and the Hauppauge keyboard controller BIOS. According to Hauppauge's Ken Plotkin, the company has (continues)*

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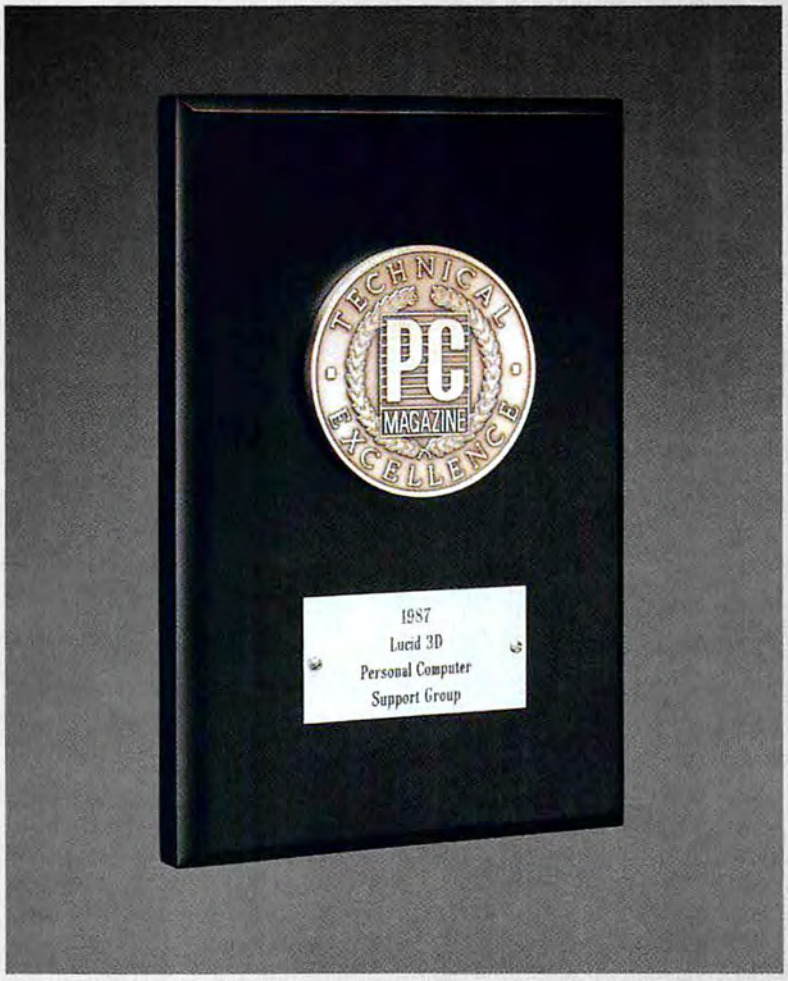

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Everything about Lucid works that way. Users say "*It is so intuitive that I really don't need a manual.*" That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said, "*If there ever was an interface idea so good it ought to be stolen and widely used, this is it.*"

Memory Resident

You can pop Lucid up instantly while working in your word processor or any other program. You can cut anything on the screen and paste it right into Lucid, or cut anything from a Lucid worksheet and paste into the application below. You can even run Lucid on top of 1-2-3 if you like, and cut and paste information from one to the other, including formulas.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note window that you instantly access with a single keystroke. You can write notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

Other Features

Lucid has over 100 innovations that cause users to say it is the best of all the spreadsheet offerings! Things like: **Speed** - background, minimal and visible recalc. **Macros** - learning macros, autoexecute macros, macros work between spreadsheets, user defined macro menus. **Mouseability** - total Mac-like mouse access, but easy keyboard control as well. **Color or Mono** - 17 user controlled color displays. **Audit** - six displays and printouts. **Windows** - multiple sheets on screen at same time. Multiple views of the same sheet. Pop-up windows of function formulas, range names, favorite labels, macro names, filenames, even a calculator. All let you select and insert right into your spreadsheet. All windows (even notes) resize and move where you want them. **Cut and Copy** - between spreadsheets, documents and between sessions. **Help** - press F1 anywhere, you get help specific to what you are doing.

Fig. 1. Let's get the detail on those ad costs, just move the widebar to that cell and press one key (grey +).

Fig. 2. Here we are instantly. Notice the lower left corner showing we are on level 2. Grey – takes you back. There is no limit to the levels you can go. Move right down to transaction level if you like.

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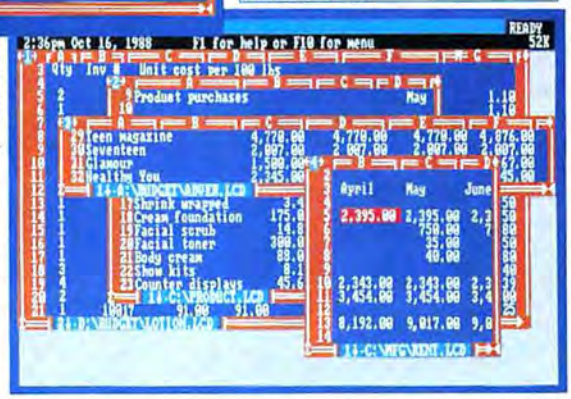

Fig. 3. Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many 3-D levels as you like. No one else can do that.

Masterwork

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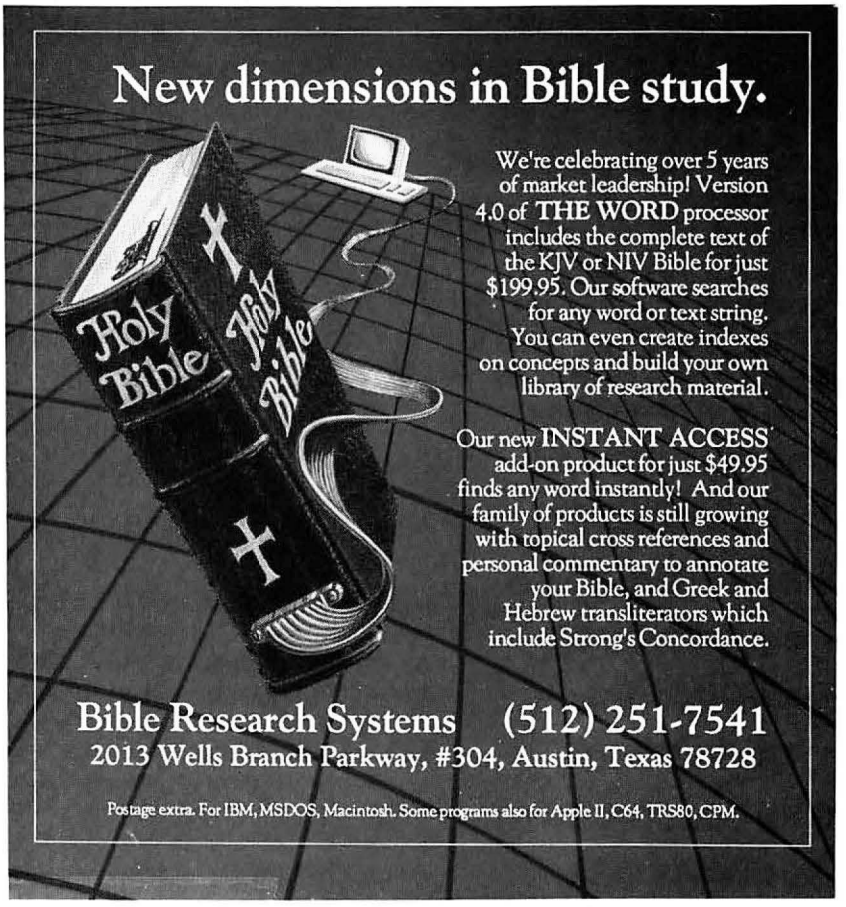

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Circle 78 on reader service card

corrected this problem in revision 1.3 of its keyboard controller, which it offers to 386 Motherboard owners free of charge. —Ed.

Missing Megabytes

I read with interest your removable media review ["Removable Resources," *PCW*, December 1987] but was sorry to find that it didn't include the system that beats all others hands down, Tandon's Personal Data Pac. The PDP is a 30MB hard disk that you can remove from its receptacle and lock away or pass along to a co-worker whose computer is equipped with a PDP receptacle. Tandon's PAC-286 is an 80286-based computer with a built-in PDP receptacle, and an external PDP system for compatibles is on the way. I'd really like to see how it fares against other removables.

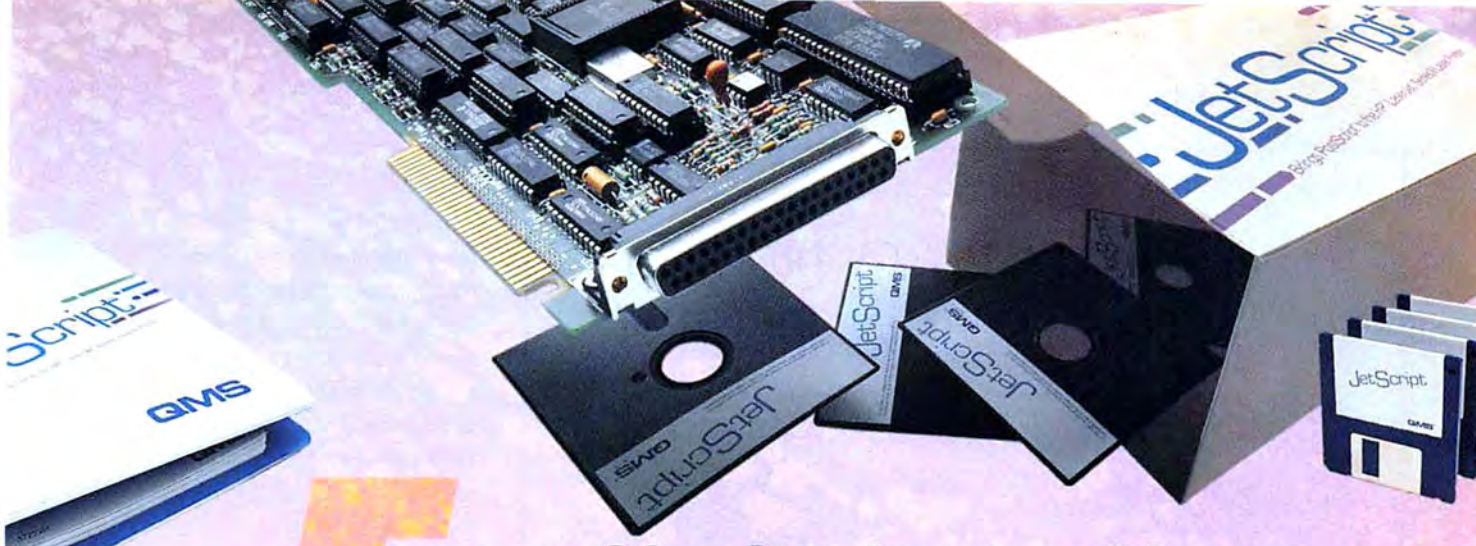
Todd J. Peloquin
Salem, Oregon

With new products being released constantly, worthy items often appear just a little too late to be included in a particular review. For a close look at Tandon's PAC-286, check The Hardware Shelf *in upcoming issues of* PC World. *Also, see David Bunnell's comments on the PDP in his column in the March issue. —Ed.*

More Than Dumb Luck

I can't accept your description of Autodesk's success in the CAD market as "lucky" ["Autodesk's Lucky Strike," *PCW*, December 1987].

(continues)



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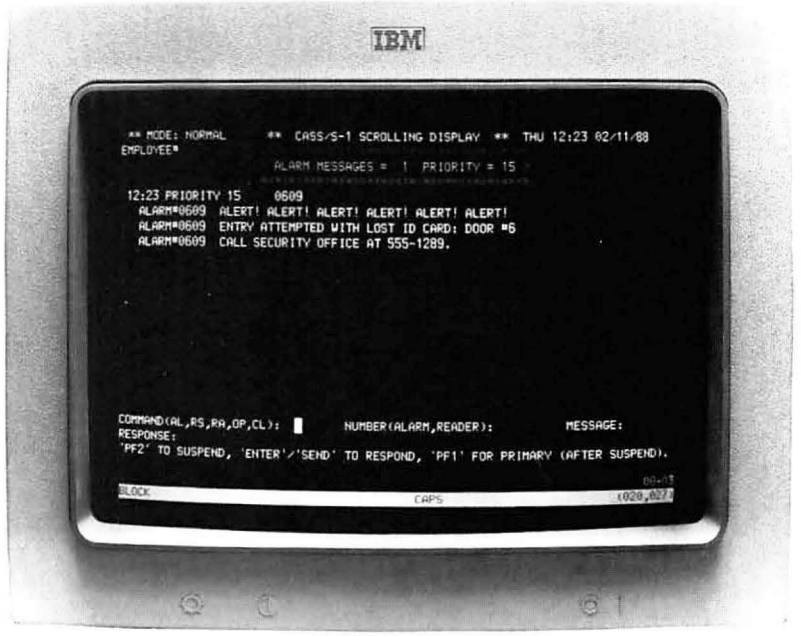

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In 1981, I paid $7500 for another manufacturer's CP/M CAD package and invested an additional $7500 in the equipment on which to run it. Within a year, the manufacturer decided to abandon CP/M in favor of DOS and ceased to offer even minimal support. It almost put me out of business.

I studied Autodesk for several years before finally risking an investment in *AutoCAD;* I needed to be sure I wouldn't be left an orphan again. I'm still with Autodesk due to its magnificent product support. Had that other CAD manufacturer not dumped its customer base, it could have been the CAD leader, and "lucky" Autodesk would still be back in the pack.

Autodesk isn't lucky, just *good.*

Walter E. Wallis
Wallis Engineering
Palo Alto, California

Precise Terms

In his review of IBM's PS/2 Model 80 ["A Model for the '80s," *PCW,* December 1987], Senior Editor Eric Knorr gives examples of "ergonomic" hardware and software features. Expansion board thumbscrews, edge connectors instead of pin connectors, cableless disk drives, and a system unit cover that you can unscrew with a quarter are all touted as ergonomic achievements, and Mr. Knorr calls the system configuration display program on IBM's Reference Diskette an "ergonomic triumph." To all of this I say, so what! Big deal!

To me, ergonomics is the art of designing things in a way that improves productivity, making

(continues)

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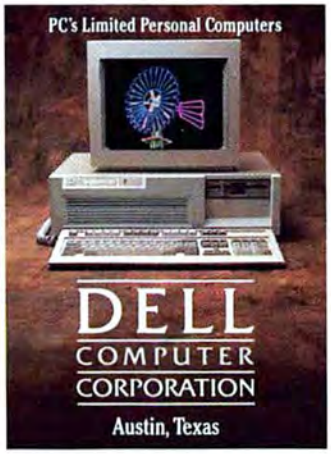

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routine tasks fast and easy. None of the features described by Mr. Knorr offers much benefit to PS/2 users as they perform their normal daily activities. How often do you remove the system cover or replace disk drives? Once a year? Perhaps less often than that.

Raymond Kostanty
Wood-Ridge, New Jersey

Corrections

In our super-hard-disk review ("Mass-Storage Muscle," *PCW*, December 1987), the features table on pages 170 and 171 incorrectly states that Core International doesn't offer free technical support. In fact, Core offers free support and also promises to replace failed equipment under warranty within 24 hours.

Pages 238 and 239 of the table in our "Mail-Order Directory" ("The Ultimate Buyer's Guide," *PCW*, January 1988) contain some errors. The entry for Computer Discount Warehouse states incorrectly that the company does not provide a money-back guarantee, does not accept company purchase orders, and charges a $5 flat fee for shipping. According to President Mike Michaels, the company offers a 30-day money-back guarantee on defective goods and charges standard shipping rates.

A better title for "Reload Programs in a Snap" in "Ten Time-Savers" on page 310 of the same issue would have been "Reload COMMAND.COM in a Snap."

The DOS command listing also contains two mistakes and should have been printed as follows:

```
COPY A:\COMMAND.COM C:\
SET COMSPEC=C:\COMMAND.COM
```

PC World regrets the errors.

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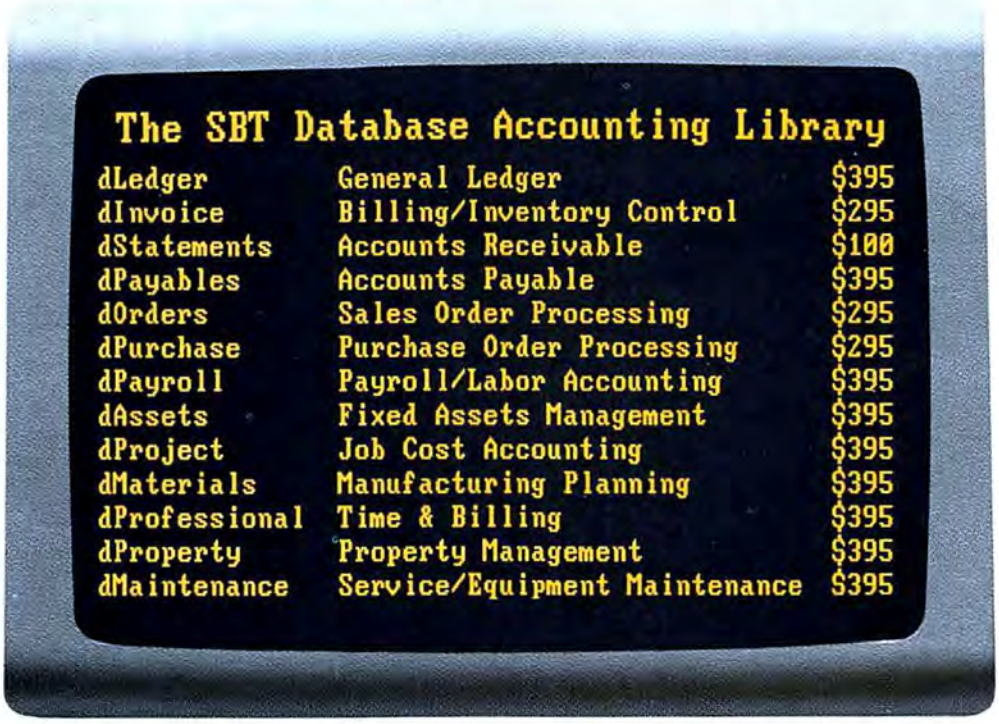

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Circle 163 on reader service card

Road Map to the Next Generation

Computer users win when they exercise their power to control technology.

That's what PC World's new look is about.

Richard Landry

As I'm sure you've already noticed, this issue marks some big changes for *PC World*. Our old format has been scrubbed down and repainted in every area, from news and reviews to opinion columns and productivity tips. NSTL benchmarks, *PC World* comparative features tables, and Executive Summaries all carry a distinctive look that highlights the importance of these key decision-making elements in our articles and departments. We hope our new format will make it easier for you to digest and act upon the avalanche of new information that comes your way each month. But that's not the whole story.

Much more than just a better way to fit form to function, *PC World*'s new look reflects our sense of the pivotal role you play in defining how the next wave of personal computer technology will be used in the office. It's no surprise to you that, despite all their short-term disadvantages and problems, OS/2 and the PS/2 are fomenting change in the workplace to a degree we haven't seen since the PC was introduced in 1981. And like most big changes, this one has the potential to bring about a fundamental shift in the balance of power, in this case within the computer industry itself as well as within the business community.

What's the nature of this change? Since their inception, PCs have held the promise of one day displacing minicomputer-based multiuser systems with network-based distributed processors. But technological and economic barriers have kept this promise from being fulfilled—until now. For as little as one-half to one-fourth the cost of a minicomputer, OS/2-based network servers and software will provide all the power of the larger systems, plus the modularity that minicomputers lack. The economics of this technology shift are compelling. They translate into a windfall for midsize and large companies that can't be ignored—the kind of price/performance breakthrough that made office computing popular in the first place.

But power still has its price. Users accustomed to operating their stand-alone workstations on a long leash may find themselves pulled up short by MIS directors anxious to reassert the control over computing resources that they lost when the IBM PC first entered their lives. And even with cooperation from MIS departments, users will be hard-pressed to muster the technical

(continues)

expertise needed to understand the wide range of choices available in network applications. One possible result? All those users who first got stuck with *dBASE* when a flat-file manager would have done the job may once again find themselves slogging through inappropriately complex applications.

The situation is even worse for small businesses, which individually lack the purchasing power to command the advice, training, and support that big businesses get from vendors and resellers. Left to puzzle out the complexities of the new technology on their own, they may find themselves choosing solutions that offer too snug a fit to accommodate future growth, or they may sink into a technology mire where more complex systems yield only more downtime and less productivity.

It's the classic situation described by noted technology author and PBS commentator James Burke in this month's "Another Angle" (p. 278): Knowledge is power. PC users first got powerful because they understood the potential of the new machines better than MIS did. Users will stay powerful only by understanding the technology well enough to insist on those products that best suit their needs.

That's what *PC World*'s new format is really all about: putting the knowledge to make smart purchase decisions in the hands of the people who have to live with those decisions. That impulse is not much different than the one that inspired this magazine more than five years ago. The difference is that now users find themselves defending their purchase authority rather than trying to attain it. Surveys conducted by International Data Corporation and other research organizations show that in recent years control over PC purchases has devolved upon middle management and end users, with MIS departments confined to testing and approving the short lists of hardware and software that they can afford to support. MIS may chalk out the playing field, but end users choose their own bats and gloves.

For several months we've been quietly gearing up to help you meet the challenge the new technology poses. We've added col-

(continues)

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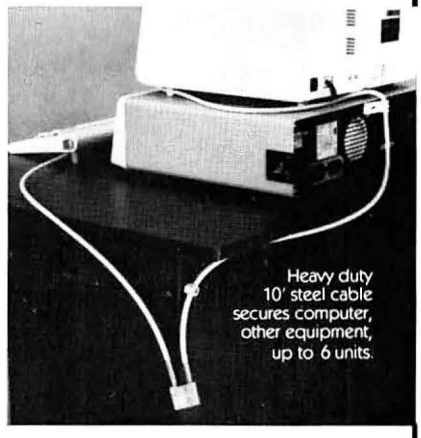

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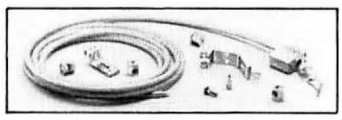

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umnists like Stewart Alsop, Will Zachmann, and Robert Carr to help you scope out the computing scene. Our *Consumer Watch* department supports the philosophy that users have a right to reliable products backed by fair service agreements. *The Upgrade Path* shows you how to make smart, targeted purchases to increase the effectiveness of existing equipment. We've expanded our review coverage and augmented our user-oriented evaluations with unbiased test results from National Software Testing Laboratories. We conclude each review with a strong recommendation for or against purchasing the product under consideration, and beginning with this issue we lay our evaluative skills on the line with "Best Buy" recommendations for those products that set price/performance standards.

Vendors don't necessarily like it when we recommend another product instead of their own. They may not see the same value you do in an upgrade that offers 90 percent of the functionality of new equipment for a third the price. That's where their interests meet yours head-on. Today, just as five years ago, you can count on *PC World* to give you the tools to face the technology onslaught and come out on top.

As always, I'm interested in your opinions on these or any other subjects. Write to me at *PC World*, 501 Second St., San Francisco, CA 94107, or send an MCI message to Richard Landry/301-3685. ●

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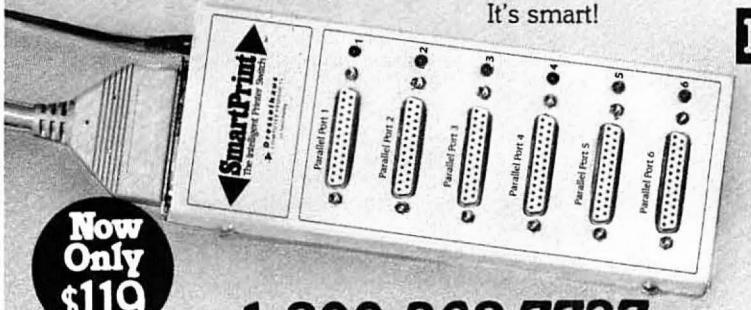

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And see how it feels to pick up the most portable portable in the world. Nothing is as easy to take. Except, maybe, its price.

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Next in

PC WORLD

May

Desktop Publishing

Far from remaining the sole province of graphic artists and in-house production managers, desktop publishing is fast becoming the most widely used method for creating and manipulating text. Next month *PC World* looks at several desktop publishing tools that make it easier for nonprofessionals to give their documents a professional look, including:

Byline, a package that excels at spiffing up *1-2-3* and *dBASE* files; and

Printers designed to work with PostScript, the standard language of desktop publishing.

Also, a roundup of scanner devices and a utilities buying guide aimed at helping you get more out of *Ventura Publisher* and *PageMaker*.

The Next Generation

OS/2 is here now—but the exciting applications that will make this new operating system a necessity are still to come. *PC World*'s editors separate myth from reality, explaining the kinds of OS/2 applications you can expect to see soon and those that will take years to develop.

The new ergonomic design of the Microsoft® Mouse gives you a more comfortable way to seize control of your work. Or your company. Depending on your ambitions.

Smooth, subtle buttons can help you master today's newest programs like Aldus Pagemaker®, Microsoft Excel and Windows. They also make pleasing, productive sounds when pushed.

As a result of its makeover, you now control the mouse with your fingertips instead of the palm of your hand. Besides a more responsive, natural feel, this frees your palm to do something else.

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Microsoft Mouse is sold in three different packages. Get the mouse with EasyCAD™ or Windows 2.0 and PC Paintbrush® for Windows or Mouse menus and Microsoft Paintbrush. Available in serial-PS/2®, bus, and InPort™ versions.

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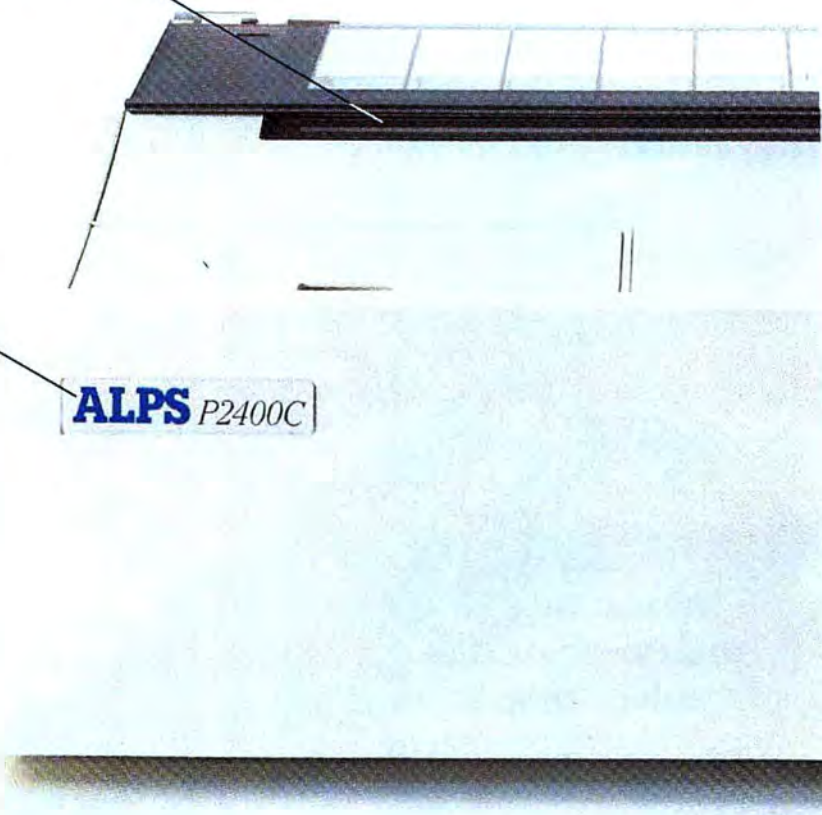
ALL IT LACKS IS

A choice of snap-in/out, 24- or 18-pin print heads gives you the versatility and ease of maintenance that other printers lack.

With a top speed of 360 cps, it makes most printers seem downright lackadaisical.



But who needs competition when you've got all this?

Namely, the ALPS P2400C™ Dot Matrix Printer.

No other printer in its class can do so much for so many for so little.

For instance, the P2400C can easily take on all the work an office full of busy PCs can dish out.

For letters, seven-color graphics, spreadsheets or whatever, its output is so brilliant, everything else appears lackluster.

And take care of it faster. Thanks not only to its talents pointed out above, but to its many others, as well.

Like a choice of draft, correspondence and letter quality print modes. A print buffer expandable to 256K. Multiple font cartridges. And full compatibility with the most popular PCs and software.

COMPETITION.

Most printers lack the good sense to include a paper-saving, push/pull tractor for both bottom and rear feed. Not this one.

You also get conveniences that many other printers are lacking. Like control of everything from the front panel, the feature menu, or from software—without using DIP switches.

Not to mention the ability to run quietly. At under 55dBA, the P24000C is one of the least noisy printers around.

One of the most durable, too. It comes with a full, one-year limited warranty. And if you give it normal care, it'll give you over five years of trouble-free performance.

Of course, there's nothing like a live performance to prove there's nothing like the P2400C.

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Happy Birthday, PS/2

The biggest benefit of IBM's PS/2 line is the renewed competition it has generated.

And it's clear that the biggest winner in all this competition is the user.

William F. Zachmann

A year has passed since IBM introduced the PS/2 line of personal computers and the OS/2 operating system. It is a mark of the profound conflicts underlying IBM's introduction of the PS/2 that today, a year later, opinions concerning the PS/2 and OS/2 and their impact on the industry are still widely divided. What's more, mistaken impressions formed a year ago still cloud many users' awareness of even the most basic facts of the matter. Following are a few choice misconceptions about the PS/2.

The PS/2 and OS/2 are linked in some fundamental way (other than by IBM's legally registered "/2" trademark). Never mind that the majority of PS/2s sold in the first year were Intel 8086–based Model 30s and 25s and thus will never be able to run OS/2. Never mind that AT-compatible 286-based systems from everybody else in the world will run OS/2 very well, thank you.

IBM's Micro Channel Architecture (MCA) is a data "superhighway" providing performance superior to that available from the "country road" bus on AT-compatible systems from other vendors. Never mind that Compaq's Deskpro 386 blows away the PS/2 Model 80 on performance and that the original 10-MHz PS/2 Models 50 and 60 are actually slower than less expensive 12-MHz AT-compatible systems. Never mind that the PS/2 Model 30—which by virtue of its fast 8086 processor actually gets much better performance than the original IBM PC and XT did—doesn't even use the MCA.

PS/2-compatible systems would appear on the scene in much the same way that IBM PC-, XT-, and AT-compatible systems did. Never mind that by the end of 1987 not a single system vendor had publicly announced a PS/2 compatible. Never mind that IBM's web of "intellectual property rights" has the entire industry tied in knots; backed by a legal staff that easily outgunned the U.S. Department of Justice, IBM seems ready to sue the pants off anybody who clones amiss.

IBM's PS/2 would automatically define the next industry standard and be IBM's "clone killer." Never mind that vendors like Compaq, Dell Computer, NEC, Wyse, NCR, Toshiba, Acer, AST, and numerous others actually grew faster than IBM in the last half of 1987, well after PS/2s started shipping. Never mind that Compaq's Deskpro 386 easily outsold IBM's PS/2 Model 80 in the year after announcement.

(continues)

IBM's "new generation" of personal computers and new operating system would lead to a radically new generation of software that would provide a powerful incentive for buying from Big Blue. Never mind that *Microsoft Windows*, first introduced in 1985, is where the action is in exciting new software. Never mind that most of that exciting new software will have been running under *Microsoft Windows 2.0* or *Windows/386* on compatible systems from many other vendors as well as IBM long before it runs on PS/2s under OS/2.

Which is not to say, however, that PS/2 will not be important or that its impact on the industry will be insignificant. Even subtracting out the mythology that still tends to surround the PS/2, the reality amounts to a crucial influence on the industry. In fact, IBM's PS/2 has already had an enormous impact that is of great benefit to users, whether they buy IBM or not.

By far the most important aspect of the PS/2 is that it constitutes an endorsement by the world's largest and most powerful computer vendor both of the graphic user interface generally and of *Microsoft Windows* as adapted in the OS/2 Presentation Manager (as well as in *Windows 2.0* and *Windows/386*). By building what in fact are very good graphics machines for the office, IBM has added enormous momentum to the trend toward graphics workstations in the workplace.

The resolution and function of the IBM VGA (Video Graphics Array) resoundingly raised the mark for all competitors selling personal computers. By offering graphics good enough for widespread office use, IBM forced competitors to scramble to meet (and in many cases exceed) the VGA's new graphics capabilities.

As is always the case when competition among vendors intensifies, users are unquestionably the winners. The relentless quest for new displays, graphics adapters, scanners, digitizers, cursor control devices, and graphics tablets and for more sophisticated software of all sorts to make use of them gives users more and more capable options at lower and lower prices.

Likewise, IBM's promise to build communications and data base capabilities into its proprietary OS/2 Extended Edition has similarly driven other vendors to match or exceed IBM's offerings. In the long run, whether users buy OS/2 Extended Edition or get their communications capabilities from vendors like 3Com, Novell, Tops, or DCA, or their relational data base software from vendors like Ashton-Tate, Ansa, Microrim, or even Borland or Lotus, they will get more for less as a result of the intensified competition.

Much as IBM would like to regain lost market share along with the effective control its dominant position in mainframe computers once gave it, the inherently standardized environment of personal computers and other microprocessor-based systems gives even small competitors a chance at winning. IBM's renewed aggressiveness stimulates equally aggressive countermoves from competitors. We, the users, benefit.

Many Happy Returns

To our good fortune, we can rest assured that IBM will continue to raise the ante by introducing new and improved products. The key to future developments lies in the Micro Channel Architecture (MCA). While it doesn't really provide huge performance gains over the earlier AT bus, the MCA certainly does provide a tighter, more complete bus design that will make it possible to build some interesting and useful systems. Its multimastering capabilities, if not in the current implementations then in later ones, can certainly be used by more intelligent peripherals controllers.

Smart disk or communications controllers linked to OS/2 Extended Edition over the Micro Channel, for example, could provide very high levels of interaction with the main processor. Smart network cards with substantial local memory and powerful processors could handle multiple network sessions as well as bulk data transfers or off-line communications in the background.

Even more promising, the MCA would make it possible to build a very smart disk controller that is, in effect, at least a low-level data base machine. This controller would provide a much higher-level interface than the cylinder/track/sector addressing of a standard personal computer disk controller. Conceivably, such a controller might be a high-level SQL server responding to data base queries from the main system microprocessor.

Alternatively, a fast Winchester disk drive might be combined with a smart control-

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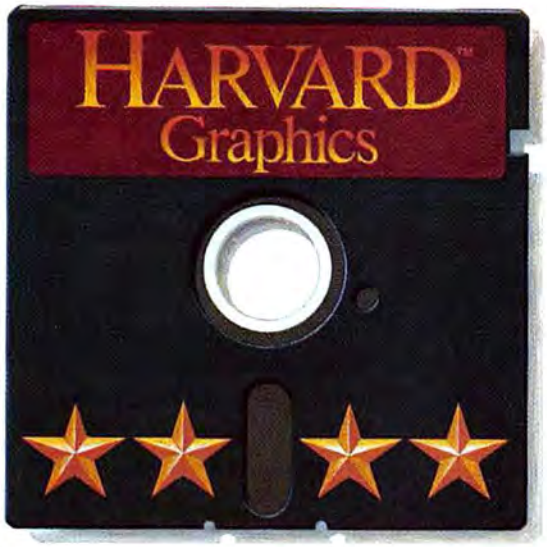

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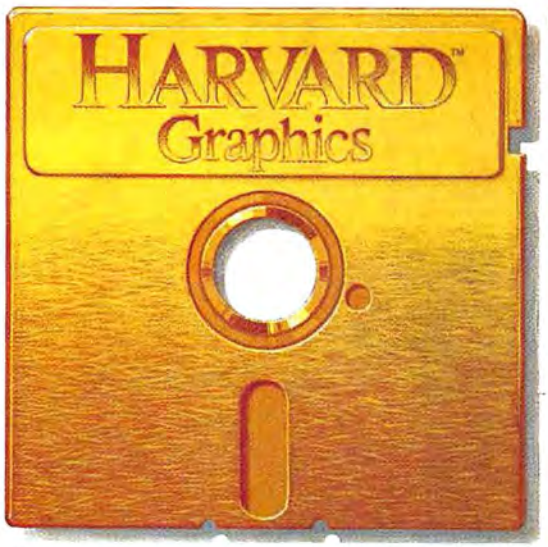

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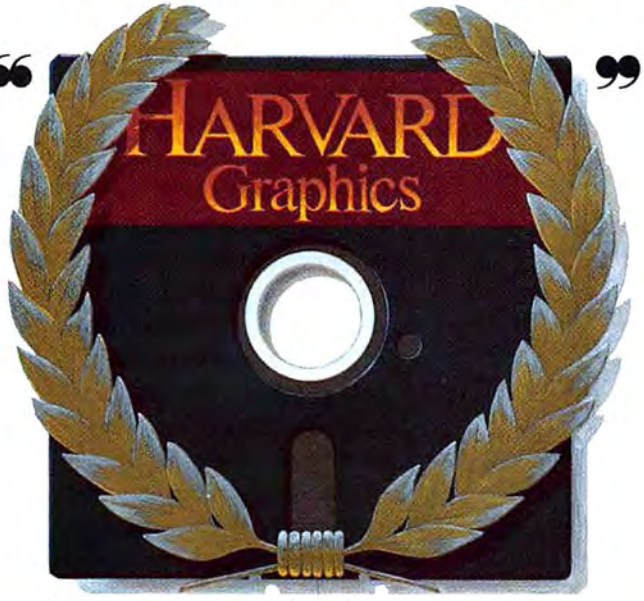

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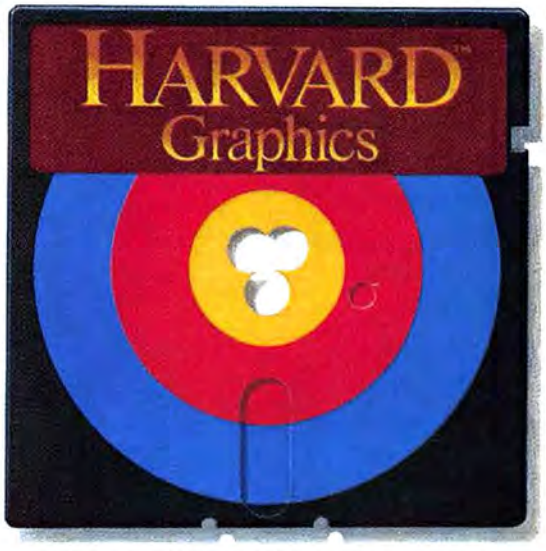

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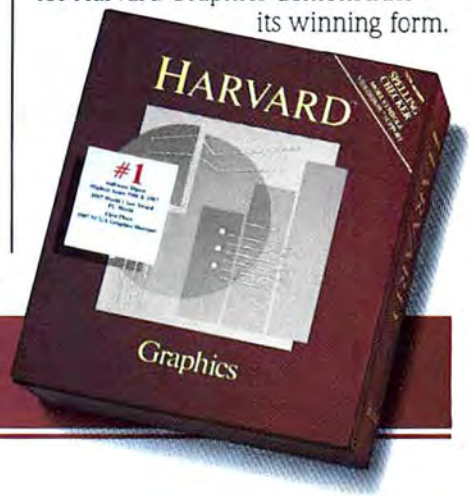

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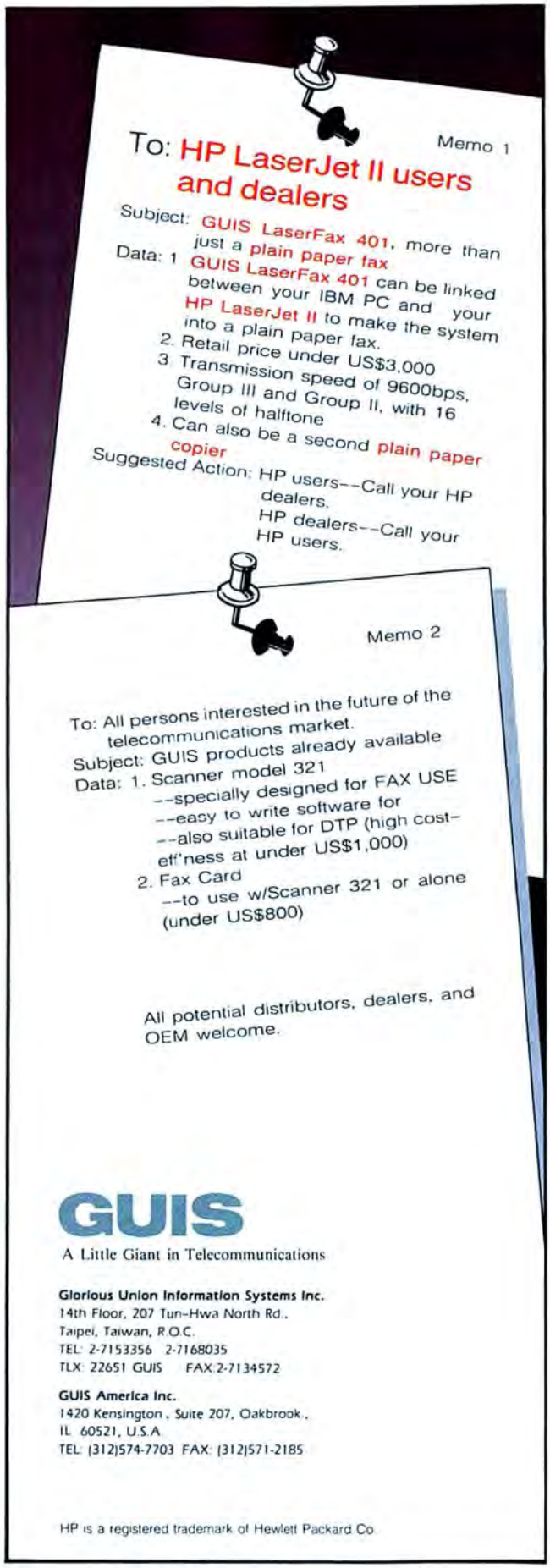
ler to create a virtual memory environment. In this way, disk storage might be handled as a direct extension of the system address space on an Intel 386–based system like the PS/2 Model 80 (or 90?). This arrangement could be used to create a personal computer equivalent of the system structure of the IBM System 38.

Whatever the future holds, IBM's competitors are certain to continue offering alternatives, whether or not IBM's legal fence around the MCA prevents direct compatibility. As AST's inclusion of an MCA-like multimaster bus in the AST Premium 386 shows, there is more than one way to achieve the same results. In fact, everything that I have just described can actually be implemented on a standard AT bus.

IBM's PS/2, whether you love it or hate it, has certainly intensified competition over the past year. As the PS/2 celebrates its first birthday, IBM will no doubt continue to offer newer and more competitive products, requiring other vendors to continue to respond. The outcome will be better systems at lower costs, the inevitable result of true competition. Let's raise a glass to the PS/2 on its birthday and toast the continued good health of IBM and all its competitors! ●

William F. Zachmann is senior vice president at International Data Corporation.



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The best ad for Key Tronic keyboards is a close look at the competition.

Last spring a certain quality conscious consumer purchased what he thought was a Key Tronic KB 5151 Professional Series keyboard from a local retailer.

Look for the Key Tronic Professional Series label on the keyboard's top left hand corner.

This same consumer later returned the keyboard to Key Tronic with a letter of complaint. The product, shown above, was used for just over a year, though it looks like it was abused for much longer. Some of the keycap legends had worn away, and had to be replaced by the stick-on labels you see here.

Truth is, while the above product was sold as a Key Tronic keyboard, a Key Tronic label never appeared on the product. There is no way it could have. Because only keyboards bearing the leading name in keyboard technology offer the quality behind that name.

Close examination will tell you immediately if the keyboard you are purchasing is from Key Tronic. First, look for the Key Tronic Professional Series label in the top left hand corner. Look also at the keyboard's legs to see if they have a rubberized non-skid covering, just another of the Key Tronic extras that ensure better performance.

Of course there are other features, not initially apparent, that separate a great keyboard from a mediocre one. Take Key Tronic's double shot molding, for example, a process that prevents the keycap legends from wearing away (which proves that the keyboard shown above is not from Key Tronic but rather the handiwork of a lesser manufacturer). And then there is Key Tronic's limited three-year warranty: a reliability guarantee that is backed by over eighteen years' experience making over eight million keyboards.

Double shot molding embeds the keycap legend in colored plastic, so it won't wear off.

Other manufacturers use a less permanent printing process.

Key Tronic's full service network and toll-free line mean there's always someone to assist you.

None of which, we might add, ever looked like this.

To find out more, contact your Key Tronic dealer. Or call toll-free 1-800-262-6006.

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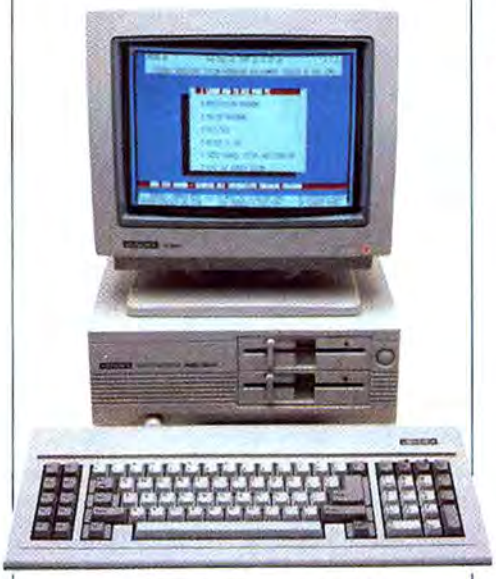

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Circle 10 on reader service card

Edited by ERIC BENDER

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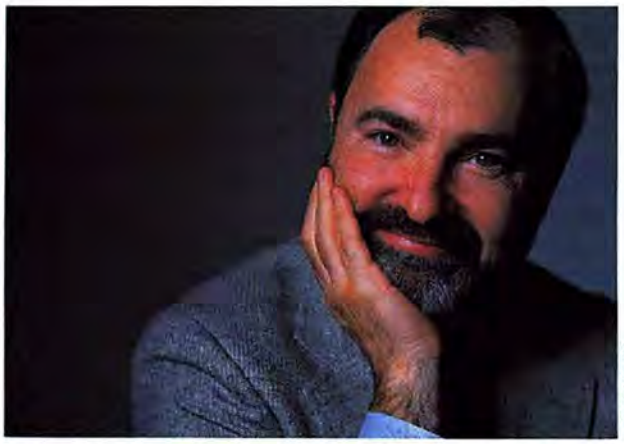
Network Suppliers Expect Strong Growth in '88

Developers Scramble as Technology Shifts to OS/2



CRAIG MORREY

Network General's Harry Saal expects customers to find good bargains in network hardware this year.

Successful local area networks (LANs) demand a fairly smooth blend of PC, adapter, cabling, file server, application, PC system software, network system software, and peripheral. This year, new standards are evolving rapidly for each of these components. And LAN suppliers are racing to churn out more intelligent or less expensive connections, powerful 386-based servers, and software that's revamped for OS/2.

Prospects look excellent for LAN suppliers who move quickly. Richard Kimball, senior analyst at Montgomery Securities in San Francisco, predicts 40 percent sales growth this year for market leaders Novell and 3Com, and 1989 may be just as bright. "Novell and 3Com are growing incredibly fast, although you still don't have great network applications," he points out.

Overall, International Data Corporation estimates that the number of PC networks shipped will rise from 221,000 last year to 385,000 this year, and installation costs aren't getting any cheaper.

As more capable nets arrive, "The total solution is going to be slightly more expensive for the end user," predicts Daniel Collins, director of software services at LAN Services, a New York reseller. "Everything having to do with hardware will fall, but software costs will rise."

Last year saw a big push for nets that run on inexpensive twisted-pair cabling, including the advent of the first such Ethernets. "A lot of people say that's very appealing," comments Peter Hayes, Businessland's director of product marketing. But Harry Saal, president of Network General, calls this "good and bad news," because several incompatible standards have been proposed.

Among decisively pleasant trends for customers, Ethernet adapters are now selling from $300 to $500—half the price of a few years ago. Prices of Token-Ring hardware also are on the wane, as products fully compatible with IBM's offering have finally appeared, Saal says. And he maintains that AT&T's Starlan nets, which seem to be dead in the water, may represent a bargain. "You can get them cheap while they last; there are literally warehouses full," Saal notes. "They're an excellent buy for someone with an extremely limited budget and no plans to grow."

In the next few years, entry-level network adapters increasingly will be built into PCs themselves. "Once the price is down to $300, the next step is to build it into the workstation," remarks 3Com chairman William Krause. Nat Goldhaber, president of TOPS, says, "I expect that the public will begin to recognize the need for connectivity in much the same way that it recognizes the need for serial ports. By 1990, very few computers will ship without networking adapters built in."

Meanwhile, Collins notes, manufacturers

(continues)

Network Rivals

PC network heavyweights Novell and 3Com have grown rapidly in the past two years, partly through acquisition. Novell bought hardware vendor Santa Clara Systems in October 1986, and purchased both micro/mainframe equipment supplier CXI and data base tool developer Softcraft in March 1987. 3Com merged with high-end network supplier Bridge Communications in September 1987.

Network

(continued)

seeking higher performance are "offloading network functionality into the card itself." Building more intelligence into the adapter, Krause suggests, will be "increasingly important as we move up the bandwidth ladder; as we evolve to 286 and

CRAIG MOREY

Standard PCs soon will include net adapters, says TOPS's Nat Goldhaber.

386 desktop computers, where sending bit-mapped graphic images is the rule rather than the exception."

Along with the movement toward 386-based servers, vendors see IBM's Micro Channel Architecture as a big step forward in the technology. IBM expects file servers to be the first machines to really exploit the architecture. Michael O'Dell, product manager for LAN systems at IBM's Entry Systems Division, points to increased system reliability, ease of handling multiple adapters, and potential for future fault-tolerant offerings. —*E. B.*

Printers Break Through 300-dpi Barrier

Higher-Resolution Laser Devices Are Coming—But Slowly

Between the current crop of 300-dots-per-inch (dpi) laser printers and low-end typesetters such as the 1270-dpi Linotronic L100 lies a yawning gap in price and image quality. Yet the gap is beginning to close, with the advent of high-resolution plain-paper printers that use laser technology rather than the photochemical processes of traditional typesetters.

Typically, these printers cost between $30,000 and $50,000, but recently Varityper, based in East Hanover, New Jersey, cut the price of its 600-dpi, 10-page-per-minute (ppm) V600 PostScript printer to $13,500. Printware, out of Saint Paul, Minnesota, is selling its 1200-by-600-dpi, 8-ppm 720IQ Laser Imager for $13,280. A $16,270 PostScript model should be available soon.

Such printers still cost at least $10,000 more than their 300-dpi cousins, and it's unlikely we'll see further dramatic price cuts soon. Most analysts, unsurprisingly, predict a long life span for the 300-dpi market.

Cathy Lyons, product marketing manager for office printing at Hewlett-Packard, points out that 300 dpi is still a novelty to many users. "We're still trying to figure out whether users can tell the difference between 300- and 600-dpi output," says Lyons. "At this point, it doesn't appear they're that sensitive to it."

Aside from the lack of demand, considerable technological barriers must fall before prices can drop. "With four times as much data being processed by a 600-dpi printer, you'll need a better print engine, a more powerful controller, and a better buffer," says Jonathan Seybold, publisher of the *Seybold Report on Desktop Publishing*.

Increased memory for print buffers and faster microprocessors can boost throughput, but those components aren't cheap. And even with a fast printer, the RS-232C interface remains a bottleneck. "Something has to happen with the interface," says John Bolt, a Dataquest market analyst. "Some people are looking at RS-422, but we're seeing a lot more interest in SCSI, which gives you better throughput."

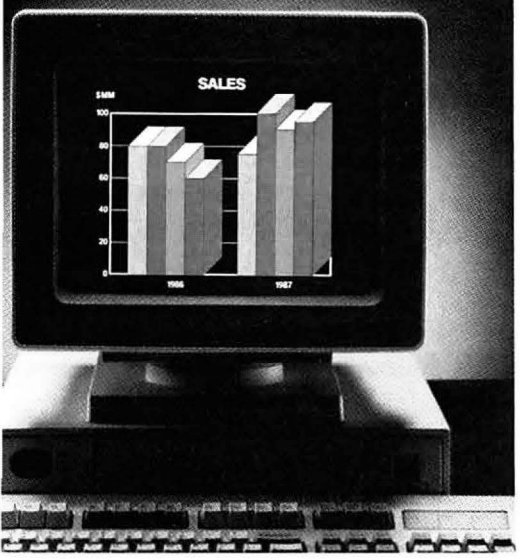
Those moving upscale are also debating the merits of 400 dpi versus 600 dpi. Current printer engines can be adjusted for 400 dpi; above 500 dpi you need new printer engines and toner processes. However, "400-dpi printers provide only marginal improvements," says Seybold. "600 dpi gets you to the point where it's a reasonable substitute for typesetting."

Analysts emphasize that dot density is only part of the image-quality story; other factors include the accuracy of the controller, the size of the dot, and the quality of the fonts. "Dots per inch is only a convenient way to measure quality," says Seybold. "Actual print quality is a much more complex issue. Unless you improve the printer as a whole, increasing addressability won't always increase the quality of the output."

Improving toner technology to print smaller dots is a top priority. R&D labs also are studying other ways to improve image quality, including varying the application of toner over a page, placing dots to create smoother curves, and changing the shape of the dot to simulate the myriad patterns that appear when you shoot a photo through a halftone screen. Such "gray-scale" printers are probably several years away.

Until prices drop and PC users become more discerning about desktop output, sales of high-resolution printers will probably remain a niche market. The OS/2 LAN Manager's improved printer sharing could help to boost sales. But by that time, high-res lasers may run into competition from low-end typesetting systems. —*Eric Brown*

FROM CREATION



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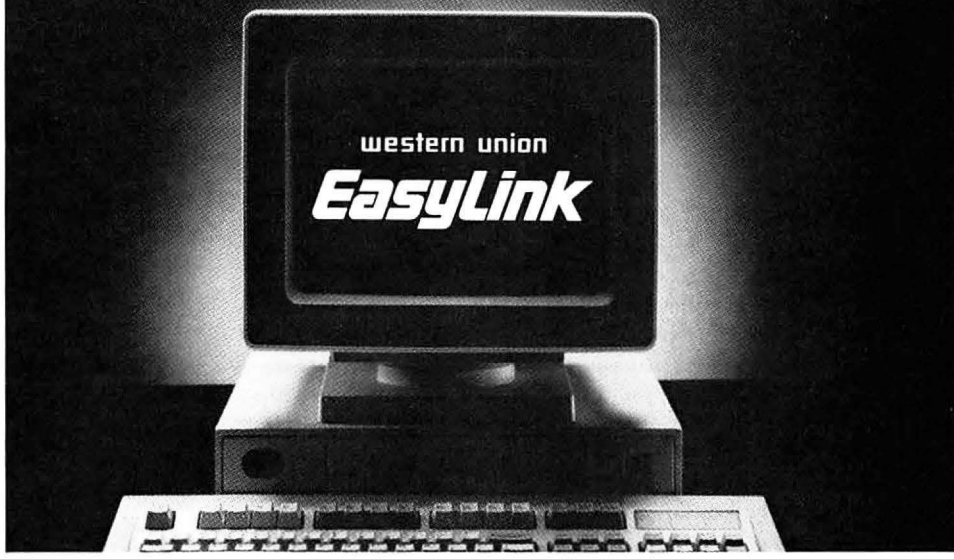

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Circle 19 on reader service card

Dell Computer Takes Own Route to Success

From Cowboy Boots to Wing Tips

Don't be deceived by the burnished spurs and Tom Mix visages in Dell Computer's recent ads. The Texas firm, which still sells under the PC's Limited brand, has galloped down the trail from maverick discounter to respectable full-service computer supplier—with largely domestic manufacturing, a cast of industry veterans, and fidelity to Job #1: pursuing leading-edge performance at very near Kmart prices.

The script begins four years ago with University of Texas dropout Michael Dell, 19, selling high-performance XT clones from his Austin condo. Today, Dell is still youthful, and his firm is still brash and bare bones. But now it cuts a more conventional profile and increasingly enters corporate America through the front door. Dell has augmented "direct response" marketing—the more discreet catchall for mail order—with a framework of corporate sales, training, and after-sale service.

Dell Computer is riding high enough to rank seventh (by its own count) among the nation's personal computer makers. In the year ended January 31, revenues were expected to break $150 million; for one month during the third quarter, sales jumped a staggering 500 percent. Earnings were fat. The firm now employs 520 in Austin and another 30 in the United Kingdom.

"We *have* moved upscale," says Dell, "but we're really enhancing our marketing activities rather than changing our focus." Michael Goulde, senior analyst with the Yankee Group, heartily concurs. "Just as its machines aren't clones, the [Dell] organization is certainly not a clone," Goulde says. "They know where they want to go."

In late 1987, the company sold $21.5 million worth of stock through a private placement, using the proceeds to assemble a national outbound corporate sales staff. And Dell Computer has stocked up with expatriates from Texas Instruments, Compaq, IBM, and, especially, Tandy.

Dell lured Graham Beachum, Tandy's top marketer, to the new post of senior vice president of marketing and sales, and then wooed away six other Tandy senior managers. More recently, Dell hired IBMer Ralph Merriman to run the firm's National Executive Briefing Center—a $1 million facility in Austin where executives try before they buy. IBM alum Bob Franks is firing up a software marketing operation.

Respectability also means customer support, and Dell buyers can procure a one-year service contract from Honeywell-Bull, good for house calls within 24 hours. "Bundling service instead of decreasing prices is one of the more brilliant marketing strokes I've seen," applauds Goulde. Dell additionally simplifies service by tossing the service department's phone number into ROM setup routines.

WILLIAM OVERBEEK

Michael Dell is adding services for Dell Computer's corporate clients.

These days, Dell Computer is unequivocally a made-in-USA manufacturer. Domestic supply, Michael Dell says, "gives corporate buyers a warm feeling."

Despite Dell's scintillating 80386-based system, the founder isn't expecting 386 dominance any time soon. He also downplays IBM's Micro Channel Architecture. "We don't see a significant base of customers buying IBM because of MCA," Dell reports. "If our customers need some device that a competitor offers, we can surely react.

"With both OS/2 and the PS/2, we're dealing with a whole lot more marketing than a lot of people realize," he adds. "When you get down to real customers—beyond the early adopters and the lunatic fringe—OS/2 won't sell unless [software written for it] delivers meaningful benefits. On the other hand, a lot of people don't understand these things, but they're making buying decisions anyway." —*Ken Greenberg*

PCsoft Clones Best-Sellers

Work-Alike Packages for Under $50

A San Diego start-up is making its debut with a dozen low-priced clones of the most popular software packages on the market. In February, PCsoft began shipping work-alikes of *dBASE III Plus*, *1-2-3*, *Dac-Easy Accounting*, and others.

Customers employ less than 15 percent of the average program's functions, suggests Vice President of Sales and Marketing Mike Reynolds, so PCsoft packages will offer a slightly lower level of capability than the best-sellers for prices ranging between $15 and $50.

Reynolds insists that these are original programs, adding that "we have taken all steps to protect ourselves." Still, the interfaces of PCsoft products will closely resemble their best-selling

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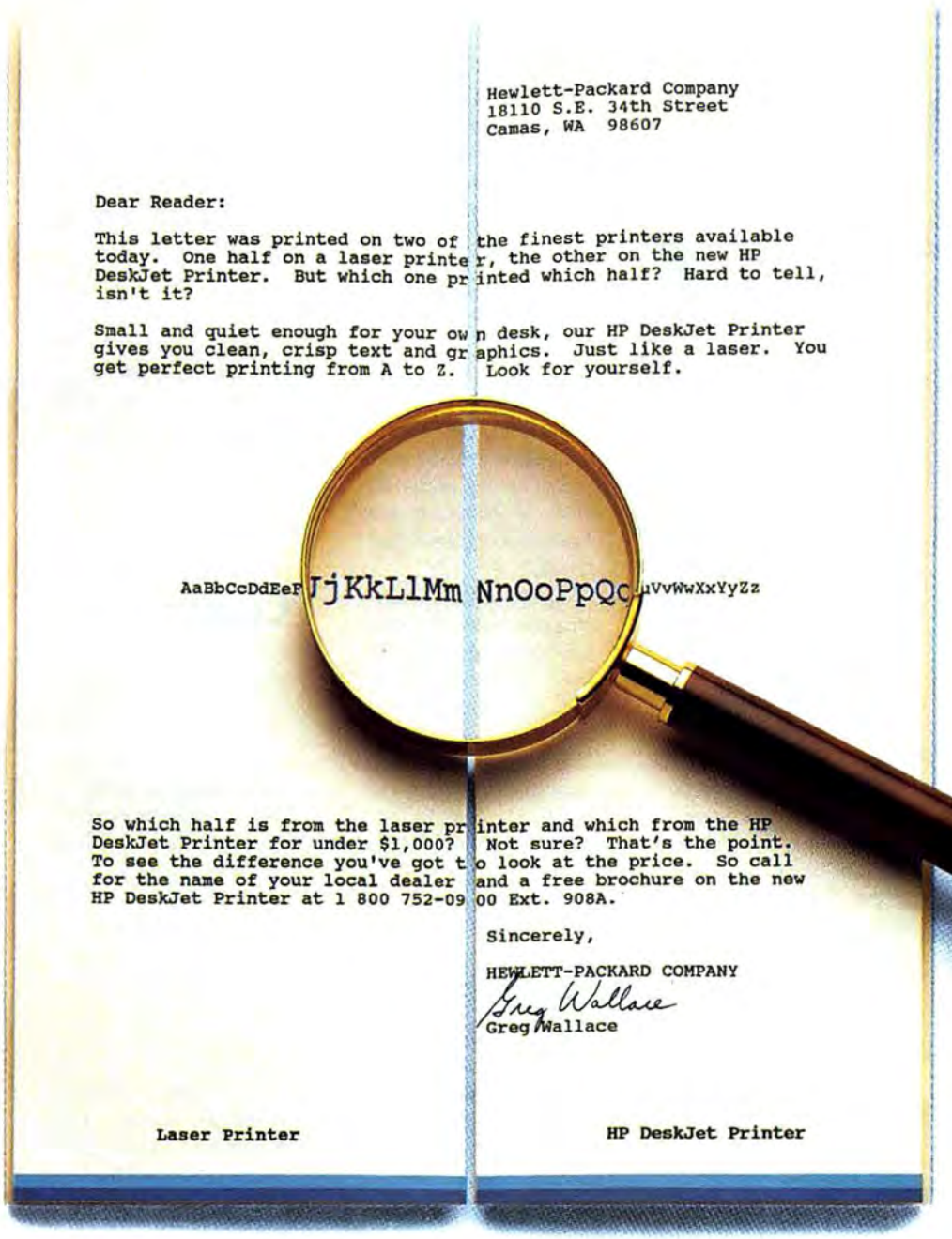
we never stop asking "What if..."

If you can see the difference, you must be looking at the price.



The New HP DeskJet Printer. Laser-Quality Output for Under $1000.

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Circle 29 on reader service card

Training in Store for Customer Support

Personnel Turnover Challenges Training Efforts

Dealer support amounts to trucking your new equipment to your car, telling you they've never heard of the problems you're having, and returning your call (if you're lucky) to give their interpretation of what manufacturer support has told them, usually several days after you've bypassed or solved the problem."

Thus Jim Hansen, publisher of *E. W.'s Computer Almanac*, sums up a common view of after-sale support by computer stores. However, the big chains acknowledge their shortfalls, and they emphasize an ongoing battle to overcome them by training.

When hiring personnel, the chains hope to find people with industry experience who understand the products and have basic selling skills, says Victor Leventhal, senior vice president for marketing and sales at ComputerLand. "But that's easier said than done in our industry," he admits wryly.

Once hired, employees may be eligible for a range of training services. Entre Computer Centers, for example, supplements basic operational, sales, and technical support courses with in-depth schooling on vertical markets such as computer-aided drafting, notes Kathy Cavanaugh, director of service and training.

Obviously, product suppliers make or break dealer training efforts. "We have very good support from our vendors," says Cavanaugh. In hardware, "a majority of the technical training is done by the vendors, because most of them require that training."

IBM upped the ante last April, notes Ned Lautenbach, head of its National Distribution Division. "We asked every one of our dealers to send all their salespeople to five days of training on the PS/2, and their technical people to ten days of training." Roughly 11,000 employees participated last year, and a few thousand more are being trained in 1988, he says. "It's the right thing to do, and it differentiates those people from others."

"The vendors are tightening the screws, and they should," says Leventhal. "The problem is that it becomes expensive for the stores." Even if vendors pay the training costs from the promotional funds they allocate to dealers, valuable personnel are out of the store, he points out. But Leventhal applauds the trend.

Major software firms, who don't place the same kind of requirements on their resellers, do work very closely with the big chains. "The high-end, support-oriented dealers have spent a lot of money building technical support staffs," notes Marty Falaro, Lotus's national sales manager for the retail channel. "We put our customer support people together with theirs."

Some chains, like Businessland, "would rather that the customer call them," Falaro points out. Lotus handles 400,000 hot-line calls a year, and it's glad to share the burden.

The industry's massive turn toward an outbound sales force has helped to improve support. "Computer stores kind of got a bum rap," maintains Jeffrey McKeever, president of MicroAge. "It's difficult to staff a retail store with knowledgeable personnel who are able to handle vertical-market questions off the shelf. You can't get high-level people standing behind a retail counter."

But the plague of personnel turnover shows no sign of diminishing. "That's a real issue for the entire industry," says Leventhal. "The turnover is pretty dramatic. It's a continual problem, particularly in the technical area—when you're trained, you're a pretty hot commodity." —*E. B.*

Clones

(continued)

counterparts, reducing training time but raising the issue of look-and-feel liability. "The look and feel is close enough to please corporate buyers," concludes Reynolds, "but not close enough to put us in legal jeopardy."

PCsoft is a spin-off of USCS, a 3-year-old repackager of about 4000 public domain PC, Macintosh, and CP/M programs. Reynolds, former sales director for Kaypro Computer, claims a dealer base of 700, including college and retail bookstores. PCsoft programs won't take sales from the best-sellers, he maintains, because they will be sold as after-market impulse buys at retail or to corporations and schools that would forgo multiple purchases of the originals. —*Mike Hogan*

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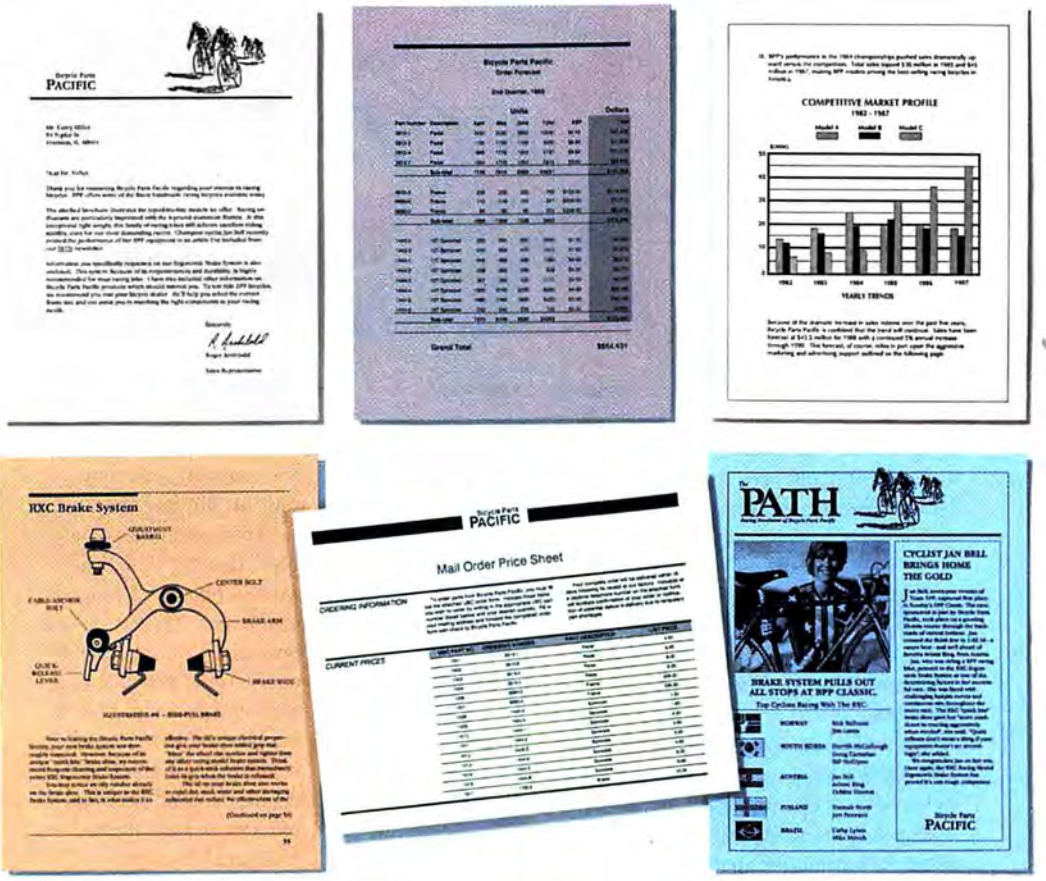

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Javelin Attempts Comeback

Hard Times for High-Profile Entry

Two-and-a-half years after launching its namesake as the financial analysis tool that would replace the spreadsheet, Javelin Software has found itself falling far short of the market. The company continues to slowly refine its offerings and to look for investors to help it keep flying.

Last summer the Cambridge, Massachusetts, vendor introduced *Javelin Plus*, which added powerful data base functions and the ability to accept what Javelin describes as "snap-in building blocks." Recently, Javelin unveiled a developer tool kit and three building blocks—for importing *1-2-3* ranges from within *Javelin Plus*, importing communications and financial data, and calculating loan amortizations. The company is also marketing two templates —one that provides basic financial modules for small business accounting, and another that analyzes stock market opportunities.

But last year when investors looked at the opportunities in Javelin's own initial public offering, they saw a $4 million firm whose profitability was marginal at best. In the two years following *Javelin*'s glitzy October 1985 debut, the company sold only slightly more than 50,000 copies, slashed pricing from $695 to $99.95, and laid off most of its sales force.

The public offering was withdrawn even before last October's market meltdown. When Javelin began calling up its own customers in an effort to find backers, rumors began to spread that the company was collapsing. The gossip increased as Javelin employees applied for positions elsewhere and the company proposed several creative approaches to paying creditors.

"I think they're dead," says Jeffrey Tarter, publisher of *Soft-letter*. "A lot of their investment is in the form of debt. Anybody interested in buying the company will simply wait until it goes under."

Tarter and others suggest, though, that the *Javelin* line itself remains promising. "There's a real potential to come in and position the product as a high-end financial modeling environment; to sell it for a couple thousand dollars to chief financial officers and corporate planners," he says.

But Javelin chairman Robert Firmin ignores that advice and angrily rejects the scuttlebutt about business failure. "The likelihood of investment is unpredictable; you can never count on investors [coming in]," he acknowledges. However, he insists that Javelin is running in the black as the year begins and will have no trouble funding itself out of earnings as long as necessary. *—Eric Bender and Mike Hogan* ●

Ken Greenberg and Eric Brown are contributing editors for PC World; *Mike Hogan is* PC World's *news editor.*

A FEW MINUTES WITH . . .

William Lowe, president, IBM Entry Systems Division:
"OS/2 will be required in the small business and education environments as well as in large accounts. We're interested in encouraging applications that are compliant with the Systems Application Architecture, and we're happy to have other applications that aren't."

Vittorio Cassoni, head of Data Systems Group, AT&T:
"The Micro Channel is not a development issue. To the extent that it becomes a standard, the industry will give us compatibility. The system software platform is the value we add; that's where we're spending our development money."

Victor Leventhal, senior vice president, ComputerLand:
"88 percent of our stores have outbound sales forces. If you're going to wait for in-house sales, you're history in this industry."

Richard Rabins, president, Alpha Software:
"Among the major applications, data base managers show the biggest gap between where customers want to be and where the market leaves them. In the latest spreadsheets, there are features that customers don't even want."

Rich Lyons, president, Corporate Class Software:
"The last thing a financial guy wants to do once he's closed on the numbers is to go into desktop publishing mode. It's like telling him, 'Now you've juggled those four balls, let's see you do it with one hand.' "

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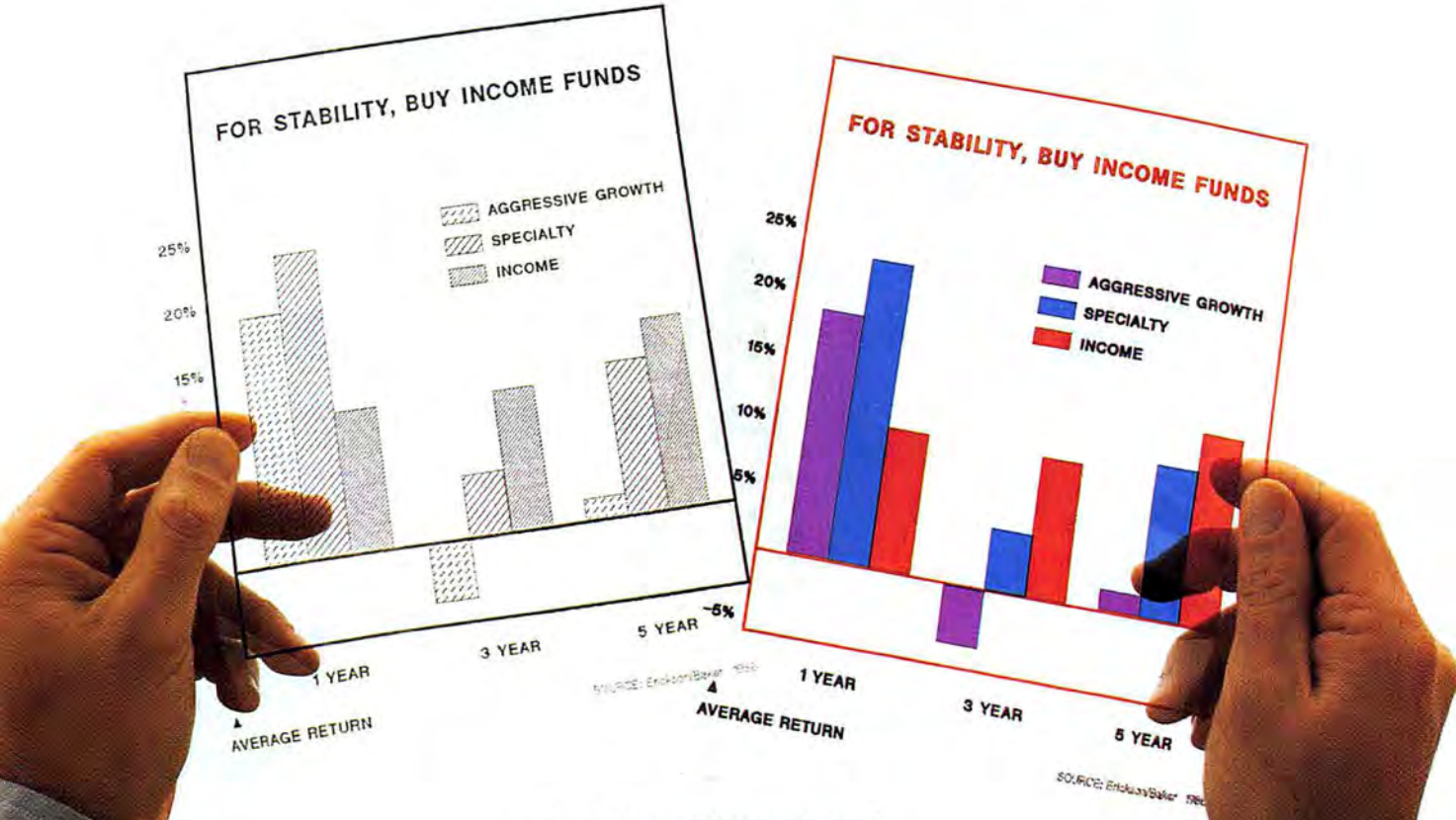
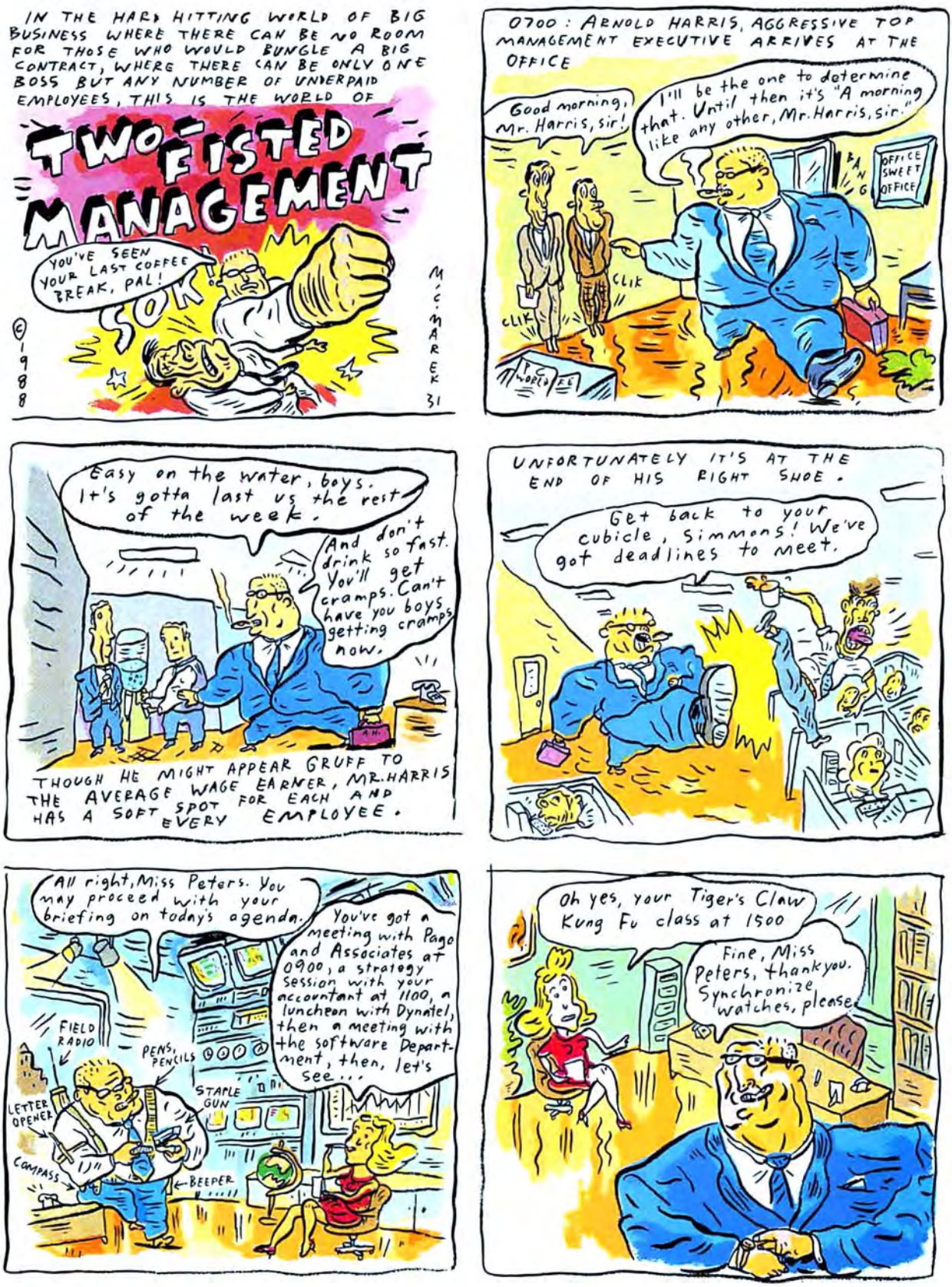


Circle 39 on reader service card

TWO-FISTED MANAGEMENT

Mark Marek



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PRODUCT OUTLOOK

90 **PRODUCT OUTLOOK**

dBASE IV
A new interface and a built-in compiler help Ashton-Tate shake off the *Paradox* blues.

ALR FlexCache 16386 and 20386
Memory and bus enhancements make these 386 powerhouses worthy contenders against the Compaq 386/20.

HP DeskJet
Hewlett-Packard delivers laser-quality output for less than half the cost of a laser printer.

Draw Applause
Move quickly from spreadsheet file to slide presentation with Ashton-Tate's latest graphics package.

Kaypro 286
Passive backplane design holds the promise of a faster future for this AT compatible.

@BASE
dBASE users get the look and feel of *1-2-3* with this new add-in to Lotus.

The Norton Programmer's Guide for OS/2
Don't want to thumb through ten volumes of documentation? Explore the mysteries of the new operating system on line.

98 **BRIEFLY NOTED**

TC921
This upgradable modem starts life at 1200 bps but is bred for higher speeds.

GEM 1st Word Plus
WYSIWYG formatting and a graphics interface distinguish this solid word processor.

The Worksheet Utilities
Funk fills the holes in the *1-2-3* environment with a team of useful programs.

100 **UPDATE**

WordPerfect 5.0
An old favorite blurs the line between word processing and desktop publishing.

SQZ Plus
Turner Hall adds in better compression, data security, and keystroke recording capabilities to its *1-2-3* utility.

TurboTax 5.0
This 1988 edition is built like a 1040 spreadsheet with a mind for the new tax laws.

Tax Preparer
Enter data into the 1040 and this program automatically updates all other necessary forms.

One-Write Plus 2.0
A small-business accounting package geared toward easy setup.

GEM/3, Concurrent DOS XM 6.0 and 386 2.0
DRI boosts the speed of its graphics environment and improves the DOS compatibility of its operating systems.

Mike Hogan

dBASE IV

Put on a Friendly Face

Blame its mainframe heritage or its ambitious scope, but *dBASE* has long had a reputation as one of the least personable programs on computer store shelves. It's also one of the most popular, thanks to the many developers whose applications have helped users make sense of the inscrutable *dBASE* dot prompt.

Now Ashton-Tate's favorite son has a personality all its own. *dBASE IV* is a well-rounded data base management system that is more functional than past versions and a lot easier to use. Some 245 new or enhanced commands make this power language even more powerful, while the addition of a structured query language and a new nonprocedural interface prepare *dBASE IV* for shaking hands with mainframes or making small talk with the PC multitudes.

The new Control Center interface replaces the Assist menu facility of *dBASE III Plus;* more than anything else, the interface resembles the menuing system of Ashton-Tate's *Framework II* integrated program, with pulldown and pop-up menus that you can easily customize using the program's menu-building facility. A series of panels lists all available data base, query, program, report, and label files. Choose one file, and it and all other files associated with it move to the active area of their respective panels. You can quickly toggle between the table (browse) view and the forms (edit) view. If you want to bypass pulldown menus, you can activate a command by hitting the <Alt> key and the first letter of the command.

While PC veterans still take pride in working from the command line, *dBASE IV* is designed to do most of your programming for you. It has a query-by-example facility that lets you select different fields and operations for multifile searches; the program writes the necessary code to complete the search. Ditto for the *dBASE IV* application generator, which lets you match generalized program functions to specific menu choices and automatically builds the necessary pop-up menus. *dBASE IV* also includes a WYSIWYG report generator.

dBASE IV generates pseudocompiled code, so that programs created with it run an average of nine times faster than do past interpreted versions. Although it won't make independently executable .EXE files, the pseudocompiler allows developers to distribute fast-running object files that can be used with a copy of the program or with a run-time module that's sold with the developer's version.

dBASE IV doesn't leave its past behind. The new program is fully compatible with the data bases, forms, programs, and so forth that you may have created using previous releases. All work performed with past versions of *dBASE* runs as is with *dBASE IV* but won't take advantage of its newly added features. The new version also makes it possible to use newly written and even former *dBASE* applications on local area networks without modification.

dBASE IV will be sold in both DOS and OS/2 1.0 versions. It requires 640K and a hard disk; the price had not been determined at press time. Ashton-Tate, 20101 Hamilton Ave., Torrance, CA 90502-1319; 213/329-8000.

ALR FlexCache 16386 and 20386

Built for Speed

The Intel 80386 processor has brought more horsepower to desktop computers than most of us ever expect to need. But if you're one of those people who just have to push the speed limit, you'll be cheered by the advent of two super-fast 80386 machines from Advanced Logic Research.

ALR knows that putting a Porsche engine in a Volkswagen will give you a fast Volkswagen; Porsche performance must be built from the ground up. A fast processor is just the starting point for the ALR FlexCache 16386 and Flex-

ALR's FlexCache 16386 (left) and FlexCache 20386 are 16-MHz and 20-MHz systems, respectively, with customized features to maximize data throughput at every stage of processing.

Cache 20386, which run at 16 and 20 MHz respectively and boast customized features that turbocharge every stage of processing.

Speed improvements start with the dual AT-bus architecture. ALR's Flex Bus provides a direct link between the CPU and 32-bit, 80-nanosecond (ns) dynamic RAM, independent of the bus's AT-compatible input/output channel. This arrangement permits memory calls at processor speed, without sacrificing compatibility with the large installed base of 8-MHz enhancement boards.

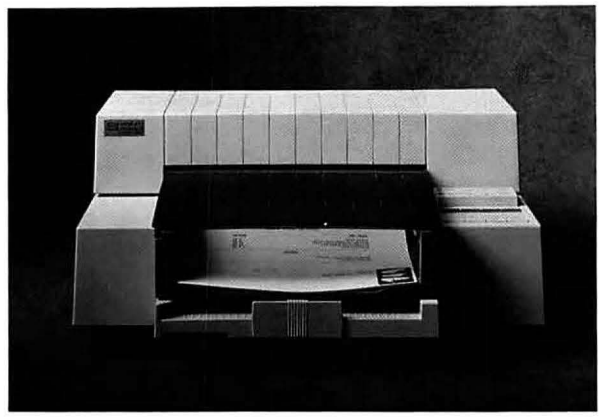
In addition, like Compaq Computer's latest 80386 desktops, the ALR FlexCache 386s exploit the Intel 82385 cache memory controller with 32K of 35ns high-speed static RAM. By holding frequently used data in the cache, the ALR machines reduce the need for the CPU to address main memory, eliminating CPU wait states 95 percent of the time.

ALR claims that the combination of these two features increases processing speed 50 percent over 386s not similarly equipped. Both machines also support an Intel 80387 coprocessor.

Moreover, the high-powered processor won't have to wait for input/output functions to catch up. ALR's architecture moves BIOS and EGA functions into 32-bit memory to speed up routines. It also features extremely quick hard disks; even the smallest has 30ms access and a 1:1 interleave hard disk controller with an effective data transfer rate of 650 kilobits per second. ALR offers 66MB and 100MB hard drives on its FlexCache 16386 and 100MB, 150MB, and 300MB drives on its FlexCache 20386. In addition, ALR's 150MB and 300MB hard disk models are equipped with an ESDI controller with 16K worth of data buffering, to reduce disk access time to 23ms and boost throughput to a scorching 779 kilobits per second.

Particularly well suited for use as network file servers or CAD workstations, or to process very large data bases or worksheets, the FlexCache desktops come with 1MB of 32-bit RAM expandable to 2MB on the system board and to 10MB with memory cards. Both machines offer two 32-bit FlexCache memory slots, as well as four 8/16-bit and two 8-bit slots. Also standard is a 1.2MB 5¼-inch floppy drive and simultaneous support for an optional 1.44MB 3½-inch drive. Neither monitor nor video controller is included.

The base price of a 16386 with a 66MB hard drive and 200-watt power supply is $4690. The 20386 with a 100MB hard drive and 220-watt power supply sells for $6490. Advanced Logic Research, 10 Chrysler, Irvine, CA 92718; 714/581-6770.



HP's Deskjet brings letter quality text and full-page 300-dpi graphics to your desktop for $995, half the price of the cheapest laser.

HP DeskJet

Leader of the Jet Set

While laser printer prices have been falling fast, most customers still find it hard to justify a laser except as a shared resource. But thanks to Hewlett-Packard, you may no longer be forced to stand in line for letter quality text and full-page graphics. HP's 300-dot-per-inch ink jet printer brings those capabilities to your desktop for $995—half the price of the cheapest laser.

Actually, that pricing pits the DeskJet against 18- or 24-wire dot-matrix printers selling for $700 to $1100. For a few dollars more or less, the 80-column DeskJet can print drafts as fast as dot matrix devices (240 cps). It also can produce letter quality compositions faster (120 vs. 80 cps) and at higher resolution (300-by-300 vs. 180-by-360 dpi). Its quiet 44db demeanor and small footprint (17.3 by 14.8 inches) are likely to gain new ground on the desktop for nonimpact technology.

A revamped ink formulation in HP's patented printhead/ink cartridge lets the DeskJet print on plain paper. But the DeskJet has 50 ink nozzles, compared to 12 on the company's ThinkJet and QuietJet printers, and a small cap/wiper that prevents clogging. The $18.95 DeskJet printhead/ink cartridge can print 1100 draft pages—two to three times as many as the ThinkJet—or 450 letter quality pages before running dry.

The DeskJet ships with Courier, Courier Bold, and Courier Compressed fonts. Twelve optional fonts are available in a variety of typefaces, sizes, and styles in twelve cartridges with various combinations of at least four of the fonts on each. Font cartridges sell for $75 to $125. A downloadable font with universal character sets is available for $95.

While the DeskJet can print a full page of graphics without memory, different amounts of memory must be added for soft-font selections at $150 for

WE'VE JUST MADE THE BEST EVEN Better

Peachtree Complete II: The Business Accounting System

New

The success story of Peachtree Complete (now with over 200,000 users) continues with the newest member of the Peachtree family, **Peachtree Complete II.** Much more than just an update, Complete II builds upon the comprehensive features that have made Peachtree the leader in small business accounting software for nearly ten years. We've added many exciting new features and designed state-of-the-art methods for using the packages. The result—all eight modules are even more powerful and easy to use, yet still priced at **just $199**—a 96% price reduction from the original $4,800.

Windows and Pop-Up Menus. Complete II is designed for user convenience. Use the cursor throughout the system to make easy "point-and-shoot" selections. If you can't remember a customer or account number while using a program, simply open a window and scroll through your customer list or chart of accounts. Select the information you're looking for directly from the table!

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Quick-and-Easy Error Handling. Complete II traps errors and gives a plain-English description of the problem along with suggested solutions.

Range Printing. Print all information on a report or select a specific range of information for print out. A great feature for restarting long reports or partial printing of certain sections.

Easiest Installation Ever. Enter your company's information once and it is reflected throughout the system. Complete II includes a separate Installation Guide, basic Accounting Primer, eight-volume Reference Library and extensive Tutorials on each package — **all at no extra charge!**

Ideal for Service Businesses. Enter information free form on service invoices or store pre-defined paragraphs of up to 160 characters. Enjoy full editing capabilities at time of invoice entry.

Eight Integrated Software Modules

- General Ledger
- Accounts Receivable
- Invoicing
- Accounts Payable
- Inventory
- Fixed Assets
- Job Cost
- Payroll

Complete II includes eight software modules that may be integrated or installed individually and may be distributed among separate computers. Install the most critical modules initially; add others later.

COMPARE FEATURE FOR FEATURE

System-Wide Features
NEW Over 450 reports
NEW Unlimited number of companies and consolidations
NEW Automatic menu-driven conversion of your existing Peachtree Business Accounting data files
NEW Increased numeric capacities to $999,999,999.99 in key areas

General Ledger
- Chart of Accounts includes 76 suggested and 26,000 user-defined accounts

NEW 1 to 13 user-defined fiscal periods
- Repeating journal entries

NEW Financial statement comparisons may include current period and year-to-date with budget and/or prior period comparison
NEW Reversing journal entries

Accounts Receivable/Invoicing
- Open item or balance forward customers

NEW Up to 14,400 customers
- Supports partial payments

NEW User-defined terms codes and aging periods
NEW Automatic transactions with monthly, bi-monthly, quarterly, semi-annual, and annual frequency options

Accounts Payable
- Up to 14,400 vendors

NEW Partial payments of invoices
- Cash requirements forecasting by due date

NEW User-defined billing cycle on automatic invoices
- Checks printed with unlimited invoice listing on stub

NEW Ability to void and reprint checks

Inventory
- Supports average, last purchase and standard costing methods
- Up to 19,500 inventory items (SKUs)

NEW Automatic price change on multiple items by percent or amount

Fixed Assets
- Handles 13,000 assets and 13 methods of depreciation

NEW Updated to handle current tax laws

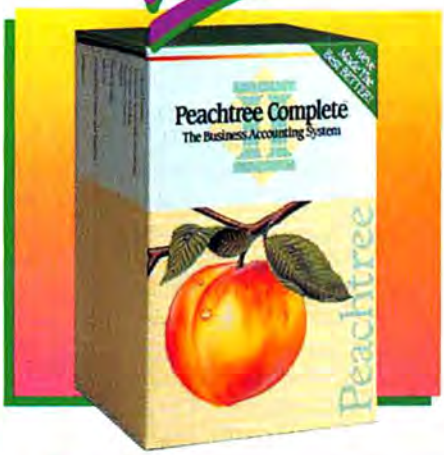
Job Cost
- Tracks costs and profitability on a job-by-job basis
- Compares estimated costs with actual costs for specific tasks

Payroll
- Built-in current year federal, state, city and county tax tables for all 50 states with automatic calculation capabilities
- Automatic payroll processing supporting hourly, salaried, commission or draw-against-commission pay types

NEW New tax laws incorporated into program
- Processes up to 3,900 employees

NEW Supports Cafeteria Plan
- User modifiable tax tables with updates published regularly by Peachtree Software

NEW Printed and magnetic media W-2s generated automatically



Money-Back Guarantee

When you purchase Peachtree Complete II directly from Peachtree Software, you're protected with a 30-Day Money Back Guarantee. If you're not satisfied, simply return the product in saleable condition within 30 days and your purchase price will be promptly refunded. (A $20 restocking fee will be charged if disk bag is opened.)

And, of course, Complete II is backed by Peachtree Software's famous technical support, labeled by *InfoWorld* as "the finest in the industry". Technical assistance is available for $1 per minute with a 20-minute minimum via a toll-free telephone number. You only pay for what you need, without unnecessary support contracts.

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Hardware Specifications
Requires PC/MS-DOS version 2.0 or higher with 384K of usable memory with a minimum 10 MB hard disk. For use with the IBM® PC, PC XT, PC AT, Personal System/2™ and compatibles. 3½" media optionally available. IBM is a registered trademark and Personal System/2 is a trademark of International Business Machines. Not copy protected.

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Circle 144 on reader service card

each 128K cartridge. An Epson FX-80 printer emulation cartridge costs $75. A 16K buffer, a Centronics parallel interface, and an RS-232C serial interface are standard.

The printer also is equipped with a 100-sheet cut-sheet feeder that can accommodate letter, legal, and European A4 paper sizes as well as manually fed #10 business envelopes. Inquiries Manager, Hewlett-Packard, 1820 Embarcadero Rd., Palo Alto, CA 94304, or local HP sales office or dealer.

Draw Applause

Drawing Applause

Recent improvements in graphics adapters, monitors, and output devices are lifting presentation graphics to new heights, and products like Ashton-Tate's *Draw Applause* are putting on a dazzling show from the higher platform.

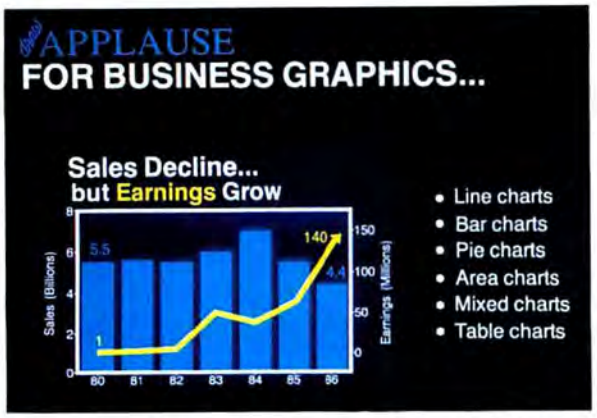
A fully integrated presentation graphics system that combines business graphics with freehand drawing and text or organization charts, *Draw Applause* hums along with EGA hardware, but it really sings when given access to the VGA's higher resolution and broader color selection.

Ashton-Tate's first graphics entry since the company acquired the graphics line of Decision Resources, *Draw Applause* departs from the menu-driven interface of the earlier *Master* series. Instead, it uses a window for each of its three modes—number charts, text charts, and drawing—with pulldown menus and support for keyboard, mouse, and graphics tablet commands. What you see is what you get—and quickly.

Draw Applause offers a full selection of standard bar, line, pie, and mixed charts that can be exploded or displayed in 3-D. Creating text charts is as easy as clicking on one of eight preformatted templates; you can customize these at will. Simply fill in the blanks or make up your own word chart variations, which you can save as standard chart forms.

You can create Gantt or organization charts in the draw window or transfer them from other Ashton-Tate products, since *Draw Applause* is file compatible with *Sign-Master*, *Diagram-Master*, and *Chart-Master*. It also reads *1-2-3* .WK1 files, Computer Graphics Metafiles, files from Lotus's *Freelance*, and Software Publishing's *Harvard Presentation Graphics*, as well as *dBASE* .DBF files.

Though aimed at the business user, *Draw Applause* also may appeal to graphic artists. Among other tricks, the package can create text spirals and array up to 40 gradations between neighboring colors for a rainbow or sunset effect. Five predefined color palettes offer 16 simultaneous colors from a choice of 64 under EGA and 64 from a selection of 256 under VGA. You can specify a slide's HSI (hue, saturation, and intensity) value for more precise color identification and up to 16 million color possibilities.



Ashton-Tate's new Draw Applause is a VGA graphics system that combines business graphics with text/organization charts and freehand drawing.

As the name implies, *Draw Applause* emphasizes the "presentation" in presentation graphics. Its built-in link to Ashton-Tate's new Master Graphics Express service lets you send a graphics file via modem and get one-day turnaround for developing slides, transparencies, and prints. The package offers a limited slide-show capability that will be enhanced later this year with the addition of a screen capture facility.

Draw Applause requires 640K of RAM and a hard disk and sells for $495. Ashton-Tate, 20101 Hamilton Ave., Torrance, CA 90502-1319; 213/329-8000.

Kaypro 286

Upgrade to First Class

Computer hardware technology has been flying along at such a clip that people who think they're buying first-class tickets sometimes find themselves sitting in coach.

Vendors offer half a dozen speeds to choose from among AT compatibles and a growing number of 80386 machines as well. If you're having trouble making up your mind, Kaypro Corporation offers an 80286-based computer that lets you take a seat in business class today and upgrade to a faster 286 or first-class 386 machine when you're ready.

Rather than building the processor into the motherboard, the Kaypro 286 plugs processor, memory, and enhancement boards into a vertical panel in the back of the

Disk Optimizer™. The original un-fragment software now has un-format. Un-believable!

It's still the safest, most effective way to put the zip back in hard disk performance.

For more than two years now, Disk Optimizer has helped PC users everywhere safely restore and maintain the smooth, slick, fast performance of their hard disks.

And now there's a new and improved Disk Optimizer that un-fragments files even more effectively. And includes enough additional disk management tools to make it one of the best software values anywhere.

So, who needs Disk Optimizer, anyway?

Simply everyone who owns a hard disk and relies on the speed and convenience it gives them.

That's because DOS is constantly slowing your hard disk down. It does it by breaking files up into pieces. Storing different chunks in different places. And that makes everything slower – loading, sorting, retrieving, backing up – because your hard disk has to chase all around to read and write different pieces of your file.

Disk Optimizer restores the speed of your hard disk by putting files back together in one contiguous piece – where they belong.

Disk Optimizer is absolutely, positively "disaster proof."

It's sad but true. Some other un-fragmenting software could lose your data if something goes wrong in the process. Like a routine reading or writing error. Or even a power failure.

But have no fear with Disk Optimizer. Nothing will go wrong because nothing *can* go wrong. Even if you yank the plug from the wall in the middle of the program. It's because only Disk Optimizer copies each file, piece by piece, then checks the newly un-fragmented version for completeness. Only then does it go back and erase the fragmented version. Not power spikes, disk failures or DOS errors – not even earthquakes – can cause data loss. And only Disk Optimizer makes you that promise. So why trust your disk to anyone else?

It's like a precision tune-up for your disk.

In addition to un-fragmenting, Disk Optimizer also lets you quickly choose the optimum layout for your disk. So your most-used files have the fastest access. And program and other unchanging files can be permanently un-fragmented and set aside on their own area on the disk.

The simple menu makes it a snap.

Un-format – one of the powerful new reasons to buy Disk Optimizer

Oops! Make a simple mistake at the keyboard and you could wipe out your hard disk with a DOS Format command. But don't worry. "Un-format" will recover your entire disk, and all your data, in just moments. It's included with your new Disk Optimizer.

Plus, you get the new "Analyze" program with a graphical display that shows your disk's condition so you'll always know when it's time to optimize again. You also get "Sorts" for organizing directories for the best appearance and sequence. "Findfile" for searching out hard to find files. "Delfile" for locating and erasing unwanted files. "Lock" and "Unlock" for file security. And more.

You could spend hundreds on other utilities and still not get all the functionality packed into Disk Optimizer at no extra charge.

Use it once and you'll discover what nearly 200,000 users already know – $69.95 is a small price to pay for the speed, convenience and safety you get only with Disk Optimizer.

Look for the new Disk Optimizer at software dealers everywhere. Or order directly from SoftLogic Solutions by calling us toll-free.

Just a few of Disk Optimizer's rave reviews:

Selected PC Magazine's "Best Of The Best" utilities.
–June 1987

"I find Disk Optimizer excellent. Disk access, even at 4.77MHz, is much faster. And loading 100 Fontasy fonts now takes seconds."
–Elizabeth Joan Doyle, Indiana

"I feel this is essential software for anyone with a hard drive."
–D. Sorenson, Texaco, California

"Easy to install, use, and most importantly, it works!"
–Dan Neilsen, General Electric Information Systems, NY

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1-2-3 is a registered trademark of Lotus Development Corporation.

Circle 18 on reader service card

box. This passive backplane, or slot technology, architecture lets you buy a minimal configuration now and add a faster processor board or denser memory cards in the future.

The $2995 Kaypro 286 ships with a 286 processor card that's switch-selectable from 6 to 12 MHz, a 1MB memory card (with 640K of linear and 384K of expanded memory) that can be expanded to 16MB, a hard disk controller, and an EGA-compatible graphics adapter that also can display MDA, CGA, and Hercules-compatible graphics. Two 8/16-bit and three 8-bit slots are available for expansion. Also standard are a 1.2MB 5¼-inch floppy drive, a 40MB hard drive with 38ms access time, a 12-inch monochrome display, a 101-key enhanced keyboard, a 160-watt power supply, a parallel port, and a serial port.

In keeping with company tradition, the Kaypro 286 comes bundled with DOS 3.10, GW BASIC, *WordStar Professional 4*, *SpeedStor*, the *Word Finder* thesaurus, and Kaypro's own *Masmenu* tree menu/DOS shell. Kaypro Corp., 533 Stevens Ave., Solana Beach, CA 92075; 619/481-4300.

@BASE

Best of Both Worlds

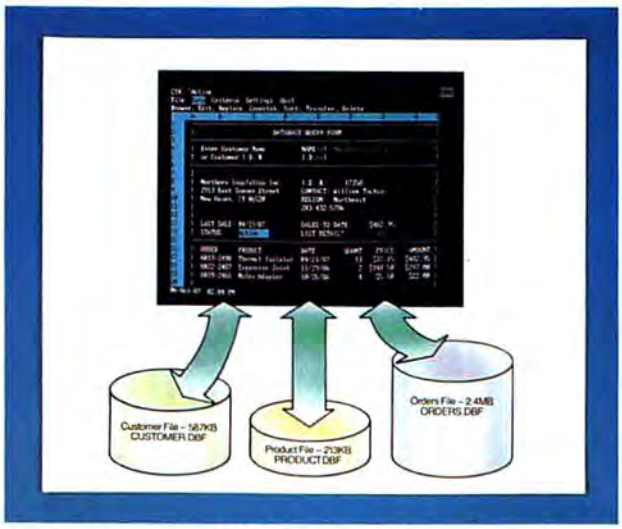
It's hard to beat the analytical power of a spreadsheet—its unique ability to convey great amounts of information at a glance. But it's also nice to have a full-featured data base manager and the convenience of being able to store most or all of your data in a single, readily accessible location. The setup is even better if it also avoids memory cram by exploiting disk-based data bases.

If you use *1-2-3* or a compatible package, you can now get all this without leaving the comfort of your worksheet interface. Personics Corporation's *@BASE* is almost like having *dBASE* tamed and tailored for your worksheet.

A *1-2-3* add-in whose menu appears at the touch of its <Alt>-<F8> hot key combination, *@BASE* lets you pass data back and forth between your data base and multiple worksheets using its own *dBASE*-like @ functions. You can browse, sort, edit, or perform any other familiar *dBASE* function with *@BASE*, including setting up criteria similar to *dBASE* filters for relational searches on up to ten files. *@BASE* offers table, form, and cross-tab views.

Using *@BASE* to dump data to disk makes it easier to break up those memory-busting worksheets into smaller units that share data between them. A macro containing *@BASE*'s @DBUpdate command can automatically update your data base, which is normally protected from accidental change by the program's file locks.

@BASE reads and writes *dBASE* .DBF files directly and will convert other data base or Lotus .WK1 files. Compatible with *1-2-3* release 2 and later, *@BASE* sells for $195 and requires 72K of system memory plus 8K for each open data base file. A hard disk is recommended. Personics Corp., 2352 Main St., Concord, MA 01742; 800/445-3311.



Personics Corporation's @ BASE is a 1-2-3 add-in that lets you pass data back and forth between your data base and multiple worksheets using its own dBASE-like @ functions.

The Norton Programmer's Guide for OS/2

OS/2 Badge of Courage

The new Operating System/2 is software of heroic proportions, and it's attracting droves of stout-hearted programmers seeking the rewards of increased memory addressability and multitasking. Your test of courage comes when you try to exploit a new OS/2 function and first must face the ten volumes of Microsoft OS/2 documentation that detail the route of your quest.

That's when it's nice to have *The Norton Programmer's Guides* on your side—whether you're a professional programmer or a hobbyist. The latest in the company's programmer reference series, *The Norton Programmer's Guide for OS/2* takes up an equally heroic 1MB on your hard disk. But at least this data is on line; you can quickly search by topic through any of the OS/2 documentation, so you don't have to wander back and forth between indexes and page references.

Designed for first-time authors of new applications as well as those porting current DOS applications to OS/2, *The*

Now make brilliant projections in minutes with PalettePlus.

Polaroid introduces an instant, high resolution PC presentation system for under $3,000.

Now you can get professional, full frame 35mm slides right off your PC.* And you can do it all in house, in color and in minutes.

As its name suggests, PalettePlus allows you to "paint" your slides any color you want for emphasis or impact. And you can preview the image in full color right on your PC screen before making the finished slide.

The PalettePlus system includes a high resolution computer image recorder, Polaroid 35mm Instant Slide System and print film camera – everything you need to make instant 35mm slides, prints and overheads right at your desk.

With new PalettePlus, you can now get the high resolution, without the high price. *PC Magazine* named it Editors' Choice saying, "PalettePlus rates as the most useful, affordable, and versatile..." film recording device on the market.

The entire PalettePlus system costs only $2,999;** and you can make brilliant slides with it for as little as 60¢ apiece. And PalettePlus comes with a 21-day satisfaction guarantee.

For more information and the name of the PalettePlus dealer nearest you call toll-free **800-343-5000**, 8 a.m. to 8 p.m. Eastern Time.

For more information, mail this coupon to Polaroid Corporation, Dept. 661, P.O. Box 5011, Clifton, NJ 07015.

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☐ Please send me more information.

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State _____ Zip _____

Telephone _____

PC make and model _____

*IBM or compatible PC equipped with an EGA or CGA board.
**Suggested list price.
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Polaroid

Circle 148 on reader service card

Guide for OS/2 includes programming examples, hints not found in the documentation, and aids such as a DOS-to-OS/2 command conversion table.

The package covers all four OS/2 function groups—keyboard, mouse, video, and DOS system and file services. A reference section offers an introduction to OS/2 features such as piping, protected mode, and interprocess communications between two programs running simultaneously. Also included are sections on multiple-variable data structures, ANSI escape sequences, and input/output control functions.

This package incorporates the *OS/2 Kernel API Data Base* and the standard *Norton Guides Engine* that drives the other Norton references. A memory-resident program, the *Engine* features six pulldown menus for accessing short descriptions of the subject matter, which then can be expanded to longer discussions. While the *Guide for OS/2* data base occupies 1MB of disk space, the *Engine* requires only 72K of RAM. The complete package sells for $150, while those who already have the *Engine* can buy the OS/2 offering for $100. The package runs under DOS and OS/2. Peter Norton Computing, 2210 Wilshire Blvd. #186, Santa Monica, CA 90403-5784; 800/451-0303, 213/453-2361.

BRIEFLY NOTED

TC921

Telenetics Corporation is offering its upgradable TC921 modem, which you can buy as a 1200-bps modem and mail back to the company later for conversion to 2400- or 9600-bps capability. The modem comes in three designs—a stand-alone version; a half-size plug-in card for PCs, ATs, and compatibles; and a full-size card for IBM Micro Channel–equipped PS/2 computers.

All versions incorporate the Microcom Networking Protocol (MNP) error correction standard and are 100 percent Hayes compatible during 1200- and 2400-bps operations. The MNP protocol includes automatic error detection and retransmission of data at speeds of up to 9600 bps.

For $125, Telenetics will change the transmitter and receiver chips of your 1200-bps TC921 to make it operate at 2400 bps. An upgrade to 9600 bps, which costs $900, requires the addition of a board with receiver, transmitter, and analog circuitry compatible with the CCITT V.32 protocol.

The TC921 1200- and 2400-bps versions sell for $595 and $695, respectively, about $100 less than comparable Hayes modems. The 9600-bps version costs $1695, compared to a $1300 Hayes V-series, but is full-duplex rather than half-duplex, allowing data to be transmitted in both directions at once. Telenetics Corp., 895 Yorba Linda Blvd., Placentia, CA 92670; 800/826-6336, 800/822-4267 in California.

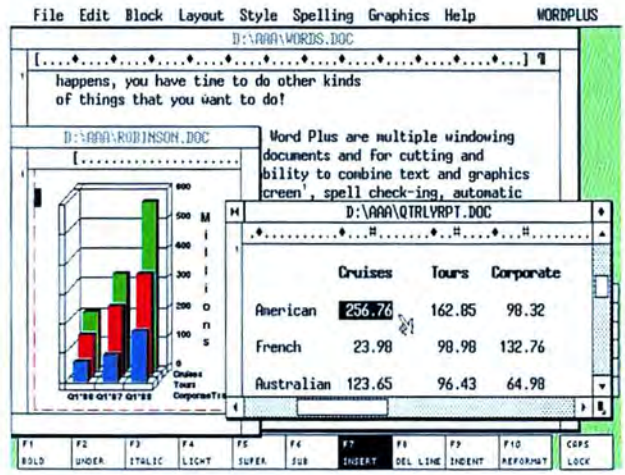
GEM 1st Word Plus

If you are a user of the *GEM* graphics environment, or would like to be, Digital Research has a word processor for the recently polished *GEM/3*. *GEM 1st Word Plus* is a what-you-see-is-what-you-get word processor, in which formatting characteristics such as boldface or italics appear on the screen as they will print.

You can point and click on pulldown menu commands with a mouse or enter them from the keyboard. Up to four windows can be opened simultaneously, and each can be sized and moved. You can cut and paste text and graphics—including charts, maps, line art, clip art, and scanned images from other *GEM* programs—from as many as four documents in the windows.

GEM 1st Word Plus includes most popular text-editing capabilities, including automatic hyphenation, left and right justification, and sophisticated search-and-replace capabilities. Formatting preferences can be saved in a style sheet on disk. The software has an onboard spelling checker with a 40,000-word dictionary and a mail merge feature that will accept names and addresses from most popular data bases, including *dBASE*.

GEM 1st Word Plus, which requires 512K, is compatible with *GEM Desktop Publisher*, *Ventura Publisher*, and other desktop publishing software. It has a suggested



GEM 1st Word Plus is a what-you-see-is-what-you-get word processor with windowing capability made especially for Digital Research's GEM/3 graphics environment.

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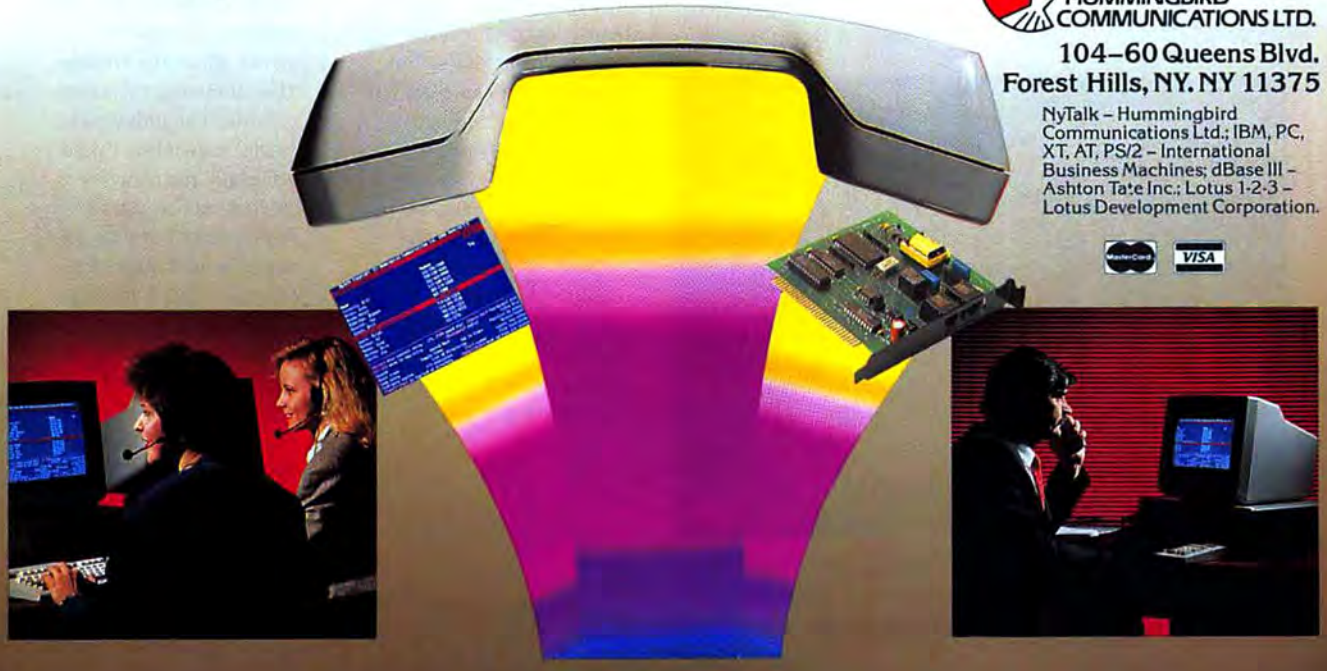

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retail price of $199 and includes a free copy of *GEM/3*, *GEM Paint*, and the *GEM Desktop* utility package. Digital Research, Box DRI, Monterey, CA 93942; 800/443-4200.

The Worksheet Utilities

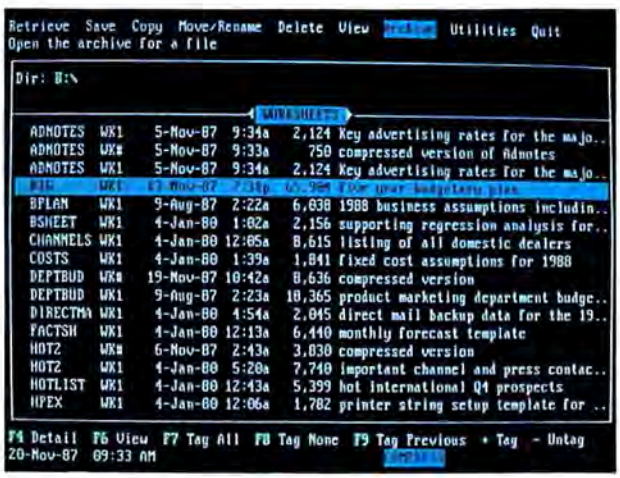
Funk Software, publisher of the popular *Sideways* worksheet-printing utility, has put together an add-in bundle called *The Worksheet Utilities* that expands the usefulness of *1-2-3* and compatible spreadsheets.

The Worksheet Utilities incorporates the features of both a tree-structured file manager and a DOS shell. You can get a quick read on your worksheet files, attach descriptions to files, and perform familiar DOS functions such as copy, move, or rename. You also can compress files.

The Worksheet Utilities offers a pulldown menu of @ functions complete with explanations. You can point to and pick your formulas and edit them from a multiline display that shows up to 240 characters of a formula, rather than the 80 available in *1-2-3* alone. Formulas are checked for errors automatically.

A print utility lets you design and name different print-setting sheets that specify margins, font, page length, and so on. This utility also offers a print setup string library containing scores of often-confusing escape code sequences for popular printers.

Taking a cue from word processors, *The Worksheet Utilities* has a search-and-replace function that will find formula elements, labels, or cell values. Its auto-save feature backs up work in progress. The $99.95 program requires 384K (counting space for *1-2-3*); a hard disk is recommended. Funk Software, 222 Third St., Cambridge, MA; 617/497-6339.



Funk Software's new add-in, The Worksheet Utilities, expands the usefulness of Lotus 1-2-3-compatible spreadsheets by adding file management, cell management, and enhanced printing capabilities.

UPDATE

WordPerfect 5.0

WordPerfect Corporation has added powerful desktop publishing features to its popular word processor, expanding format options and offering better management of text/graphics combinations. *WordPerfect 5.0* has five type sizes and a variety of text capabilities, including subscript, superscript, boldface, underlining, redlining, strikeout, and even color for color printers. The software lets you mix formats in a document and, using its new style key, copy the formatting of one portion of a document to another.

WordPerfect 5.0 automatically wraps text around a graphics box placed anywhere on a page and lets you preview how the integrated page will look printed. All keyboard control functions are programmable—for example, you can reassign <F1> as the help key or program the *WordStar* cursor-control diamond onto your keyboard. A macro editor is included.

Your work group can create a master document, such as a project paper or annual report, linking several files like chapters in a book. Version 5.0 retails for $495. Upgrades from any previous version cost $50. WordPerfect Corp., 266 W. Center, Orem, UT 84057; 801/227-4020.

SQZ Plus

SQZ Plus, the newest version of Turner Hall's data compression utility for *1-2-3* and compatible spreadsheets, squeezes files 30 to 40 percent tighter than the previous version does and provides greater protection from data loss. *SQZ Plus* enables you to back up files from within a worksheet as well as recover files damaged by a bad disk or telephone transmission.

The new version adds an extensive tracking capability. For example, you can create a log of spreadsheet changes under your initials with short remarks about the changes. The automatic keystroke recorder has unlimited "undo" capabilities without heavy memory requirements, so you can restore every keystroke since the last major file operation. *SQZ Plus* also has file-level password protection. The price is $99.95. Turner Hall Publishing, 10201 Torre Ave., Cupertino, CA 95014; 800/556-1234, 800/441-2345 in California.

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For ease of learning we rate Freeway Advanced very good."
Glen Tapanila and Tom Bigley, InfoWorld, Oct. 12, 1987

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Freeway versus Other Communications Software

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FREEWAY Advanced	YES	YES	YES	YES	YES	YES	YES	YES	NO	$139.00
Xtalk XVI	NO	NO	NO	NO	NO	NO	NO	YES	WELL	$195.00
Xtalk Mk.4	YES	NO	NO	YES	YES	YES	YES	YES	WELL	$159.00
Smartcomll	NO	NO	YES	LIMITED	LIMITED	NO	NO	NO	NO	$149.00
MS Access	NO	NO	NO	LIMITED	LIMITED	YES	YES	YES	NO	$245.00

"Freeway and its big brother, Freeway Advanced, are aptly named for communication programs. Both packages, because of their readily learned menu structures, conjure images of tooling down the highway in a sporty car."
Ron White, PC WEEK, Oct. 6, 1987

"The menus and screens are exceptionally well-designed . . . all the features of the best terminal programs available, it lacks neither speed nor efficiency. Best of all, it is easy to use. I was up and running within half an hour of reading the manual."
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TurboTax 5.0

Reflecting changes in the tax laws, the 1988 edition of ChipSoft's *TurboTax 5.0* also incorporates several features that make filling out your taxes faster and easier. Set up like a spreadsheet, the new *TurboTax 5.0* has a quick link to help you find the appropriate supplemental form required to answer a question on the 1040 form.

In addition, the program provides context-sensitive on-line IRS instruction. And after you've completed your return, *TurboTax 5.0*'s data examiner helps pinpoint any omissions. As always, there's an alternative tax worksheet for trying out different filing options and a tax window for checking the tax owed or refund status at any point. *TurboTax 5.0* costs $75. ChipSoft, 5045 Shoreham Pl. #101, San Diego, CA 92122; 619/453-8722.

Tax Preparer

HowardSoft's 1988 edition of *Tax Preparer* can handle more than 300 automatic transfers of information among forms, eliminating many duplicate entries and manual calculations. Once data is entered into the 1040 form, the software automatically completes many built-in worksheets and generates more than 20 of the most popular IRS forms and schedules.

Any numerical changes are reflected automatically throughout all appropriate schedules, and the software automatically checks each entry against the tax code to ensure its correctness. *Tax Preparer* also enables you to play "what if" scenarios with different filing methods, and its new interface features windows and split screens. *Tax Preparer* sells for $295. HowardSoft, 1224 Prospect St. #150, La Jolla, CA 92037; 619/454-0121.

One-Write Plus 2.0

The single-entry accounting package *One-Write Plus 2.0* now installs automatically, requiring no DOS procedures. And if creating a general ledger seems too difficult at first, you can start with any of the other three independent modules—accounts receivable, accounts payable, and payroll—bringing the rest of the modules on line as you're ready.

Moreover, the general ledger automatically sets up a chart of accounts from 14 samples modeled after various kinds of businesses. The general ledger has been expanded to provide more flexibility in reporting periods and prior-period adjustments, as well as increased journal distribution capabilities, optional departmental accounting, and more flexible monthly and year-end closing procedures.

One-Write Plus 2.0 contains an invoicing function. Designed for smaller businesses, the program requires a minimum of 384K for the general ledger, 512K for the other modules, and a hard drive. Each module sells for $250, and upgrades are available for $75 per module. Great American Software, 9 Columbia Dr., Amherst, NH 03031-0910; 800/528-5015, 603/889-5400.

GEM/3, Concurrent DOS XM and 386

Digital Research has upgraded *GEM*, its graphics operating environment, as well as its multiuser, multitasking operating systems, Concurrent DOS 386 for 80386-based systems and Concurrent DOS XM for 8086- and 80286-based computers.

GEM/3 is up to four times faster than previous versions, uses less disk space, and is easier to install and use; it's also both VGA- and Adobe PostScript–compatible.

Concurrent DOS 386 release 2.0 now can run up to 255 DOS applications as well as memory-resident programs on the main system console and up to two on each of 25 serial terminals. DOS 3.30 byte-level record locking is supported for data base applications. Concurrent DOS XM release 6.0 is now compatible with DOS 3.30 and a wider range of DOS applications. Both products are now compatible with IBM's PS/2 computers.

GEM/3 is packaged with each of the *GEM/3* applications. Concurrent DOS 386 release 2.0 and Concurrent DOS XM release 6.0 sell for $495 and $395, respectively. Digital Research, Box DRI, Monterey, CA 93942; 800/443-4200, 408/649-3896. ●

WordPerfect Corporation has added powerful desktop publishing features to its popular word processor, such as the ability to include different fonts in the same document and to automatically wrap text around a graphics "box" placed anywhere on a page.

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My Letters,Numbers,Words *(ages 2 to 6)* . . . 27.
Kids Stuff *(ages 2 to 6)* . . . . . 27.
True BASIC, Inc. ... NCP
RTrigonometry . . . . . 32.
RAlgebra . . . . . 32.

RECREATIONAL

Accolade ... CP *(reqs. graphics brd.)*
RHardball *(baseball simulation)* . . . . . 24.
RMean 18 *(great golf game, CGA or EGA)* . . . 29.
Electronic Arts ... CP *(reqs. graphics brd.)*
Chessmaster 2000 . . . . . 32.
Chuck Yeager's Flight Simulator . . . . . 32.
Grand Slam Bridge . . . . . 45.
Hayden Software ... CP
Sargon III *(requires CGA)* . . . . . 15.

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F-15 Srike Eagle *(requires CGA)* . . . . . 22.
Silent Service *(requires CGA)* . . . . . 22.
Gunship *(requires CGA or EGA)* . . . . . 32.
Microsoft ... CP
□Flight Simulator 2.13 *(reqs. graphics brd.)* . . 35.
Mindscape ... CP *(reqs. graphics brd.)*
□Defender of the Crown . . . . . 24.
□Balance of Power . . . . . 30.
Parlor Software ... CP
□Bridge Parlor *(best Bridge simulation)* . . . . . 49.
Sierra On-Line ... CP
•Leisure Suit Larry *(requires CGA or EGA)* . . . 25.
•Space Quest *(requires CGA or EGA)* . . . . . 33.
•King's Quest III *(requires CGA or EGA)* . . . . 33.
Sphere, Inc. ... NCP
GATO *(submarine simulation, requires CGA)* 12.
•Falcon *(F-16 simulation, reqs. graphics brd.)* 32.
Sublogic ... NCP
Jet 2.1 *(requires EGA or CGA)* . . . . . 33.
XOR ... NCP
□NFL Challenge . . . . . 69.

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(upgrades to 1 Meg or 2 Meg w/Piggyback) 299.
Advantage 2 512k *(for PS/2)* . . . . . 309.
RAMpage! 286 512k *(upgrades to 2 Meg)* 339.
Hot Shot 286 *(10 MHz)* . . . . . 399.
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LQ-500 *(80 column, 180 cps)* . . . . . call
LQ-850 printer *(80 column, 264 cps)* . . . . . call
LQ-1050 printer *(136 column, 264 cps)* . . . . call
LQ-2500 printer*(136 column, 324 cps)* . . . . call
LX-800 printer *(80 column, 180 cps)* . . . . . call
Printer-to-IBM cable (6 feet) . . . . . 15.
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Quattro Goes 1-2-3 Better

Borland's new spreadsheet takes its inspiration from 1-2-3 and adds a few improvements. But will evolution within the standard spell success?

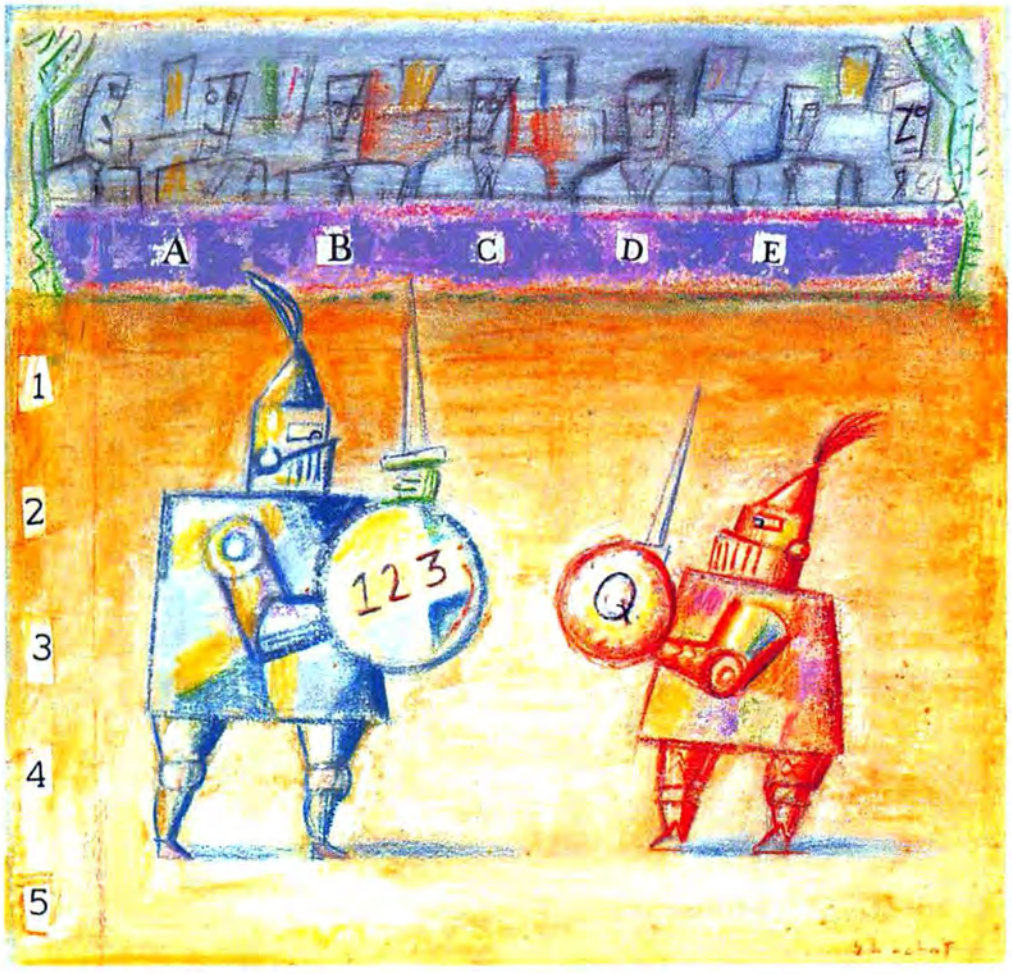
William Urschel

According to one theory of evolution, drastic changes occur in sudden bursts, not in gradual increments. That's the message that dominates Borland's ads for its new spreadsheet: A chimp with a calculator transforms (via ape-men clutching *VisiCalc* and *1-2-3*) into a polished businessman holding *Quattro*. But in fact, not much about *Quattro* is radically different. Like *1-2-3*, it runs worksheet files on a 256-by-8192-cell matrix, offering graphics, a rudimentary data base, and macros. It even works like *1-2-3*, with the slash key bringing up menus listing familiar options. If a clone of *1-2-3* release 2.01 is what you want, *Quattro* may be the ticket.

Borland hopes *Quattro* will derail *1-2-3* with superior speed, more polish, better business graphics, and a lower price. The results, however, are mixed. It's faster than *1-2-3* in some places but slower in others, and it does have polish but also reveals some blemishes. On a more positive note, the graphics are distinctly better, and the price—$195—is a lot lower. In addition, *Quattro* comes with three add-ins: a menu-building utility, a transcript program, and a version of Turner Hall's *SQZ Plus*, the file-compression utility.

Speed at Issue

Quattro's installation process is truly automatic. When you copy the files onto a hard disk, the program adjusts itself to your hardware, sensing the monitor type, coprocessor status, and so on. Installing *Quattro* on four different machines—a vintage XT with a monochrome monitor, a Compaq Deskpro 286, an AT clone with an EGA display, and an IBM PS/2 Model 30—was effortless. You can override the automatic settings, but it's hard to imagine you will need to.



ANDREW SHACHAT

Once installed, *Quattro* loads quickly from a hard disk, faster than *1-2-3* release 2.01. A few extra seconds at the start of a session may not matter much, but when it comes to saving and loading worksheets—operations often performed dozens of times in a session—a little edge helps, and *Quattro* has more than a little. *Quattro* loaded files five times faster than *1-2-3* on my test system, a 10-MHz AT clone with a 72MB hard disk—a disparity that didn't occur in other benchmarks.

But loading files quickly isn't of any value if they're not in a format you can

FEATURES EVALUATION

Quattro Compared to 1-2-3

Quattro faithfully emulates 1-2-3's features list—and takes it a step beyond.

	Quattro	1-2-3 release 2.01
Data Entry and Editing		
Reads/writes ASCII	●	●
Reads/writes .WKS	●	●
Reads/writes .WK1	●	●
Reads/writes .DBF	●	●
Reads/writes .DB2	●	●
Goto feature	●	●
Global search and replace	●	○
Searches using wild cards	●	●
Inserts range	●	○
Transposes column to row	●	●
Transposes row to column	●	●
Underlining in cells	◒ [1]	○
Boldface in cells	◒ [1]	○
Invisible/hide feature	●	●
Capacity		
Maximum number of rows	8192	8192
Maximum number of columns	256	256
Maximum cell width	240	240
Maximum number of windows per screen	2	2
Maximum number of models displayed concurrently	1	1
Maximum number of keys sorted concurrently	5	2
Supports expanded memory	●	●
Supports three-dimensional models	○	○
Supports dynamically linked files	○	◒ [2]
Supports mouse	○	○
Supports math coprocessor	●	●
Minimal recalculation	●	◒ [3]
Background calculation	○	○
Password protection	●	●

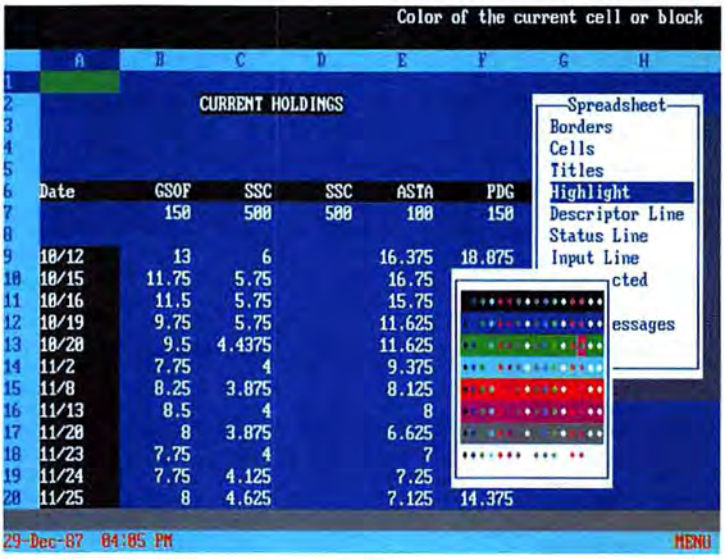
	Quattro	1-2-3 release 2.01
Reporting and Graphs		
Maximum report width (in characters per line)	240	240
Automatic page numbering	●	●
Number of graph types	10	6
Maximum number of viewable data points in a series	5994	8192
Maximum number of printable data points in a series	189	8192
Number of font styles per printed worksheet or graph	1	1
Number of colors supported	16	7
Color can be tied to value	●	○
Free text on graphs	○	○
Prints sideways	○	○
Spooler	○	○
Macro/Programming		
Macro libraries	○	○
Macro learn mode	●	◒ [2]
IF...THEN...ELSE statements	●	●
Input statements	●	●
Step mode	●	●
Trace cells option	●	●
DOS access from macro procedure	●	○
Reads/writes 1-2-3 macros	●	●

● Yes ○ No ◒ Deficient

[1] With monochrome monitors only.
[2] With Lotus's HAL.
[3] With Lotus's Speedup.

use. Here again *Quattro* scores with a file-conversion system that's nearly transparent. Loading a worksheet in *Paradox*, *dBASE II* or *III*, *Symphony*, *1-2-3* release 1A or 2.0, or Educational (.WKE) format involves selecting the file from a pop-up menu; the translation process happens automatically. To save the file in its original format, just type in the proper extension. That's fast.

Speed is even more important when it comes to recalculation. In speed tests conducted by the National Software Testing Laboratories (NSTL) using an expanded memory board, *Quattro* was slower in spots than *1-2-3* with *Speedup* (Lotus's intelligent recalculation utility); *Excel* took the lead. *Quattro* was at its fastest when its intelligent recalculation capability came into play—in other words, when not all the formulas in the test worksheet needed to be recalculated.



Quattro lets you change almost everything about your screen display, from the position of the edit line to the resolution of graphs. The color palette offers a choice of 122 screen shades.

Out of Memory

In the power play between *Quattro* and *1-2-3*, *Quattro* definitely loses in one category—capacity. Working on a 640K AT, NSTL found that its standard 75-by-75 matrix of formulas for benchmarking spreadsheets wouldn't fit into RAM with *Quattro* installed. Borland estimates the practical limit on worksheet size to be 275K to 325K on a 640K system.

Even without add-ins or alternative menus, *Quattro* needs a minimum of 317K, in contrast with *1-2-3*'s 214K requirement. So depending on how it's set up, *Quattro* occupies approximately 100K more than *1-2-3*, and with all worksheets held in RAM, that's 100K less work space. This difference points to the inevitable trade-off between capacity and convenience: *Quattro*'s integrated programs (for printing, converting files, and so on) consume memory, but they make the package much easier to use than *1-2-3*.

Expanded memory users should note that *Quattro* stores long labels, long formulas, and numbers longer than six digits in expanded memory. But even if you have, say, 2MB of expanded memory, you won't be able to create a worksheet that big. That's because the pointers to data stored in expanded memory eventually fill up conventional memory.

With 2MB of expanded memory installed on a 640K system, the maximum worksheet size for a worksheet containing only formulas ranged from 714K to 1.4MB, depending on the layout of the matrix. (Increasing the number of rows and decreasing the number of columns lets you create bigger worksheets.) With a worksheet that contained only labels, the maximum worksheet size ranged from 534K to 634K. Of course, the results you get will vary, depending on layout, type of data, and length of data.

Tests also showed that *1-2-3* worksheets are generally smaller than *Quattro*'s, even when you allow for the extra 100K or so that *Quattro* needs. In tests where the same worksheet was loaded into *Quattro* and *1-2-3*, *Quattro* required from 4.7K more RAM on small files to 24.6K more on the largest file *Quattro* could handle on my AT clone. The only exception was a sparse-matrix worksheet, in which every other line of data was skipped. Here *Quattro* had 4.9K more RAM left over

NSTL TEST REPORT

Quattro

Excel took the lead against Quattro and 1-2-3 with Speedup in recalculation tests in expanded memory.

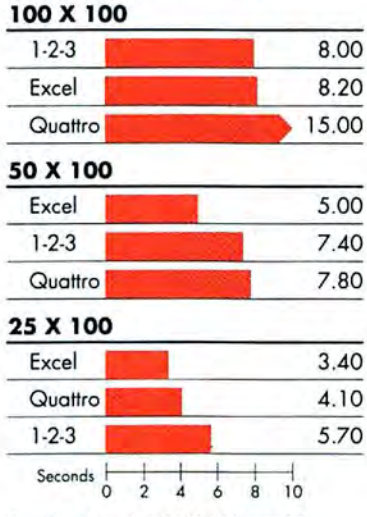
Addition

Multiplication

Exponentiation

Division

Multiplication with coprocessor



Exponentiation with coprocessor

Benchmarks were conducted on an IBM AT Model 339 (8 MHz, 30MB hard disk) equipped with a 2MB AST RAMpage 286 board, which provides expanded memory. *1-2-3* tests were performed using *Speedup*. All cells were given a starting value of 0 and formatted to display fixed numerics with two decimal places. Column width was set globally at 5. For all tests, all cells except A1 contained similar formulas. For example, in the multiplication test, B1 contained the formula *A1*1.01*, C1 contained *B1*1.01*, and so on. Time was measured until control was returned to the user.

Complete recalc (100 X 100 matrix)
For the complete recalculation tests, the value in cell A1 was changed to 1, except for the exponentiation benchmarks, where it was changed to 2.

Partial recalc (50 X 100 matrix)
After the full recalculation benchmarks, the cursor was moved to cell A51. The formula in that cell was replaced with 0. Next, 1 was entered into cell A51, except for exponentiation tests, where 2 was entered.

Partial recalc (25 X 100 matrix)
After the 50 X 100 matrix was benchmarked, the initial formula was restored to cell A51 and the worksheet was recalculated. Starting at cell A76, the procedure used with the 50 X 100 matrix was used to benchmark the 25 X 100 portion.

Data based on tests designed and conducted by National Software Testing Laboratories (NSTL). All rights reserved.

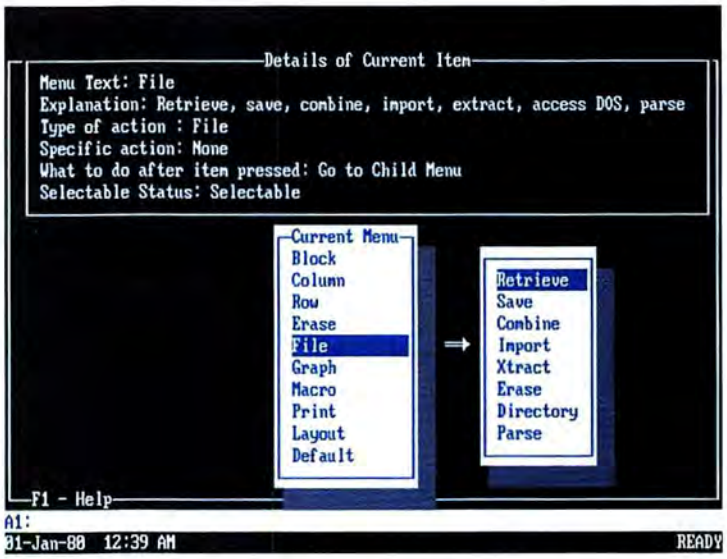
than *1-2-3* did—if you discount the extra 100K or so it needs to run.

But when it comes to saving disk space, *Quattro* makes things easy by providing a stripped-down version of *SQZ Plus*, which can compress files 75 percent or more. All you have to do is save the worksheet with the .WKZ extension (.WK$ or .WK! for *1-2-3* files). When you load the worksheets again, *Quattro* automatically reconstitutes the file. If you need to telecommunicate worksheets or store them on floppy disks, *SQZ* can save transmission time and storage space.

Having It Your Way

Quattro offers you a choice of its own menu system or a setup identical to *1-2-3*'s. In each case the menus pop up in shadowed boxes on the right side of the screen, with some overlap so you can see which menu you came from. But *Quattro* doesn't stop there—with Menu Builder, another of the add-in utilities, you can customize the menus any way you like.

A few of *Quattro*'s basic editing operations require more keystrokes than the same procedures do in *1-2-3*—for example, instead of /Copy you must use /Block Copy—but on the whole, the command system is similar. And *Quattro* has some nice extras. For example, you can search and replace text (in formulas or blocks) anywhere on the worksheet and even reformat paragraphs to a specified width.



Menu Builder makes modifying menus easy; you simply edit the name of the menu command or create an entirely new option.

You can also set the program to display certain values in color so that all negative numbers appear in, say, red—helpful for drawing attention to critical parts of a worksheet.

Quattro also has a better way of entering dates. To manipulate a date mathematically in *1-2-3*, you must enter it as a string (or calculate it as a serial number) and then use @functions and range formatting to display it the way you want. In *Quattro*, you just press a couple of keys, enter the date, and the program automatically enters the serial number in the cell (for calculations) but displays the format as you entered it.

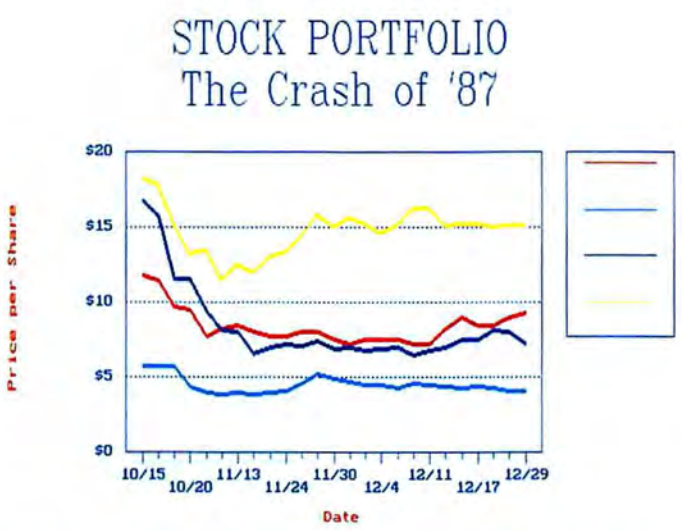
Although *Quattro* doesn't have an undo command, it does come with an interesting add-in called Transcript, which saves your keystrokes to a separate disk file. If disaster strikes, all you have to do is load the last version of the worksheet and play back all or part of the log file. You can even load the log into your worksheet and use it as the basis of a macro program.

Power on Par

Although *Quattro*'s power features are similar to *1-2-3*'s, Borland has clearly tried to make them more accessible. For example, although *Quattro*'s 100

NSTL BENCHMARK TESTING

The exclusive test facility for *PC World*, **National Software Testing Laboratories (NSTL)**, is an independent organization that specializes in evaluating personal computer hardware and software. A recognized pioneer in state-of-the-art test design, **NSTL** believes that the most useful benchmark tests measure how well products perform when executing typical business tasks. **NSTL** testers follow detailed test plans that simulate normal operating conditions. A controlled testing methodology ensures objective, accurate, and consistent results and gives consumers a sound basis for making purchase decisions. **NSTL** publishes its test results in *Software Digest Ratings Report*® and *PC Digest*.™ Neither publication accepts advertising. **NSTL** is located in Philadelphia, Pennsylvania.



Creating graphs is what Quattro does best. With 10 graph types, 11 on-screen fonts, 16 colors, and a myriad of minor options, you can see a polished product very quickly.

@ functions don't improve much on *1-2-3*'s 89, you can easily display them (and their syntax) on a pop-up menu and paste them directly into a formula.

Where *Quattro* really surpasses *1-2-3* is in its macro programming environment. *Quattro*'s learn mode automatically records keystrokes in a worksheet range, which you can edit later. If you aren't comfortable enough with *Quattro* to record as you go, you can write an entire macro program from menus. You choose the desired action from the menu—anything from erasing a cell to prompting the user for a string—and the program enters the script. Slash commands are automatically spelled out; for example, /BS is entered for you as {/BASICS,SHOWMEM}.

The niftiest macro tools, however, are in the debugging arsenal. Taking a cue from animated debuggers like Microsoft's *CodeView*, *Quattro*'s split screen lets you watch your macro executing in the top half and keep an eye on the values in "trace cells" in the bottom half. You can also set conditional break points, which stop the program when a cell reaches a certain value. It's a lot faster than planting {?} commands throughout your script.

To run *1-2-3* macro programs, of course, you must use the alternate *1-2-3* menu system. I ran three short *1-2-3* accounting macro programs through *Quattro* with no problems whatsoever. In macro and @ function compatibility tests performed by NSTL, *Quattro* worked fine with worksheets created for *1-2-3* release 2.01. Note, however, that *Quattro* won't work with *1-2-3* add-in products.

Quattro's analytical and data base capabilities are about as limited as *1-2-3*'s. The two programs' sensitivity ("what if") tables and matrix functions are virtually identical, and their data bases provide only the basic extraction and deletion capabilities. However, with *Quattro* you can sort on up to five keys, compared to *1-2-3*'s two. *Quattro* also has a data-entry-form option, but it limits entry to unprotected cells. If you want to see a real entry-form-driven, flat-file data base on a spreadsheet, look at *Symphony*.

Better Business Graphics

Ten minutes after drawing a pie chart with *Quattro*, I realized that I'd avoided *1-2-3* graphs whenever possible. To set up *Quattro* graphs you make selections from a series of menus as in *1-2-3*, but *Quattro*'s menus are far more logical: The option you need at a specific moment in your graph's evolution is likely to be right on the menu in front of you.

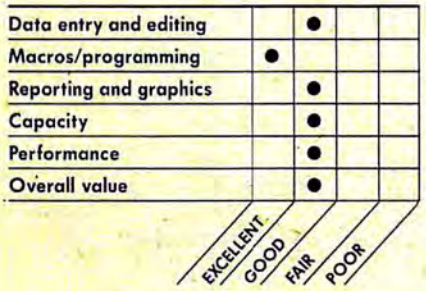
Besides being better organized, the *Quattro* graph menus have more options: 10 graph types to *1-2-3*'s 6 (*Quattro* actually has more than 10, if you count being able to combine, say, a bar chart and a line graph in a single display). *Quattro* also offers more graph colors (16 to *1-2-3*'s 7) and more on-screen fonts (11 to *1-2-3*'s 1, as well as a full range of sizes). There are some convenient touches, too, such as being able to adjust the aspect ratio interactively to round out egg-shaped pie charts.

EXECUTIVE SUMMARY

Quattro

Spreadsheet software

Quattro would be an excellent 1-2-3 2.01 clone—easier to install and use, with faster file retrieval, much better graphics, a good macro environment, great documentation, and a lower price—if it didn't hog quite so much RAM or limit the number of data points in a printed graph to 189. Because of these problems *Quattro* missed an overall value of *excellent.*



But despite its many improvements, *Quattro* had a serious shortcoming at press time: Printed graphs were limited to 189 data points in a series (although you could view 5994), compared to *1-2-3*'s 8192 and *Excel*'s 2000. A remedy was in the works for the graph point problem and for another printing snag—four-digit numbers printed out with an extra character in the margins. According to Bev German, Borland's public relations manager for business products, the company's policy is to fix bugs for free. *Quattro* users can request fixes directly from Borland or download them when available from the Borland forum on CompuServe.

Printing graphs with *Quattro* is much easier than with *1-2-3*. There is no separate access system or PrintGraph disk, no .PIC file (although *Quattro* can generate one, if you need it)—you just select Print from the graph menu. *Quattro* even supports PostScript, allowing you to generate hard copy on an Apple LaserWriter, or on a Linotronic for typeset-sharp graphics.

Not a New Idiom

Surprisingly, *Quattro* doesn't offer any radically new or useful twists on the *1-2-3* concept—and it's certainly not for lack of good ideas. General Optimization's *What's Best* added linear programming to *1-2-3*. Lotus's *Symphony* showed us spreadsheet-based forms management and telecommunications. *VP-Planner* and others provided linked worksheets. And *Excel*—a major competitor—introduced a whole new Mac-flavored interface.

On the other hand, it's clear that Borland wanted to tread well-traveled ground. But does *Quattro* offer enough as a clone? The price is right, and the refinements—ease of use, improved graphics, faster file loading, and macro debugging, among others—all look good. But *Quattro* isn't faster at recalculating worksheets than *1-2-3* with *Speedup*. Beyond that, version 1.0's main shortcomings—limited worksheet capacity and the relatively small number of printable data points—may give power users pause.

In future releases, *Quattro* should be a better value than *1-2-3* release 2.01—assuming a better *1-2-3* release 2.01 is all you want. *Quattro* will soon face *1-2-3* release 3.0 and *1-2-3/G*, the graphics version, and of course *Excel* is already on the market. Confronted with this competition, *Quattro*'s strongest suit may be its economical price. ●

William Urschel is president of Arc Tangent, maker of ArcList, *a mailing list management program.*

WHERE TO BUY

Quattro
Borland Int'l
4585 Scotts Valley Dr.
Scotts Valley, CA 95066
408/438-8400
List price: $195
Requirements: 384K, DOS 2.00 or later version
Not copy protected

Still Waiting for Windows/386

Ready to run two, three, even ten applications at once on your 80386 system?

Microsoft Windows/386 can do the job, but speed-conscious users may find the company's prize heifer a white elephant.

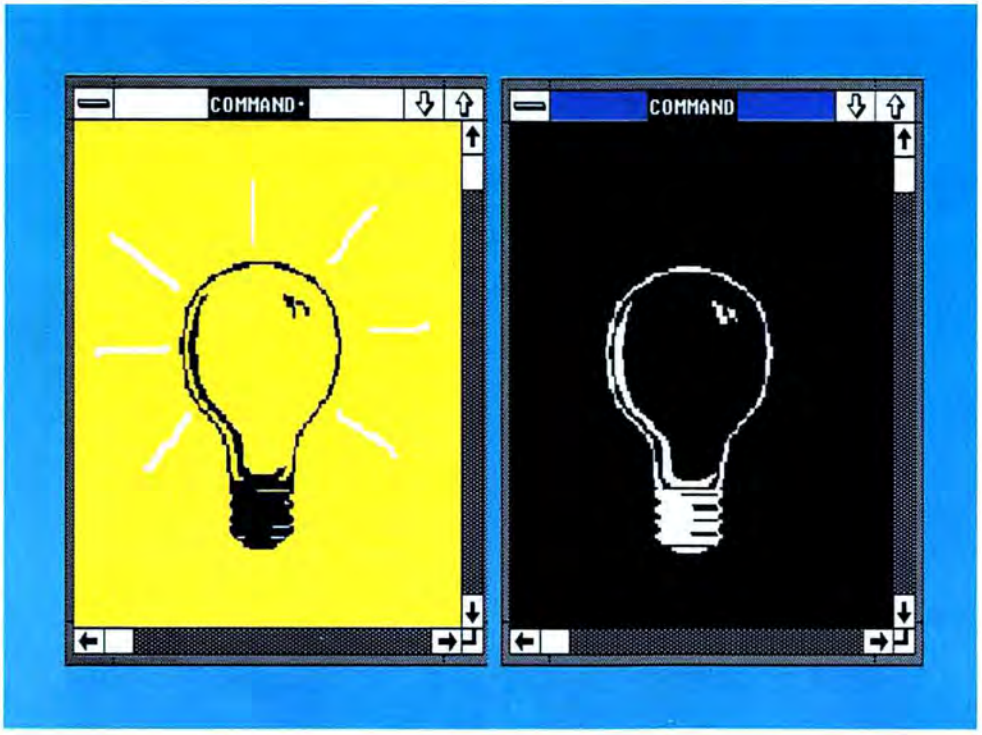
Robert Luhn

Is *Windows/386* truly "the soul of the new machines," the multitasking powerhouse that turns 80386-based computers into "sensitive, intuitive, highly visual" electronic tools? That's what Microsoft claims. Users may think otherwise.

There's no disputing that *Windows/386* is a quantum leap forward for Microsoft's beleaguered *Windows* family. Unlike earlier versions of this Macintosh-like, graphics operating environment, *Windows/386* delivers the multitasking goods that Microsoft has been promising for years. The program adroitly taps the 80386's virtual 86 mode, divvying up RAM to create drum-tight 640K "virtual PCs" that run off-the-shelf DOS applications along with programs designed specifically for *Windows*. *Windows/386* gives each virtual PC its own window. You can thus run a screen-hogger like *1-2-3* in a scalable, movable window next to another holding *PageMaker* and quickly switch between the two without quitting either application.

Better still, shuttling data to and fro doesn't require file conversion; you merely mark the data in one window, lift it out with an electronic clipboard, and paste it directly into another window. If you're sharing data among *Windows*-specific applications, fonts and other character attributes are sometimes preserved. With a few exceptions (you can't paste a graphic generated by a *Windows* program into a DOS application, for example), the process is straightforward.

If you love pulldown menus, dialog boxes, using a mouse, and being prompted at every turn, you'll love the *Windows/386* interface. Operations such as scaling windows and cutting and pasting data between applications are the same no matter where you are in the environment; *Windows*-specific applications share even more conventions. Although the interface was clearly designed with the mouse in mind, Microsoft has wisely included a complete set of keyboard commands. *Windows/386* also provides a clutch of utilities, including a calculator, a calendar, a card file, and a notepad, along with a basic word processor and a paint program appropriately dubbed *Write* and *Paint*.



But running a passel of DOS applications simultaneously is *Windows/386*'s primary claim to fame, and the environment offers a fair number of options. You can run applications on screen in overlapping windows or behind a foreground application that fills the entire screen, or run a single application in "exclusive" mode and let it monopolize the system's resources while other programs are suspended. *1-2-3*, *Framework*, and other programs that normally use a numeric coprocessor and expanded memory can access them via *Windows/386;* the environment also supports LIM 4.0, the new Lotus/Intel/Microsoft expanded memory specification, that gives such programs entrée to as much as 32MB of RAM.

Best of all, unlike multitasking competitors such as *PC-MOS/386* and *Desqview 2.0*, *Windows/386* can run virtually any DOS application, and it's practically crashproof. For example, if *R:base* gobbles up the memory in its 640K virtual machine and goes into digital shock, it won't freeze the entire system. You can close its window and move on to another application.

Finally, there's no denying the future. The *Windows* interface is destined to become the standard in an OS/2 world ordained by IBM. If you master *Windows/386*, says Microsoft, you'll feel right at home when the OS/2 Presentation Manager arrives.

Windows Redux

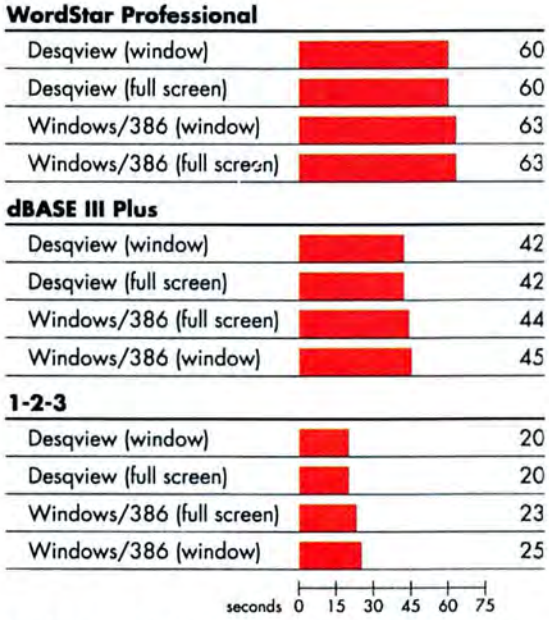
On the other hand, is getting acquainted with OS/2's future interface worth $195? Probably not. Besides, OS/2 cannot (and never will) multitask DOS applications (see "Getting the Feel of OS/2" in this issue). If that's what you're after, *Windows/386* is one approach, though *Desqview 2.01*, which juggles DOS applications more quickly, may be a better one (see "Multitasking Now!" *PCW*, December 1987).

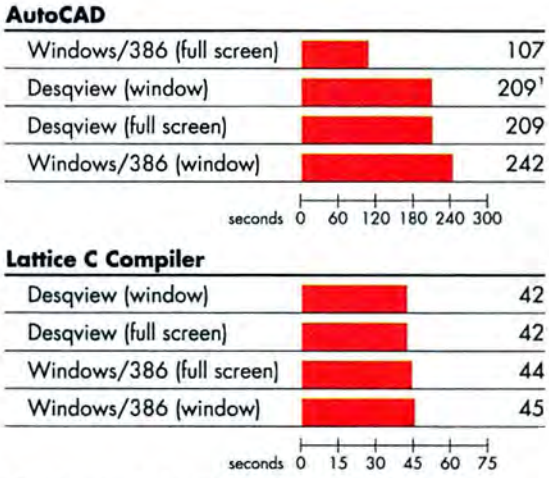
Performance can't be ignored when evaluating a multitasking environment, and in this contest *Windows/386* comes

NSTL TEST REPORT

80386-Based Operating Environments

Running applications under Windows/386 can be an exercise in patience. Desqview is no speed demon either, but it generally runs 5 to 20 percent faster.





[1] *Desqview* automatically switches to full-screen mode when displaying high-resolution EGA graphics, such as those found in *AutoCAD*.

All tests were conducted using *Windows/386 2.01* and *Desqview 2.01*; Microsoft claims that version 2.03 (unavailable in time for testing) offers some speed improvements. Tests were performed on a Compaq Deskpro 386/20 with a Compaq EGA adapter and display and 5MB of RAM installed. The Compaq disk caching software was installed for the tests run under *Desqview*. The disk caching program included with *Windows/386* was installed for tests with that environment. *Desqview* was tested with the *Quarterdeck Expanded Memory Manager* installed. Each application was run both in a window (a portion of the screen) and in the full screen (as if the program were running under DOS).

WordStar Professional
Although disk access plays a small part in this benchmark, processing and memory speeds are the most significant factors. The test measures the time required to perform four operations on a 15,364-word document.

dBASE III Plus
Disk access speed is the most significant factor for this benchmark. The test measures the time required to produce a report based on a three-file join, select, and sort.

1-2-3
Because no disk access is required, this benchmark depends almost entirely on the processing and memory access speeds of the systems. In the test, a *1-2-3* macro executes a series of recalculations within a 50 X 50 cell matrix.

AutoCAD
Disk access, processing speed, and memory access all contribute to a product's performance in this benchmark. However, the speed and type of math coprocessor used by the system are the most important factors. The test uses the sample office drawing provided with *AutoCAD* and measures the time required to retrieve and display the drawing, zoom in on a small detail within the drawing, zoom out to reveal the entire drawing, and print the entire drawing.

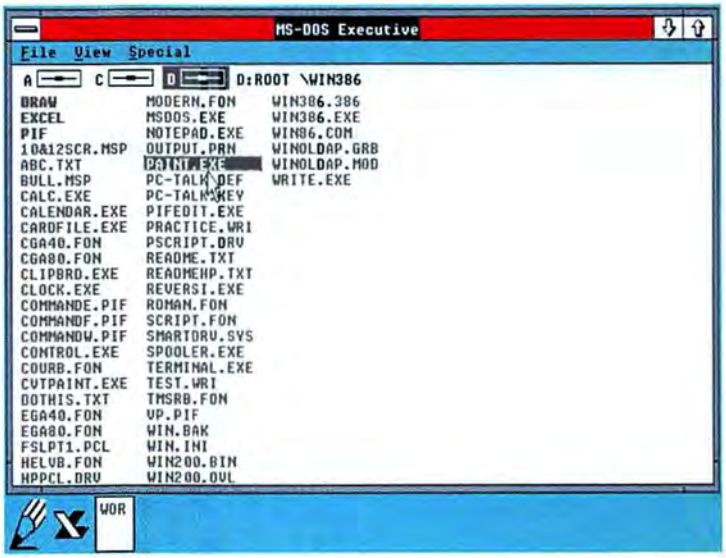
Lattice C Compiler
In this benchmark, the sequential disk access rate is the most important factor. Applications such as file managers commonly rely on this type of disk access. The test measures the time required to compile and link two 1000-line programs and is performed automatically using a DOS batch file.

Data based on tests designed and conducted by National Software Testing Laboratories (NSTL). All rights reserved.

out second best. In tests conducted by National Software Testing Laboratories (NSTL), *Windows/386* performed 5 to 20 percent slower than *Desqview*. What NSTL's formal tests don't show is *Windows/386*'s abysmally slow screen-refresh rate. Run Microsoft's speedy *Word 4.0* in a window under *Windows/386* on an 80386 system with 2MB of RAM (the minimum configuration), and you'll feel like you're word processing under water. Add a second task to the mix—such as *Crosstalk XVI* downloading an MCI Mail message—and *Word*'s once-sprightly cursor has to practically claw its way down the screen. Direct an application to print a file under *Windows/386*, and you might as well forget about running anything else.

Memory management from the user's standpoint isn't particularly adept in *Windows/386*—or for that matter, in *Desqview*. Although both dole out memory to applications without user intervention, neither can tell you how much memory remains in a given virtual machine—and whether or not loading that 200K document will bring *WordPerfect*'s virtual machine to a grinding halt. If *Windows/386* and *Desqview* incorporated OS/2-like virtual memory schemes that treated disk space like RAM, the issue would be moot. As it is, the best *Windows/386* can do is to swap parts of its code or other *Windows* applications to disk; *Desqview* swaps out entire DOS applications.

Those who are keen on customizing their multitasking environment will definitely lean toward *Desqview 2.01*. In this environment you can create macros that automatically open menus, issue commands, place applications in windows, or even slip into a window and run the program there. Users can also optimize *Desqview*'s performance by specifying how much processing time each application receives, features that *Windows/386* pointedly lacks. If you tinker with *Windows/386*'s system files, you can direct it to load specific programs automatically, place them in windows, and set tasking status. But that's about it.



The MS-DOS Executive is home base for the Windows user. It's here that you launch applications, log on to subdirectories, and access DOS commands.

Working With Windows

Desqview's extra speed and versatility deserve praise, but users will probably be more interested in managing a mess of applications at once. Naturally, Microsoft claims that *Windows*' intuitive interface is just the ticket, but don't be fooled. You still need a solid understanding of DOS, subdirectories, and command file conventions to steer *Windows/386* properly.

This becomes evident when you load *Windows/386* and encounter the MS-DOS Executive, which is little more than a glorified DIR listing. It's easy enough to master, though. To display the contents of a subdirectory, highlight its name and press <Enter> or click the mouse button twice. To launch a program, highlight the appropriate command file name (such as WS.COM) and double-click it. This presumes, of course, that you know which .EXE, .COM, or .BAT file actually starts an application. Unfortunately, *Windows/386* offers no guidance in this situation.

Unless you specify otherwise, a DOS application initially runs in full-screen exclusive mode. It appears to be running under DOS, the mouse works with it, and performance is barely affected. Press <Alt>-<Space> and *Windows/386* slaps

FEATURES EVALUATION

Windows/386 and Desqview 2.01 Compared

Both Windows/386 and Desqview 2.01 are 80386 control programs that use windows to manage multiple applications. Windows/386 offers a more pleasing mouse-driven interface and tons of accessories; Desqview is built for speed, the keyboard, and running the most popular applications.

Application Management	Windows/386 2.03	Desqview 2.01
Run multiple copies of same program	●	●
Run memory-resident programs	●	●
Run two programs in a virtual machine	●	●
Run EGA applications	●	◒ [1]
Work with screen blanker	○	●
Specify processor time per application	○	●
Tasking		
exclusive	●	●
foreground	●	●
background	●	●
suspend freeze	●	●
Terminate virtual machine	●	●
Overlapped windows	●	●
Tiled windows	●	●
Cut and paste		
text	●	●
graphics	● [2]	○
Tools [3]		
auto-dialer	●	●
calculator	●	◒ [3]
calendar	●	◒ [3]
card file	●	○
clipboard	●	●
clock	●	○
communications program	●	◒ [3]
disk cache	●	○
macro processor	○	●
notepad	●	◒ [3]
paint program	●	○
print spooler	●	○
RAM disk	○	○
word processor	●	○

Installation and Configuration	Windows/386 2.03	Desqview 2.01
Disk space required	2MB	360K
Minimum RAM	1MB	640K
Coprocessor support		
8088	○	●
8086	○	●
80286	○	●
80386	●	●
8087	○	●
80287	●	●
80387	●	●
Install new devices within environment	◒ [4]	◒ [5]
Environment-specific manuals	◒ [6]	●
On-line help	○	●
Memory Management		
Virtual memory system	○	○
Expanded memory support	●	●
LIM 4.0 support	●	●
Maximum virtual machine size	640K	640K
Sizes virtual machines	●	●
Memory status		
for environment	◒ [7]	●
for virtual machine	○	○

● Yes ○ No ◒ Deficient

[1] EGA programs freeze when run in background.

[2] Between Windows applications or from some standard applications into Windows applications.

[3] Available as part of Desqview Companions 1 for $99.95.

[4] Only printers and fonts.

[5] Only mice and video displays; printers must be installed on a program-by-program basis.

[6] Main manual and Windows/386 manual conflict in several areas.

[7] Memory reading from 'About MS-DOS Exec...' is unreliable.

a full-screen window around the application and pops open the control-menu box, where you'll see options for cutting and pasting data and selecting the application's tasking mode. You'll also notice that the program runs more slowly—and that control of the mouse has been relinquished to *Windows/386*. Click the minimize box, and the application is put in a window that covers about 75 percent of the screen; click it again, and the application shrinks to an icon at the bottom of the screen. This frees up work space and a little RAM, but it doesn't necessarily suspend the program.

To move or size a window, grab the appropriate spot with the pointer and yank. You can't size a window out of existence, and you can pop an application back to full-screen display with a single click. It's also difficult to lose data. *Windows/386* won't let you permanently close any window until you quit the application using its native commands. If a program does crash and send a file to data heaven, you can at least shut down its virtual machine and free up some RAM.

You can return to the MS-DOS Executive at any time, load more programs, and stuff them into windows. Just remember that the more applications *Windows/386* juggles, the slower everything runs. Most users will take the manual's advice and run applications in full-screen exclusive mode, and turn to windows only when cutting and pasting data among several applications.

Once you get the hang of the *Windows* way, the environment is relatively easy to manage. But there are a lot of menus to open, dialog boxes to fill in, and icons to click—a situation that cries out for an environment-wide macro language that isn't there. You can automate some *Windows* operations, but as you'll see, it takes patience and a willingness to futz.

Virtual Machine Verities

By design, virtual machines are more or less sealed, and thus data can be moved among applications only a screenful at a time using an electronic clipboard. However, because *Windows*-specific applications share the same virtual machine and data format, you could scoop up an entire *Excel* file with the *Windows/386* clipboard and dump it into *PageMaker*. You can even pour *Windows* data into a DOS application, such as *Word*.

To move data to and fro, pull the source and target applications onto the screen, paint out the data, select the Copy command, jump into the other window, and select Paste.

But in the cut-and-paste department, *Desqview* still has the edge. With a couple of keystrokes you can easily gather any number of screens from one DOS application and paste the entire collection into another. This is something *Windows/386* doesn't offer—but should.

As you might expect, both environments run most memory-resident programs, although vintage pop-ups such as *PopDOS* may occasionally freeze their virtual machine. Of course, the point of memory-resident programs is being able to pop them up over any application. This is clearly impossible with protected virtual machines, but you can write a batch file that loads a cherished utility (such as *ProKey*) and a main application (such as *WordStar*) into the same virtual machine.

Configuration and Customization

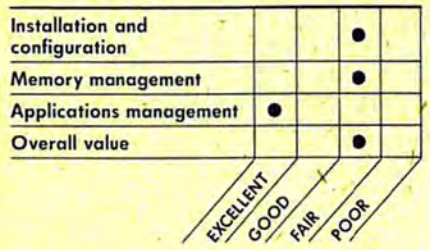
Like most Microsoft programs, installing *Windows/386* is a snap. Type INSTALL at the DOS prompt, answer a few questions about the hardware setup, swap three floppy disks, and you're through.

EXECUTIVE SUMMARY

Windows/386

Operating environment

This graphics operating environment isn't as fast as Desqview at juggling a number of DOS applications. But it can run almost any program, and Windows-specific programs are highly integrated. A macro language for automating repetitive operations, however, is lacking.



Windows/386 demands 2MB of RAM and disk storage; if you want something resembling real-time operations with even a handful of DOS applications, 4MB of RAM is strongly recommended.

Unfortunately, *Windows/386* isn't particularly adept at managing all this memory efficiently. You know something's up when you try to run a third DOS application on a 2MB system and a 'Not enough memory to run' message appears. The problem? *Windows/386* assumes every DOS application requires a 640K virtual machine. Luckily you can override this default and shrink virtual machines to fit by creating Program Information Files (PIFs) for your applications.

You create a PIF—which resembles a combination batch file and CONFIG.SYS—by filling in a simple on-screen form. You specify a program's location, where data files are stored, minimum and maximum RAM requirements, and tasking status (Usage Controls). Once the PIF is saved, you won't have to find the program's directory or size its window—just click its PIF.

Fine-tuning PIFs, however, can be a pain. A PIF must nab enough memory so an application can work with a decent-size data file, but not commandeer so much RAM that there's not enough left for other programs. The *Windows/386* user manual offers few tips in this area, and even fewer on creating PIFs for applications started with batch files. It's a trial-and-error process, and at times a maddening one.

Unfortunately, your long day's journey has just begun. If you want *Windows/386* to load a specific group of applications at start-up—or if you merely want to prevent the environment from handing over all system RAM to the first DOS application that uses expanded memory—you must dig through WIN.INI, the *Windows/386* system file, and modify various statements. It's a job that requires a lot of experimentation, largely because the manual's advice is sometimes erroneous.

Thankfully, you can install new devices for the environment and all *Windows* applications by simply running CONTROL.EXE (the *Windows* control panel) and selecting the proper settings in a couple of menus. The downside? The only devices you can install are printers and their fonts—a design flaw carried over from the days of *Windows 1.xx*. To add a new mouse, keyboard, or monitor, you must reinstall *Windows/386* from scratch. If *Windows/386* is the soul of the new machines, it's a soul with one foot firmly in the past.

Glitches and Gaffes

Windows/386 would be a bit easier to configure and customize if Microsoft supplied a detailed, *Windows/386*-specific user manual. What you get is a sketchy 33-page guide on *Windows/386* operations and a thick *Windows 2.0* manual that sometimes contradicts it. For example, much of the latter manual's advice on using and modifying PIFs, running DOS applications with batch files, using third-party expanded memory management software, and directing *Windows* to con-

serve memory simply won't work with *Windows/386*. To get an accurate picture, you must sift through the eight README files on *Windows/386*'s setup disks and thoroughly examine the comments in WIN.INI.

Windows/386's error handling can also be erratic. If you're printing a *Word* file and the printer dies or somebody trips over the cable, *Word*'s virtual machine will sometimes seize, taking your data and even the entire *Windows/386* environment with it. On other occasions, *Windows/386* will pop up an error message that offers escape—but attempting to abort printing merely displays the same message over and over.

What will infuriate even Microsoft devotees, though, is *Windows/386*'s incompatibility with the screen fonts used by *Windows 1.xx* applications. For example, it prevents *PageMaker 1.xx* from displaying previously created publications or even its toolbox. To set things right, you must convert *PageMaker*'s screen fonts with a supplied utility. Another surprise: Old *Windows Paint* files can't be read by *Windows/386* applications unless they are likewise converted. These aren't critical flaws—and Microsoft has duly supplied patches and conversion utilities—but it clearly demonstrates that *Windows/386* is not for the inexperienced user.

Making the Windows Choice

Windows/386 is like *Word* was three years ago—a great idea hampered by unbearably slow performance. Given Microsoft's ease-of-use pitch, it's galling that you have to spend so much time dealing with PIF files, WIN.INI, and other minutiae. If *Windows/386* wants to win this reviewer's nod next time around, you will be able to manage memory, add *all* new devices, and indicate which applications to load at startup from a menu. Memory status on every virtual machine should be a mouse click away, and an environment-wide macro language should be available to automate repetitive tasks.

In the meantime, should you use *Windows/386* for multitasking your DOS applications? Yes—if you're a power user and willing to make the commitment in hardware and time. Not only will you need a healthy measure of patience and RAM, but a VGA video setup (which refreshes the screen faster than an EGA setup) or a graphics coprocessor board to boost performance to acceptable levels. Just keep in mind that *Desqview* requires no more work to set up and manage, and it's faster at running a workaday word processor, a spreadsheet, and a communications program simultaneously.

Of course, if sharing data among desktop publishing, presentation graphics, and other *Windows*-based applications is your goal, *Windows/386* is a natural choice. The release of *Windows/386* (and *Windows 2.0*, the 8088 and 80286 version) has generated excitement among developers, and compelling applications in a class with *PageMaker* and *Excel* may be forthcoming. But after years of promises, there are still no major word processors, data managers, or communications programs designed specifically for the *Windows* environment. Until the Ashton-Tates and Lotuses of the world jump aboard the *Windows* bandwagon, you should consider staying off. ●

Robert Luhn is a senior editor for PC World.

WHERE TO BUY

Windows/386 2.03
Microsoft Corp.
16011 N.E. 36th Way
Box 97017
Redmond, WA 98073-9717
206/882-8080
List price: $195, upgrade for registered Windows owners $95
Requirements: Deskpro 386 or compatible 80386-based system; 1MB (2MB recommended); 1.2MB floppy disk drive; hard disk; CGA, EGA, or VGA video setup; DOS 3.10 or later version
Not copy protected

Five Tools for Team Writing

The network versions of five popular word processors battle it out on a LAN.

Beyond allowing you to share data, these programs provide useful group authoring tools.

Eric Brown

Establishing a network for word processing can save you money by lowering the cost per station and making it possible to share expensive printers. But the biggest benefit—especially for group writing projects—is the ability to share data. When choosing a network word processor, it's important to explore the group authoring features that help monitor word processing pools and coordinate large, multiple-document projects. These tools include redlining, document summary screens, password protection, and document search and retrieval.

This article compares five popular network word processors—*MultiMate Advantage II LAN*, *pfs:professional write* with *pfs:professional network*, *Samna Word IV Network*, *WordPerfect Network—First Station*, and the LAN version of *WordStar Professional* release 4. Rather than comparing word processing features, the review focuses on each product's LAN support and its value as a network group authoring tool. You'll want to determine which program has the best mix of features for your purposes.

Network Basics

All tests except those involving *MultiMate Advantage II LAN* were performed on an Ethernet LAN running Novell Advanced Netware 286 version 2.0a. Because *MultiMate Advantage II LAN* requires version 2.0a++ of Novell's workstation shell, it was tested with that later version. All the programs also support 3Com and IBM networks, and most support additional ones. In *PC World* speed tests, none of the programs was slower than its standalone version.

All the programs require that the network supervisor modify the network operating system to assign access rights to the program subdirectories. The installation process ranges from merely creating a directory and copying over the program files to building a variety of personal directories and modifying log-on scripts. All the packages let each user customize the program to his or her liking—for example, by setting personal margin defaults and help levels.

All support local (non-network) printing, as well as Novell's print spooling features, which let users queue files to various networked printers. Finally, and most important, all provide some form of

file locking when a user attempts to open a file that's in use.

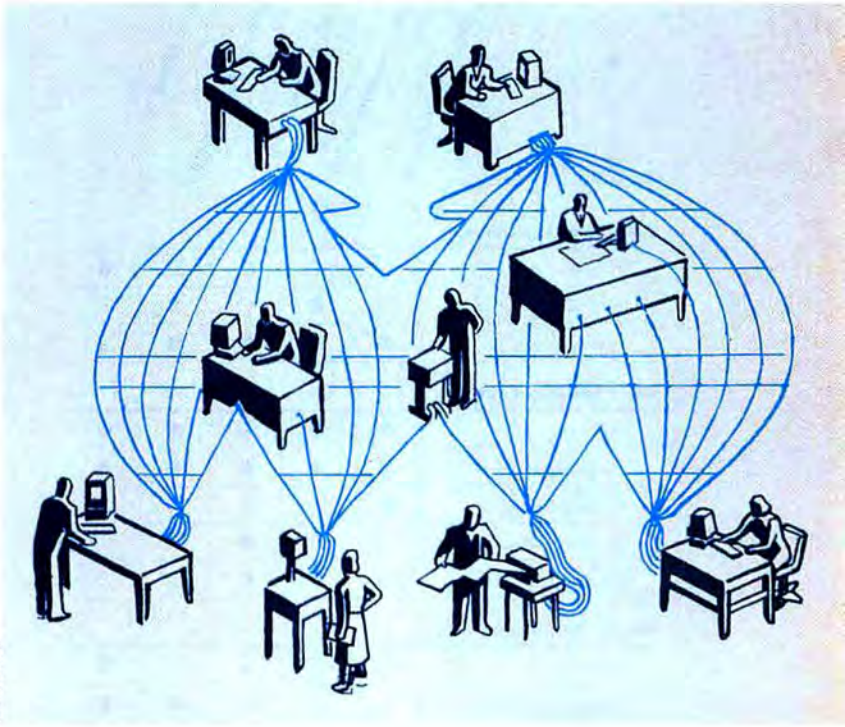
Group Authoring

Dedicated tools such as Brøderbund's *ForComment* (see "Author, Author, Author!" *PCW*, August 1987) have group authoring capabilities far beyond what the programs reviewed here offer. *ForComment*, which can run on a LAN, allows up to 15 reviewers to comment on a document, automatically collects all the changes in a master file, and creates an auditing trail of changes.

While none of these word processors offers that level of sophistication, two of the programs have a redlining feature that tracks insertions and deletions. The next editor can then view the file and decide what text should be retained or deleted. Some of the programs also password-protect files.

Document summaries are particularly helpful on a LAN. These individual forms go a step beyond file directories, including detailed information such as the operator's name and the length of editing time. Even more valuable on large LANs is the ability to hunt for lost documents, using either full-text or labeled-field searches. Full-text searches locate files by searching for text strings within documents. Field searches scan only the data entered on a document summary screen.

Disappointingly, none of the products offers version tracking—the ability to tag each edit with a version number. This feature, found in programs such as *Microsoft Word 4.0* and *Lotus Manuscript*, can do wonders to help managers monitor the progress of complex documents.



DAVID SUTER

WordStar Professional Release 4, the LAN Version

The $495 LAN version of this major update to the perennial *WordStar* acts as the server program for an unlimited number of users. Each node costs $150 extra. The manual is thorough, spelling out how to assign access to users and how to map drives. Once the net is set up, you merely create a directory and copy the files over. To allow users to customize setups, you copy three personal files to each user's home drive.

WordStar Professional's file locking scheme offers the most reasonable approach of any of the programs reviewed. If you try to open an occupied file, a prompt offers you the opportunity to browse the file without editing rights.

FEATURES EVALUATION

Network Word Processing

Interested in sharing data? Here's what you can expect in the way of group authoring tools.

● Yes
○ No
◒ Deficient

	WordStar Professional release 4	pfs:professional write 1.00 with network 1.00	WordPerfect Network First Station 4.5	MultiMate Advantage II LAN 1.0	Samna Word IV Network 1.1
Setup and Installation					
Installation utility	○	○	○	○	●
LAN administration tools	○	●	○	○	○
LAN documentation	●	●	●	●	◒ [1]
Data Security Features					
File locking	●	●	◒ [2]	●	●
File locking message	●	●	●	●	●
Browse locked file	●	○	●	○	○
Two users edit same file	○	○	●	○	○
Password protection	○	●	●	○	○
Group Authoring Tools					
Redlining	○	○	◒ [3]	○	●
Document summaries	○	○	●	●	●
File searching	○	○	●	●	○
Networks Specifically Supported					
Novell	●	●	●	●	●
3Com 3+	●	●	●	●	●
IBM Token-Ring	●	●	●	●	○
IBM PC Network	●	●	●	●	●
ViaNet	○	●	○	○	○
AST-PCnet	○	○	●	○	○
Torus Tapestry	○	○	●	○	○
Fox 10Net	○	○	●	○	○
3Com EtherSeries	○	○	●	○	○
AT&T Starlan	○	○	○	○	●

[1] Samna's LAN documentation implies you need only one directory; actually you must create a subdirectory for each user.

[2] WordPerfect allows more than one user to edit a file at once, a potentially confusing approach to file locking.

[3] With WordPerfect you can mark additions or deletions, but you can't view the redlining unless you print the file.

When you open the file, a Protected Mode menu displays only cursor commands. Attempts to delete, move, or add text result in nothing but a beep. Unfortunately, secondary users can't browse the entire contents of a large file. The cutoff point depends on your PC's memory and the size of your text buffer, but on a 640K system the limit was about 50K.

WordStar's group authoring tools are the weakest of the products reviewed. The program contains no redlining or file search features and no document summary capability—just the standard directory containing the file name and size. Moreover, you cannot password-protect files.

pfs:professional write 1.00 and pfs:professional network 1.00

Unlike the other programs, *pfs:professional write* doesn't come in a LAN version. However, you can make it multiuser by buying the $499 *pfs:professional network*, which also supports *professional file* and *professional plan*. One copy of *network* gives five users access to a *pfs* application.

network has the most understandable manual of the lot. To install the program, you create directories for *write* and *network*, copy the files over, and copy two personal files to each user's home drive. You also have to modify each user's log-on script. *network*'s file locking technique is simple and restrictive. You may not browse a file that's in use.

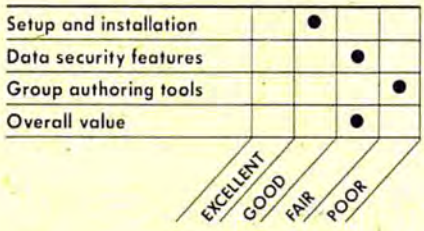
network is the only program that offers a menu-driven utility for keeping track of users. The menu duplicates some network operating system chores by letting the supervisor mete out access to particular *pfs* programs and add, replace, and delete users. Instead of delineating each user's rights in the network program, the supervisor can give everyone full access to the *pfs* directories and then restrict access via the easier and more complete *network* menus. However, on LANs that also contain non-*pfs* products, supervisors may find it more convenient to work directly with the operating system.

EXECUTIVE SUMMARY

WordStar Professional release 4, the LAN version

Word processing software

The LAN version of WordStar release 4 offers little in the way of group authoring tools, but it comes with thorough documentation and provides a safe, flexible file locking scheme.



write's group authoring skills are only slightly better than *WordStar Professional*'s. The program lacks redlining, file searching, and individual document summary screens. However, its document directory is better than *WordStar*'s, listing name, size, revision date, and a brief description. Another plus—you can password-protect files.

WordPerfect Network—First Station 4.5

Like *WordStar Professional*, *WordPerfect*'s LAN version consists of a server program—the $695 *First Station*—and an unlimited number of secondary nodes at $150 each. Installation is straightforward, but the brief documentation requires that the supervisor fully understand the LAN operating system and how to assign user rights. Once that's out of the way, you merely create a directory, copy the files over, and flag the program files as shareable.

When you log on to *WordPerfect*, you're prompted for a three-letter code that acts as a pointer to the file in which each user can store customization changes. *WordPerfect* provides the loosest file locking safeguards of any of the packages reviewed. You can edit a file that's already in use and save it under a different name. While some users may enjoy this flexibility, it could quickly lead to chaos. More confusing, the only sign that you're looking at an occupied file is the presence of brackets around the file name in a corner of the screen. The file locking itself works fine, however, prohibiting you from saving the file under the same name.

WordPerfect's document summary screens are adequate for most needs, displaying the file name and date of creation, in addition to author, typist, and comments. Better yet, you can use the full-text Word Search feature to locate files using wild cards as well as AND/OR-type operators. *WordPerfect* also lets you assign passwords of up to 75 characters.

With *WordPerfect*'s redlining feature, you can instruct the program to mark all added text with a vertical bar in the margins and mark all deleted text in strikeout mode. Later, you or another user can remove vertical markings and delete the strikeout text, either selectively or all at once. However, the markings show up only when printed, which hinders quick group editing on a LAN. This limitation is expected to disappear with the release of *WordPerfect 5.0*.

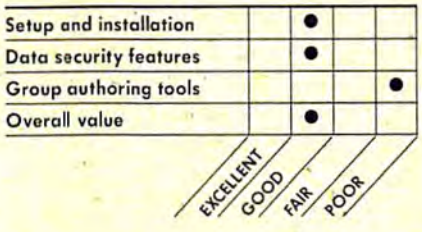
EXECUTIVE SUMMARY

pfs:professional network 1.00

pfs:professional write 1.00

Word processing software

pfs:professional network turns this limited yet easy-to-use word processor into a solid multiuser program. Although *write* skimps on group writing tools, *network*'s menu-driven interface makes life easier for network administrators.



EXECUTIVE SUMMARY

WordPerfect Network—First Station 4.5

Word processing software

The LAN version of this popular word processor is marred by a liberal file locking scheme that could lead to confusion. But it's the only program reviewed that offers all the major group writing features.

MultiMate Advantage II LAN 1.0

Long a darling of the office automation crowd, *MultiMate Advantage II* should win its way into a number of production-oriented networks. With the LAN version you can network five users for $1445; each additional node costs $150. OnFile, an adjunct filing program, cannot be shared.

MultiMate II LAN's tedious yet thorough manual makes it clear that installation takes planning and time. You not only must assign program defaults and map new drives, you also must decide whether to create a simple LAN or an expanded LAN. With the simple LAN, you set up two directories, one for write-protected program files and the other for read/write documents. For the expanded option, you must create a private drive for each network member, enabling users to store customized defaults and nonshareable documents.

MultiMate LAN locks you completely out of a file in use; however, it's the only program reviewed with a hot key for reattempting access. Boilerplate and macros can be used by several persons at once, but only one user at a time can create or edit them.

MultiMate II has no redlining or password-protection features, but its document summary screens are exhaustive. Their most practical feature allows you to enter three identifying keywords in order to locate a file later. You can search on any of the keywords as well as on the comment field and other summary screen labels. You can also combine search labels and search using the OR operator, but you can't perform wild-card searches.

Samna Word IV Network 1.1

Another office automation heavyweight, *Samna Word IV* is a natural for LAN use. However, each copy of the $1225 LAN version provides access for only three users. The program's installation utility works fine, but the poorly organized manual can be confusing. For example, it implies that you need only one directory, when in fact you must create a subdirectory for each user.

Samna's file locking method is simple and restrictive. As with the *pfs* programs, a terse error message states that the file is not available for use.

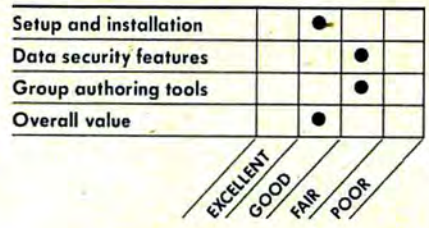
Samna provides a respectable set of group authoring tools. The program's redlining feature, called Revision Marking, is more sophisticated than *WordPerfect*'s, allowing you to choose the print

EXECUTIVE SUMMARY

MultiMate Advantage II LAN 1.0

Word processing software

Aimed at production-oriented networks, *MultiMate II*'s LAN version offers the best networking features of the programs reviewed, including a hot key for retrying access to an occupied file. Its document summary features are also quite thorough.

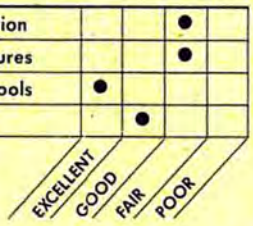


EXECUTIVE SUMMARY

Samna Word IV Network 1.1

Word processing software

Samna's LAN version suffers from confusing documentation, but it offers excellent group writing tools, including the best redlining feature of the programs reviewed.



attributes for insertions and deletions. More important, those attributes are visible on screen so you can bypass the print cycle for quick editing.

Next to *MultiMate II*, *Samna Word IV* offers the most complete document summary screens, including an extended file name, a description, creation and revision dates, and the names of the originator and operator. It also includes time spent editing and the number of pages and keystrokes in a session. However, the program lacks other features such as password protection and file searching.

Tough Choices

All these programs provide adequate file locking, although *WordPerfect*'s flexible scheme can cause problems with version control. So if you're satisfied with the stand-alone version of a program, you'll probably want to move up to the LAN version. If you're looking for new blood, remember that as word processors these programs vary greatly; don't judge them just by their network features.

With that in mind, *MultiMate Advantage II LAN* wins out among the high-end programs by providing the best LAN support and offering excellent summary screens and search capabilities. *WordPerfect*'s group authoring features are better than most, but its file locking scheme can easily create confusion. *Samna Word IV Network* also provides well-intentioned group authoring tools but suffers from disorganized documentation. The LAN version of *WordStar Professional* needs some basic group authoring and password-protection features. Among lower-end programs, *pfs* takes the lead with a low price and a helpful LAN utility.

All the programs could use some work, especially on their group authoring features. As networks become more popular, word processing packages should appear that better exploit the LAN environment. ●

Eric Brown is a contributing editor for PC World.

WHERE TO BUY

MultiMate Advantage II LAN 1.0
Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502-1319
213/329-8000
Requirements: 350K, DOS 3.10
List price: $1445 for five users, $150 for each additional user, $50 per user to upgrade single-user versions
Not copy protected

pfs:professional network 1.00
pfs:professional write 1.00
Software Publishing Corp.
P.O. Box 7210
1901 Landings Dr.
Mountain View, CA 94039-7210
415/962-8910
Requirements: 512K, DOS 3.10
List price: network for five users $499, pfs:write $199
Not copy protected

WordPerfect Network—First Station 4.5
WordPerfect Corp.
288 W. Center St.
Orem, UT 84057-9971
801/225-5000 (information), 800/321-4566 (orders)
Requirements: 256K, DOS 3.10
List price: First Station $695, subsequent nodes $150 each
Not copy protected

WordStar Professional release 4, the LAN version
MicroPro Int'l Corp.
33 San Pablo Ave.
San Rafael, CA 94903
800/227-5609
Requirements: 256K, DOS 3.10
List price: LAN server copy $495, additional nodes $150 each
Not copy protected

Samna Word IV Network 1.1
Samna Corp.
2700 N.E. Expressway #C700
Atlanta, GA 30345-9990
800/831-9679, 404/321-5006
Requirements: 448K, DOS 3.10
List price: $1225 for three users, $575 for each subsequent set of three users
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Wyse 386 system, 1.2 floppy, 1 m.b. Ram, serial/parallel port, clock calendar, DOS $2595

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132 **WordStar 2000 Plus Release 3.0**
Finally up to speed, WordStar 2000 has graduated from word processor to work environment, offering users a variety of handy utilities.

136 **InstaPlan 1.03**
A flexible project planner with stylish graphics for just $99 uses the audience as its central metaphor.

142 **Freeway Advanced 2.1**
Despite a maze of menus and slow file transfers, *Freeway Advanced* used to be a bargain—until the price went up.

150 **SmartKey 5.2**
The veteran macro processor now offers a slick interface and conditional macros.

152 **Ask Dan About Your Taxes**
An expert system analyzes your tax situation, then advises you on how to deal with one of life's two inevitabilities.

WordStar 2000 Plus Release 3.0

Word processor

PROS: Operates much faster, imports graphics, includes thesaurus and file search utility

CONS: No mouse support, poor use of function keys, awkward command structure

People used to talk about *WordStar 2000* in the hushed tones reserved for a sickroom. Slow and quirky, the program sold so poorly it was an embarrassment to its creator. Release 3.0 is much faster than earlier versions and offers function key commands, page preview, a built-in thesaurus, and a raft of add-on utilities ranging from *PC-Outline* to *Fill-a-Form*. Yet it still doesn't offer mouse support and relies on a menu-and-command structure that's increasingly out-of-date.

The most notable changes in *WordStar 2000* blur the line between word processing and desktop publishing. The program now incorporates an improved version of *Inset* that lets you grab, crop, and resize images from such programs as *1-2-3*, *PC-Paint*, and *AutoCAD* and insert them into *WordStar 2000* files for printing. With the basic graphics editor you can modify images you've captured or create new ones from scratch. Release 3.0's new page preview feature lets you see how text will appear on a page, but you can't edit the greeked text. And if you're inserting a graphic into a document, page preview won't display the two together—it shows only the space reserved for the image.

Release 3.0's impressive cursor speed is sure to be its most popular new feature. Scrolling is twice as fast as in release 2.0, and disk saves show about a 25 percent pickup. Search and replace from the beginning to end of a document is roughly four times faster. *WordStar 2000*

can now keep up with such speedsters as *WordPerfect 4.2*, and *Microsoft Word 4.0*.

Formatting is also much improved. The name of the last file edited is automatically highlighted when you enter the Format menu, and Quit-and-Format and Quit-and-Edit options let you switch quickly from one mode to the other. Unfortunately, the Format menu routine remains as inefficient as ever. Instead of presenting all the settings on screen at once and letting you select what you want to change, you have to run through 26 separate prompts. However, on-screen paragraph formatting is quicker and now works in the background while you type.

WordStar 2000 veterans whose fingers (and noses) have been bent out of shape by three-key commands will be relieved to learn that release 3.0 makes full use of the function keys, alone and paired with <Ctrl>, <Alt>, or <Shift>. Function key assignments could have been better thought out, however. For example, the program gives you function key access to the MailMerge menu—which you're not likely to use very often—instead of a simple way to highlight a paragraph for copying, deleting, or moving.

Many of release 3.0's other enhancements, although welcome, are more like catch-ups. You can now temporarily exit to DOS, for example, use wild cards when entering file names, and check the active document's total number of words, lines, and pages from within the program—capabilities other word processors already have. And some interesting new features could have been better implemented. A new command, Speed Write, lets you start writing without first picking a name and format for a document, so you don't have to put someone on hold while you crank up the program to jot down a note; but this should be a default instead of a menu choice. Another potentially important addition is FileLocator, a speedy utility that finds files whose names you've forgotten, but it can deal with only one directory at a time. *WordStar 2000* also offers a fast 550,000-synonym thesaurus to accompany its spelling checker.

Included in release 3.0 is Star Exchange, a versatile file-conversion utility that allows two-way conversions with *DisplayWrite*, *Microsoft Word*, *MultiMate Advantage II*, *WordPerfect*, *WordStar Professional*, ASCII, and IBM DCA .FFT files. What's more, a number of documents can be queued for translation, so you can go get a cup of coffee while the dirty work gets done.

PATRICK McDONNELL

Even with all its added features, *WordStar 2000* requires just 512K, the same amount as release 2.0 alone. The biggest difference is that release 3.0 has grown from a word processor to an entire working environment, letting users mix and match optional utilities from the main menu to suit their personal styles. The thesaurus, FileLocator, *Inset*, and Star Exchange are modular additions to the main program, so they won't take up valuable disk space or RAM if you don't need them. Moreover, *WordStar 2000* comes with three stand-alone programs that, once installed, can be accessed through the main menu: *Fill-a-Form*, for creating, entering, and printing invoices and other kinds of forms; *PC-Outline*, a popular outliner; and *ShowText*, to help create such presentation visuals as signs, exhibit boards, text charts, and tables.

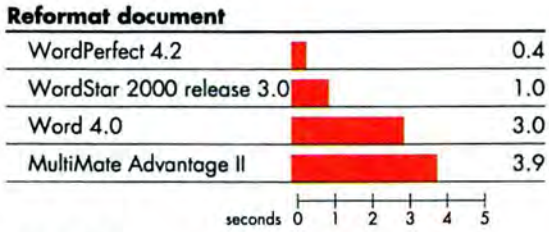
Finally, release 3.0 can easily be expanded with several useful add-ons. If its basic dictionary isn't enough, for $25 you can buy a legal dictionary, a medical dictionary, or one that features financial and insurance terms.

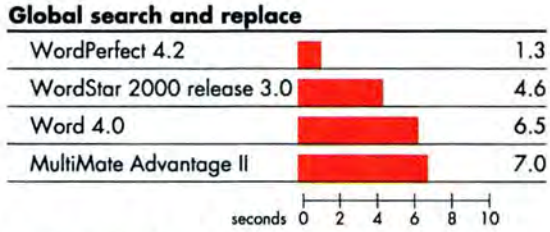
With an eye toward a lucrative vertical market, MicroPro offers a special version of *WordStar 2000* customized for lawyers. Costing $100 more, the Legal Edition includes the specialized legal dictionary, *CompareRite* (a program that compares

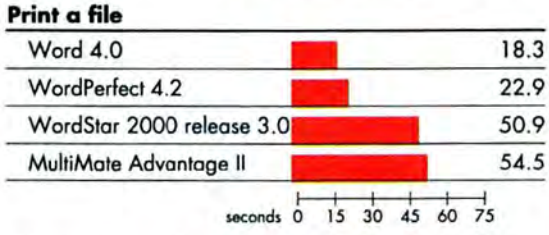
NSTL TEST REPORT

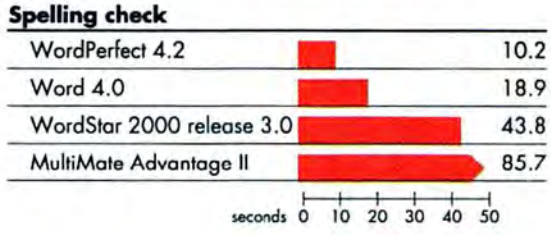
WordStar 2000 Plus Release 3.0

In its new release, WordStar 2000 generally keeps up with Word and WordPerfect, leaving MultiMate Advantage II far behind.









All benchmarks were performed on an 8-MHz 640K IBM AT with a 30MB hard disk. All tests except the spelling check used an 8-page (480-line) text file consisting of groups of four characters separated by spaces (e.g., *aaaa bbbb cccc*). The file was formatted at 60 lines per page with margins set at 1 and 60. A carriage return and blank line followed every 9 lines of text. This pattern was repeated throughout the document. Times were measured from the keystroke initiating the test until control was returned to the user.

Reformat document
The times to reformat the document after changing the right margin from 60 to 50, and then from 50 to 60, were averaged for each program.

Print a file
This benchmark used a device that simulates an infinitely fast printer, one not slowed by paper or printhead movement. The performance text file was "printed" to the device at the maximum speed supported by the program. Times with an actual printer would be greater.

Global search and replace
With the cursor positioned at the beginning of the text file, the program was instructed to automatically replace all (240) instances of *aaaa* with *AAAA*.

Spelling check
This benchmark recorded the time a program's spelling checker required to proof a 28,051-character ASCII file (consisting of thirty 14-line paragraphs) after the file had been read into each program and saved in that program's format.

Data based on tests designed and conducted by National Software Testing Laboratories (NSTL). All rights reserved.

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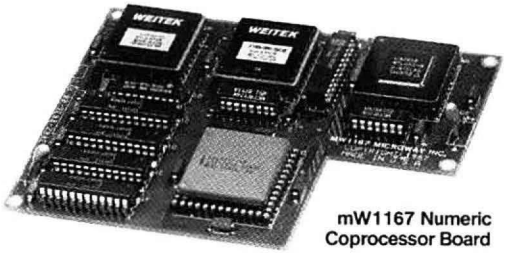

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An example of the benefit of excellent code is a 32-bit matrix multiply. In this benchmark an NDP Fortran-386 program is run against the same program compiled with a 16-bit Fortran. Both programs were run on the same 80386 system. However, the 32-bit code ran 7.5 times faster than the 16-bit code, and 58.5 times faster than the 16-bit code executing on an IBM PC.

NDP FORTRAN-386™ $595
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The **mW1167™** is a MicroWay designed high speed numeric coprocessor that works with the 80386. It plugs into a 121 pin "Weitek" socket that is actually a super set of the 80387. This socket is available on a number of motherboards and accelerators including the AT&T 6386, Tandy 4000, Compaq 386/20, Hewlett Packard RS/20 and MicroWay Number Smasher 386. It combines the 64-bit Weitek 1163/64 floating point multiplier/adder with a Weitek/Intel designed "glue chip". The mW1167™ runs at 3.6 MegaWhetstones (compiled with NDP Fortran-386) which is a factor of 16 faster than an AT and 2 to 4 times faster than an 80387.

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Monoputer T414-20 with 2 meg[1] ...$1495
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[1]Includes Occam

80386 Multi-User Solutions

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Phar Lap™ created the first tools that make it possible to develop 80386 applications which run under MS-DOS yet take advantage of the full power of the 80386. These include an 80386 monitor/loader that runs the 80386 in protected linear address mode, an assembler, linker and debugger. These tools are required for the MS-DOS version of the MicroWay NDP Compilers.

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FEATURES EVALUATION

Word Processor Features

Feature for feature, WordStar 2000 release 3.0 stands up well against its competitors.

	WordStar 2000 3.0	WordPerfect 4.2	Word 4.0	MultiMate Advantage II
On-screen display				
Column and line number	●	●	●	●
Page breaks	●	●	●	●
Boldface and underline	●	●	●	●
Italics	○	○	●	○
Formatting				
Conditional page breaks	●	●	●	○
Widow/orphan control	●	●	●	●
Automatic hyphenation	●	●	●	●
Decimal tabs	●	●	●	●
Multiple column types on same page	○	●	●	●
Search and replace functions				
Conditionally ignores case	●	●	●	●
Wild-card search	●	●	●	○
Searches control characters	●	●	●	●
Printing				
Proportional spacing	●	●	●	●
Queues documents	○	●	●	●
Prints in background	●	●	●	●
Special features				
Macros	●	●	●	●
Macro learn mode	●	●	●	○
Spelling checker and thesaurus	●	●	●	●
Outliner and math functions	●	●	●	●
Numbers footnotes	●	●	●	●
Maximum header/footer lines	3	◒	◒	5
Windows (maximum)	3	2	8	1
Mail merge	●	●	●	●
Creates index	●	●	●	○
Creates table of contents	●	●	●	●
Telecommunications module	●	○	○	○
Undo command	○	○	●	○
Undo delete	●	●	●	●

[1] Unlimited.

● Yes ○ No ◒ Deficient

two versions of a document and produces a third that shows changes), and *CiteRite* (a citation checker).

If *WordStar 2000* seems a Johnny-come-lately in some areas, it leads the pack in printer support. The program accommodates over 400 printers, including 30 laser printers. It also offers full support for PostScript and a special program for downloading soft fonts to HP laser printers.

With release 3.0, MicroPro has cut *WordStar 2000*'s price, improved its speed, and added a rash of new features and utilities. But it hasn't substantially changed a word processor that many users find unwieldy and complex. While greatly improved, the patient may not yet be off the critical list. —*Patrick Marshall*

WHERE TO BUY

WordStar 2000 Plus release 3.0
MicroPro Int'l
33 San Pablo Ave.
San Rafael, CA 94903
415/499-1200
List price: $495, Legal Edition $595
Requirements: 384K (512K for graphics and supplementary programs), two disk drives, DOS 2.00 or later version
Not copy protected

InstaPlan

Project planner

BEST BUY

PROS: Easy to use, superb graphics, intelligent resource scheduling and costing, very inexpensive

CONS: No plotter support

If your best-laid plans go oft awry, you should know about *InstaPlan*, an unorthodox, easy-to-use project planner with far more flexibility than such heavyweights as *Time Line* and *SuperProject*. *InstaPlan* can't handle a Pentagon weapons system, but it can help you design an audit, run a consulting project, or launch an advertising campaign. At $99, it's also a tremendous bargain. An extra $70 buys

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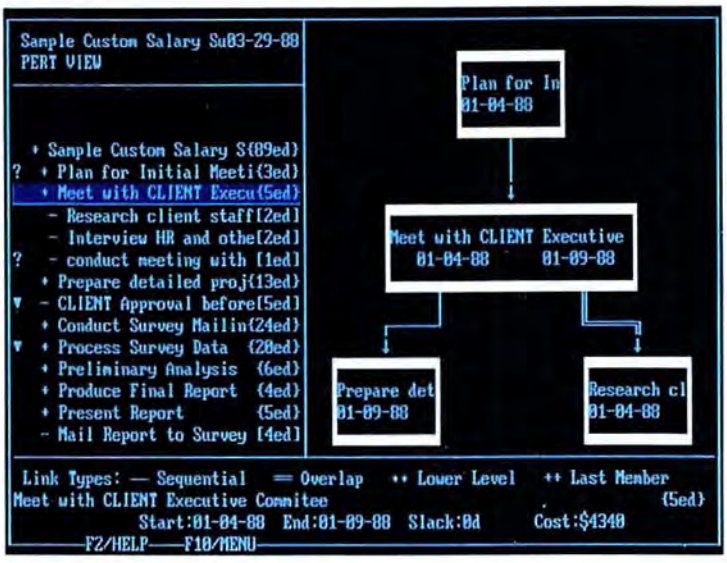

InstaPlan displays project management's traditional PERT chart in an unusual layout that lets you zero in on a specific part of the plan.

a version that includes a "reference plan" feature that lets you track the implementation of a project against the original plan.

Traditionally, project management software takes one of two approaches. With the critical path method used by *Time Line*, the planner maps out project activities chronologically using start and stop dates. The critical path, embodied in a Gantt chart, traces the shortest route to completing the project. *SuperProject* plots events in a similar start/stop date fashion but uses the Program Evaluation and Review Technique (PERT) to link the project's steps and milestones.

Both *Time Line* and *SuperProject* require extensive planning *before* you can start entering data, since moving data around and editing the activities information is difficult once relationships between tasks and resources have been established. With *InstaPlan*, on the other hand, you simply outline the project's steps and add or change details as it unfolds. If you already know how to construct an outline using a word processor, *ThinkTank*, *Ready*, or *PC-Outline*, data entry is a snap.

Each line in the outline represents an activity in the schedule, and you can expand or collapse the outline with a keystroke. *InstaPlan* considers any related items indented under a line to be an activity group, and it automatically subtotals their costs in the Resource spreadsheet. As you move activities around, *InstaPlan* recalculates and replaces the items in the PERT, Gantt, and Resource spreadsheet charts.

Unlike most project management software, *InstaPlan* provides a number of views that give different perspectives on specific parts of a project. Data can be entered in any of the views, and the program will update corresponding entries in all the others.

InstaPlan's main Activity screen displays time elapsed for each activity, as well as the subtotals and totals of days or hours for each major activity group.

In the Gantt view you see a truncated Activity screen on the left, and on the right a conventional critical path, normal work days, delays, milestones, slack time, and actual and reference times. While viewing the Gantt chart, you can still edit the Activity view.

In the Schedule view, you set the project's dates and timetables relative to each other. The Resource view shows all of a project's resources—materials, individuals, groups, fixed and variable costs, and so on—billing rates, and work hours. The Spreadsheet view automatically tallies the time and cost of resources, making it easy to assign, add, subtract, and try what-if scenarios with the resource assignments. In the Resource Calendar view, you adjust the project's length.

From the main menu, you can switch to any view; search for strings; edit and move lines or activities; set dates, dollars, or colors; and print reports.

InstaPlan takes about 468K RAM above DOS, leaving the remainder (up to the 640K DOS limit) for the actual project (the program doesn't support extended memory). This gives you enough room for a project encompassing some 600 activities with two or three resources apiece. You can specify as many resources as you want, and each task can have as many dependencies as necessary up to the limits of memory.

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August 11, 1987
Vol 1, No 1

COMMUNICATIONS

PERSPECTIVES

REVIEWS

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SPECIAL REPORT

COLUMNS

January 25,1988
Vol 2, No 2

MacintoshToday

Users hail Mac-to-VAX link; DEC has even bigger plans

Apple's LU 6.2 seen in show spotlight

22 companies form users group for professionals

Communications program adapts Mac interface to remote systems

Expo packs 'em in

shows off innovative system software

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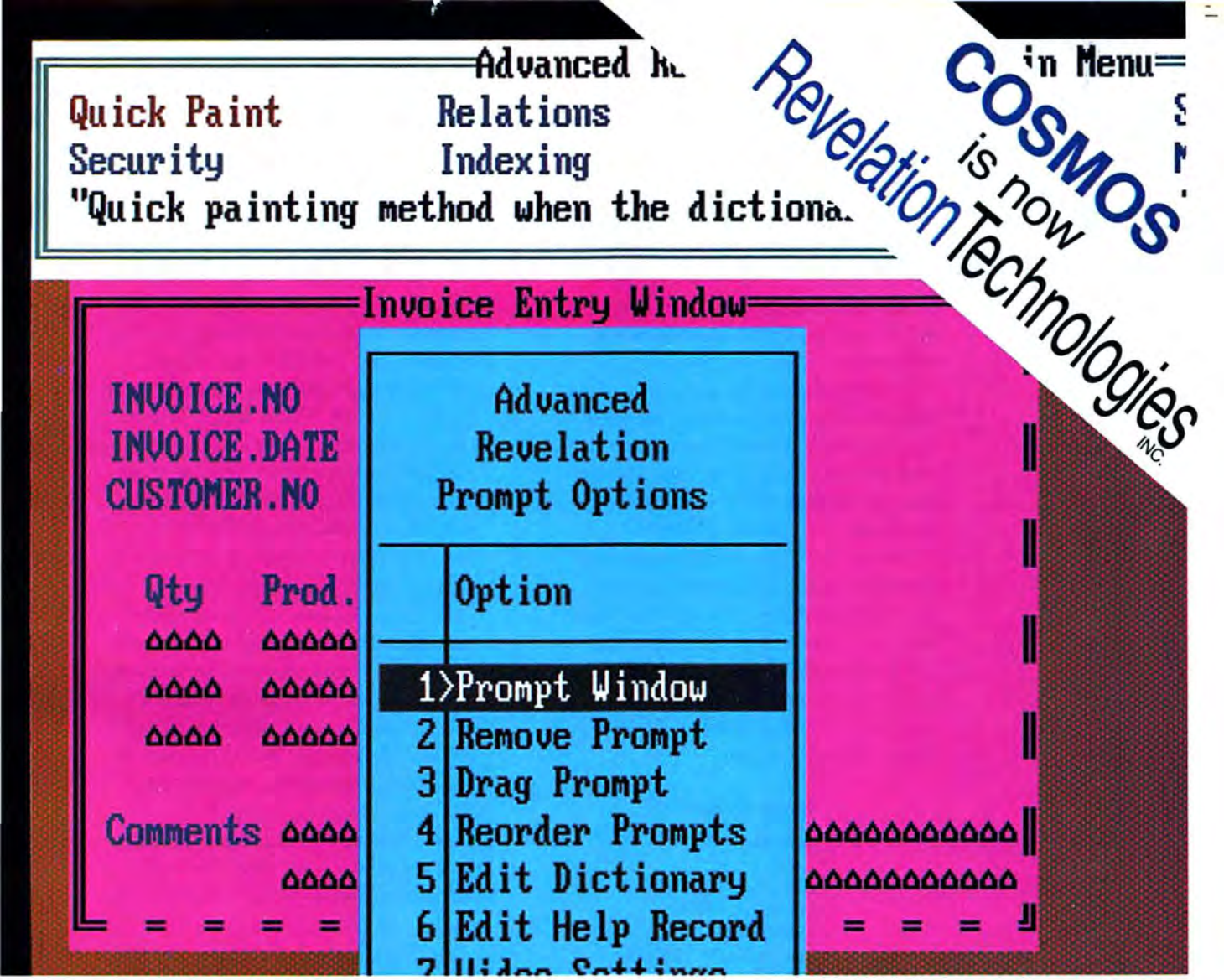

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The program's report function matches the quality of its superb graphics display. Besides generating reports by view, a special Activity Chart shows such items as start and stop dates, planned versus actual costs, task completion dates, and milestones.

InstaPlan supports a wide range of dot matrix and laser printers but, inexplicably, no plotters. Though it sometimes lapses into sexist language, the program's documentation is well written, profusely illustrated, and includes a tutorial.

Overall, *InstaPlan* treats project management in a way that makes allowances for life's vicissitudes without letting them destroy a well-conceived plan. You may not want to use it to build a battleship, but *InstaPlan* can help you drain a swamp before the alligators get out of hand. —*Woody Liswood*

WHERE TO BUY

InstaPlan 1.03
InstaPlan Corp.
655 Redwood Hwy. #311
Mill Valley, CA 94941
415/389-1414
List price: $99, $169 with tracker feature
Requirements: 468K, two disk drives, DOS 2.00 or later version
Not copy protected

Freeway Advanced

Communications program

PROS: Crosstalk emulation, automatic–log-on script utility, password protection

CONS: Complex menu structure, no on-line printing, slow file transfers

When a barrage of full-page ads announced the debut of *Freeway Advanced* last year, the program looked like a bargain at $89.95; a pared-down basic version cost an amazing $24.95. The program wasn't perfect, but it sure was cheap. Alas, manufacturer Kortek soon raised the price to $139 and more than doubled the tab for the basic version. Nowadays, compared to *Relay Silver*, which costs $150, *Freeway Advanced* isn't much of a steal.

Freeway Advanced is a command- and menu-driven general communications program that features a *Crosstalk*-style script language, a learn mode for creating automatic–log-on scripts, and password protection on groups of phone numbers. It emulates VT 100, VT 52, and TTY terminals and supports Kermit, XMODEM, YMODEM, and CompuServe B file transfer protocols in addition to a proprietary protocol. Unfortunately, *Freeway Advanced* is awkward to set up, lacks on-line printing, and isn't particularly fast.

Freeway Advanced 2.1 can remember 120 different 20-digit phone numbers and their related communications parameters, which it gathers into "phone books." It's a handy organizational device—you can group related entries such as information utilities, bulletin boards, and individual PCs—but a rigid one. Phone books are limited to 12 entries apiece, and you can't copy settings between phone books. You can password-protect entire phone books but not individual listings.

Once the system is configured and the numbers entered, *Freeway Advanced* is fairly easy to use. From the main menu, one keystroke brings up a phone book, another one dials the system you select, and you're on line. You can save the session to disk and upload and download files, but—and here's a major omission—the program offers no way to print files.

Freeway Advanced allows you to switch easily from data to voice and back again, and to step out to DOS temporarily without terminating the session. Although it has a single-page notepad for quickly jotting and sending messages on line, it can't save or load files.

Like most modern communications packages, *Freeway Advanced* offers a learn mode, which records the keystrokes you use to connect with an on-line service, thus automatically creating a log-on script. The program can work unattended and has an auto-answer mode, but it lacks

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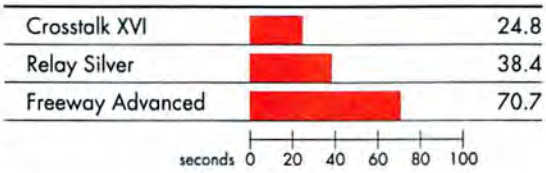
NSTL TEST REPORT

Freeway Advanced

In most tests, Freeway Advanced lagged badly behind such standard communications programs as Crosstalk XVI and Relay Silver.

No protocol

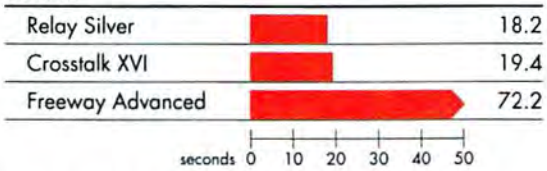


Protocol

Proprietary

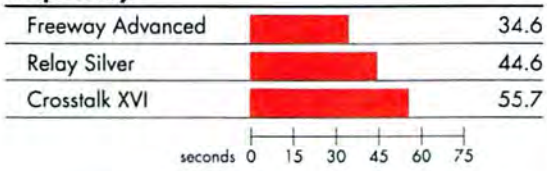
XMODEM

Kermit



Protocol/error

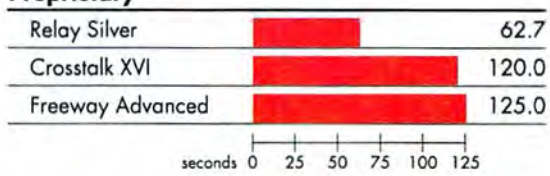
Proprietary



Tests were performed using *Crosstalk XVI 3.61, Relay Silver 1.0,* and *Freeway Advanced 2.1.* All tests were performed on a pair of IBM PC XTs connected by a null modem cable. Tests consisted of the transmission of a 10K file at 9600 bps. Prior to testing, each hard disk was formatted and DOS 3.20 was installed in its own directory. A CONFIG.SYS file was then created in the root directory, specifying FILES=20 and BUFFERS=25. Finally, the communications program was installed in its own directory according to the manufacturer's instructions. The identical program and version number were used on each computer, but to maintain the integrity of our tests, the program serial numbers were different. In tests using protocols, each program was run with Checksum XMODEM and Kermit. Although these protocols are not universal standards, most communications programs support them. The proprietary protocol included with each was also tested.

Protocol/error/delay

Proprietary

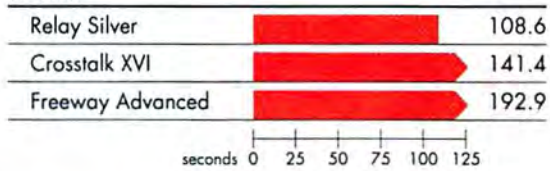


Protocol/delay

Proprietary

XMODEM

Kermit



No protocol
The program was set to display each character as it was echoed from the host (remote echo).

Protocol
The program transmitted a 10K text file at 9600 bps with Checksum XMODEM and Kermit.

Protocol/error
A 10K text file was transmitted, and errors were inserted into the transfer at the rate of 1 character dropout and 1 changed byte per 1500 characters.

Protocol/error/delay
A 10K text file was transmitted, and errors were inserted into the transfer at the rate of 1 character dropout and 1 changed byte per 1500 characters. Characters were delayed approximately .5 second between computers.

Protocol/delay
For this test, characters were delayed approximately .5 second between computers.

Data based on tests designed and conducted by National Software Testing Laboratories (NSTL). All rights reserved.

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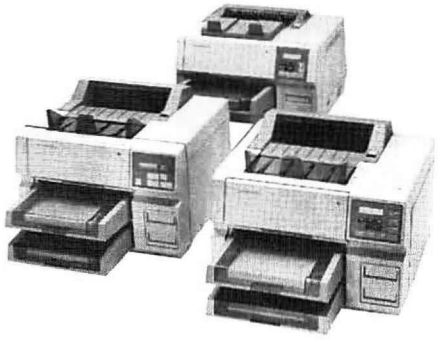

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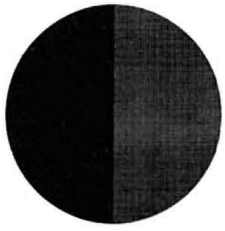

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In its menu-driven mode, Freeway Advanced forces users to page through several menu layers to perform some routine setup tasks.

the remote features that would let a distant PC send files to or fetch them from your system.

Probably the best thing about *Freeway Advanced* is that you can swap its menu maze for a *Crosstalk*-like command mode. The full set of *Crosstalk XVI* commands is supported, with some extensions that control *Freeway Advanced*'s menus. Existing *Crosstalk* scripts work fine in the program, and you can write your own with any word processor that produces ASCII files.

As far as performance is concerned, *Freeway Advanced*'s general operation leaves a lot to be desired. NSTL tests show that, compared with *Relay Silver* and *Crosstalk*, some *Freeway Advanced* transfers were downright sluggish. In nonprotocol transfers, for example, it was nearly three times slower than *Crosstalk XVI 3.16*.

At press time, Kortek had just released *Freeway Advanced* version 2.2, which adds a status line and colors in terminal mode and an expanded communications buffer, and can accommodate phone numbers up to 35 characters long. The company claims that the program's performance is somewhat better than that of version 2.1. Registered users can download version 2.2 free from Kortek's BBS (415/327-4589).

Overall, *Freeway Advanced* is an odd collection of nifty features and curious oversights. When it was first introduced, the program was such a buy that its limitations could be easily overlooked. Now that customers are faced with a higher price, forgiveness may come a little harder. *—Daniel J. Rosenbaum*

WHERE TO BUY

Freeway Advanced 2.1
Kortek
505 Hamilton Ave.
Palo Alto, CA 94301
800/327-0310, 415/327-4555
List price: $139, basic version $59.95
Requirements: 300K, two disk drives, DOS 2.00 or later version
Not copy protected

SmartKey 5.2

Macro processor

PROS: Conditional macro capability, impressive range of features, inexpensive, RAM-frugal

CONS: Can't load all macros into the edit screen at once, disorganized help system

Long before *Keyworks* or *SuperKey* was a gleam in its programmer's eye, *SmartKey* was already helping personal computer users shortcut their keyboards. Now, nine years after its original release, *SmartKey* version 5.2 adds impressive new features and a cleaner interface to an old standby.

SmartKey 5.2 lets you edit macros as you write them, for example, instead of making you load a special editor. It can also run *SideKick* with a macro, insert time delays ranging from 1 second to 11 days, convert text to upper- or lowercase, and direct printer setup strings to a port. *SmartKey*'s help system is weak, however, and editing a group of macros already in memory is so cumbersome it's hardly worth the effort.

Considering how far it has come, *SmartKey* deserves some sort of Most Improved award. Version 5.1 made designing menus a matter of answering a few questions regarding the size and posi-

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tion of each menu element on the screen. It could also create mnemonically named macros that you run by typing a few characters instead of the usual <Shift>-*key* combination.

With version 5.2, *SmartKey* takes a step into the realm of conditional programming first explored by *Keyworks Advanced* (see *The Software Shelf*, *PCW*, November 1987). *SmartKey 5.2* can read the current system time or date, detect specific characters on screen, and take action accordingly. Two conditional branching options are offered: UNTIL suspends macro execution until the specified condition occurs; IF tells *SmartKey* to play back one of two macros depending on the condition—for example, when a 'Printing completed' message appears on screen or when the system clock reads '5:30 pm'.

As with any good macro program, you can tailor *SmartKey* to your liking at installation, specifying a hot key, the macro playback speed, the edit-window size and colors, and the presence of a Hercules or EGA board. *SmartKey* requires just 37K of RAM and keeps its nonmacro features—such as file encryption—in separate utilities.

One of *SmartKey*'s few shortcomings concerns editing macro files in RAM. Although the macro editor has an excellent selection of text-manipulation commands, there is no way to load all the macros into the editor at once. To revise a set of definitions, you must first examine the macros with the List function, exit *SmartKey*, load it again, press the hot key of the macro you want to touch up, save the changes, exit *SmartKey*, then load and edit the next macro.

One further weakness: *SmartKey*'s menu-driven on-line "tutorial" is essentially a collection of text screens that you must search for a desired topic. The program's user manuals are somewhat more serviceable and include plenty of examples.

With its birdlike appetite for memory, budget price, and abundant features, *SmartKey* is a real bargain among macro programs. If you can live with less-than-convenient on-line macro editing, *SmartKey*'s new conditional commands and screen-building power will soon have you performing like a macro maestro.
—*George Beinhorn*

WHERE TO BUY

SmartKey 5.2
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22901 Mill Creek Dr., Ste. B
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PROS: Easy to master, expert system provides analysis and specific recommendations, inexpensive

CONS: Not suitable for complex returns, two schedules not integrated with rest of program

For a personal tax preparation program, *Ask Dan About Your Taxes* is a lot smarter than it looks. It offers extensive on-line help, calculates your taxes, and prints out the results for you to copy. That's helpful, but it's no big deal. What sets *Ask Dan* apart is an innovative expert system that actually gives you tax advice. Whenever you have trouble with an item on the 1040 form, the program leads you through a question-and-answer session and tells you how to treat the item. *Ask Dan* doesn't offer on-line help for all parts of all the IRS schedules, and it isn't suited to certain complex returns, but it can make filing the average personal return interesting, if not fun.

For designer Daniel Caine, publishing a program like *Ask Dan* takes some courage. Despite a number of disclaimers, *Ask Dan* clearly makes recommendations—and that could expose Caine to what is called preparer's liability. It's unlikely he'll be sued, though. *Ask Dan* is a care-

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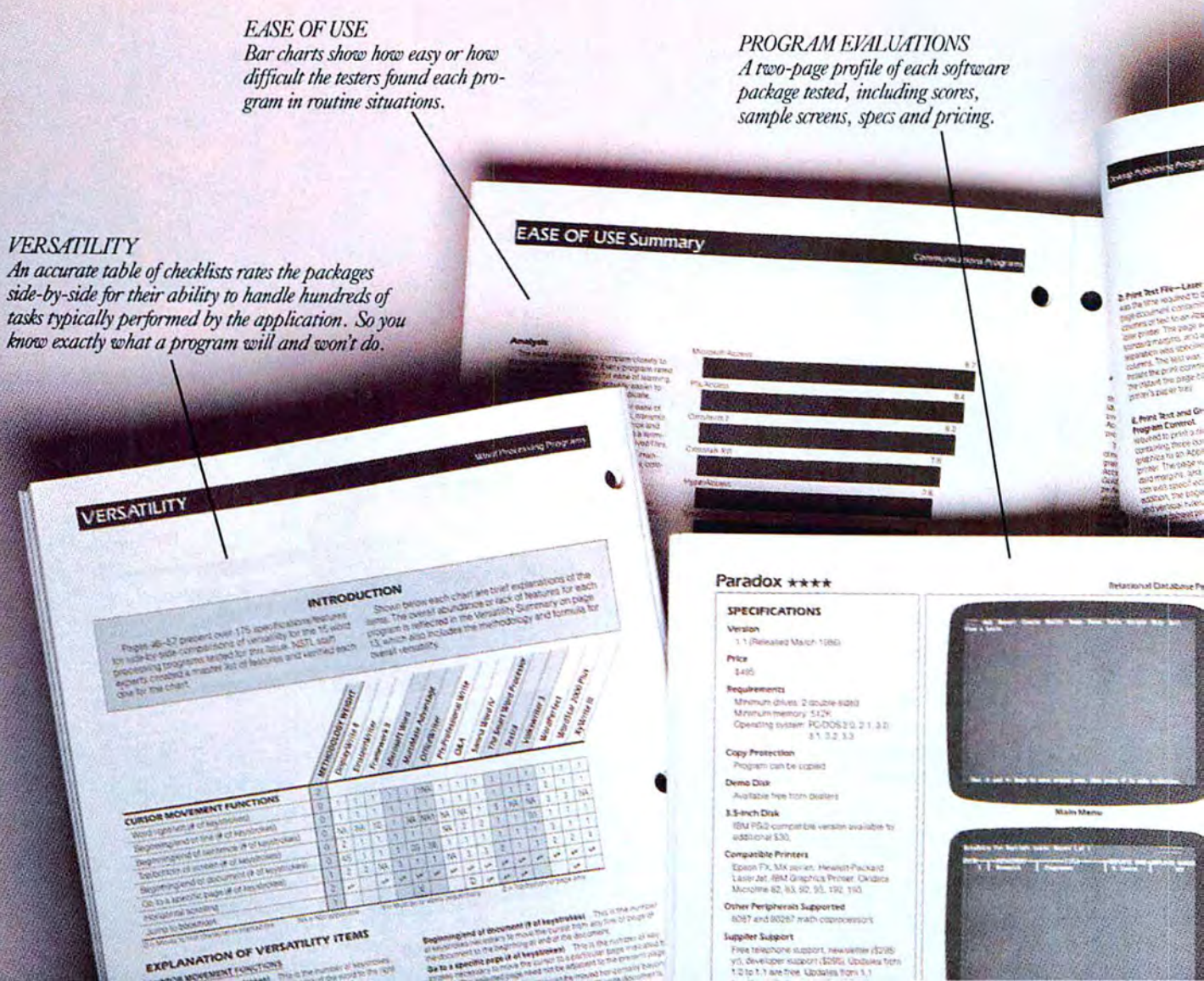

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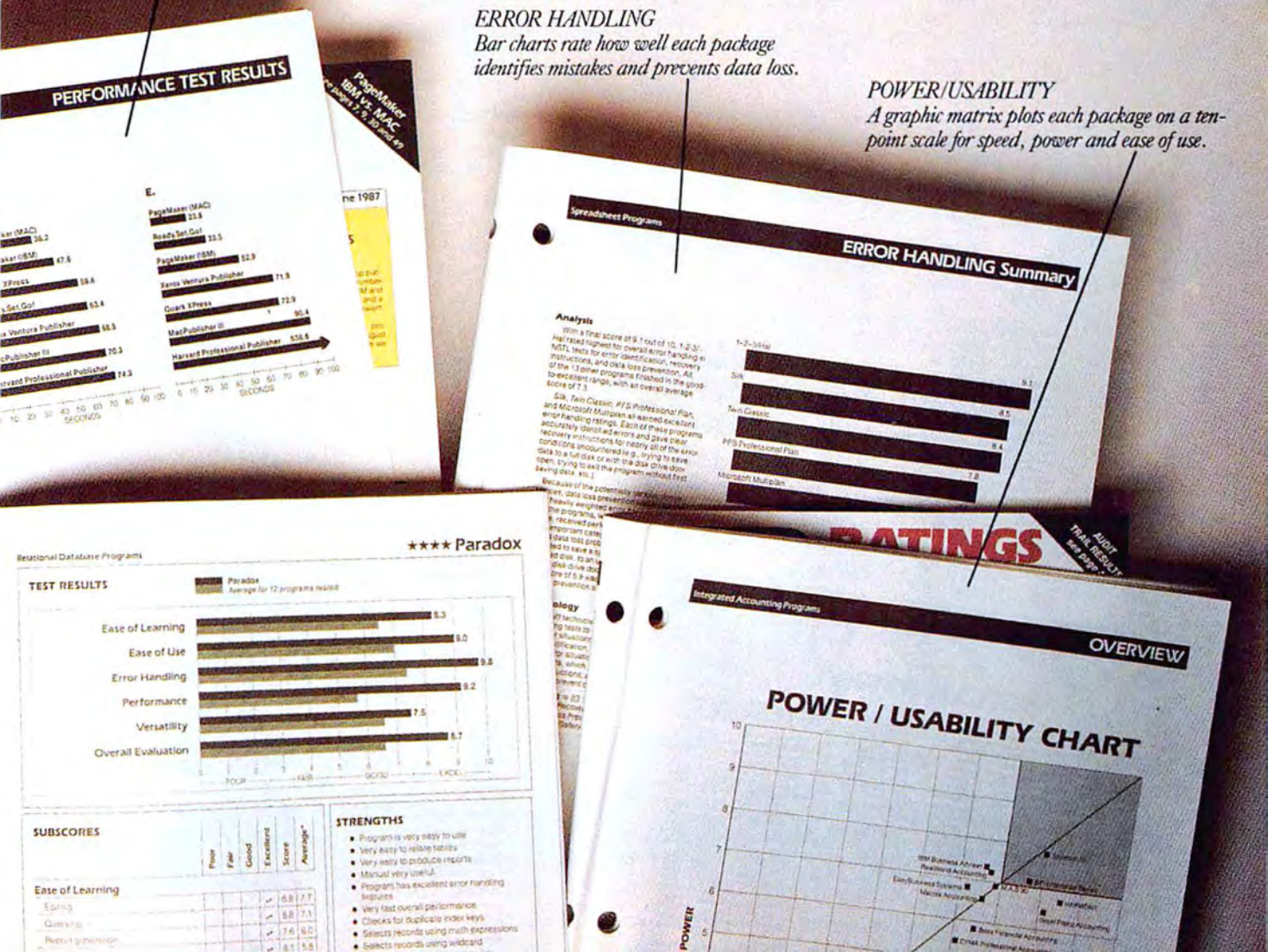

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PCW 4/88

dBASE Users!
Independent Reviewers Say:

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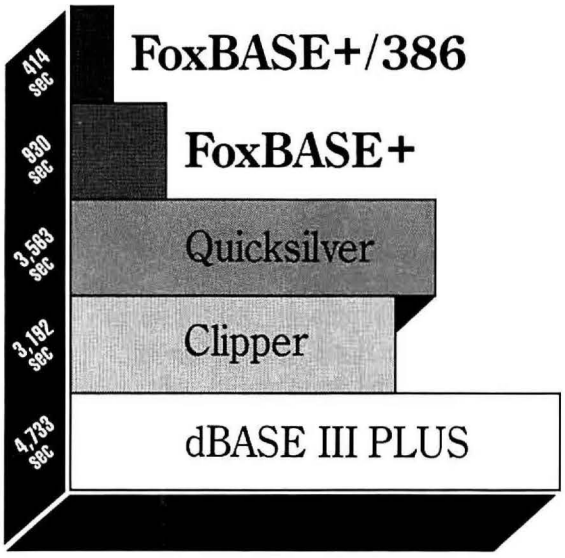
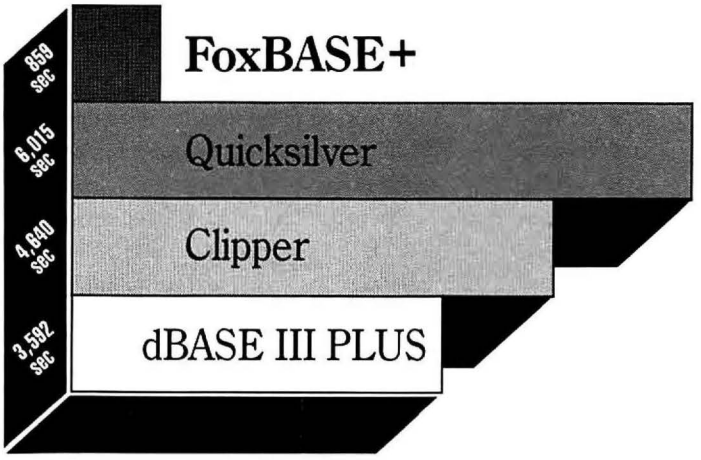


Data Based Advisor



BYTE Magazine

FoxBASE+ Fastest By Far

BYTE* benchmarks show that FoxBASE+ takes only 14 minutes to do what dBASE III PLUS needs an hour to do. The others are even slower. Clipper needs an hour and 17 minutes. Quicksilver needs an hour and 40 minutes.

Nobody beat FoxBASE+ in ***even one*** of the 27 BYTE benchmarks.

FoxBASE+ zipped through the exhaustive Data Based Advisor** benchmarks in just 15.5 minutes. New FoxBASE+/386 ran them in only 7 minutes! By contrast Clipper took 53 minutes, Quicksilver took 59 minutes, and dBASE III PLUS took an hour and 18 minutes.

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*Using the benchmark timings published in BYTE, September 1987.
**Using the suite of benchmarks published in Data Based Advisor, March 1987.

Fox Software
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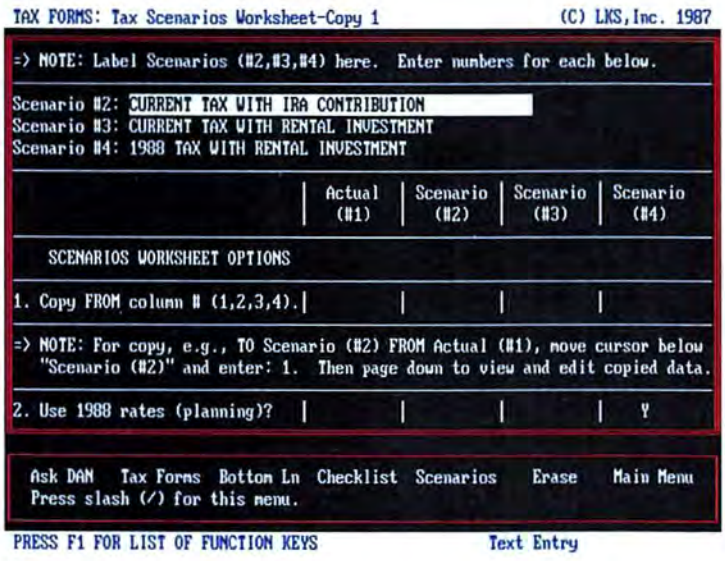
Circle 68 on reader service card



To find out how restructuring your finances will affect your tax liability, try the Scenarios option in Ask Dan About Your Taxes.

fully crafted program that goes into great detail to analyze a tax situation, and its conclusions seem reliable.

The program includes a pop-up calculator, a memo pad for making short notes while preparing returns, and a scratch pad that lets users build detail schedules to support a particular schedule. A checklist feature creates a personalized list of the tax forms you should consider filing.

Ask Dan's main 1040 screen is hot-linked to all the major tax schedules—including business-related ones—but its interactive help is mainly limited to personal tax topics: interest deductions, charitable contributions, moving expenses, and the like. And *Ask Dan* won't generate a 1040 form you can mail to the IRS. After doing its computations the program prints out completed facsimiles, but you still have to fill out the actual returns by hand.

Ask Dan is remarkably easy to use. The main screen displays a 1040 form with a menu area below it. Working your way through the form is straightforward and even a little boring—until you need help. Suppose you can't decide how to treat an IRA deduction. With the cursor on the 1040 IRA line, three keystrokes move you to the appropriate help section. *Ask Dan* will ask whether you or your spouse are under 70½ years of age, are active participants in another qualified plan, or have received any alimony or separate maintenance payments that might affect the IRA deductibility limitations. The program then calculates how much of your current-year IRA contribution is deductible and enters the figure on the appropriate line.

If you want to see what changes in income or deductions can do to your tax liability, try *Ask Dan*'s Bottomline and Scenarios features. Bottomline lets you recalculate the amount of tax due while you're preparing the return; Scenarios lets you project your future tax liability.

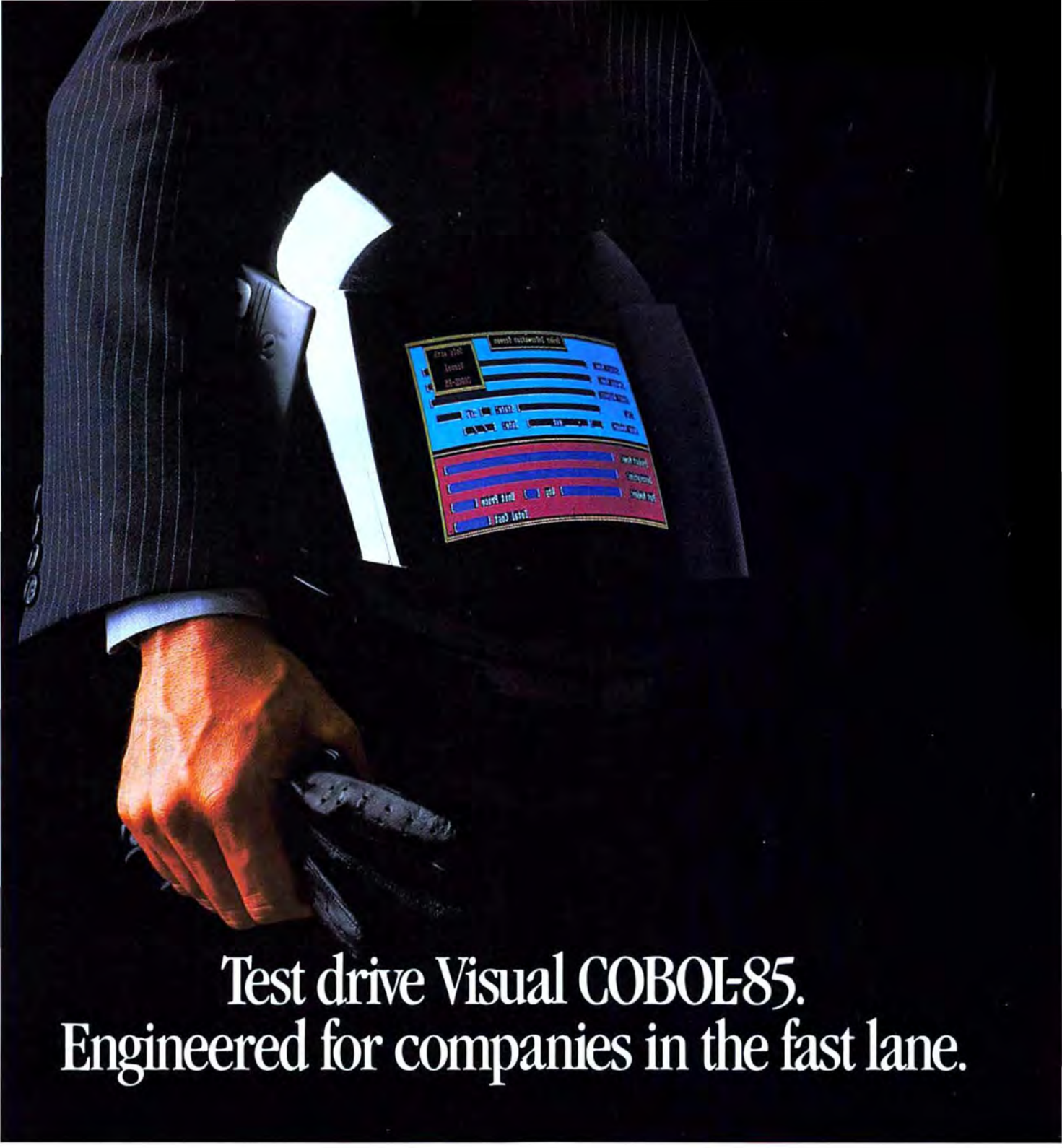
The only real drawback to this innovative program is that two important schedules—for passive loss and alternative minimum tax—aren't well integrated into the program.

The idea of turning tax decisions over to a piece of software will strike people as either novel or frightening. Even if you ultimately decide that a human being will make better company at an IRS audit, you'll find *Ask Dan* provocative and helpful. —*Jeffrey M. Whitton*

WHERE TO BUY

Ask Dan About Your Taxes
Legal Knowledge Systems
195 Maplewood St.
Watertown, MA 02172
617/923-2322
List price: $69.95
Requirements: 512K, two disk drives (hard disk recommended), DOS 2.00 or later version
Not copy protected

Patrick Marshall edits the Commentary Page of the Oakland Tribune. *Woody Liswood is a human resource consultant living in Midland Park, New Jersey, who specializes in compensation and incentive issues. Daniel J. Rosenbaum is a former UPI reporter and the author of* WordPerfect Advanced Techniques *(Que, Indianapolis, 1987). George Beinhorn is a freelance writer in Nevada City, California. Jeffrey M. Whitton is a manager in the tax department of the Orange County, California, office of Deloitte Haskins & Sells.* ●



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Circle 59 on reader service card

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COMPAQ

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162 **Tandy 4000**
A late entry in the 386 sweepstakes has stats to rival IBM's and Compaq's—for thousands less.

166 **Portable Vectra CS**
Although it tips the scale at 18 pounds, you may find Hewlett-Packard's hefty new laptop worth its weight in features.

170 **Racal-Vadic 9600VP**
This brainy modem adjusts its rate automatically to foil noisy phone lines—and speed your data transfer.

180 **Proprinter XL24**
Faster and smarter than its 8-pin ancestor, IBM's 24-pin dot matrix printer does everything but envelopes.

184 **Power Saver Plus**
For your darkest hour—8½ minutes of emergency power in a box that fits beneath your monitor.

Tandy 4000

386 system

BEST BUY

PROS: Fast processing speed, disk caching software included

CONS: Expensive RAM modules and hardware options, 5¼-inch floppy drive not available as a standard feature

Computer users' continuing lust for greater speed and power has made 80386 computers even more plentiful than 1988 presidential hopefuls. What started out just 18 months ago as a small, high-end market dominated by a single front-runner is now attracting scores of candidates, including machines from all the major parties. Among the newest challengers is Tandy's 386 PC, the Tandy 4000.

While the Tandy 4000 is not a campaign leader, its 16-MHz 80386 processor (software switchable to 8 MHz), 32-bit interleaved RAM, and disk caching software deliver performance very close to that of the two leading 16-MHz PCs—the IBM Model 80 and the Compaq Deskpro 386. The basic system comes with 1MB of RAM, a 3½-inch floppy disk drive, and one serial and one parallel port; it carries a low list price of $2599. Fully configured with EGA graphics, 2MB of system RAM, and a 40MB hard disk, the Tandy 4000 weighs in at a comfy $5446—not cheap, but thousands less than comparable PCs from IBM and Compaq.

The front panel of the system's 18-by-19-by-6-inch cabinet displays a familiar AT-style power indicator, a keylock, and a large, fire-engine-red reset button. Three half-height bays are located at the right; the power switch is placed handily on the right side, toward the back.

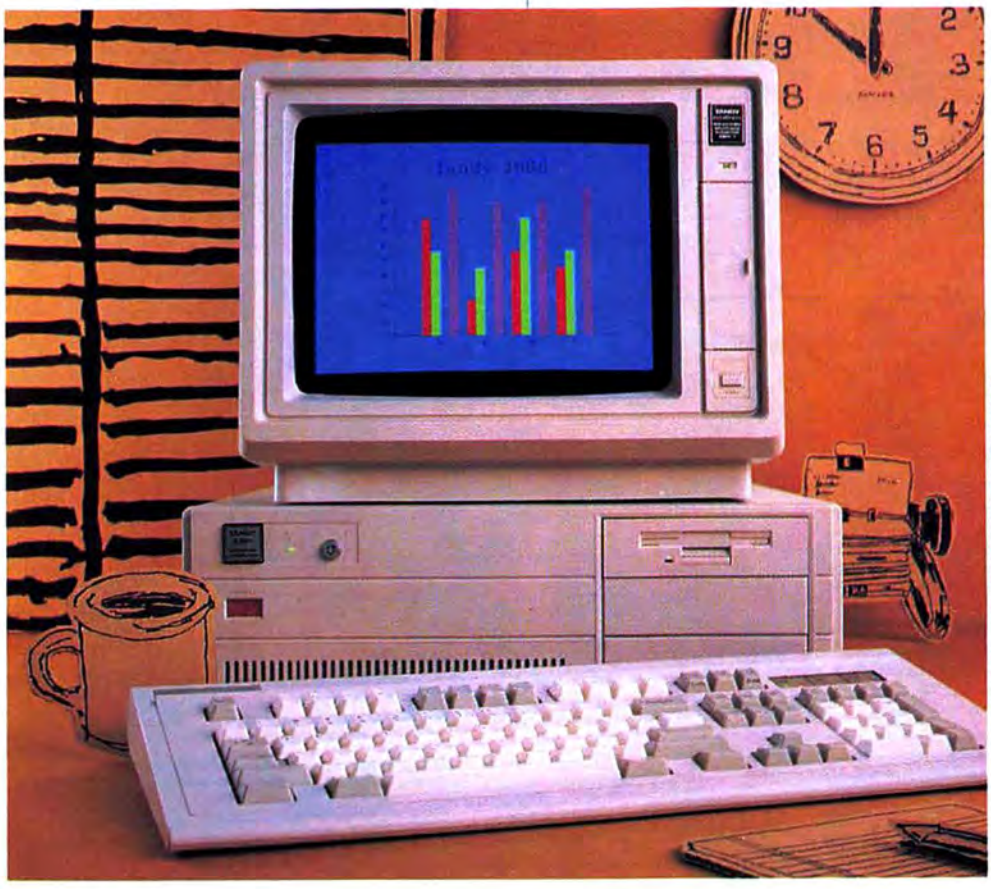
The Tandy comes with a standard 1MB of 32-bit dynamic RAM in the form of two 512K single in-line memory modules (SIMMs) that take up two of four SIMM

sockets on the motherboard. A SIMM RAM Upgrade Kit ($430) adds two more memory modules to the motherboard for a system total of 2MB. With the standard 1MB installed, the system operates at one-wait-state, peak 386 performance. With 2MB of RAM installed, a memory-interleaving scheme kicks in, resulting in memory access close to that of a zero-wait-state operation and a performance gain of about 25 percent. (Intel's motherboard uses a similar interleaving technique; see the review of the Kaypro 386E in "Beware the Cutting Edge," *PCW*, November 1987.)

Currently, Tandy populates the SIMMs in the 4000 with 256-kilobit dynamic RAM chips; it plans to move up soon to SIMMs with 1-megabit dynamic RAM chips, at which time the capacity of the motherboard will make a quantum leap to 8MB. Until then, the only 32-bit expansion option is Tandy's 2MB memory expansion board ($799), which plugs into a proprietary 32-bit slot on the motherboard to top off 32-bit RAM at 4MB. Meanwhile, RAM-hungry users can fill memory capacity above 4MB with conventional 8- or 16-bit memory boards—and learn to live with the performance loss.

The motherboard contains sockets for both 80287 and 80387 math coprocessor chips. The 80387 socket also accommodates Weitek's high-velocity numeric coprocessor board; the Weitek can be used either instead of or in conjunction with an 80387 to speed up math-intensive applications. While Tandy does not sell the Weitek coprocessor module, it is available from MicroWay for $1495.

The motherboard features a total of nine expansion slots: one proprietary 32-bit slot for use with Tandy's memory expansion board, plus six 8/16-bit and two 8-



PHOTOGRAPHY BY JOHN GREENLEIGH ILLUSTRATION BY WARD SCHUMAKER

Tandy's first 80386 machine sells for a low $2599 base price and—aside from the 3½-inch, 1.44MB disk drive—offers plain-vanilla features.

bit slots. The serial/parallel adapter takes up one 8-bit slot; if you install the optional video controller, it uses up the other. The optional Tandy Enhanced Graphics Adapter provides MDA, CGA, and EGA emulation for $300.

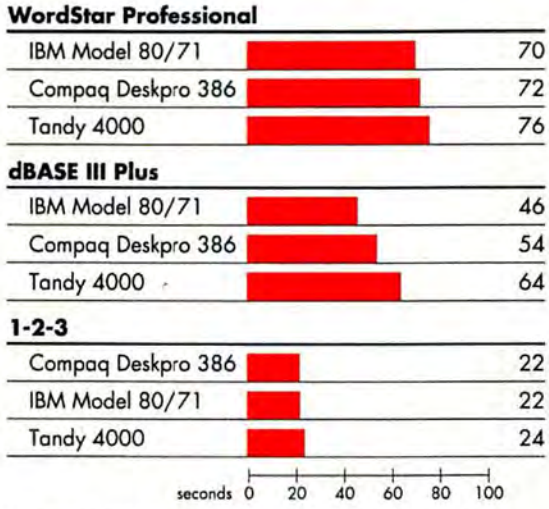
Tandy has borrowed a page from IBM's PS/2 book by including a 1.44MB 3½-inch drive as a standard feature, but PC, XT, or AT owners with mountains of data on 5¼-inch floppies may find switching to the smaller format inconvenient. If you want 5¼-inch capability, you have to buy an optional 360K drive for $199; strangely, Tandy does not offer a 1.2MB floppy drive for this system, but a 1.2MB drive from another source ought to work.

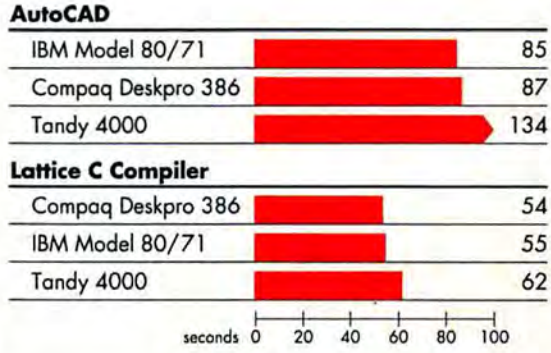
The built-in floppy disk controller, located on the motherboard, supports only two floppy drives. Today hardly anyone is likely to use an 80386 computer without a hard drive. However, installing Tandy's hard disk upgrade renders the built-in controller virtually useless. To install the 20MB or 40MB hard disk options, you have to disable this controller and connect all drives to an optional disk controller

NSTL TEST REPORT

Tandy 4000

The Tandy 4000 runs close on the heels of the top-speed 386 winners, lagging badly only in the AutoCAD test.





All computers compared were tested with disk caching on. The Compaq machine tested was a Deskpro 386 Model 40.

WordStar Professional
Although disk access plays a small part in this benchmark, processing and memory access speeds are the most significant factors. The test measures the time required to perform four operations on a 15,364-word document.

dBASE III Plus
Disk access speed is the most significant factor for this benchmark. The test measures the time required to produce a report based on a three-file join, select, and sort.

1-2-3
Because no disk access is required, this benchmark depends almost entirely on the processing and memory access speeds of the systems. In this test, a 1-2-3 macro executes a series of recalculations within a 50 X 50 cell matrix.

AutoCAD
Disk access, processing speed, and memory access all contribute to a product's performance in this benchmark. However, the speed and type of math coprocessor used by the system are the most important factors. The test uses the sample office drawing provided with *AutoCAD* and measures the time required to retrieve and display the drawing, zoom in on a small detail within the drawing, zoom out to reveal the entire drawing, and print the entire drawing.

Lattice C Compiler
In this benchmark, the sequential disk access rate is the most important factor. Applications such as file managers commonly rely on this type of disk access. The test measures the time required to compile and link two 1000-line programs and is performed automatically using a DOS batch file.

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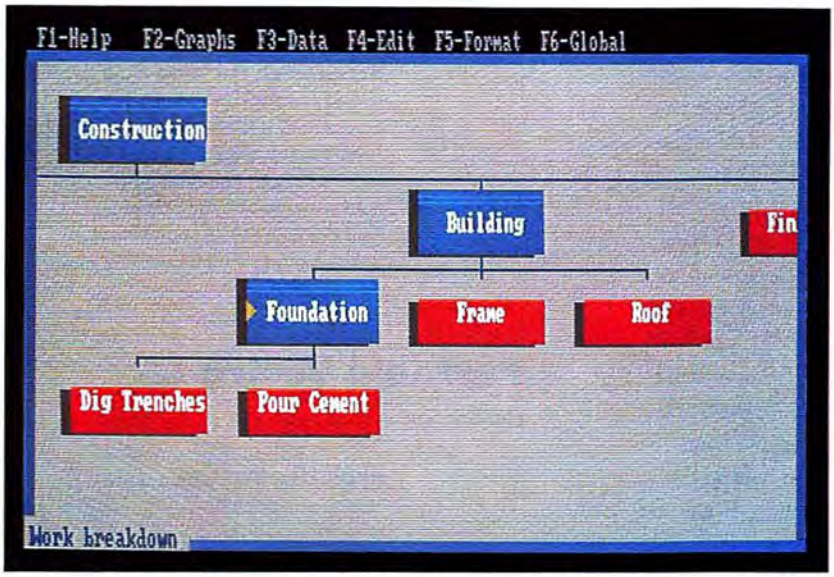

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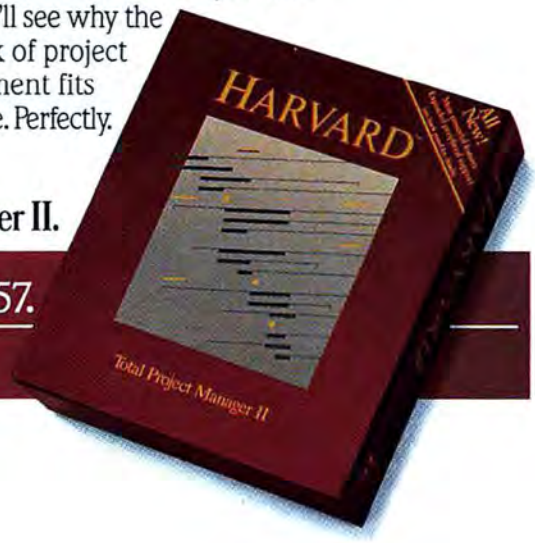

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that supports two floppy and two hard disks. Presumably, a third-party hard disk will work as well, with the simple expedient of dropping a controller (or a hard disk card) into a vacant slot.

The 101-key keyboard is made to Tandy's specs by Key Tronic and is identical to the somewhat nonstandard keyboard used in the highly successful Tandy 3000. The keys themselves have a nice feel.

The Tandy 4000 comes with a powerful package of speed-up and memory management software, including a disk caching utility and a disk optimizer that rearranges data clusters contiguously for improved hard disk performance. You also get a compression program that shrinks files, and a hard disk backup utility that puts DOS's backup routine to shame. Tandy's expanded memory manager allows applications written to the Lotus/Intel/Microsoft 3.*x* spec to access up to 16MB of memory. It does not, however, support the improved LIM 4.0 spec.

In addition to the MS-DOS operating system, Tandy offers Xenix 5; OS/2 and UNIX System 5.3 are promised soon. Networking experts will be happy to know that 3Com's Ethernet LAN adapter works with the Tandy 4000 and is available from Tandy or Radio Shack for $495.

The Tandy 4000's memory interleaving, disk caching, and memory management boost its performance into the range of the best 16-MHz 386s. In the 386 campaign, these figures should help make the Tandy 4000 a favorite with power-hungry business voters.

Unfortunately, in several other areas the Tandy candidacy falls short of the mark. Until 2MB SIMM arrays are available, users are limited to 4MB of 32-bit system memory, compared with the standard 16MB of 32-bit RAM available in other systems; a paltry total of three device bays offers limited expandability; and the numbers on Tandy's options price list read like a Neiman-Marcus catalog. Still, these drawbacks are hardly fatal. With prudent accessory shopping (somewhere other than Radio Shack), you can assemble a fully configured Tandy 4000 for about $4000. In a crowded race, that price could turn Tandy's dark horse into the people's choice. —*TJ Byers*

WHERE TO BUY

Tandy 4000
Tandy Corp.
1700 One Tandy Center
Fort Worth, TX 76102
817/390-3300
List price: with 1MB, 3½-inch floppy drive, 101-key keyboard, one serial and one parallel port, TEMM expanded memory management software, disk caching software, MS-DOS 3.20 $2599
Accessories: 1MB SIMM RAM upgrade kit $430; 2MB memory expansion board $799; 3½-inch, 1.44MB floppy disk drive $300; 5¼-inch 360K floppy disk drive $199; hard disk controller $349; 20MB hard disk $599; 40MB hard disk $1399; Tandy Enhanced Graphics Adapter $300

Portable Vectra CS

Battery-powered laptop

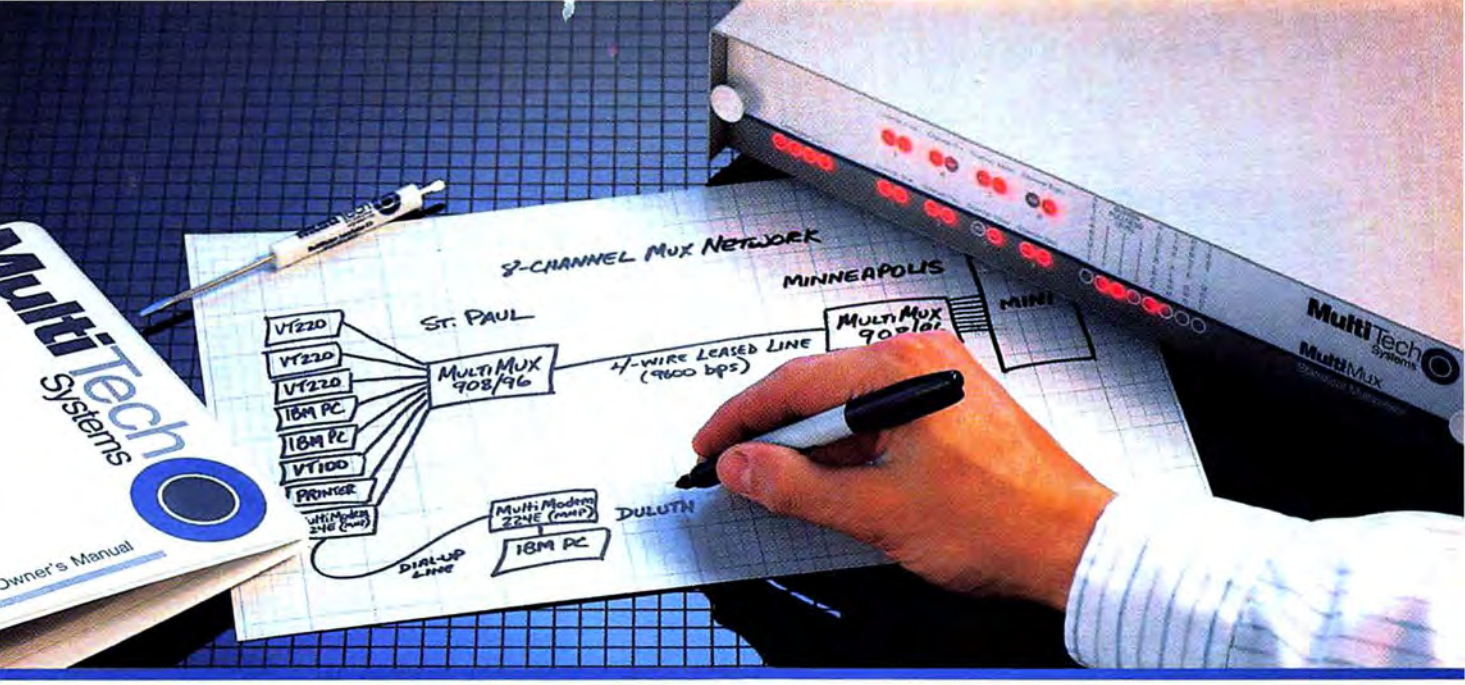
PROS: Long battery life, expandable, good keyboard

CONS: Heavy, mediocre display

Early laptop computers, such as the Radio Shack Model 100, fit in a suitcase, and most of today's powerful models pretend to fit in one. The HP Vectra CS, however, thinks it *is* a suitcase. In fact, the Vectra's bulk (14 by 16½ by 3½ inches) and weight (18 pounds—three times as heavy as the Toshiba T1000) place it in the category of such schleppable computers as the original Compaq or Kaypro.

However, packed into the Vectra CS's oversize, heavyweight case is a fast, rugged, battery-powered computer with a number of unusual features, including four proprietary expansion slots, an enhanced-style keyboard, and a powerful removable battery (with a built-in charge meter) that keeps the machine humming for a full 10 hours.

The $2495 Vectra CS uses the NEC V30 microprocessor (compatible with the



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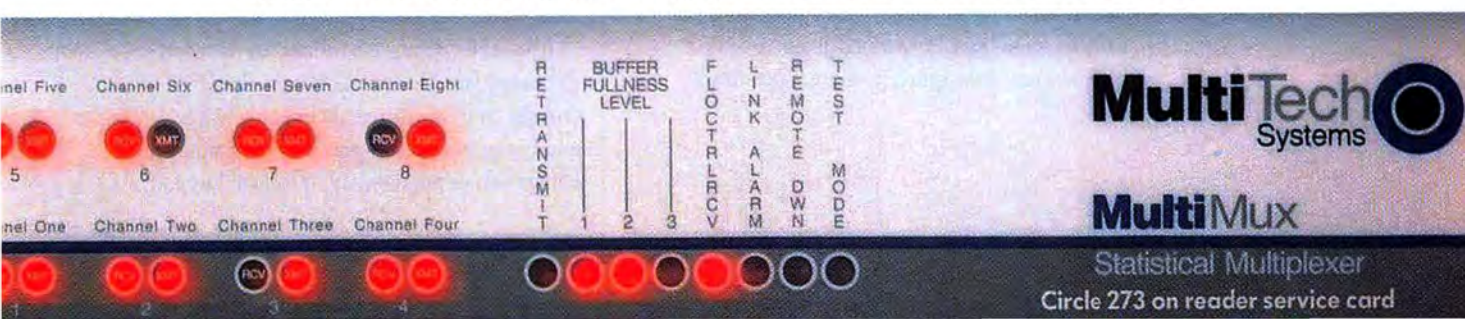

Circle 273 on reader service card

PHOTOGRAPHY BY JOHN GREENLEIGH ILLUSTRATION BY WARD SCHUMAKER

The HP Vectra CS provides an amazing 15 hours of battery life, but the high $2495 price, mediocre display, and 18-pound heft may limit the machine's appeal.

Intel 8086) running at 7.16 MHz. The machine comes with two 3½-inch, 1.44MB disk drives (among the first in the industry outside the PS/2 line), plus 640K of RAM and a built-in clock/calendar. A hard disk version, the Vectra CS Model 20, is also available (for $3595), but the CS is not upgradable to the Model 20.

Much of the Vectra CS's heft is due to a massive lead-acid battery pack, about the size and weight of a cobblestone. The battery pack is both rechargeable and removable, allowing you to prepare multiple battery packs for extended use away from wall plugs—assuming you're willing to lug *two* cobblestones. HP claims each battery pack lasts up to 10 hours—about twice as long as standard laptop batteries do. In fact, our tests verified an amazing 15-hour battery life, even when both drives were in use frequently. Of course, using a modem will deplete the battery more quickly, and battery endurance ebbs with age.

The Vectra CS also has an extremely useful LCD power meter built into the case to show just how much juice remains—and how quickly you need to find an outlet. No more guessing, and no more battery-low warning lights in the airport.

If you've ever opened your laptop too quickly and spilled floppy disks all over the floor, you'll be pleased with the two floppy disk holders built into the lid of the CS. Each holder stores three 3½-inch floppies.

Very few laptops offer substantial expansion capability. The Vectra CS's four proprietary expansion slots allow it to be configured in much the same way as a desktop machine, though each added expansion board draws current and therefore shortens battery life. HP offers a serial/parallel adapter; a CGA-compatible video board; internal 2400- and 1200-bps modems; and a 2MB expanded memory board (which comes in two versions—with and without two serial ports). Up to 6MB of expanded memory can be installed in the Vectra CS (using three of the four expansion slots).

Aside from its weight, the Vectra CS's biggest shortcoming lies in its CGA-compatible LCD screen. The supertwist display's lack of contrast makes it hard on the eyes from all angles, even under ideal lighting conditions. Backlighting would cure this problem, and while a backlit screen would shorten battery life, the Vectra CS's massive power pack should be able to handle it.

The Vectra CS's relatively large size enables it to incorporate an enhanced IBM-style keyboard complete with a separate numeric pad (lacking in most other laptops). The keyboard touch is among the best.

While the Vectra CS is hardly a top performer compared to the latest 80286 and 80386 computers, it acquits itself extremely well in NSTL's performance tests, nearly halving the Toshiba T1000 laptop's performance scores and even besting the PS/2 Model 25. The Vectra CS also passes NSTL's compatibility tests with ease.

Like everything else made by Hewlett-Packard, the Vectra CS seems durable enough to give future archaeologists a good idea of how we primitives computed. Its speed, expandability, numeric keypad,

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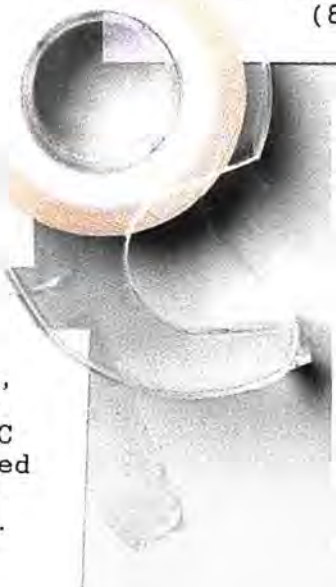

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Circle 16 on reader service card

and amazing battery life are impressive, but an eye-burning LCD display and shoulder-busting bulk are serious drawbacks for frequent fliers who need a lightweight portable computer. —*Lewis Perdue*

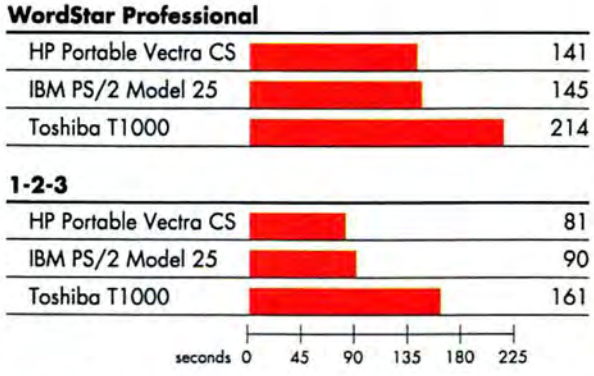
WHERE TO BUY

Portable Vectra CS
Hewlett-Packard
503/757-2000
List price: with 640K, two 3½-inch floppy disk drives, parallel/video port adapter $2495; hard disk version (Model 20) $3595
Accessories: dual serial adapter with 2MB expanded memory $1795; 1200-bps modem $450, 2400-bps modem $695; DOS 3.20 $95

NSTL TEST REPORT

HP Portable Vectra CS

The HP Vectra CS delivers impressive performance for a laptop, blowing past Toshiba's T1000 by a wide margin and even edging the PS/2 Model 25.



WordStar Professional
This benchmark is run from a single floppy disk. Once *WordStar Professional* version 3.31 is loaded and the benchmark file is opened, a global search and replace substitutes the word *today* for all occurrences of *tomorrow*. The cursor is then returned to the beginning of the document.

1-2-3
Because no disk access is required, the *1-2-3* benchmark depends almost entirely on the processing and memory access speeds of the systems. In this benchmark, a *1-2-3* macro executes a series of recalculations within a 50 X 50 cell matrix.

Data based on tests designed and conducted by National Software Testing Laboratories (NSTL). All rights reserved.

Racal-Vadic 9600VP

9600-bps auto-dial modem

PROS: Fast data transfer, transparent error checking

CONS: No 2400-bps capability, incompatible with some telecommunications programs

If you're an executive whose business pushes megabytes of text or graphics data coast to coast daily, the chance to cut your telecom bills (and the time your employees spend staring at a telecom screen) by more than 80 percent ought to be welcome indeed. Theoretically, that's what you can save by trading in your 1200-bps modem for a 9600-bps model.

Unfortunately, moving up to the higher speed presents a higher level of challenges and frustrations even for experienced users. Like all other 9600-bps modems, Racal-Vadic's 9600VP auto-dial modem—a relative old-timer with a newly reduced price of $995—takes two modems to tango. Hardware-based error checking is necessary for 9600-bps communications, and because there's no standard for a high-speed protocol, an identical modem must be at the other end of the data link.

Externally, little about the 9600VP is unique. It's a small, flat, beige modem with a bulky AC adapter and 11 membrane switches on the front panel for setting speed, answer mode, sync/async, and so on. The unit has no speaker and no on/off switch; it also lacks DIP switches, but all commands can be handled from the computer's keyboard or the membrane switches.

The modem runs at 300, 1200, and 9600 bps in the familiar asynchronous mode and 1200, 4800, 7200, and 9600 bps using the synchronous mode common to mainframe communications. Unfortunately, the modem fails to support 2400 bps—a particular disappointment, given the growing number of 2400-bps modems and on-line services.

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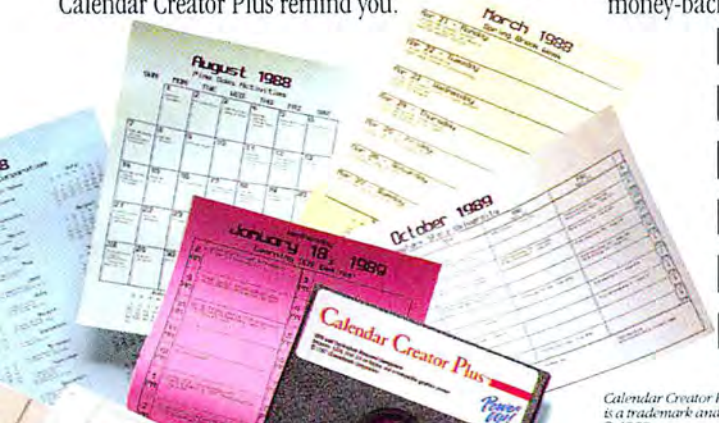

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Circle 50 on reader service card

At 9600 bps, software-based error-checking routines like XMODEM or Kermit either don't work at all or slow down transmission significantly. Racal-Vadic's alternative is a proprietary firmware version of the MNP protocol, one of two popular mainframe error-checking schemes. Even with error checking, however, the higher you crank transmission speed, the more vulnerable you become to noisy phone lines. The 9600VP breaks the noise barrier by constantly checking the condition of the line and slowing down if noisy lines are causing unacceptable data losses. If line quality improves, the modem bounces back to seek the highest possible speed for transmission.

Setting up the modem hardware couldn't be easier; it's plug-and-go as far as the telephone and electrical lines are concerned. Serious head scratching begins when it's time to marry the modem to your telecommunications software.

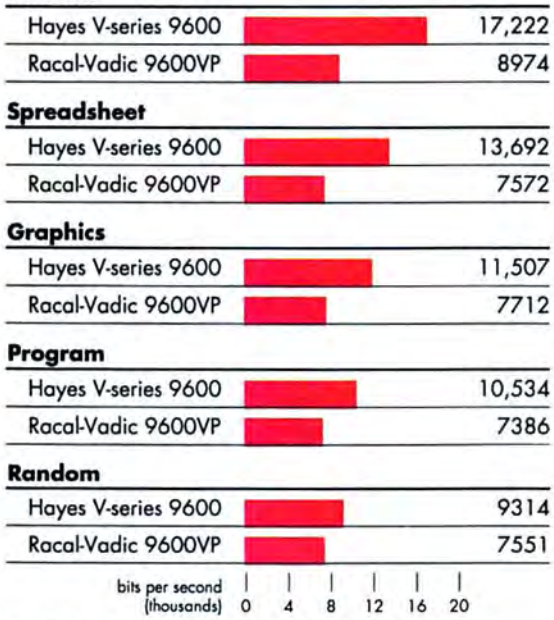
The 9600VP is sort of Hayes compatible. You need to type in a long list of cryptic codes, and even then it bombs out

NSTL TEST REPORT

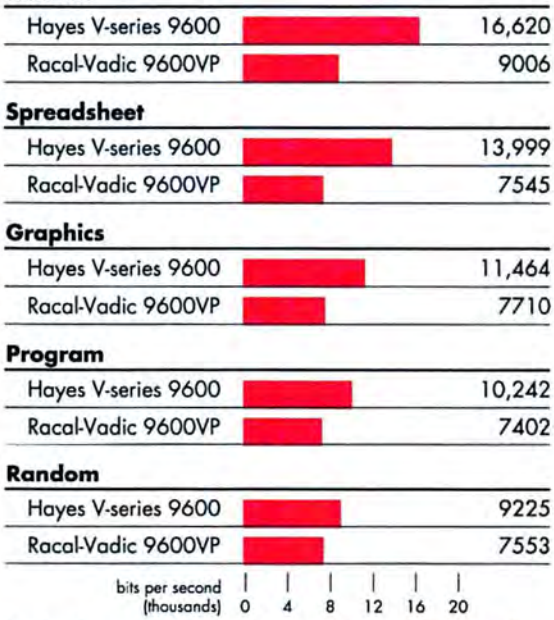
Racal-Vadic 9600VP

The Racal-Vadic 9600VP fails to match the Hayes V-series 9600—although, to be fair, the V-series' hardware-based data compression gives it a big advantage.

Clean Line



Average Line



These benchmarks measured the modems' throughput when transferring different types of files under various line conditions. The modems were tested with two Model 339 IBM ATs running *HyperAccess* from Hilgraeve. Each computer ran at 8 MHz and had a 30MB hard disk.

Line Conditions
Two modems plugged into a TAS 1010 VoiceBand Channel Simulator transmitted data while impairments were added to reproduce conditions found on clean, average, and dirty lines. To arrive at the proper settings for each line type, we used the 1982–1983 AT&T Bell Labs "End Office Connection Study." AT&T measured ten impairments, such as white noise, signal loss, amplitude jitter, and phase jitter, on 6500 predivestiture long-distance phone lines. The study revealed that a clean line had a maximum white-noise level of 30 decibels (db); an average line, a level of 32db; and a dirty line, a level of 35db.

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tcp

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with *SideKick*'s auto-dialer more often than not. Furthermore, while most popular telecommunications programs will run the 9600VP at 1200 bps, Racal-Vadic recommends *Crosstalk*, *Carbon Copy*, and *Reflection* for higher speeds. But be warned: Unless you're experienced, getting the 9600VP to sing along with this software is no easy task.

Part of the problem is that the manual accompanying the modem contains significant errors. For example, some of the commands in the *Crosstalk XVI* setup are incomplete or simply missing. In addition, 22 programmable option settings are stored in the modem's memory. These settings allow the high degree of customization required to connect with a variety of mainframes and can be changed via your keyboard—but they must be set just so to keep your software happy.

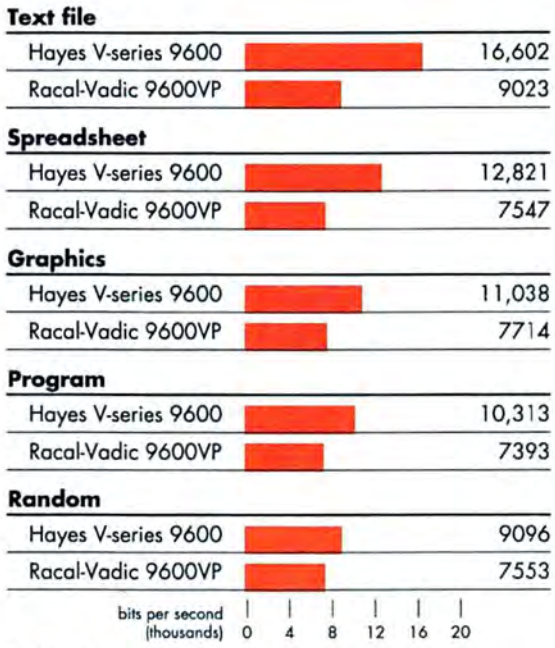
Although in NSTL's tests the Racal-Vadic consistently ran behind the pricier Hayes V-series 9600—which uses hardware-based data compression to boost its effective transmission speed—it still offers big improvements over conventional 1200-bps modems. Typically, sending a 36K file at 1200 bps takes nearly 7 minutes; running at 9600 bps under *Crosstalk XVI*, the 9600VP sent a 36K file cleanly down the line in 48 seconds. A 136K file was sent in less than 3 minutes.

Should you invest $1000 for a 9600-bps modem? The answer is a firm "maybe," depending on the quantity of data you regularly run through your PC. Data-intensive businesses will find the 9600VP

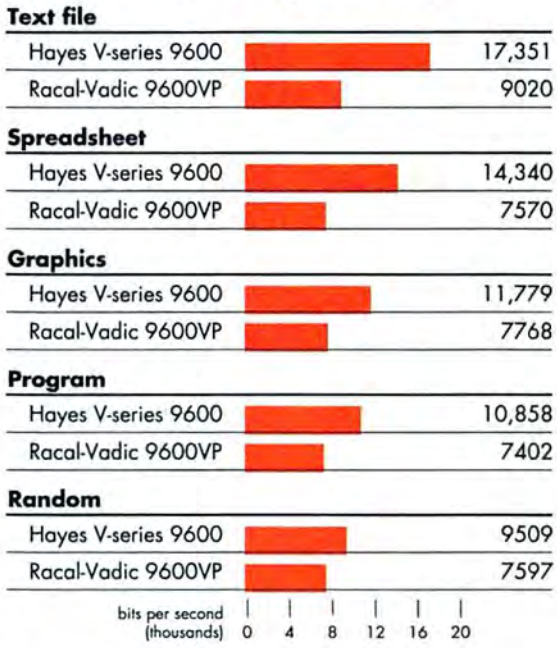
NSTL TEST REPORT

Continued

Dirty Line



Direct Line (no impairments)



File Transfer
The proprietary Hyper Protocol included in *HyperAccess* was used to transfer five files from hard disk to hard disk under each line condition. The files, each 100K long, consisted of an ASCII text file, a *1-2-3* spreadsheet file, a program file, a file composed of randomly generated binary codes, and a bit-mapped graphics file. Data compression provided by Hyper Protocol was turned off for all of the tests. The connection between computer and modem was established at the highest speed setting. The throughput in bits per second (bps) for each test was calculated by dividing 1 million bits (100,000 bytes X 10 bits per byte transferred) by the transfer time in seconds.

Data based on tests designed and conducted by National Software Testing Laboratories (NSTL). All rights reserved.

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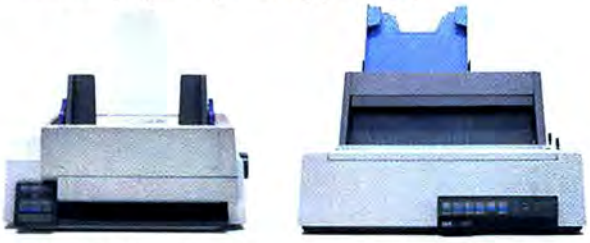

The IBM Proprinter X24 with optional sheet feed (left) and the IBM Quietwriter III Printer with single-drawer sheet feed (right).

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a worthwhile investment; just remember that its price is paid in configuration time as well as dollars. On the other hand, it's worth keeping in mind that for only $300 more, the newer, faster Hayes V-series 9600 modem (see "Thoroughly Modern Modems," *PCW*, March 1988) offers all the features of the 9600VP, plus data compression and, sometime in 1988, support on CompuServe. —*J. T. Johnson*

WHERE TO BUY

Racal-Vadic 9600VP
Racal-Vadic
1525 McCarthy Blvd.
Milpitas, CA 95035
408/432-8008
List price: $995

Proprinter XL24

24-wire dot matrix printer

PROS: Very fast, excellent print quality, front slot for feeding cut sheets

CONS: Can't print envelopes, difficult to thread paper

The appearance of IBM's 8-pin Proprinter a few years ago was a real breakthrough for business users. Aside from its delightfully low price, the machine's most impressive feature was its ability to handle cut sheets without your having to disengage the fanfold paper, as all other printers at the time required. With the Proprinter, you could feed a sheet of letterhead or an envelope through a slot in the front of the printer, and it would roll up in front of the fanfold paper. Print quality was only so-so, and the Proprinter wasn't blindingly fast—but its cut-sheet capability was irresistible.

The new 24-pin Proprinter retains many of the familiar features of its predecessor—including, happily, a reasonable price tag: $799 (wide-carriage models cost $1049). It has also stuck with its reliable front-slot approach to cut sheets.

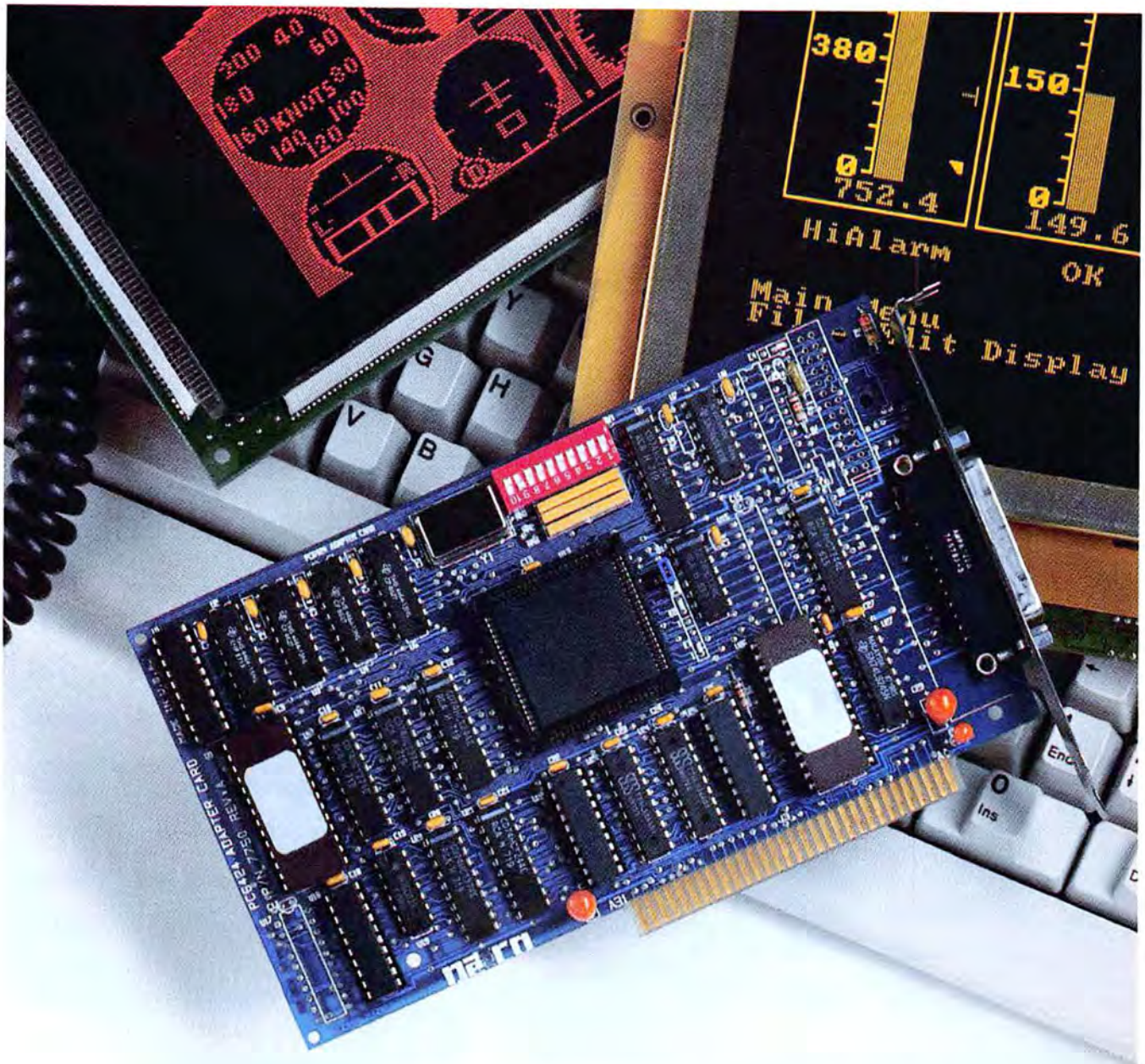
Where the Proprinter XL24 *has* departed from its old design, the news is mostly good. NLQ output on the new machine is immensely improved, and it prints much faster than the old model. In high-speed draft mode, the Proprinter blasts out a standard, 250-word page in just under 13 seconds; the same page takes only 30 seconds in a LtrQ mode that's virtually indistinguishable from daisy wheel output. Variable character width (5, 6, 7, 10, 12, and 16 pitch) is available, assuming your word processor's printer driver knows how to ask for it; the most common pitches can be selected from the printer's control panel. Several line-spacing options are supported as well.

The major bad news is that unlike its 8-pin ancestor, the Proprinter will not print envelopes. The manual is explicit on this point and warns that even attempting to print an envelope may damage the printhead. This design decision is woefully retrograde; the only way you'll be able to address envelopes is with a stand-alone typewriter or fanfold labels.

The Proprinter makes it very easy to change ribbons and surprisingly difficult to load fanfold paper. A new auto-loading feature seems designed to help you thread the fanfold, but you must still engage pinwheels and paper holes with meticulous care; heaven help anyone who creases or tears the paper even a little. Once you've got the paper engaged, the auto-loader threads it automatically and with painful slowness between the rollers and under the printhead; you'd do just as well using the platen wheel to feed it by hand.

Several other new features are far more useful. The cover, which functions primarily to reduce printing noise, can be pressed down to clamp fanfold paper in place, making it easy to tear off printed sheets. A Quiet key on the front panel produces a noticeable reduction in racket (at a slight drop in speed). Double-high characters can be printed as well as the more common double-wide. And a DIP switch on the wide-carriage model can change the print line's length from 13 inches to 8 inches to prevent printing on the platen inadvertently.

The Proprinter is a fast, well-built, immensely impressive printer—especially for the price. It's a loser in the envelope



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Power Saver Plus

Uninterruptible power supply

PROS: Low price, recharges quickly, fits beneath monitor

CONS: Indicator lamps hard to interpret

Remember the time computer gremlins arranged for the power to fail all through your office building, just as you were saving your spreadsheet recalc to disk?

Power Saver Plus, a relatively low-priced ($799), uninterruptible power supply (UPS) from Computer Accessories, will solve the gremlin problem, at least as far as power is concerned. If the AC fails, the Power Saver's built-in battery will provide 8½ minutes of backup power, more than enough time to shut down the system in an orderly fashion.

Designed to tuck unobtrusively beneath your monitor, the flat, rectangular unit plugs into the wall socket. It features six switches (each with its own on/off indicator lamp) that control matched outlets on the back. Backup battery support is supplied to only three of the outlets, but all five provide protection against power spikes and overloads; there's even a phone jack to keep power surges from trashing your modem via the phone line.

When tested, a fully charged Power Saver Plus kept a Compaq Deskpro 286 and monitor running for the promised 8½ minutes. The changeover from line power to battery backup was flawless; all programs ran smoothly through the power crash. When a printer or a modem was in use, the Power Saver battery reserve dropped to approximately 4 minutes.

When external power fails and the Power Saver kicks in, it begins beeping every 10 seconds—presumably to call you back from across the office. Fortunately, an alarm defeat button will quiet the beep while you're saving and shutting down. Even when the beeper is off, however, it's hard to miss some of the side effects of battery operation. Lines begin to crawl up from the bottom of the monitor, accompanied by a nasty sound (gnats? angry gremlins?) emanating from the power strip itself. Clearly, UPS's are not intended to replace AC.

The power pack recharges automatically when AC power is on. While the manual states that it takes 8 hours to suck up a full 8-minute charge, in actual use a complete recharge required only 3 hours.

In any case, 8½ minutes may not seem like a lot of battery time—especially if you're away from your PC when the power fails—but UPS's with longer backup time cost hundreds of dollars more and are much bulkier. At $799, the compact Power Saver Plus will give you enough time to save data to disk—and it won't steal any precious desktop (or foot) space. If you've got gremlins on your mind and a bottom line to consider, this may be your best line of defense. —*Sam Hagerty-Hammond*

WHERE TO BUY

Power Saver Plus
Computer Accessories Corp.
6610 Nancy Ridge Rd.
San Diego, CA 92121
800/582-0852
List price: $799 (auxiliary battery pack price not available)

TJ Byers is a freelance writer and the author of Inside the IBM AT *(McGraw-Hill, New York, 1986). Lewis Perdue is the author of* Supercharging Your PC *(Osborne/McGraw-Hill, Berkeley, 1987). J. T. Johnson is a professor of journalism at San Francisco State University. Sam Hagerty-Hammond is a San Francisco Bay Area computer consultant.*

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■ Free Form

Tornado is FREE-FORM. It works the way you think. To start a new window you just press N, and enter information. No file names. No extra keystrokes. To retrieve information you just press G (for Get), with any word or phrase—you'll watch Tornado zip through your windows like lightning linking and opening those requested. You can even flip through your windows with the arrow keys and watch them instantly pile up and lift away. These are just three of 18 easy but powerful features.

■ Space Station

Tornado is being used on the complex US Space Station project—but it does simple things too: When Harry calls you on the phone, in two seconds flat you'll display the six windows on Harry before he finishes his first sentence! No more embarrassing pauses or scrambling for information. Tornado is so versatile you can: write and print a letter faster than ever; track things to do; edit electronic mail; and plan a project or event—quickly and easily. You can even build a sophisticated "knowledge" base—or an unstructured data base—without programming. And that's not all. Track phone conversations, numbers, sales leads, and all your other RANDOM information. With the new option you get a "Library" of windows containing: free-form calendar, project planner, grid maker, city/state/area code/time zone translator, and much more. On a portable, Tornado is your ideal moving office. Best of all, you tailor Tornado to your own needs—easily!

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"Excellent Excellent Excellent Excellent"
PC World, Patrick Marshall

"one of the niftiest ... programs I've ever seen."
BYTE, Jerry Pournelle

"Excellent value"
InfoWorld, Review Board

"a significant productivity tool"
PC Magazine, Chris Johnston

"simple ... superfast"
New York Times, Diment

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24 hr. modem: (201) 342-8101

☐ **YES,** send me ____ copies of Tornado at $99.95 each plus $3.50 shipping or ____ copies of Tornado with Library at $149.95 plus $3.50 shipping. ($10 shipping outside USA & Canada). NJ residents add 6% tax. No purchase orders. To order, mail coupon or call (800) 342-5930.

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State: _____ **Zip:** _____

Telephone: _____

MICRO LOGIC CORP.
Dept. T92, 100 2nd St., POB 174
Hackensack, New Jersey 07602

Specifications: FEATURES: free-form & predefined windows, scrolling within window, import & export to files & screens, cut & paste, auto word wrap, time & date stamp, move & join & dup windows, mono or selectable color, definable Hot-key or non-resident, unloadable, LAN support, context help, extended ASCII, smart fully adjustable windows, parallel text processing, progressive resolution and "and-or-not" like searching without keywords, and more. **COMPATIBITLITY:** IBM-PC/XT/AT/PS2 and compatibles; mono, CGA, 80 col EGA, and Hercules displays; 60K minimum RAM; 3.5" disk on request. **CAPACITY:** Up to 500 windows per pile - 50 piles. Not copy protected.

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Work like this doesn't just happen.

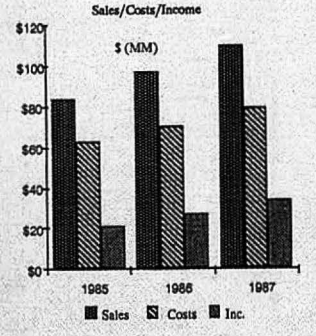
LKXS RADIOGRAPHY OPERATING GROUP

Review of Operations

During 1987, the LKXS radiography companies pressed forward vigorously with a series of product introductions and marketing programs designed to transform LKXS into a "new business" girded for continued growth in both the increasingly competitive U.S. biotechnology field and the emerging biotechnology market worldwide.

Profits Up in Growth Year

Throughout 1987, employees worked diligently to improve current product quality, control operating costs, and provide outstanding customer service. As a result, LKXS recorded its best profit year ever despite substantial expenditures to develop and introduce the Model NR2.



To foster continued growth in overseas markets, we opened subsidiaries in Japan and Hong Kong.

These commitments have already paid off with international sales accounting for 7% of total revenues. Next year, we expect a strong showing as these subsidiaries continue to establish themselves.

1987 Revenues by Area

(Dollars in millions)

REGION	AMOUNT	PERCENT
Northwest	$ 3433	35%
Midwest	$ 2885	29%
New York	$ 1094	11%
New England	$ 1088	11%
Southwest	$ 713	7%
Int'l	$ 633	7%
TOTAL	$9846	100%

To make sure we stay closely in touch with our customers, in 1987 the LKXS companies expanded their customer service areas by 20%, spending $25 million to train their account management personnel.

Model NR2 is a Success

The introduction of the Model NR2 is a good example of our success in pressing technology forward and communicating the benefits of this new technology to hospitals and research institutes around the world.

LKXS representatives introduced the Model NR2 at major conferences in the field, both in the United States and overseas, to an

Review of Operations *page 1*

Besides having the fastest on-screen response, Microsoft® Word 4.0 lets you do almost everything faster. With speed keys you can do things like print, save, and undo or repeat any edit with a single keystroke.

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It takes a couple of seconds.

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Make a line italic
2 keystrokes

Add a footer
1 keystroke

Box around text
5 keystrokes
Adjust box when text is added
0 keystrokes

Include a named range from a spreadsheet
5 keystrokes

LKXS RADIOGRAPHY OPERATING GROUP

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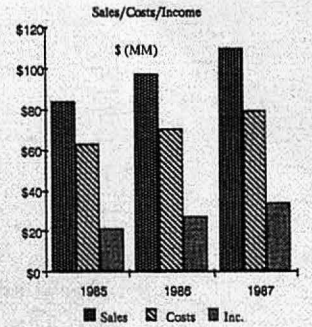

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Review of Operations *page 1*

LEADING WORD PROCESSOR KEYSTROKE COMPARISONS

Keystrokes needed to:	Microsoft Word 4.0	WordPerfect™ 4.2	DisplayWrite™ 4 1.0	MultiMate Advantage™ II 1.0
Change line font size	5	13	11	5
Make a line italic	2	13	11	5
Box around text	5	8	8	7
Adjust box when text is added	0	11	12	10
Include named range from a spreadsheet	5	Not Possible	Not Possible	34
Add a footer	1	6	7	5

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Output produced on a Hewlett Packard LaserJet Series II using Microsoft Pageview with text prepared by Microsoft Word.

Offer good in the 50 United States only. The cost of the evaluation version is fully refundable when you buy Microsoft Word 4.0. There is a $5.00 shipping and handling fee.

The evaluation version of Microsoft Word 4.0 is limited only by the size of the file you can create. It does not include the spellchecker or thesaurus available in the full version of Word 4.0.

A report detailing the benchmark tests, their methodology and hardware systems is available, at no charge, by calling 1-800-541-1261, Dept. B30.

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Getting the Feel of OS/2

Eric Knorr

PC World answers key questions about the operating system everyone's talking about—but hardly anyone's used.

Even if you never buy into OS/2, sooner or later you're bound to encounter it. Think back to the first time you saw a DOS root directory. What can you expect to see when OS/2 boots up? Will you be lost in a hostile environment?

Relax, DOS users. When the Presentation Manager (OS/2's *Windows*-like front end) arrives, only *Windows* aficionados will feel immediately at home. But underneath that shell will be an operating system that's as familiar as DIR. OS/2's multitasking and memory-handling features may make it seem like a distant relative of DOS, but it looks and acts like DOS's smarter brother.

To prepare you for your first brush with OS/2, *PC World* offers straightforward answers to some of the most obvious questions. We refer in all cases to IBM's OS/2 Standard Edition 1.00, so some explanations (particularly those concerning documentation and installation) may not apply to the Microsoft version.

Are OS/2 commands similar to DOS commands?

OS/2 commands aren't just similar, they're nearly identical to DOS's, right down to the stuffy DOS syntax. DIR, COPY, DEL, FORMAT, RENAME, BACKUP —you name it, OS/2's got it (see the sidebar "Command Report" for the exceptions, plus a summary of new OS/2 commands). Making, changing, and removing directories is still a matter of MD, CD, and RD. And you'll be disappointed to learn that file names remain restricted to eight characters with a three-character limit on the extension.

What kind of hardware do I need to run OS/2?

You need a hard disk and at least 1.5MB of RAM. IBM's OS/2 1.00 arrived at *PC World* on four 1.44MB, 3½-inch disks, one of which was devoted to the installation and tutorial program. Once installed, OS/2 occupies close to 2.5MB of disk space in 112 files.

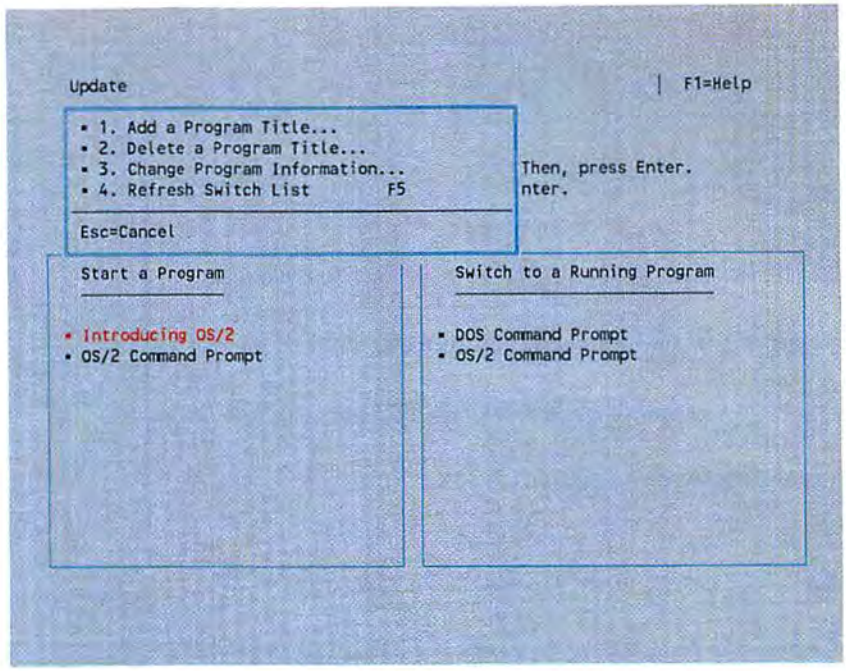
Because OS/2 takes up about 500K of RAM, the 1.5MB figure supplied by IBM is really a bare minimum. The same goes for the company's recommended minimum of 2MB for running DOS and OS/2 programs together. After all, the main benefit of

OS/2 is access to as much as 16MB of extended memory, and limiting yourself to a mere 384K more than DOS offers is absurd. Microsoft states that a minimum of 2.5MB to 3MB is more realistic for running both DOS and OS/2 applications.

Is OS/2 difficult to install?

IBM's OS/2 is easier to install than DOS. The installation and tutorial program resembles that of the PS/2 Reference Diskette (see "A Model for the '80s," *PCW*, December 1987). You pop the installation disk in drive A:, reboot, and page your way through screenfuls of clearly written instructions, complete with logical menus and pretty graphics. Altogether, installation should take about half an hour.

One of the most polite things about the installation program is that it automatically creates a CONFIG.SYS file and an AUTOEXEC.BAT file. All you do is respond to a series of prompts and the files are written for you. If you don't know how to answer the prompts, OS/2 supplies default values. That's a relief, because OS/2 more than doubles the number of DOS's CONFIG.SYS commands.



The Program Selector enables you to load OS/2 programs without exiting to the command prompt. You add, delete, or modify program titles on the Start a Program list using the Update function.

Do I have to reformat my DOS hard disk to install OS/2?

Not if you plan to run DOS and OS/2 on the same PC. The installation program asks you if you want to use DOS applications. If so, it installs OS/2 and leaves everything except DOS intact (your old CONFIG.SYS and AUTOEXEC.BAT are renamed with .BAK extensions). If not, you're presented with a high-class equivalent of FDISK that enables you to partition your hard disk before reformatting. Sadly, OS/2 retains DOS's 32MB limit for logical drives.

How is the DOS compatibility box different from DOS?

First of all, *compatibility box* is a pretentious term for an area of the OS/2 environment reserved for DOS and DOS applications. It may change if you add the much-anticipated Presentation Manager, but currently the compatibility box is not boxy at all. DOS does not appear in a window. It does not pop up or pull down. It simply looks like DOS.

The main discrepancy between DOS and DOS under OS/2—and it's a maddening one—is that the latter is limited to about 500K. The saving grace is that DOS mode supports the new Lotus/Intel/Microsoft Expanded Memory Specification version 4.0. This enables you to run large expanded-memory DOS programs, though naturally any memory you use over the 500K allotted to DOS mode cuts into the RAM available for OS/2 applications.

You'll also notice cosmetic differences. The default DOS prompt for the root directory is C:\>, just as if you'd written PROMPT =PG in your AUTOEXEC-.BAT file. More obviously, you'll see a white bar with blue characters that reads 'DOS Ctrl+ Esc=Program Selector—Type HELP=help' at the top of the screen. (When you're in OS/2, you'll see a blue bar with white characters beginning with 'OS/2'.)

What's the first thing you see on screen when an OS/2 system boots up?

After a couple of status messages and the blue IBM start-up screen flash by, the Program Selector appears. Essentially a main menu for the operating system, the Program Selector is the most obvious difference in look and feel between OS/2 and DOS. (And you need this front end, because OS/2 clutters the root directory with 50 files.) The Program Selector divides the screen into three areas: Start a Program, Update, and Switch to a Running Program.

Start a Program lists all the OS/2 programs available; Update offers all the tools necessary to edit this list. You start OS/2 programs by highlighting the program name and pressing <Enter>. To run a DOS program, you must select 'DOS Command Prompt' and start up the program in the conventional way.

Once a program starts, its name is duplicated on the Switch to a Running Program list. 'DOS Command Prompt' is always listed here if you opted for DOS compatibility during installation. When running multiple programs, the quickest way to switch among them is with <Alt>-<Esc>, which cycles you through programs in the order you loaded them.

If you select the OS/2 command prompt instead, you'll find it looks slightly different. The [C:\] prompt and the white-on-blue bar are the only obvious clues that you're in the OS/2 environment (DOS and OS/2 directories look exactly the same). <Ctrl>-<Esc> returns you to the Program Selector from either the OS/2 or the DOS prompt.

How many programs will OS/2 let me run at one time?

OS/2 can handle up to 12 programs at once but only one DOS program at a time. OS/2 programs run in the background, whereas the DOS application is suspended when it's not on screen.

Several of the new OS/2 CONFIG.SYS statements enable you to adjust processing, memory, and I/O priorities when multitasking. OS/2 applications will come with default priority settings, so theoretically, the operating system should be able to arbitrate successfully without your intervention. Nonetheless, if you know what you're doing, tuning concurrent processes may augment system performance.

What happens if I don't have enough RAM to run all the programs I want simultaneously?

Interestingly, you're not out of luck. Next to multitasking and access to protected mode, OS/2's most important feature is its ability to overcome memory limitations. When an OS/2 program runs out of RAM, the operating system hunts for chunks of unused memory and consolidates them, creating larger segments into which data can be moved. If memory is still short, OS/2's virtual memory function kicks in and begins swapping segments to and from the hard disk. CONFIG.SYS statements let you determine the size of the blocks and the directory in which the memory overflow will be held. You need at least 512K of disk space for virtual memory, but you may want to devote an entire logical drive to the purpose—virtual memory can hog several megabytes if you're low on RAM and high on multitasking. Naturally, virtual memory is slower than real memory.

COMMAND REPORT

Most users will be surprised to discover few differences between using OS/2 and using DOS. Only a handful of DOS 3.30 commands are not recognized by OS/2 in its native mode. Fewer still are excluded from OS/2's DOS mode; most of these are so obscure that the average user never encounters them. The small group of OS/2-specific commands constitutes the most important difference between the two command sets.

The following DOS 3.30 commands are not recognized by OS/2 in its native mode:

APPEND adds to the DOS CONFIG.SYS PATH statement, which extends the search path outside the current directory. The OS/2 command DPATH performs roughly the same function.

ASSIGN enables you to reassign DOS drive letters. This command is used most often for old programs that demand A: and B: drives and won't recognize drive C:; OS/2 programs will never have this problem.

BREAK (plus ON) instructs DOS to check for <Ctrl>-<Break> at all times (not just during screen, keyboard, and printer operations). OS/2 always checks for <Ctrl>-<Break>.

COMMAND can start a DOS command processor only; the equivalent in OS/2 is CMD.

GRAFTABL specifies the code page to be used when swapping character sets. The OS/2 CONFIG.SYS statement CODEPAGE does a similar job.

JOIN lets you replace a drive letter with a directory name. OS/2 omits this reassignment capability because it will not work in a network configuration.

SUBST lets you replace a directory name with a drive letter. This command is used primarily for old programs that won't recognize subdirectories; OS/2 programs will always recognize subdirectories.

The following DOS 3.30 commands are not recognized by OS/2 in either its native or DOS mode:

CTTY enables you to change support from a standard keyboard and monitor to any character-based input/output device. This DOS command was scrapped due to possible device assignment conflicts with OS/2 applications.

FASTOPEN copies directories and the locations of recently opened files to memory, facilitating fast searches for DOS files. This command was an option in DOS because of memory considerations; if you had enough RAM, you could afford the increased performance. Due to an abundance of protected-mode memory, OS/2 makes this command internal.

GRAPHICS is the screen dump command for sending an image displayed by a Color/Graphics Adapter (or compatible) to one of five IBM (or compatible) graphics printers. OS/2 has no graphics screen dump capability, because OS/2 applications are expected to include it.

NLSFUNC helps prepare DOS for code page switching (swapping character sets). The OS/2 CONFIG.SYS statement DEVINFO replaces this command.

SELECT is normally used to create a bootable DOS disk with CONFIG.SYS and AUTOEXEC.BAT files that configure a system for a particular country. The IBM OS/2 installation program performs the equivalent of SELECT's functions.

SHARE prepares DOS for network file-sharing operations and ensures data integrity if a floppy disk read or write is interrupted. These functions are internal to OS/2.

OS/2 offers the following commands not available in DOS 3.30:

ANSI enables support for redefining keys, manipulating the cursor, and changing display color attributes. The effect is identical to that of the DOS CONFIG.SYS statement DEVICE=ANSI.SYS.

CMD starts an OS/2 command processor.

CREATEDD is short for *create dump diskette;* the disks created are meant to hold the contents of memory. Dump disks are designed to help diagnose system problems.

DETACH disconnects an OS/2 program from its command processor, causing the program to run without ever writing to the screen. OS/2 supports separate chunks of video memory for up to 16 applications; detaching a program that doesn't need to write to the screen (such as a spooler) prevents one of those chunks from being unnecessarily consumed.

DPATH is roughly the same as the DOS APPEND command, which adds to the CONFIG.SYS PATH statement.

EXIT terminates the current command processor and returns to the previous one. If no previous command processor exists, typing *exit* returns you to the Program Selector.

HELP is the gateway to OS/2's potent help facility. Entering this command, a space, and the unique number provided with nearly all error messages summons a list of possible causes and a paragraph of recommended action.

PATCH is a programmer's tool for fixing code. It is designed to be used with patches supplied by IBM.

SPOOL intercepts print data from different applications, ensuring that print files don't get mixed up. Print files are stored in a queue within a special subdirectory.

START is designed to be used in OS/2's equivalent of AUTOEXEC.BAT, STARTUP.CMD. A line in STARTUP.CMD that contains START plus an OS/2 program's start-up command loads that program. Multiple lines of this kind will automatically load multiple programs at system start-up.

TRACE permits system tracing of specified events (such as opening a file) and places the results in a buffer for diagnostic purposes.

TRACEFMT captures the contents of the trace buffer and sends it to the screen. You can redirect trace buffer contents to a file or to a printer. —*E. K.*

Is there an equivalent to VDISK.SYS?

In fact, OS/2 retains VDISK.SYS, DOS's handy RAM disk utility. But hey—that's not all. PS/2 users win biggest with IBM's acclaimed disk-caching utility, plus a driver for the IBM mouse. And everybody gets a print spooler, which installs automatically (with its own print-dump subdirectory) from the OS/2 setup program. OS/2 programs will send the spooler files as a matter of course; you can make the spooler work in DOS mode by pressing <Ctrl>-<Alt>-<Print Screen>.

Are the support materials that much better than DOS's?

Without question. A 50-page User's Guide (about one-third the size of DOS 3.30's equivalent) parallels the on-line OS/2 tutorial, and the Reference Manual sports clever diagrams showing the syntax of each command. Best of all, the command explanations are now written in English.

The on-line support, however, is the most impressive. Pressing <F1> in any area of the Program Selector supplies you with context-sensitive, on-line help. Even better, every OS/2 error message comes with a code number; to get the whole story, you type *help*, press the <Space> bar, type the number, and press <Enter>. A list appears stating the possible mistakes you or the system made, along with a crisply written paragraph recommending action. Very few applications are as helpful as OS/2.

If no OS/2 programs are loaded, do DOS applications run slower under OS/2?

In informal testing, they ran at about the same speed. That means if the OS/2 application you need isn't available but you're determined to move up to the new environment in the long run, you've got nothing to lose by making the switch now—provided your favorite DOS application runs in the compatibility box. Next month, look for National Software Testing Laboratories' compatibility tests, along with a more in-depth examination of what it will be like to use OS/2. ●

Eric Knorr is a senior editor for PC World.

WHERE TO BUY

OS/2
IBM
P.O. Box 1328-W
Boca Raton, FL 33429
305/998-2000
List price: $295
Requirements: 1.5MB, hard disk

IS SUCCESS KILLING AST?

AST Research's sales are still shooting straight up, but the bottom fell out of earnings last year as the company entered the systems market. Can AST survive the ride?

When Safi Qureshey, Tom Yuen, and Albert Wong met in a Los Angeles–area restaurant in 1980 to plan strategy for their new add-on board company, they couldn't agree on one issue: Who would be president? Since nobody wanted the honor, they settled the matter by drawing straws. Qureshey ended up titular head of AST Research, while Yuen and Wong became executive vice presidents.

Insiders say this incident set the tone for both the management style and structure of a company that has become one of the great success stories in the PC industry. Albert, Safi, and Tom turned a $40,000 stake into a diversified company with 1500 employees and an annual revenue run rate of more than $300 million.

"A, S, and T"—as they are usually referred to around the firm's Irvine, California, headquarters—still practice a consensus style of management that emphasizes cooperation and individual initiative within the work environment. "The culture was great," says former marketing director Tony Paradiso, now a Laguna Beach, California, consultant. "It was a very people-oriented environment. Everyone worked as a team, put in long hours, and had a concern for doing things right." Other former employees emphasize the partners' easy accessi-

MIKE HOGAN

Tom Yuen (left), Safi Qureshey, and Albert Wong (not shown) are taking AST down a dangerous new path.

MAX AGUILERA-HELLWEG

bility and informal management style (see the sidebar "The Fast Buck Doesn't Stop Here").

But today AST's management is being called into question as the firm faces the greatest challenge of its young life. Sales are still exploding, but earnings have plummeted, draining the company's cash reserves. Revenues jumped 96 percent to $78.6 million in the first quarter ended September 30, 1987—another record performance in a long string of record-breaking quarters. But net income dropped from $3.1 million in first quarter 1986 to a mere $72,000 in the first quarter of 1987. Cash on hand plunged from $39.8 million at the start of that quarter to $12.4 million at the end, while another $32 million worth of inventory piled up, bringing the inventory total to $84 million. Those numbers dragged the stock price down below book value to a new 52-week low (prices have since rebounded moderately).

Even as AST launched an aggressive new line of Premium products, Wall Street analysts wondered aloud whether the company had outgrown the partners' entrepreneurial management style. Would AST fall victim to the paradox that had killed other high-tech entrepreneurial firms—in which success outdistanced the founders' management skills? Or would its recent quarterly performance turn out to be a misstep in AST's otherwise steady climb?

Even as AST launched an aggressive new line of Premium products, Wall Street analysts wondered aloud whether the company had outgrown the partners' entrepreneurial management style.

The Need to Diversify

While still the clear leader in PC enhancement products, the company is facing stiffening competition in a very unstable market. This couldn't have happened at a worse time. About 16 months ago, the partners revealed an ambitious plan to transform AST from just an add-on board manufacturer into a player in the highly competitive systems business as well.

The three founders had planned all along to build computers, insists Qureshey, who even discussed the prospect in a 1983 annual report. They realized that they couldn't build a company as large as they wanted if they were forever trying to second-guess IBM's product plans. That resolve was strengthened in 1984 when IBM introduced the faster, more functional PC AT. The AT began to undercut the need for AST's SixPakPlus multifunction board, which at one time accounted for 70 percent of the firm's revenues.

AST came out with AT upgrades, like the Advantage Premium board, and expanded its product line with significant offerings in graphics and communications as well as entries in the DEC and Apple markets. But until recently, its core business had been PC upgrades, and as Big Blue continued to build more functionality into its base systems, the demand for add-ons diminished. AST needed another cash cow.

So in January 1987, the company shipped its own fast AT compatible, hedging its bets by simultaneously launching a laser printer and scanner into the emerging desktop publishing market. The Premium/286, offering proprietary Fastslot bus technology and enhanced expanded memory on the motherboard, has been well accepted, with 75,000 units sold in its first year. The Premium line anchors the Systems Product Group, which grew to account for 70 percent of AST's revenues in well under a year.

Eye Off the Ball?

But it's a long way from the revenue section of an income statement to its bottom line. The Premium/286 required considerable investment in R&D and manufacturing facilities and, with its low pricing, yielded only about a 22 percent gross margin. The Premium ramp-up drained resources from an established board business whose margins were in the neighborhood of 50 percent. Profits suffered.

Then IBM rolled out the full-featured PS/2 line, eliminating many add-on market opportunities, heightening market competition, and eroding board margins. And while the PS/2 created new add-on opportunities, they demanded additional investments, and AST was slower to react with new products than suppliers such as Orchid Technologies.

"They really took their eye off the ball—their board business," claims analyst Benny Lorenzo of L.F. Rothschild & Company. "If a small company like Orchid could come out with PS/2 boards quickly, there's no reason why AST couldn't, except for the dilution of management's attention because of [its emphasis on] systems."

The leap into systems took a toll on management in other ways, too. It was "a very easy decision among the three partners, but it wasn't so easy to get the next level of management on

board," admits Yuen. "We did have to twist many people's arms." Many middle managers were uncomfortable taking on powerhouses like IBM and Compaq. Some decided to take their AST stock and go elsewhere.

The product changeover also marked the end of an experiment with so-called professional management. A couple years before, the partners had recruited Thomas Stickel as senior vice president of sales and marketing and Bruce Edwards as chief financial officer to establish a more traditional management reporting structure and greater financial control.

As Yuen explains it, these two executives were vested with large amounts of AST stock and could afford to pursue other interests. But another former high-level AST manager claims that these and other top managers left because they felt their authority was being undercut by the partners' excessive day-to-day involvement and their tendency to be too lenient with nonperforming employees.

"All the strong management is gone," insists this former executive. "The people who are left are more concerned about their continued employment and don't want to rock any boats. So they end up waiting for direction to be handed down to them from A, S, and T."

Meanwhile, the company continues to reorganize. The most recent restructuring is intended to tie senior managers' sales quotas more closely to specific product lines, redirecting attention away from high-priced/low-margin systems sales and back to low-ticket/high-margin board sales.

When cash reserves fell from $39.8 million to $12.5 million in one quarter, some outsiders blamed a lack of strong middle management. But Yuen insists the cash was spent appropriately. "Do you want us to sit on it and be a banker? Or do you want us to invest it in the business we know best? Our personal fortunes are tied to the company. The three of us have more to lose than anyone else."

Yuen defends the inventory buildup as necessary to compete with the delivery schedules of IBM and other established vendors. Compared

THE FAST BUCK DOESN'T STOP HERE

Last October 19, AST Research held an elaborate product introduction for its new 80386-based computer and 80286 workstation at New York's famous Guggenheim Museum. President Safi Qureshey came in late for the noontime buffet. "Well, I lost about a third of my wealth since I came here this morning," he mentioned casually as he sat down.

Ironically, what should have been one of the happiest days in the lives of AST's founders—Qureshey, Albert Wong, and Tom Yuen—turned out to be the day the stock market crashed twice as hard it did in 1929.

But despite the beating their company's stock has taken, the trio has so far refused to turn away from the basic operating principles and goals they have maintained since the company was founded. Qureshey, Wong, and Yuen continue to run the $300 million firm as though it were a family business. Their priorities are product quality, customers, employees, and stock prices—in that order.

Most dealers who carry the machine report exceptional performance, says JoeAnn Stahel, chief operating officer for the Storeboard retail tracking service. Comments on AST always refer to the Premium/286's speed, quality construction, and good price/performance characteristics, she reports.

Much the same is heard from AST customers. "We found the Premium/286 to have the best overall performance, the best price/performance, and the best standard architecture of all those we looked at," says Tom Egan, vice president and manager of office systems for the commercial banking group of Wells Fargo Bank. His company uses Premium/286s in a crucial role as local area network servers in 24 California loan offices. "We analyzed the company, too, and found it to be very solid and progressive. All in all, we were very impressed."

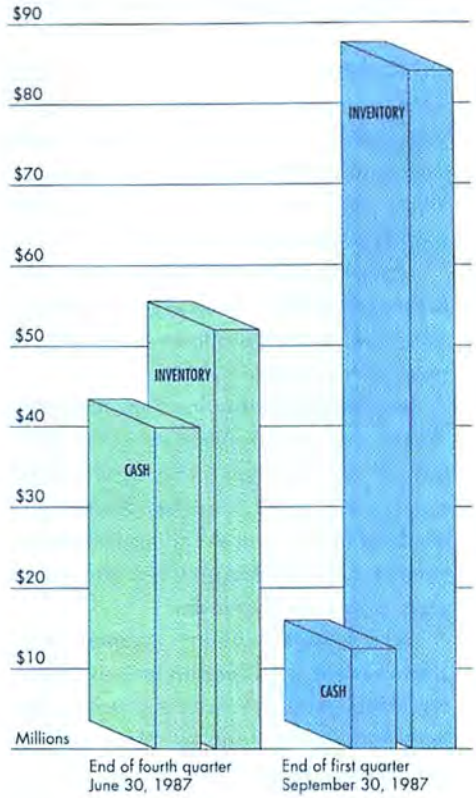
The company's reputation for quality in boards and now computers didn't just happen. Ash Jain, former head of AST's Apple Enhancement Division, recalls numerous incidents when operations chief Albert Wong refused to compromise quality for the sake of cost containment. Once when a tiny defect was found in SixPakPlus boards as a truckload was leaving the dock, Wong called the truck back and had thousands of packages unpacked, the boards disassembled, and the defective part replaced.

The partners don't consider this philanthropy, but rather a way to build a company for the long term. A case in point is the $1.5 million in extra air freight they spent in the quarter ended September 30 to make sure that their dealers were supplied quickly. "That $1.5 million in excess air freight comes right off the bottom line," Yuen acknowledges. "But we're already making such a big investment, why not spend another one or two million to ensure that we get market share?"

The founders' goal is to build a half-billion-dollar company by the end of the decade, and they figure they won't get there by playing it safe. —*M. H.*

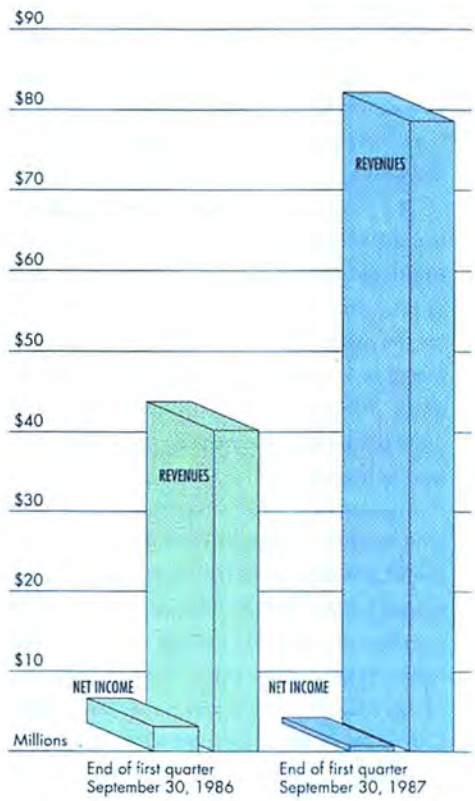
TURNING GOLD INTO SILICON

While AST's inventories mounted to a high of $84 million, cash on hand plummeted from $39.8 million at the start of first quarter 1987 to $12.4 million at the end.



SELLING MORE, EARNING LESS

Compared to the same quarter in 1986, AST revenues jumped 96 percent to $78.6 million in the first quarter ended September 30, 1987, but net income dropped from $3.1 million to a mere $72,000.



to boards, computers require the warehousing of far more difficult-to-obtain components, he notes. But analysts like Thomas A. Galvin, a vice president at Shearson Lehman Brothers, don't entirely buy that argument. Galvin points out that AST is turning over its inventory little more than three times a year. By comparison, Apple turns over its inventory eight times a year, and Compaq Computer turns over its higher-priced products as often as six times annually.

Turning It Around

Still, the numbers belie several significant accomplishments. AST has retooled its factories, brought a Taiwan facility on line, reoriented its internal organization toward a new business, maintained its existing business, and successfully kicked its way into a long-overcrowded market. The company accomplished that in record time. It rectified its board shortcomings, bringing out a full PS/2 line at COMDEX/Fall, and is now shipping 12,000 computers a month.

At this writing, Storeboard market research ranks the Premium/286 a distant third behind IBM and Compaq machines in a field of almost 100 AT compatibles sold through independent retailers (not counting Tandy's Radio Shack outlets). And AST is narrowing the gap.

The manufacturer has decided to channel sales through distributors and dealers to ensure good customer support. Market research conducted just before the Premium/286 introduction indicated that the AST brand name would gain the computer a fair hearing with resellers; but AST also knew that it would have to, as Yuen puts it, buy its way into the crowded market with low prices. The strategy appears to be working; the company has garnered more than 500 dealers (compared to 2000 for its boards) and is signing up 20 more a month.

"I was the number one skeptic when they came along with a computer," admits Robert Hahn, vice president of Continental Resources, a Bedford, Massachusetts, reseller. "My attitude was that no matter how good you are at boards, you can't compete in this dog-eat-dog business of computers."

Now Continental Resources is one of AST's biggest dealers, selling more than 1000 Premium/286s last year. Continental stuck with AST, Hahn says, because of AST's ability to deliver products on time, its willingness to quickly overcome problems, and the quality of the AST product. Although he carries nine PC lines, the Premium/286, he says, "is our computer of choice. It's the first one we take in to a customer."

Thanks to the Premium/286's warm reception, AST has been able to raise the price of the machine a couple of hundred dollars, bringing margins up to "the high 20s." The recent start of volume shipments of an innovative 80386-based Premium and a line of high-end workstations, both carrying margins of better than 40 percent, should further boost AST's overall profitability.

With start-up investments completed, the partners feel that they are over the hump in the systems business. Now they will rely, they say, on their extensive surface-mount and custom silicon production capabilities to drive costs down and further improve the bottom line.

"People look at the financial numbers, and they tend to draw conclusions based on short-term views of the company," complains Yuen. "There are operational issues that we have to address. We can definitely be more efficient. But we have made a lot of investments to secure our commitment in the systems business, and a lot of the financial analysts don't see that."

At this writing, preliminary indications are that second quarter 1988 will show the first quarter-to-quarter earnings improvement in a year, as well as set another record for revenues ($92 million). The company expects earnings of about 15 cents a share (compared to the first quarter's penny a share)—well beyond most analysts' predictions.

AST continues to be informal and open in its managerial style, but the partners are injecting more discipline into the corporate culture. "The three founders used to be very lenient," says Ash Jain, former head of the Apple Enhancement Division. "But there has been a maturing of the company, and the founders are coming to grips with reality."

The Premium ramp-up drained resources from an established board business whose margins were in the neighborhood of 50 percent. Profits suffered.

Wall Street would prefer to see even tighter structure. "There are no problems with the products," observes L.F. Rothschild's Lorenzo. The partners "are great in R&D and production, and they're no slouches in the distribution game. But they need to delegate more. They have to let go and give authority as well as responsibility. They just haven't given [professional management] enough time."

The three admit they are looking for some well-qualified help, but they don't envision passing the company over to a "professional manager" the way Apple Computer founder Steve Jobs passed the company over to Pepsico executive John Sculley.

"I think that the need for control, the need for discipline, the need for organization are all good ideas," says Qureshey. "But what we have shared and what this industry still needs is a certain amount of entrepreneurial spirit and creativity. We have not run a company of this size, so we don't claim to have all the answers. No company does. But we learn as we go forward together."

The role of the founders doesn't upset their customers or dealers at all. "We go to our customers selling AST's financial strength," emphasizes Continental Resources' Hahn. "You are looking at a company with $100 million net worth, no debt, and a 3-to-1 current ratio [the ratio of liquid assets to liabilities due within a year]. It's a marvelous company with great opportunities to keep growing with the technology. Their profits are not all that great, but that's the investment they are spending to get where they want to go. Analysts are short-sighted; all they want is profits."

To tell the truth, although Wall Street projects a couple of rocky quarters ahead for AST, most analysts are bullish on the company's long-term outlook because they're willing to bet on the founders. "My bottom line on AST," says Lorenzo, "is that I think they will make it because of the people involved."●

Mike Hogan is the news editor for PC World.

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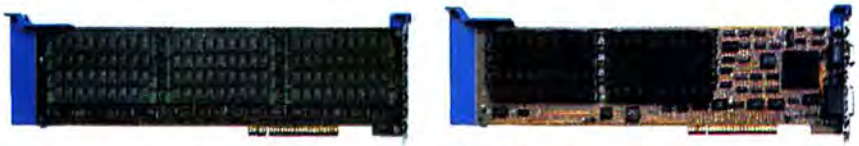

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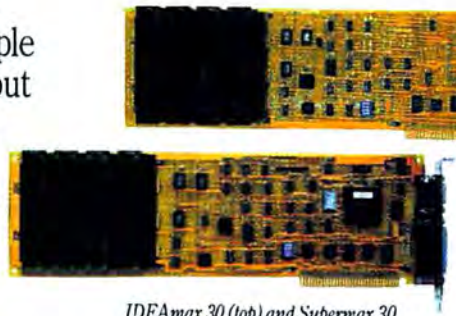

IDEAmax 30 (top) and Supermax 30 (bottom), for the IBM PS/2 Model 30, PC and XT.

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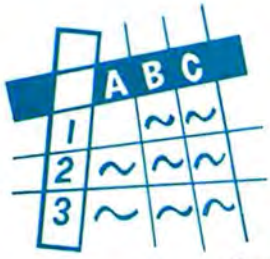
Circle 251 on reader service card

Measure the Costs of PC Ownership

What does it really cost to have that PC sitting on your desk? It's worth your while to find out how much more an upgrade to the latest technology will be.



Spreadsheets

Charles R. Ryan

Just how much it actually costs to implement personal computers in the workplace is a hotly debated issue. Of course, initial hardware and software purchases are only the beginning; the big costs will be training, work interruptions, and other intangibles.

Still, it's possible to measure ownership costs fairly accurately over time, as distinct from operating costs (such as disks and paper) or total user costs (all of the aforementioned plus training, downtime, and so on). This information can help you answer such questions as, How much should you budget for new equipment? Should you lease or buy? How much of a difference is there between the net cost of owning True Blue or Compaq versus clones? How much more does it cost to own new as opposed to used equipment? What will it really cost right now to upgrade from 80286-class machines to 80386-based systems?

The template in Figure 1 evaluates ownership costs for the equipment in a hypothetical office using Compaq Portables and IBM PC ATs, and projects costs for anticipated purchases. Certain information about each machine was taken from the office's business records. Though your office's equipment may vary, the formulas contained in this template can help you evaluate your own equipment needs and expenses.

For the Compaq Portable (column C), the worksheet calculates net ownership cost (cell C33) by

Personal Computer Ownership Cost Calculations

	A	B	C	D	E	F	G	H
1					3-year	3-year	3-year	
2			Compaq		projection	projection	projection	
3			Portable	IBM AT	for old AT	for 386 upgrade	for new 386	Source
4			-------	------	------	-------	-------	------
5	Year purchased		1984	1985	1985	1988	1988	
6								
7	Purchase price		$3651	$5989	$5989	$1200	$5500	Purchase receipt
8								
9	Total depreciation taken		$2012	$3300	$5690	$854	$3190	Tax returns
10								
11	+ Sales tax		$288	$473	$473	$95	$435	Purchase receipt
12	+ Service and maint. costs		$351	$404	$942	$77	$231	Expense records
13	+ Insurance		$96	$101	$236	$27	$127	Expense records
14	+ Property taxes		$141	$154	$359	$41	$215	Expense records
15			------	------	------	------	------	------
16	= Ownership costs		$876	$1132	$2010	$240	$1008	
17								
18	Marginal tax rate		30.0%	30.0%	29.0%	28.0%	28.0%	Tax tables
19								
20	Tax savings at							
21	marginal tax rate	1	$866	$1330	$2233	$306	$1175	Calculated
22								
23	Investment Tax Credit (ITC)	2	$365	$599	$599	--	--	Tax returns
24								
25	Resale price		$1000	$1900	$1150	$329	$1500	Market conditions
26								
27	Tax increase on gain							
28	(or decrease on loss)							
29	at marginal tax rate	3	($192)	($237)	$247	($5)	($227)	Calculated
30								
31	ITC recapture	4	$219	$359	--	--	--	Tax returns
32			------	------	------	------	------	
33	Net ownership cost		$2323	$3415	$4264	$800	$3606	
34			======	======	======	======	======	
35	----------							
36	Summary		Current figures			3-year projections		
37	-------		----------			----------		
38								
39	Number of months owned		42	27	63	36	36	
40								
41	Ownership cost per month		$55	$126	$68	$22	$100	
42								
43	Average annual ownership cost		$664	$1518	$812	$267	$1202	
45	Resale price compared to							
46	purchase price		27.4%	31.7%	19.2%	27.4%	27.3%	
47	Average annual decline							
48	in market value		20.7%	30.3%	15.4%	24.2%	24.2%	
49	----------							

50 [1] Depreciation + ownership costs x marginal tax rate.

51

52 [2] 10% of purchase price; not available after 1985.

53

54 [3] Resale price - (purchase price - total depreciation) x marginal tax rate.

55

56 [4] Prorated if equipment is sold before five years.

Historical analysis
"What if" projections

FIGURE 1: Using your business records and this 1-2-3 template, you can evaluate ownership costs for the PCs you own and estimate costs for anticipated purchases as well. Dollar values in this example are rounded off to the nearest dollar.

adding the purchase price (C7) to the other ownership costs (C16) and then subtracting the tax savings (C21), the Investment Tax Credit (C23), if applicable, and the probable (or actual) resale price (C25). Then the worksheet calculates the tax effect of selling or planning to sell your equipment (adding the amounts found in cells C29 and C31). The resulting figure is your net ownership cost.

Then, in a summary section that begins on row 36, the ownership costs per month (C41) and per year (C43) are calculated. Also included are two other calculations: one that compares resale price to the original cost (C45) and another that gives the average annual rate of depreciation (C48).

BUILDING THE TEMPLATE

To set up the template, type in the labels as shown in the figure, substituting your own computer brands. Then enter the data in rows 5, 7, 9, 11, 12, 13, 14, 18, 23, 25, 31, and 39 from your business records. Next, type in the formulas for column C and copy them across the worksheet. Here are the formulas:

Cell C16—Ownership costs: @SUM(C11..C14)
This formula factors in other costs such as local sales tax, service and maintenance, insurance, and property taxes. You can also add a row here to factor in any interest costs associated with financing a PC.

Cell C21—Tax savings at marginal tax rate: (C9+C16)*C18
To calculate the tax you've saved by owning a PC, add total depreciation to ownership costs and multiply the result by your marginal tax rate.

Cell C23—Investment Tax Credit (ITC): C7*0.1
ITC is no longer available after 1985. This tax savings should be included when analyzing equipment purchased in 1985 or earlier.

Cell C29—Tax increase on gain (or decrease on loss) at marginal tax rate: [C25-(C7-C9)]*C18
Use this formula to determine the tax you save or owe for the depreciation you've taken on your PCs.

Cell C33—Net ownership cost: C7+C16-C21-C23-C25+C29-C31
Net ownership cost takes into account purchase price (C7), ownership costs (C16), applicable tax breaks (C21, C23, C29, and C31), and the resale price (C25).

Cell C41—Ownership cost per month: C33/C39
Here's a simple calculation dividing net ownership costs by the total number of months you've owned your PC.

Cell C43—Average annual ownership cost: C41*12
This formula calculates ownership costs for a 12-month period.

Cell C45—Resale price compared to purchase price: C25/C7
This percentage helps you determine how the resale price compares to the original cost.

Cell C48—Average annual decline in market value: ((C7-C25)/C39)*12/(C7)
This calculation reveals the average rate at which your equipment loses its dollar value each year—useful for estimating what the resale value of your equipment will be in the future.

Fine-Tuning the Facts

Notice that in several entries, such as total depreciation, property tax, and marginal tax rate, income taxes affect ownership costs. You may need some help from a tax specialist or a CPA to make those calculations, or you can obtain the necessary tax data from your business's tax returns. For PC hobbyists and nonprofit organizations, there is no income tax impact associated with PC ownership.

Net ownership costs for users who can't take income tax deductions for their computers are 43 to 54 percent more than costs shown in Figure 1. Likewise, under the new IRS code's lower tax brackets and lack of investment tax credits, the net ownership cost will be approximately 9 to 11 percent greater than these historical costs.

If you haven't actually sold any used equipment, you'll have to estimate its resale value to fill in row 25. Good sources for used computer price information are *The Computer Blue Book*

(Sybex, Alameda, CA, 1988) for $9.95 and the Boston Computer Exchange (P.O. Box 1177, Boston, MA 02103, 617/542-4414), a clearinghouse for used computer prices worldwide. You can also estimate prices by looking at classified newspaper ads or talking with dealers or user group members.

To Upgrade or Not

In addition to providing historical cost information, the template can help you make decisions about upgrading equipment. For example, should you buy a new 80386 for a street price of $5500 or upgrade an old AT with an Intel Inboard 386/AT for $1200? Columns E, F, and G calculate the costs of upgrading from an 80286 to an 80386.

Comparing the historical cost record for the IBM AT (D33) with the net ownership cost estimate (E33) reveals that it will cost $849, after taxes, in additional depreciation, maintenance, and other ownership costs to keep the old AT for, say, three more years. The after-tax ownership cost for the Intel Inboard 386/AT upgrade is $800 (F33), which makes the total cost for an upgraded AT $1649. It will cost about $3606 (G33) to own a new 80386 for three years. Therefore, going with the new 80386 system will probably cost an additional $1956, or approximately $55 more per month over three years. By plugging in the numbers for your own equipment, you can produce an accurate picture of the cost of any buy or sell decision. ●

Charles R. Ryan is a financial management consultant in Seattle.

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* March 10, 1987 issue, page 278.

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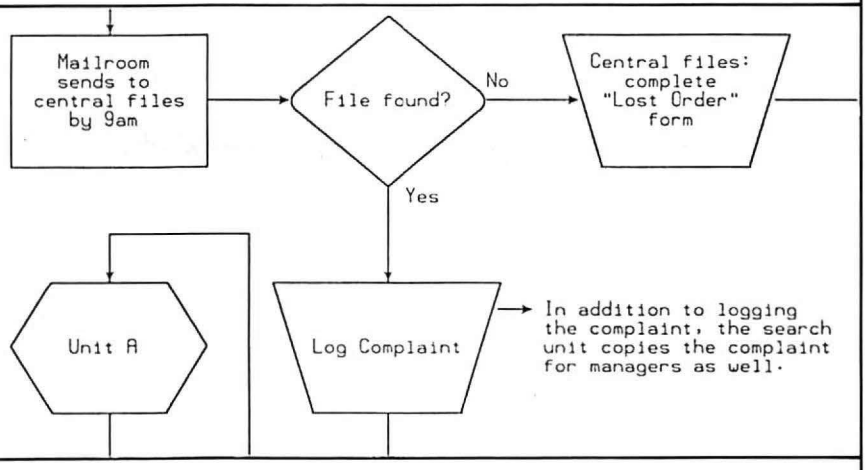

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Circle 14 on reader service card

CONSUMER WATCH

Advice and information for the computer consumer

Should you buy a service contract for your PC? For cost-conscious consumers, the answer may be no.

Anita Amirrezvani

Taking a Calculated Risk

Just a couple of years ago, buying a service contract for computer equipment was a matter of course. Today the story is different. As PCs break less often and replacement costs continue to fall, some users say it makes sense to risk downtime in exchange for smaller service bills.

Take Chris Wong of Marshall & Stevens, a financial and real estate consulting firm headquartered in Los Angeles. "Until a year ago, Marshall & Stevens had a full on-site contract with a third-party maintenance vendor, with bills in the neighborhood of $6000 per month," says Wong, director of business services for the company's ten eastern division offices.

"But now we've curtailed our maintenance service by about two-thirds. PCs are better constructed these days, and we're not experiencing as many problems," says Wong. "If a PC that's not under contract *does* break, we have it fixed on a time-and-materials basis. On the books, this has saved us money."

Users agree that service contracts are critical for PCs that simply can't have any downtime. "I support financial traders, and if a trader's PC dies it's got to be fixed the same day," says Steven Roth, vice president of applications development for Marine Midland Bank in New York. "When you consider lost revenue, the cost of a contract pales in comparison."

Still, Roth says that in other situations it makes sense to think twice about buying a contract. "The price of hardware is going down. If you've got a clone and downtime won't cause a disaster, it probably doesn't pay to get a service contract—unless it's very inexpensive."

Equipment that is cheaper to buy new than to repair should also not be under contract. "Low-end dot matrix printers, floppy drives, and keyboards can cost as much to repair as to replace," says Jan Calloway, editor of *Microservice Management*, a magazine for service providers published in Overland Park, Kansas. "On the other hand, some users are willing to leave the repair-or-replace decision to the service company and enjoy the peace of mind of having a contract."

Whether you buy a service contract also depends on how you use a given product. "I don't have a service contract for my Compaq Portable, but if I were hauling it on and off airplanes all the time I would definitely get one," says Andy Thomas, director of field service consultation for The Data Group in Burlington, Massachusetts.

Of course, not buying a service contract has its risks. Labor charges range from $50 to $100

(continues)

TABLE 1

What You Can Expect to Pay for Service

The prices in this table are estimates for typical low-end and high-end systems, such as a plain-vanilla IBM PC with a monochrome monitor and two floppy disk drives, and a top-of-the-line Compaq Deskpro 386 with a 40MB hard disk, an EGA monitor, and a Hewlett-Packard LaserJet. Note that prices vary depending on your location and the type of equipment and specific services required.

	Service information				Annual contract costs			
					Ship in[1]		Carry in	
	Number of service locations	IBM-compatible PCs serviced (not all models may be serviced)	Uses third-party replacement parts	At customer's request?	Low-end system	High-end system	Low-end system	High-end system
AT&T 180 Hansen Ct. Wood Dale, IL 60191 800/922-0354	200	AT&T only	y	y	$176	$774.84	$176	$774.84
Businessland[3] 1001 Ridder Park Dr. San Jose, CA 95131 408/437-0400	100	Compaq, IBM, Wyse, Zenith	n	n/a	$153	$821	$153	$821
ComputerLand[4] 1310 Sutter St. San Francisco, CA 94109 415/928-5297	500+	AST, AT&T, Compaq, Hewlett-Packard, IBM, NEC, Tandon, Zenith	y	y	$196.60	$960.80	$196.60	$960.80
Honeywell-Bull[5] Customer Service Division 141 Needham St., Newton, MA 02161 617/552-6000	200+	Compaq, IBM, PC's Limited, Tandon, Zenith	n	n/a	$190	n/a	$190	n/a
IBM National Service Division 400 Parsons Pond Dr. Franklin Lakes, NJ 07417 201/848-1900	194	IBM systems only and selected peripherals by Amdek, AST, Epson, Forte, Hayes, Hercules, Hewlett-Packard, Okidata, and Tecmar	n	n	n/a	n/a	n/a	n/a

[1] Customer usually pays freight costs.
[2] Travel charges may be extra.
[3] Prices quoted are for the second year of a machine's life. First-year prices are lower for machines purchased from Businessland.

per hour or more plus parts, with premiums for on-site repair. Customers without contracts don't get preferred service. And if your machine is a lemon, you could end up paying more for time-and-materials service than for an annual contract.

To get the most security for the least money, a combination of service methods may be the best approach: full on-site contracts for essential equipment, time-and-materials arrangements for inexpensive products like clones and machines that can be temporarily replaced, and a program of self-maintenance to guard against equipment failure. Even limited self-maintenance—diagnostics, upgrades, and minor repairs—can help prevent costly service bills.

Clarifying Contract Costs

An overview of contract costs gives new meaning to the old line, "You better shop around." Our interviews with 11 national service companies and retail service providers turned up big variations in price (see Table 1, "What You Can Expect to Pay for Service"). Typically, though, an annual service contract for a PC ranges from about 10 to 14 percent of the retail cost of the equipment, according to a survey by *Microservice Management*.

The longer you're prepared to wait for service, the less you'll pay. Annual contract costs for

(continues)

Pick up and deliver		On site		Minimum number of PCs for volume discount	Percent discount	Hourly labor charge (outside contract)			
Low-end system	High-end system	Low-end system	High-end system			Ship in[1]	Carry in	Pick up and deliver[2]	On site[2]
n/a	n/a	$402	$1761	25	15	$90	$90	n/a	$90 ($220 min.)
$153	$821	$230	$1172	5	varies	$65	$65	$65	$75
$246	$1201	$246	$1201	10	10	$75	$60	$60	$75
n/a	n/a	$235	n/a	varies	varies	$60 ($30 min.)	$60 ($30 min.)	n/a	$85
$85	$315	$85	$315	150–499 500–999 over 1000	15 20 25	n/a	n/a	n/a	$115

(CONTINUES)

[4] Prices may vary somewhat by location.
[5] Estimates for 386 machines were not available at press time.
[6] Pick-up-and-deliver service is available on request.

TABLE 1

(CONTINUED)

	Service information				Annual contract costs			
					Ship in[1]		Carry in	
	Number of service locations	IBM-compatible PCs serviced (not all models may be serviced)	Uses third-party replacement parts	At customer's request?	Low-end system	High-end system	Low-end system	High-end system
Intelogic Trace Turtle Creek Tower One P.O. Box 400044 San Antonio, TX 78229-8470 512/699-5700	230	Compaq, IBM, and many compatibles	n	n/a	$251.20	$1169.69	$266.90	$1242.70
Momentum[5] 201 Littleton Rd. Morris Plains, NJ 07950 800/257-7796 201/984-9400 (NJ)	140	Compaq, IBM, and many compatibles	y	y	$148	n/a	$148	n/a
NCR Customer Service Division Third-Party Services 9391 Washington Church Rd. Miamisburg, OH 45342 800/982-6804	400 +	Compaq, IBM, Wyse, Zenith	n	n	$146	$450	$146	$450
Sorbus 50 E. Suedesford Rd. Frazer, PA 19355 800/FOR-INFO	200	Compaq, IBM, and many compatibles	y	y	$147	$862	$147	$862
TRW Customer Service Division 15 Law Dr. Fairfield, NJ 07006 800/922-0897 201/575-7110 (NJ)	150	Compaq, IBM, and many compatibles	n	n/a	n/a	n/a	$192	$793
Xerox Service Business Xerox Square Rochester, NY 14644 716/423-3308	78	Compaq, IBM, and many compatibles	y	n	$227	$1079	$227	$1079

[1] Customer usually pays freight costs.
[2] Travel charges may be extra.
[3] Prices quoted are for the second year of a machine's life. First-year prices are lower for machines purchased from Businessland.

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Now you can turn any PC into a powerful voice mail system. Without interfering with your computing.

It's called The Complete Answering Machine. And it is the most sophisticated, affordable voice mail system you can buy.

Hourly labor charge (outside contract)

Pick up and deliver		On site		Minimum number of PCs for volume discount	Percent discount	Ship in[1]	Carry in	Pick up and deliver[2]	On site[2]
Low-end system	High-end system	Low-end system	High-end system						
[6]	[6]	$314	$1462	10	10	$80	$80	[6]	$80 ($80 min.)
$164	n/a	$182.50	n/a	varies	3–45	$60	$60	$100 8 a.m. –5 p.m. $115 after hrs. & Sat. $125 Sun. & holidays	same as pick up and deliver
n/a	n/a	$292	$900	15 (on site only)	5	$109	$109	n/a	$109 (8 a.m.–5 p.m.) $142 (after 5 p.m.)
$147	$862	$237	$1257	10	10	$66	$66	$66	$106
n/a	n/a	$235	$973	10	10–20	$50	$65	n/a	$104
$279	$1209	$338	$1457	50	5–10 (ship in) 10–35 (other)	$85	$85	$85	$85

[4] Prices may vary somewhat by location.
[5] Estimates for 386 machines were not available at press time.
[6] Pick-up-and-deliver service is available on request.

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Circle 44 on reader service card

ship-in and for carry-in service, which can require anywhere from two days to two weeks, often run about the same—and in both cases you'll pay for transporting the product to the repair site. Pick-up-and-deliver service and on-site service tend to be in the luxury category, costing 50 or even 100 percent more than the other types of service. Volume discounts of 10 percent are generally available for ten PCs or more.

To save money, consumers should consider alternatives to traditional contracts. Sorbus, for example, offers a policy that covers all parts at a fixed monthly rate; labor is billed as needed. Intelogic Trace has a "shared risk" program that benefits high-volume users: The contract costs one-quarter of the company's regular price, and each service call is billed at a flat rate up to a maximum amount.

RTK Computer Services of Middlesex, New Jersey, offers volume overnight replacement contracts. The company enters your system information into its data base; when a problem arises, an RTK bench technician attempts to diagnose the problem over the phone. According to RTK president George Fenwick, about 30 to 35 percent of the problems are solved by phone; the rest of the time the company ships out the necessary replacement part via overnight mail. In return, you send RTK the defective part.

Fenwick says the service is geared to firms with PCs distributed in small groups across the country, like insurance companies. Although RTK deals in volume, annual contract costs for a plain-vanilla IBM PC were estimated for comparison's sake at $239; at the high end, a contract for a Compaq Deskpro 386 system with an EGA monitor and a Hewlett-Packard LaserJet was estimated at $790 per year.

> The only reason IBM is making positive moves for consumers is to put pressure on third-party maintainers."

As a selling point, some mail-order companies offer free third-party service contracts when you purchase their products. Acer Technologies in San Jose, California, provides a one-year contract through TRW with the purchase of certain Acer computer models or any laser printer. For the first four months, the service is on site if you're within a 50-mile radius of a TRW location; during the next eight months the service is carry in. Similarly, Dell Computer, maker of PC's Limited products, supplies a one-year on-site service contract through Honeywell-Bull for users within a 100-mile radius of a Honeywell-Bull service bureau.

Competition Heats Up

Recently, large vendors such as IBM, Honeywell, NCR, and Xerox have entered the third-party service market, causing consternation among independent maintenance companies. "A couple of years ago, large manufacturers were not inclined to fix other companies' products," says Mike MacNaughton, chairman of an annual conference on the service industry and president of Business Development International in Franklin Lakes, New Jersey. "Now they realize they're inviting their customers to go elsewhere for service."

But some independent companies claim that manufacturers-turned-service-providers aren't playing fair. "IBM is obviously discouraging third parties that maintain IBM equipment," charges Roger Grant, vice president of marketing for Intelogic Trace. IBM recently closed 61 parts stores and raised its handling charges for emergency parts. According to an IBM spokesperson, these moves "were not intended to cut out competition but to create greater operating efficiency."

IBM's service contract prices for the PS/2 line are undeniably attractive. An annual on-site contract for a PS/2 Model 25 is only $85 per year; the price for a high-end system, such as a Model 80 with a 40MB hard disk, a monitor, and a Proprinter II, is $315.

At the moment consumers are likely to benefit, but Roger Grant warns that the good times might not last. "The only reason IBM is making these positive moves for consumers is to put pressure on third-party maintainers. But if IBM successfully discourages other service companies, discounts may become a thing of the past."

At a service conference held in 1987, industry representatives stressed one major theme: Service companies will have to offer more to keep afloat. "We can't

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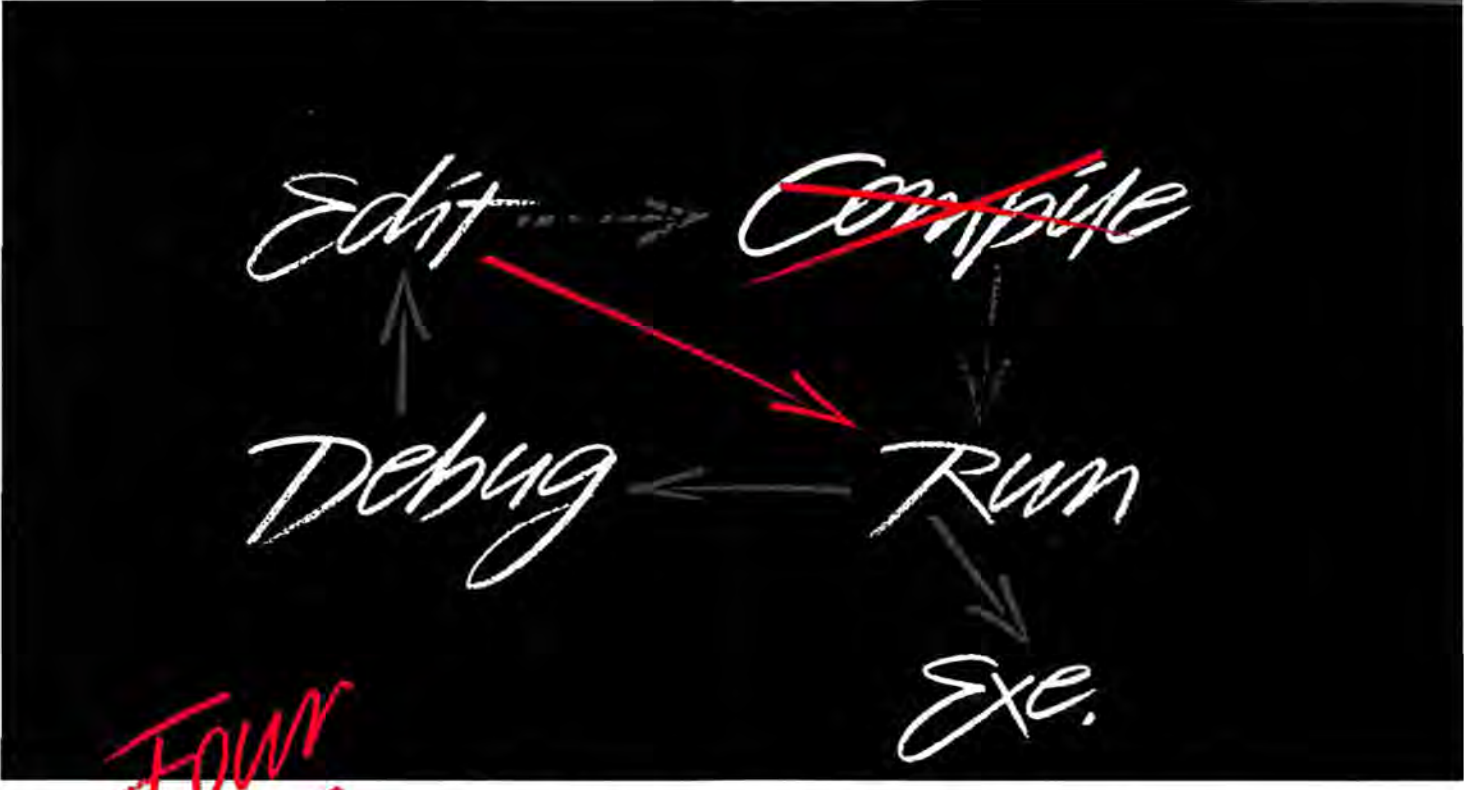

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compete with manufacturers if we just fix the box," said Richard Schwoebel, president of the service company Momentum. "Most successful third-party service companies will have to provide added services, such as network and software support," said William Fitzgerald, vice president of technical services at Control Data Corporation, which mainly services companies with large systems. "For the user, there will be one telephone number to call, one person to talk to, and no finger pointing among vendors."

Because of heightened competition, consumers can benefit by actively exploring service contract options. "Contracts are more entrepreneurial now," says *Microservice Management* editor Calloway. "Service companies are offering site planning, consulting, 'loaner' technicians, training, and software support and are writing creative contracts that allow for rebates on unused services. Today, users can expect a service contract to be written specifically for their needs."

SHOP TALK

You Can't Beat Good Service

Recently I took my Compaq Portable to an authorized dealer for replacement of the monitor assembly. After the repair was made, I noticed that about 1 inch of unscanned image remained at the top of the picture tube. When I tried to run *dBASE III Plus*, the help information, which falls on lines 24 and 25, was no longer visible on screen.

After taking the computer back to the shop, I found out that the company had invalidated my Compaq warranty by using third-party replacement parts instead of Compaq-authorized parts. When I called Compaq, I was told that many computer stores are substituting third-party parts and not telling their customers. A word of wisdom: Ask questions! Third-party replacement parts are generally older and could have serious defects, since they are manufactured to lesser standards.

David A. Christofferson
Gig Harbor, Washington

When I called Compaq, I was told that many computer stores are substituting third-party parts and not telling their customers."

Editor's note: In a phone interview, Compaq spokeswoman Debra Globe offered these tips:

"To verify that you are indeed buying your PC and getting service from an authorized dealer, call a Compaq representative at 800/231-0900. While a PC is under warranty, dealers are required to use Compaq-authorized parts. Still, when you take the PC in for service, request that the dealer use Compaq-authorized parts to keep your warranty valid, and get the agreement in writing on the repair receipt.

"If you have problems with a dealer, call or write our customer relations department at 20555 FM-149, Houston, TX 77070; 713/370-0412."

Service, Please

In October 1986 my company bought a Xerox 4045 laser printer for $4995. Shortly before the 90-day warranty elapsed, we checked on obtaining a service contract. We were appalled to discover that it would cost $960 per year plus 2.2 cents per copy for each page in excess of 15,000. Because of Xerox's reputation for quality, we decided to forgo the contract. Unfortunately, just six months later the machine broke down and would produce nothing more than a line of stars across the page.

A Xerox technician cheerfully replaced the circuit board and handed us a bill for $1600. Upon requesting reimbursement from Xerox for this obviously defective part, I was informed that based on annual usage of 50,000 copies, this machine required an average of 4.6 service calls per year and that the failure could have been caused by any number of factors, including a power surge (though our system is protected by a line filter). Furthermore, I was informed that after the 90-day warranty period, the company takes no responsibility for product failure.

Jay D. Crom
San Francisco, California

Xerox Corporation responds: Our printers are fully warranted for 90 days, as Mr. Crom stated, and our full-service-maintenance prices are published for all products. Our price for the Xerox 4045 is $480

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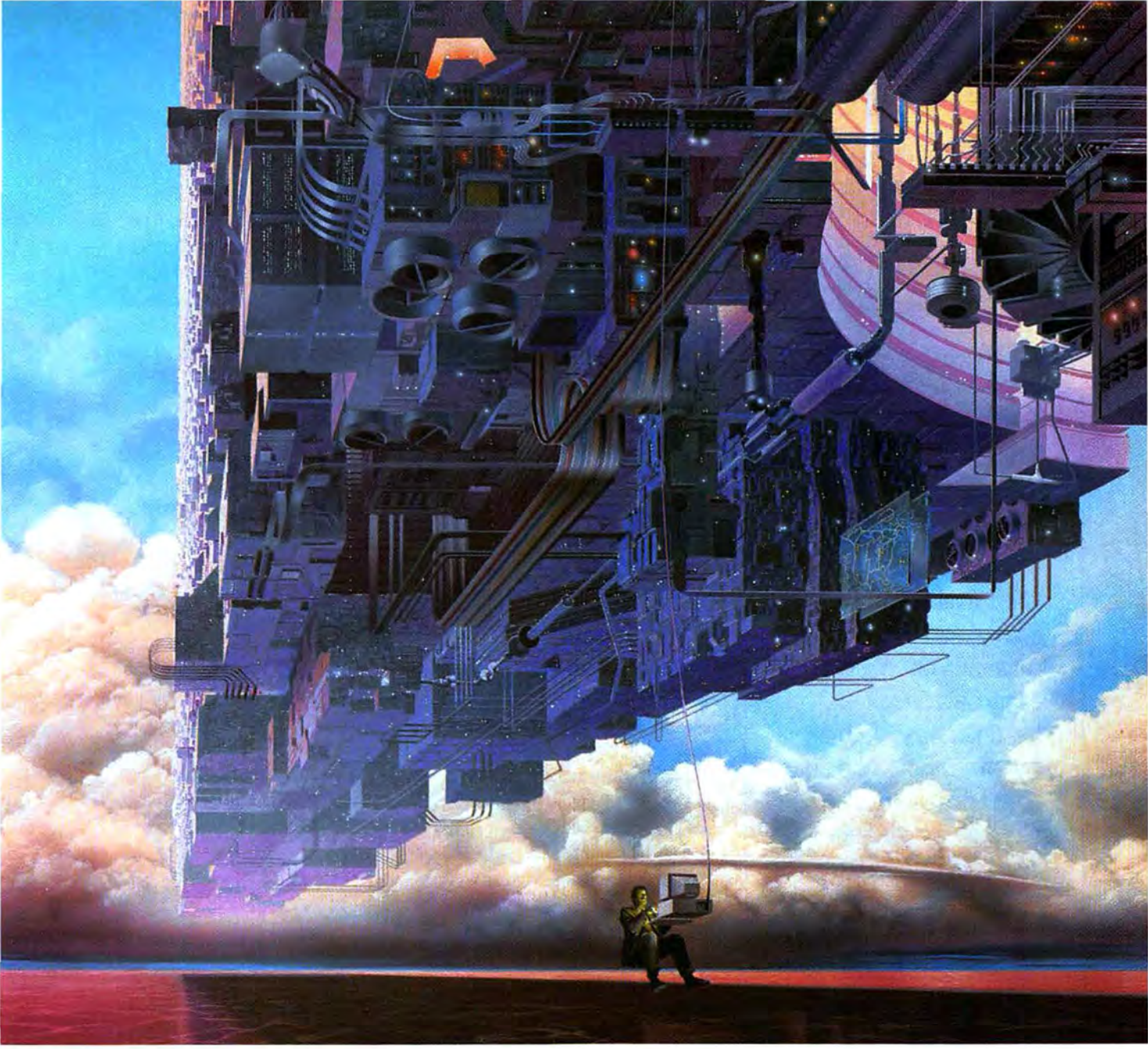

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Circle 63 on reader service card

per year for the printer-only model, $540 per year for the printer-copier model, plus 1.2 cents per page. Although Mr. Crom believes the service charge on his 4045 was high, we believe our prices are quite competitive.

George Tunick, Manager
Decentralized Printing
System Marketing

Editor's note: Before buying hardware, ask about the average annual number of service calls. That information will help you decide whether you need an annual contract.

PC American Update

In December 1987 a *PC World* reader alerted us that PC American Marketing, a mail-order company in Fountain Valley, California, had stopped answering its phones and that there was no forwarding number. A visit to PC American headquarters confirmed that the company had packed up and disappeared. At press time *PC World* learned that owner Phil Herman had filed for bankruptcy.

The bankruptcy case number is SA8800704JR. If you have a claim against PC American, fill out a proof-of-claim form (available at most stationery stores and through the court) and send it to U.S. Bankruptcy Court, P.O. Box 12600, Santa Ana, CA 92712; 714/836-2993.

Six for the Price of Six

In the December 1987 issue of *PC World*, I noticed an ad for printer ribbons by SupplyLine of Lombard, Illinois. The ad stated, "Buy 6 ribbons and GET 6 FREE" and listed the ribbon prices for various printers. For my Epson EX-800 the price was $4.88. This led me to believe that I could purchase 6 ribbons at $4.88 each and receive 6 free. However, in placing the order I learned that there is no such thing as "6 free." You might as well order any number of ribbons, as they are all $4.88 each!

Michael C. Cooper
Norwalk, Ohio

SupplyLine responds: We have no intention of misleading consumers with our advertisement. As a policy all our sales consultants must tell the customer the regular retail price per ribbon followed by the net price—which we advertise. We explain that our regular retail on that ribbon is $9.76, over 34 percent off the manufacturer's suggested retail. Customers who buy 6 ribbons will get 6 free. Thus, their net price per ribbon is $4.88 each, the price we advertise.

Dan DeBoer
Vice President

Editor's note: Whatever SupplyLine's intentions, anyone who looks at the ad is likely to come to the same conclusion as Michael Cooper.

Got a gripe? Want to set the record straight? Write Consumer Watch, PC World, *501 Second St., San Francisco, CA 94107, or use MCI Mail PCWORLD/179-3813, CompuServe 74055,412, or The Source STE908. Include your name, city, state, and daytime telephone number with all correspondence. Letters may be edited for length and style. Due to volume, we cannot acknowledge every letter.*

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, 30MB	$1925.00	6386 40MG	$3492.00

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TOSHIBA

HIBA 1100 LAPTOP, 1 DRIVE	$2274.00
HIBA 3100/20	$3245.00

WYSE

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THE UPGRADE PATH

Hands-on advice for upgrading PCs, compatibles, and peripherals

This month: The WORM turns for the PC, a mighty printer buffer board, a snap-on hard disk for the T1100 Plus, and more

Robert Luhn

Bright Lights, Big Storage

The storage soothsayers claim the erasable optical disk will change the way we use computers, but affordable high-capacity drives still seem a few years away. At best, Kodak may deliver working prototypes of a 50MB drive sometime this year.

But for organizations with data to burn—insurance companies, hospitals, retail chains, banks, and the like—50MB is a thimbleful. Until truly massive erasable optical drives appear, the choice of archivists and backup artists everywhere will be write-once, read-many optical drives—WORM for short—that use removable disks. WORM drives are no longer the preserve of fat cats, either. The ISI 525 internal WORM drive examined here, which uses removable 5-inch 115MB and 230MB cartridges, costs $2595. Not pocket money, to be sure, but the device is far more cost efficient than any hard disk, Bernoulli Box, or tape backup system.

Installing and working with WORM drives has also grown simpler. You just slide the ISI 525 drive into a PC's full-height bay, pop its ESDI controller into a slot, and install ISI's WORM-TOS device driver. You don't have to "mount" files or deal with arcane utilities—all DOS commands from CHKDSK to XCOPY work, and you can create partitions larger than 32MB. The ISI 525 can be installed in PCs, XTs, ATs, compatible systems, and 16-MHz 80386 machines; the company is currently testing the drive with 20-MHz systems.

Before you do anything, of course, park the system's hard disk, turn the system off, remove all external cables, and pop off the system cover. Pull the ISI disk controller board out of its antistatic bag and set it on top of the bag. The factory DIP switch settings will suffice for PCs and XTs; for ATs, set switch 8 in the on position. Insert the board in any free slot except the short slot nearest the power supply.

Next, remove the ISI 525 drive from its wrapper and, holding it by its metal frame, slide it into a full-height storage bay. If the four screws on the bottom of the drive prevent it from going in, remove them. But make absolutely sure the circuit card on the bottom of the drive doesn't touch the system's metal chassis, or you could fry the drive when you turn the system on. When in doubt, place a sheet of Mylar or cardboard between the drive and the bottom of the drive bay. As with a hard disk drive, you'll have to jockey a power connector into the keyed white receptacle at the back of the ISI drive and snake a pair of keyed ribbon cables from the controller to the drive. Once that's done, reassemble the system and turn it on.

(continues)

At this point the manual incorrectly directs you to slip the ISI utility disk into drive A: and run INSTALL.BAT to copy WORM-TOS to the system disk. In fact, you must run either INSTSML.BAT or INSTBIG.BAT, depending on whether you want disk partitions meeting or exceeding DOS's 32MB limit. Either way, a \WT subdirectory is created and the necessary files copied into it. To finish the job, you can modify the system's CONFIG.SYS and AUTOEXEC.BAT files or copy those supplied by ISI to the root directory.

Reboot the system, and you're ready to create disk partitions. Push an optical disk cartridge into the ISI 525 drive, and at the DOS prompt type **DPU** *n*:, where *n* is the drive letter (usually D) displayed by WORM-TOS when the system was rebooted. Press **< F10 >** to create the first partition, specify a partition size (in this case, 32MB), supply a label, confirm your choices, and in a few seconds the partition is created. Repeat the procedure until the disk is spent, and reboot the system. WORM-TOS will confirm that drives D:, E:, F:, and so on are available.

Getting to each drive can take a little effort. DOS initially recognizes only the first partition (D). To log on to any other partition, you must run DPU again, select 'Change Current Partition' from the menu, identify the desired partition, and exit to DOS. You can automate this entire sequence, however, by placing DPU *e:* /C *n* in the system's AUTOEXEC.BAT file. The /C issues the change partition command; *e* is the drive letter you want to assign to the desired partition; *n* is the partition's ID number.

MARK FARBIN

The ISI 525 optical drive installs and acts just like a hard disk. The difference: removable 230MB cartridges.

Although the ISI 525 acts like a hard disk, remember that it's a write-once device: Once you create a partition, you can't change it. Since "deleted" and "edited" files are actually still on the disk, keep modifications to a minimum or you may find the optical cartridge suddenly full. In short, use the ISI 525 as a super backup device, or store data that isn't likely to change much—financial records, finished publications, font and image libraries, and the like—and you'll find this initially pricey investment well worth the money.

WHERE TO BUY

ISI 525
Information Storage, Inc.
2768 Janitell Rd.
Colorado Springs, CO 80906
303/579-0460
List price: $2595; 230MB cartridge $135, 115MB cartridge $95
Requirements: 512K; DOS 2.00 or later version (DOS 3.xx recommended); PC, XT, AT, close compatible, or 16-MHz 80386 computer

Stick-On Laptop Hard Disk

Most Toshiba T1100 laptop computer users would probably love to have a fast, capacious hard disk at their beck and call on the road and in the office. Unfortunately, the T1100 is strictly a dual floppy affair. To add the necessary storage punch, you must take the upgrade path.

The climb can be relatively easy if you turn to Axonix's ThinPack external expansion unit for the T1100 Plus. (Units are also available for the T1200 and T3100 systems.) The featherlight box, which matches the T1100 Plus in girth and styling, not only accommodates a 65ms 20MB or 30MB hard disk but also has three half-length PC expansion slots that can hold modem boards, EMS boards, EGA video adapters, and other devices.

To join the T1100 Plus and the ThinPack, you slide an interface board into the T1100 Plus's one slot, snap the two units together, and connect a cable. The whole process takes an hour or two and

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MARK FARBIN

Adding the ThinPack expansion unit (with hard disk and modem) to the T1100 Plus is no lick-and-stick operation. You must mount brackets on the laptop and then latch the units together.

requires two screwdrivers—a small Phillips and a flat-blade. Axonix's poorly organized and muddily illustrated manual lists all the necessary steps, but read the manual thoroughly before attempting this upgrade.

The first thing to do (and one of the last steps mentioned in the manual) is to confirm the version number of the T1100 Plus's BIOS ROM. If the system relies on a version prior to 1.08, you must either replace the BIOS ROM or forgo using the ThinPack with Toshiba MS-DOS 3.20. To get the facts, boot the system with a DOS disk containing a copy of DEBUG.COM in drive A:. At the prompt type **DEBUG < Enter >** and at the hyphen, **D FE00:0 < Enter >**; the ROM's version number will appear on the right side of the screen.

Next, check the manual to see if the ThinPack options you've bought require you to change the DIP switch settings in the T1100 Plus or move jumpers in the ThinPack. The ThinPack examined here—complete with 30MB hard disk, internal 2400-bps modem, and EMS board—was properly configured at the factory and required no changes to the T1100 Plus. But some devices will force you to dig through both units, so do the digging before you go any further.

Once these issues are settled, turn off the T1100 Plus and any internal devices, snap the screen closed, remove all external cables and floppy disks, and swing the unit around so the back is facing you. Remove the two screws holding the metal plate over the system's expansion slot; if a board is present, remove it. You may have to gently insert the tip of a small flat-blade screwdriver between the board's bracket and the T1100 Plus and twist to pop the board out. Angle the Axonix expansion board, chip-side up, into the now empty slot; push it in until you feel the connector snap into place, and secure its mounting bracket with the two screws.

Properly mating the T1100 Plus and ThinPack means attaching two mounting brackets on the underside of the computer and a pair of guideposts on its back. Flip the T1100 Plus onto its back, remove the two outside screws near the handle, and tighten the brackets in place with the supplied flat-head screws. Then remove the two outside screws at the back of the system unit and replace them with the plastic-collared posts.

Turn the T1100 Plus upright and slip it headfirst into the matching brackets on top of the ThinPack. Make sure the linkup is secure by lifting up on both sides; then flick the latches on the ThinPack over the posts on the back of the T1100 Plus. This may take some doing—the latches are bolted just a little too low, so you'll have to press the two units together to lock the latches down. And once you do, you'll find the posts in the T1100 Plus practically yanked out of their sockets. The latches are also easily snagged by cables or clothing. Axonix claims it has since redesigned these latches to minimize such problems.

Once the units are united, plug the cable hanging from the ThinPack into the connector protruding from the T1100 Plus's expansion slot, and attach the ThinPack's AC adapter. Before you plug the adapter into a wall socket, make sure everything is switched off. Then flick on the adapter, the ThinPack, and finally, the T1100 Plus. Since Axonix performs only a low-level format on the hard disk, you must turn to DOS's FDISK and FORMAT utilities to finish the job.

You'll find the ThinPack a totable, rugged companion for

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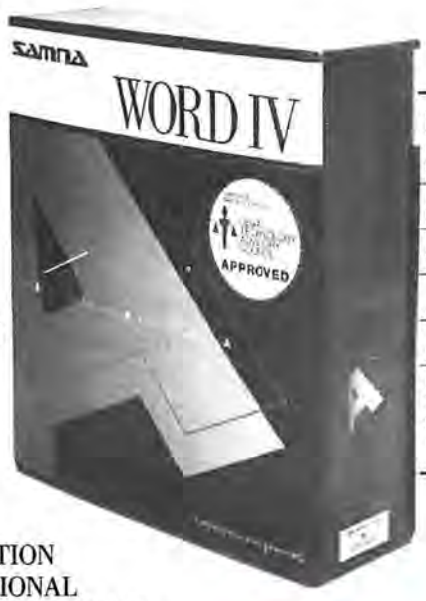

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your T1100 Plus. The hard disk flawlessly passed an informal torture test that forced it to repeatedly read, write, and randomly search a 1MB file for 2 hours, and survived numerous trips to and from the office. Just remember to keep an eye on those latches—they make it a little too easy to pop the two units apart accidentally.

WHERE TO BUY

ThinPack Expansion Unit for the T1100 Plus
Axonix Corp.
2257 South 1100 East
Salt Lake City, UT 84106
801/466-9797
List price: expansion unit $699, with 20MB hard disk $1395, with 30MB hard disk $1495

The Ultimate Print Buffer

Programs from *WordStar* to *Excel* offer print spooling—ostensibly a way to print one file while you work on another. But as most users discover, print spooling turns speedy programs into slugabeds because so much system memory is consumed by the spooler utility and the file being printed. One solution is *PrintQ*, which spools files to disk instead of RAM (see *The Software Shelf*, *PCW*, February 1988).

A faster, albeit more expensive, route is to tackle the problem at its source: the printer. Nonlaser printers typically come with 8K of RAM at most—barely enough to hold a 1000-word document. But add Ditron's 1MB MegaPrint buffer board (complete with its own processor) to your PC, and a printer can effectively accommodate a 600-page document. This takes a mighty load off the PC and makes spooling unnecessary. For example, send a 50K document to a printer connected to the MegaPrint, and your PC will be freed up for other work in less than a minute. The MegaPrint is a perfect upgrade for desktop publishing PCs or computers acting as printer servers for a local area network.

At $495, the MegaPrint is no steal, but it's darn close. (Those with slimmer budgets can obtain the 256K ExecuPrint or the 64K MiniPrint for $180 or $155, respectively, and add memory chips on their own.) Upgrade-wary users will also appreciate

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the MegaPrint's straightforward installation. You merely set a jumper on the board, slip the board into a free slot, and connect the printer to the MegaPrint's parallel port. The tools of the upgrade: a small flat-blade screwdriver for removing the computer's cover and a pair of needle-nose pliers.

Most systems already have a parallel printer adapter installed as LPT1, so you must first run Ditron's SWAP utility to see if the MegaPrint and the adapter will conflict. Chances are they will, so you can either remove the existing parallel adapter, install it as a second printer port (LPT2), or reconfigure the MegaPrint. The latter may be the simplest approach—or the only one, if your system relies on

(continues)

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- **Just before you remove the device from its packing, ground yourself by touching the fan grille on the back of a turned-off PC that's plugged into a grounded outlet.**
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IBM's monochrome video and printer adapter.

The steps: Ground yourself, remove the MegaPrint from its antistatic wrapper, find the jumper block closest to the bank of RAM chips, and slip the supplied jumper over the top two pins of the block with a pair of needle-nose pliers. The MegaPrint is now configured as LPT2; later you'll run a utility that automatically redirects output from the old adapter to the MegaPrint.

Park the system's hard disk, turn the machine off, unplug all external cables, and open up the system. Put the MegaPrint in any free slot (including an XT's short slot) and secure the board's mounting bracket to the backplane. Reassemble the computer, connect the printer to the MegaPrint's parallel port, and turn the system back on.

If you use *Microsoft Word* or other applications that can direct output to any port, your work is done. But if you want DOS and all applications to treat the MegaPrint as LPT1, slip Ditron's utility disk into drive A: and type SWAP1&2. The two adapter addresses are swapped, and the MegaPrint becomes the default printer port. You can automate this swapping by copying SWAP1&2.EXE to the system disk and adding SWAP1&2 to the system's AUTOEXEC.BAT file. The Ditron disk also includes a program that empties the buffer (handy if you need to abort a big print job) and a memory-resident utility that lets you perform the preceding task and others within any application. Of course, the MegaPrint isn't a panacea for all your PC's performance problems, but it's a great way to beat the print-time blues.

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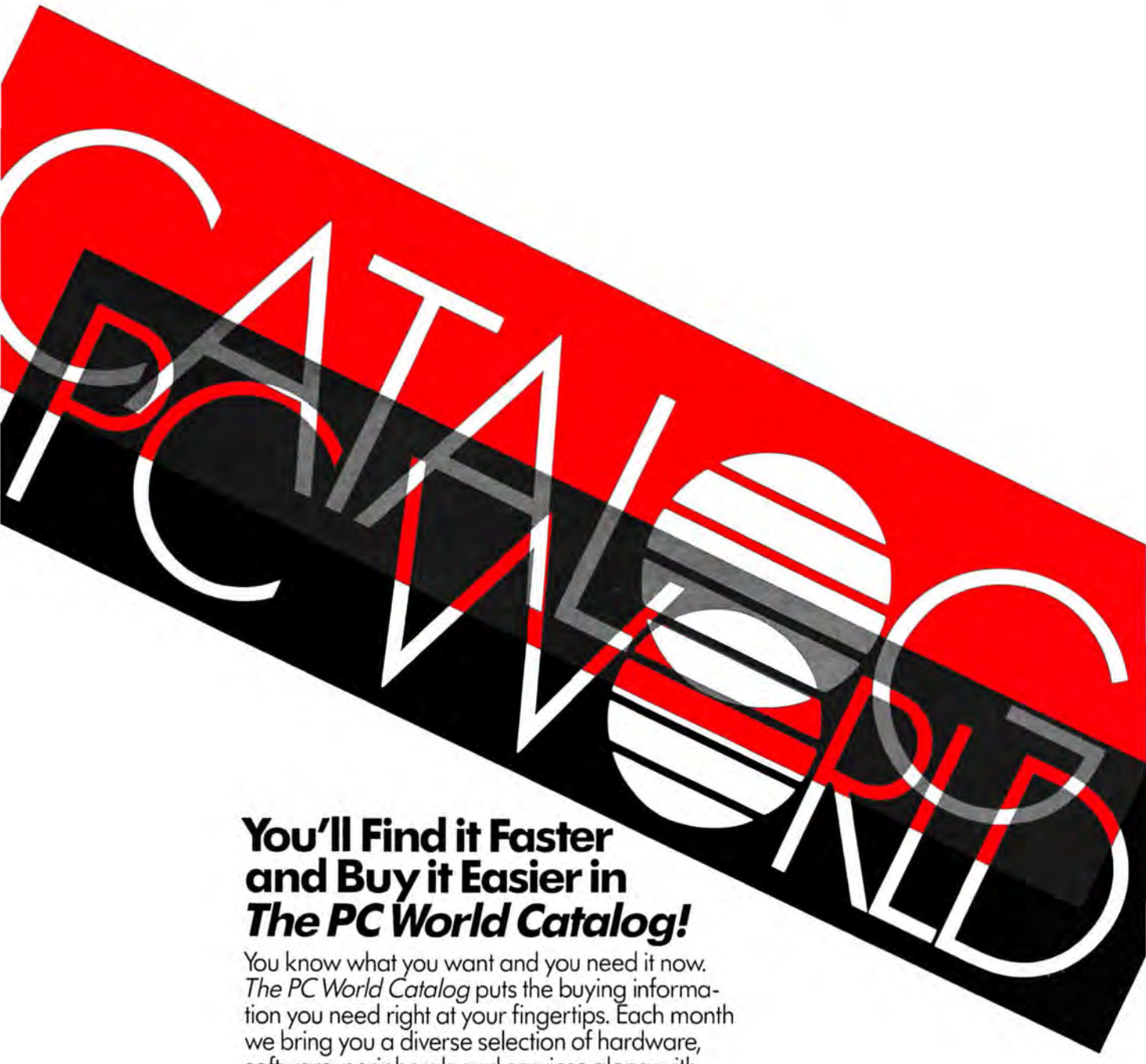
Upgrade Update

LaserJet Series II owners with a hankering for more printer memory can now get it at their local ComputerLand. Pacific Data Products of San Diego, maker of the expandable 1-2-4 memory board (see "A Plus for the Series II," *The Upgrade Path*, February 1988), is manufacturing the board under the Sysdyne label for the computer chain. Since ComputerLand buys in quantity, expect to save as much as 12 percent on the price of the unpopulated board.

Please forward submissions and queries to The Upgrade Path, PC World, *501 Second St., San Francisco, CA 94107, or electronically to MCI Mail PCWORLD/179-3813, CompuServe 74055,412, or The Source STE908. Articles submitted by mail should be accompanied by a self-addressed, stamped envelope and an ASCII file of the item.*



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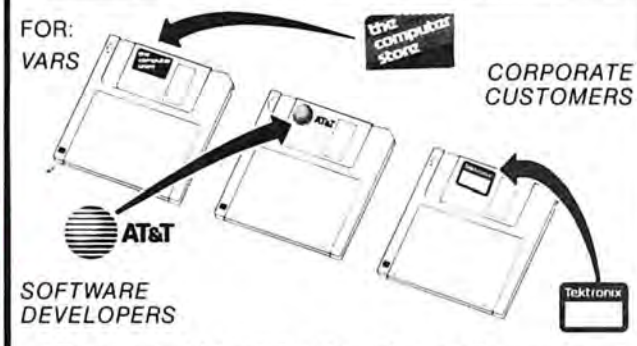

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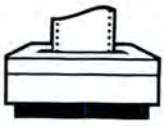

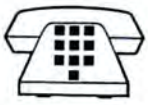

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THE HELP SCREEN

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One utility to disable the <Print Screen> key and another to set <Caps Lock>, <Num Lock>, and <Scroll Lock> on or off; the ANSI.SYS Escape commands; and a closer look at December's AUTOEXEC.BAT file

Karl Koessel

<Print Screen> Panacea

Q. *I read with interest Tom Swan's tip in "Ten Time-Savers" [PCW, January 1988] on killing the <Print Screen> key. It's a real help for those of us who don't have a printer. Unfortunately, I also don't have a compiler, which Mr. Swan recommends for creating an executable DOS program. Having to load BASIC and a program just to change one byte in the system is inelegant, not to mention overkill. It's like using a moving van to carry a TV set next door. Can you provide a small .COM or .EXE file that will turn off the print screen function?*

Walter Williams
Norfolk, Virginia

A. No problem. The assembly language listing PRNTSCRN.ASM (see Listing 1) creates PRNTSCRN.COM, which lets you activate and deactivate <Print Screen> at will. To disable the key, execute the command PRNTSCRN OFF at the DOS prompt. To enable the key, use PRNTSCRN ON. If you omit the parameter or type something other than ON or OFF (lowercase is also acceptable), PRNTSCRN will display its error message, set ERRORLEVEL to 1, and return you to DOS.

How does it work? Basically, this simple program fetches the number of characters that were typed on the DOS command line after the command PRNTSCRN. (This number is found at address CS:80h.) If that number is zero, meaning neither the ON nor the OFF parameter was entered, the error message is displayed. Otherwise, the program saves the number of characters and then gets the first character, makes it uppercase, and compares it against a capital *O*, the first letter of both ON and OFF. If the character is not an *O*, the program loops back to get, capitalize, and compare the next character. The loop instruction automatically decrements the saved number of characters and does not execute after that number becomes zero. If the end of the command line is reached before an *O* is found, the error message is displayed.

The loop continues until an *O* is found (or there are no more characters to test). When an *O* is found, the next character in the command line is compared to an *F;* if it matches, the program skips over the code that looks for an *N.* If neither an *F* nor an *N* is found, the error message is displayed. When ON or OFF is detected, the first byte of the DOS and BASIC Data area is set to 0 or 1, respectively, enabling or suspending the <Print Screen> key as explained in Tom Swan's January article.

(continues)

```
            TITLE prntscrn    ;The Help Screen, PC World, April 1988

_TEXT       SEGMENT           ;Define code segment
            ASSUME   cs:_TEXT,ds:_TEXT,ss:_TEXT ;Set segment registers
            ORG   100h        ;.COM programs start at 100h, after PSP

start:      jmp   begin       ;Jump over error message

err_msg     DB    "Type PRNTSCRN ON or PRNTSCRN OFF",0Dh,0Ah
lerr_msg    EQU   $ - err_msg ;Length of error message

begin:      mov   si,80h      ;80th byte holds number of bytes to check
            lodsb       ;Put byte that SI points to in AL; increment SI
            cmp   al,0        ;Was command issued without a parameter?
            jz    input_err   ;If no parameter, go to input_err routine
            mov   cl,al       ;Use CL to hold # of bytes left to check
get_char:   lodsb       ;Put byte that SI points to in AL; increment SI
            and   al,11011111b      ;Convert byte to uppercase
            cmp   al,'O'      ;Is byte an O?
            jz    on_or_off   ;If yes, go to on_or_off
            loop  get_char    ;If CL not 0, get another character
            jmp   input_err   ;If end of command line is found before
                              ; finding an O, go to input_err routine

on_or_off:  lodsb       ;Put byte that SI points to in AL; increment SI
            and   al,11011111b      ;Convert byte to uppercase
            cmp   al,'N'      ;Is byte an N?
            jz    on_byte     ;If yes, ON confirmed; go to on_byte
            cmp   al,'F'      ;If not an N, is byte an F?
            jnz   input_err   ;If neither, go to input_err routine

off_byte:   mov   al,1        ;Set 1 in AL for print screen busy
            jmp   set_byte    ;Go set print screen byte

on_byte:    mov   al,0        ;Set 0 in AL for print screen ready

set_byte:   mov   bx,50h      ;Set BX to value of DOS & BASIC Data area
            mov   es,bx       ;Begin ES at DOS & BASIC Data area
            mov   di,0        ;Point DI at print screen (first) byte
            mov   es:[di],al  ;Set byte on/off according to value of AL
            xor   al,al       ;Set errorlevel 0, no errors
            jmp   exit        ;Go to exit

input_err:  mov   bx,1        ;File handle for standard output
            mov   cx,lerr_msg ;Load length of message
            mov   dx,OFFSET err_msg ;Load starting address of message
            mov   ah,40h      ;DOS write function
            int   21h         ;Call DOS
            mov   al,1        ;Set errorlevel 1

exit:       mov   ah,4Ch      ;DOS exit function
            int   21h         ;Call DOS

_TEXT       ENDS
            END   start
```

LISTING 1: PRNTSCRN.ASM creates a small .COM program that disables or activates the <Print Screen> key.

Readers without an assembler can use BASIC to create PRNTSCRN.COM. Load BASIC and enter the lines shown in PRNTSCRN.DAT, Listing 2. Check your work carefully and save the lines with the command **SAVE "PRNTSCRN.DAT",A < Enter >** . Type the command **NEW**, press **< Enter >** , and input the lines shown in the X-MAKER2.BAS listing of this month's *.* column. Save this program with the command **SAVE "X-MAKER2" < Enter >** . Next, issue the commands **MERGE "PRNTSCRN.DAT" < Enter >** and **RUN < Enter >** to create PRNTSCRN.COM.

Nixing <Num Lock>

Q. *I am responsible for a number of ATs and PS/2s that are used primarily for 3728 terminal emulation via Micro Plus's MP01 terminal-emulation adapter. Whenever our machines are started or rebooted, they automatically set the <Num Lock> key's status bit to on. The emulator board, however, requires Num Lock to be off before the emulator is engaged. As a result, users have to turn off Num Lock manually every time they start work.*

I'm looking for a utility that will deactivate Num Lock. I already have a similar utility that activates Caps Lock. Having AUTOEXEC.BAT invoke such a utility would alleviate much frustration in my office.

Rick Bell
Santa Clara, California

A. The answer to this problem is similar to the previous item's solution for toggling the print screen function on and off. In this case, however, there's more

```
1000 DATA "PRNTSCRN.COM"
1010 DATA 1,EB,23,90,54,79,70,65,20,50,52,4E,54,53,43,52,4E,-1,E9
1020 DATA 2,20,4F,4E,20,6F,72,20,50,52,4E,54,53,43,52,4E,20,-1,44
1030 DATA 3,4F,46,46,0D,0A,BE,80,00,AC,3C,00,74,30,8A,C8,AC,-1,6B
1040 DATA 4,24,DF,3C,4F,74,05,E2,F7,EB,23,90,AC,24,DF,3C,4E,-1,FD
1050 DATA 5,74,09,3C,46,75,17,B0,01,EB,03,90,B0,00,BB,50,00,8E,-1,F5
1060 DATA 6,C3,BF,*2,26,88,05,32,C0,EB,10,90,BB,01,00,B9,-1,C6
1070 DATA 7,22,00,BA,03,01,B4,40,CD,21,B0,01,B4,4C,CD,21,-1,C5,-1
```

LISTING 2: PRNTSCRN.DAT consists of the DATA lines that *.*'s X-MAKER2.BAS uses to create PRNTSCRN.COM.

```
1000 DATA "LOCKKEYS.COM"
1010 DATA 1,EB,7D,90,0D,0A,42,61,64,20,6F,72,20,6D,69,73,73,-1,C0
1020 DATA 2,69,6E,67,20,70,61,72,61,6D,65,74,65,72,3B,20,75,-1,73
1030 DATA 3,73,65,20,6F,6E,65,20,6F,72,20,6D,6F,72,65,20,6F,-1,0B
1040 DATA 4,66,20,74,68,65,73,65,3A,0D,0A,0A,09,43,61,70,73,-1,3A
1050 DATA 5,3A,6F,6E,20,20,20,20,4E,75,6D,3A,6F,6E,20,20,20,-1,03
1060 DATA 6,20,53,63,72,6F,6C,6C,3A,6F,6E,0D,0A,0A,09,43,61,-1,55
1070 DATA 7,70,73,3A,6F,66,66,20,20,20,4E,75,6D,3A,6F,66,66,-1,D8
1080 DATA 8,20,20,20,53,63,72,6F,6C,6C,3A,6F,66,66,0D,0A,BE,-1,A9
1090 DATA 9,80,00,AC,8A,C8,BB,40,00,8E,C3,BF,17,00,B7,FF,E8,-1,3B
1100 DATA 10,4C,00,72,2D,3C,00,74,F7,B3,BF,3C,43,74,0C,D0,CB,-1,A1
1110 DATA 11,3C,4E,74,06,D0,CB,3C,53,75,21,E8,3E,00,72,1C,32,-1,B4
1120 DATA 12,FF,3C,00,75,05,26,20,1D,EB,D5,F6,D3,26,08,1D,EB,-1,07
1130 DATA 13,CE,80,FF,00,75,05,32,C0,EB,10,90,BB,01,00,B9,7C,-1,58
1140 DATA 14,00,BA,03,01,B4,40,CD,21,B0,01,B4,4C,CD,21,80,F9,-1,C8
1150 DATA 15,00,74,06,AC,24,DF,FE,C9,C3,F9,C3,E8,F0,FF,72,29,-1,1C
1160 DATA 16,3C,1A,75,F7,E8,E7,FF,72,20,3C,4F,75,1C,E8,DE,FF,-1,9D
1170 DATA 17,72,17,3C,4E,74,10,3C,46,75,0F,E8,D1,FF,72,0A,3C,-1,C1
1180 DATA 18,46,75,06,32,C0,C3,0C,FF,C3,F9,C3,-1,A6,-1
```

LISTING 3: LOCKKEYS.DAT consists of the DATA lines that *.*'s X-MAKER2.BAS uses to create LOCKKEYS.COM.

```
path d:\batch;d:\wp\word;c:\dos;d:\util\misc;
prompt $e[30;46m$p$g
echo ^[x3>lpt1
c:\dos\mode com1:96,n,8,1,p
c:\dos\mode lpt2=com1
d:\util\cruise\cruise /10 /b
c:\dos\graphics
d:\util\superkey\key
d:\util\sidekick\sk
d:\util\superkey\key d:\util\superkey\autosk-l /ml
cd c:\junk
cd d:\unfiled
d:
cls
word todolist
```

LISTING 4: An AUTOEXEC.BAT file typically sets up the system's extended directory search paths, modifies the default prompt and screen colors, initializes the printer(s), installs memory-resident programs, sets the desired current drive and directory, and calls up the application that you use first each morning.

than one key to be manipulated, and each is controlled by a single bit rather than a whole byte: You've already mentioned <Caps Lock> and <Num Lock>; we may as well throw in <Scroll Lock>, too.

So I offer LOCKKEYS.COM, a utility that controls the status of one or more Lock keys. Thus, LOCKKEYS has six valid parameters: C:on, C:off, N:on, N:off, S:on, and S:off. You can use any combination of parameters (in uppercase or lowercase) without changing the status of any unspecified key(s).

To create LOCKKEYS.COM, load BASIC and enter the lines shown in LOCKKEYS.DAT, Listing 3. Check your work carefully, and save the lines with the command **SAVE "LOCKKEYS.DAT",A < Enter >** . Type the command **LOAD "X-MAKER2"** and press **< Enter >** to load the program that you saved to make PRNTSCRN.COM in the previous item. Next, issue the commands **MERGE "LOCKKEYS.DAT" < Enter >** and **RUN < Enter >** to create LOCKKEYS.COM.

To test the utility, type the command **LOCKKEYS C:on N:off** and press **< Enter >** . <Caps Lock>'s light should come on, <Num Lock>'s light should go out, and <Scroll Lock>'s light should be unchanged.

ANSI.SYS Codes

Q. *Looking through my DOS manual, I find few details about ANSI.SYS, the extended screen and keyboard driver. There's a paragraph in the section on the DEVICE command and an equivalent amount of text in the explanation of the PROMPT command. Both sections men-*

(continues)

tion that the CONFIG.SYS file must contain the line DEVICE = ANSI.SYS; they then refer the reader to the DOS Technical Reference *manual for instructions on using ANSI.SYS.*

I understand that ANSI.SYS control sequences can be used to set the screen's colors, reassign the keys, and perform other related screen and keyboard functions. However, I can't justify spending the $100 IBM lists the manual for when all I need is the list of ANSI.SYS commands. Can PC World *help?*

Bob Green
Albany, New York

A. Sure. For your convenience, Table 1 lists the available ANSI.SYS control sequences and their functions. Note that *Esc* denotes the Escape character, not the letters *Esc* or the <Esc> key, and that the ANSI.SYS commands are case-sensitive. Generally, the PROMPT command is used to send ANSI.SYS commands to the screen because PROMPT translates each $e within its parameter string into the Escape character. Also, you should know that ANSI.SYS does not have to be in the root directory. I keep mine in C:\DOS along with the rest of the files from my system's original DOS disks. Accordingly, my system's CONFIG.SYS file contains the line DEVICE = C:\DOS\ANSI.SYS.

To view an example of ANSI.SYS's capabilities, issue this DOS command:

```
PROMPT $e[s$e[1;33;44m$e
  [1;67H$d$e[2;67H$t$h$h$h$e
  [1;31;40m$e[u$p$e[0;32;40m$g
```

(Note that there's only one space, after the *T* in PROMPT.)

(continues)

TABLE 1

The ANSI.SYS Control Sequences

Cursor control		
CUP	Esc [#;#H	**Cursor position:** Moves cursor to specified line; column. Default values are one and one.
CUU	Esc [#A	**Cursor up:** Moves cursor up # lines without changing columns. Default value is one. Ignored if cursor on top line.
CUD	Esc [#B	**Cursor down:** Moves cursor down # lines without changing columns. Default value is one. Ignored if cursor on bottom line.
CUF	Esc [#C	**Cursor forward:** Moves cursor forward # columns without changing lines. Default value is one. Ignored if cursor in rightmost column.
CUB	Esc [#D	**Cursor backward:** Moves cursor back # columns without changing lines. Default value is one. Ignored if cursor in leftmost column.
HVP	Esc [#;#f	**Horizontal and vertical position:** Same as CUP.
DSR	Esc [6n	**Device status report:** Causes console driver to output a CPR sequence. (Do not use as part of a prompt.)
CPR	Esc [#;#R	**Cursor position report:** This sequence reports the current cursor position (line; column) through the standard input device.
SCP	Esc [s	**Save cursor position:** Current cursor position is saved. Can be restored with RCP.
RCP	ESC [u	**Restore cursor position:** Restores cursor position to the last position saved by SCP.
Erasing		
ED	Esc [2J	**Erase in display:** Clears screen and homes cursor.
EL	Esc [k	**Erase in line:** Erases from cursor to the end of line.
Mode of operation		
SGR	Esc [#; ... ;#m	**Set graphics rendition:** Subsequent characters have attribute specified by parameter.

Parameter	Meaning
0	Normal (black on white)
1	Bold (high intensity)
4	Underline (IBM Monochrome Display only)
5	Blink
7	Inverse video
8	Cancelled (invisible)
30	Black foreground
31	Red foreground
32	Green foreground
33	Yellow foreground
34	Blue foreground

(CONTINUES)

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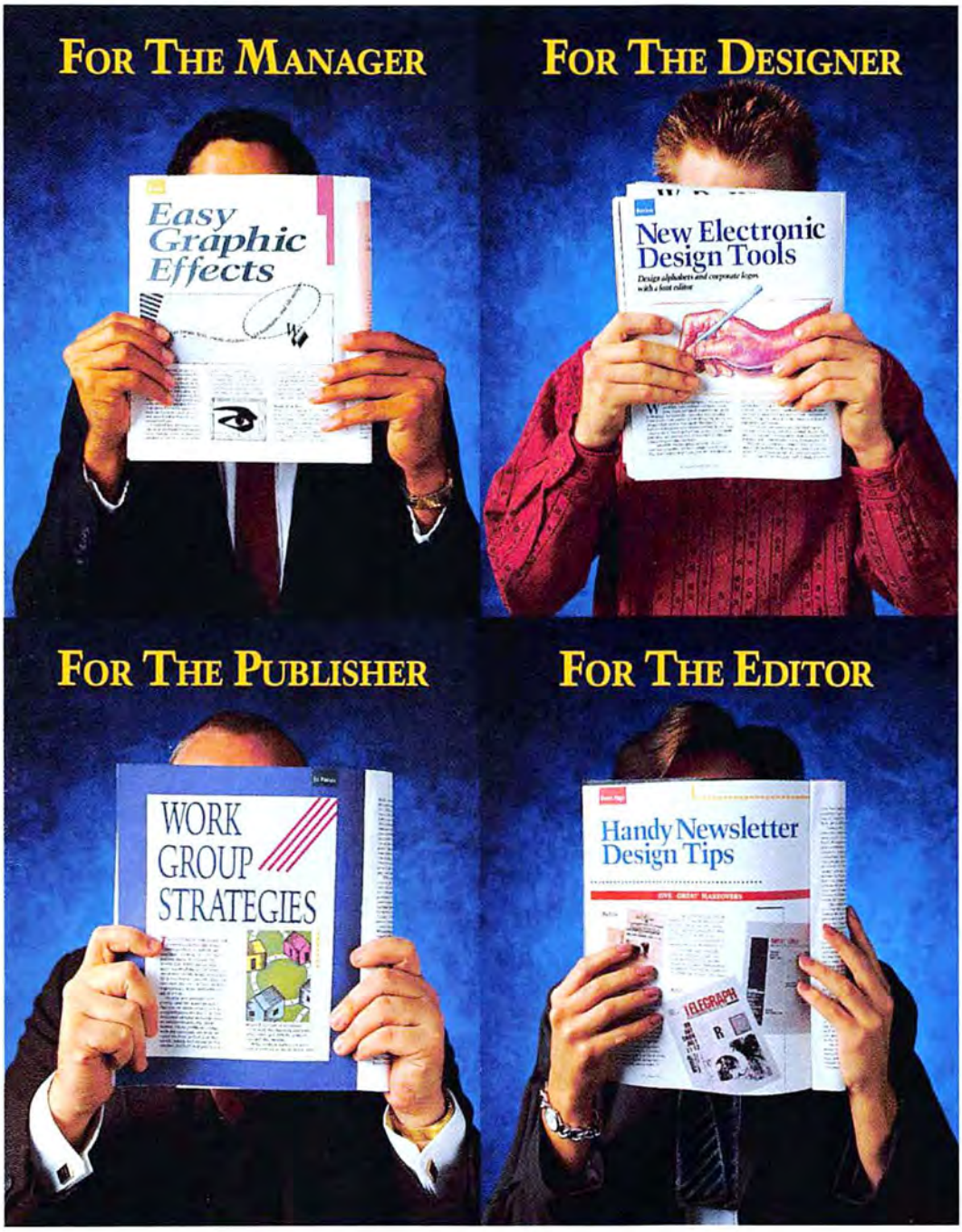

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TABLE 1

(CONTINUED)

		35	Magenta foreground
		36	Cyan foreground
		37	White foreground
		40	Black background
		41	Red background
		42	Green background
		43	Yellow background
		44	Blue background
		45	Magenta background
		46	Cyan background
		47	White background
SM	Esc [=#h or Esc [=h or Esc [=0h or Esc [?7h	**Set mode:** Invokes screen width or type specified by the parameter.	
		Parameter	Meaning
		0	40×25 black and white
		1	40×25 color
		2	80×25 black and white
		3	80×25 color
		4	320×200 color
		5	320×200 black and white
		6	640×200 black and white
		7	Wrap at end of line
RM	Esc [=#l or Esc [=l or Esc [=0l or Esc [?7l	**Reset mode:** Parameters are the same as Set mode except for 7, which resets wrap at end-of-line mode.	
Keyboard key reassignment			
KKR	Esc [#;#;...#p or Esc ["string";p or Esc [#;"string"; #;"string";#p or any other combination of strings and decimal numbers	**Keyboard key reassignment:** The first ASCII code specifies which code is being redefined. (If the first code is 0, then it and the next code specify an extended ASCII key, such as <F1>.) The remaining values define the sequence of ASCII codes (the key's new definition) to be generated when this key is pressed.	

AUTOEXEC.BAT Revisited

Production errors rendered Listing A, which accompanied the sidebar entitled "The AUTOEXEC.BAT File" ("Power Your PC With Batch Files," *PCW*, December 1987), confusing at best. And judging by the questions I've received, many readers could use a more detailed explanation of some of the batch file's commands. The corrected version is shown in Listing 4.

As this listing shows, the PATH command and its list of directories must appear on the same line. The list may not include spaces. Each directory listed should be prefixed by its appropriate drive letter and full path, starting from the root directory. Directories are separated by semicolons. A subsequent PATH command will replace—not supplement—the list of directories.

To carry out the instructions contained in the AUTOEXEC.BAT file's PROMPT command, the ANSI.SYS driver must first be installed by CONFIG.SYS (see the answer to the previous question). If the driver is not correctly installed, the ANSI.SYS control sequence will be displayed as part of the prompt instead of functioning as intended.

AUTOEXEC's third command sends a three-character string (Escape x3) to the printer attached to LPT1, instructing the printer to use its IBM character set. The Escape character (shown in the listing as ^[ ) cannot be entered directly from the keyboard, so use EDLIN to add Escape after you've saved an otherwise completed AUTOEXEC.BAT file. (EDLIN can be found on the DOS disk.) Issue the command **EDLIN AUTOEXEC.BAT**

< **Enter** > , then type the number of the line you want to edit (in this case, **3**) and press < **Enter** > . Line 3 is displayed and the cursor appears on the beginning of the next line. Press < **F2** > and then type the character that is at the point where you want to insert the Escape character (in this case, **x**). All the characters preceding the *x* are displayed. Press < **Insert** > , < **Ctrl** > **-V**, and [to insert Escape. Press < **F3** > and < **Enter** > to complete the line. Press **E** and then < **Enter** > to save the file and exit EDLIN.

GRAPHICS.COM, like EDLIN, resides on your system's DOS disk. Executing the GRAPHICS command installs this memory-resident extension of the PC's built-in, text-mode print screen function. That done, pressing <Print Screen> will send on-screen graphics as well as text to an IBM Graphics or Epson dot matrix printer (or a compatible) connected to LPT1.

Finally, the *SuperKey* command (KEY), the macro file name (AUTOSK-L.MAC), and the program's /ML switch (which instructs *SuperKey* to load the specified macro file) must be on the same line. Note that because neither the command file nor the macro file is in the current directory of the default drive, both file names include their drive and path prefix.

Do you have any questions concerning the IBM PC or compatibles? Send them to The Help Screen, PC World, *501 Second St., San Francisco, CA 94107 or electronically to MCI Mail PC-WORLD/179-3813, CompuServe 74055,412, or The Source STE908.* ●

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STAR-DOT-STAR

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A global exchange of personal computer discoveries

Increase your type-ahead buffer size without wasting memory, center screen text with a clever and simple dBASE procedure, issue DOS commands from BASIC, and break WordStar's logjam.

Edited by Tom Swan

Build a Bigger Type-Ahead Buffer

Although I'm not a fast typist, I often fill my PC's puny 16-character type-ahead buffer when I rapidly type several commands in a row. Tired of hearing that telltale beep and being forced to wait until the ROM BIOS keyboard routine was ready to accept more characters, I decided to build myself a bigger type-ahead buffer.

Normally, terminate-and-stay-resident (TSR) programs are used for this sort of utility. In this case, however, the ROM BIOS requires that the buffer be within the 64K segment that starts at hexadecimal address 0040. Because a TSR program might be loaded anywhere in memory, installing a TSR type-ahead buffer could place it beyond the reach of the ROM BIOS.

So instead of creating a TSR program, I wrote TYPEAHED.ASM [see Listing 1], the assembly language source code for the dummy device driver TYPEAHED.SYS. Because device drivers are loaded before other resident utilities, it's unlikely they'll end up beyond the reach of the ROM BIOS keyboard routine. What's more, device drivers have short 18-byte headers, compared to the 256 or more bytes wasted by the typical TSR program.

Assemble TYPEAHED.ASM and link the resultant .OBJ file as usual. Then convert the .EXE file to a binary .SYS driver file with the command EXE2BIN TYPEAHED TYPEAHED.SYS. [Readers who don't have an assembler can create TYPEAHED.SYS using BASIC. Instructions are in the editor's note at the end of this item.]

Insert the line DEVICE = TYPEAHED.SYS in your system's CONFIG.SYS file. Then, with TYPEAHED.SYS in the root directory of the boot disk, reboot to install the 128-character type-ahead buffer, which should be large enough for even the nimblest touch typist. [You can, of course, keep TYPEAHED.SYS in a different drive and/or directory as long as the DEVICE command correctly specifies the drive and/or directory holding TYPEAHED.SYS. For example, if TYPEAHED.SYS resides in C:\DRIVERS, use the command DEVICE = C:\DRIVERS\TYPEAHED.SYS in the CONFIG.SYS file.]

When booting, if you see the message 'Too high in memory! No TYPEAHED installed', move DEVICE = TYPEAHED.SYS nearer to the beginning of CONFIG.SYS. This will place TYPEAHED lower in memory by making it one of the first drivers installed. When you see the message 'TYPEAHED installed', you're ready to start pounding the ivories.

Clifford J. Vander Yacht
Jackson, Michigan

(continues)

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```
PAGE    ,132
TITLE   TYPEAHED - Expands type ahead buffer to 128 characters.
SUBTTL  Clifford J. Vander Yacht


Chars           EQU     128
Bytes           EQU     Chars*2
IOPacket        STRUC
IO_CMDLEN       DB      ?
IO_UNIT         DB      ?
IO_CMD          DB      ?
IO_STATUS       DW      ?
                DB      8 DUP(?)
IO_MEDIA        DB      ?
IO_ADDRESS      DW      ?
                DW      ?
IO_COUNT        DW      ?
IO_START        DW      ?
IOPacket        ENDS


DATA            SEGMENT AT 40H
                ORG     001AH
BUFFER_HEAD     DW      ?
BUFFER_TAIL     DW      ?
                ORG     0080H
BUFFER_START    DW      ?
BUFFER_END      DW      ?
DATA            ENDS


CSEG            SEGMENT
                ASSUME  CS:CSEG, DS:NOTHING, ES:NOTHING
                ORG     0000H           ; Origin for Device Drivers


Prefix          DD      -1
                DW      8000H
                DW      Strat
                DW      Intr
                DB      'Typeahed'


NewBuff EQU     $                       ; Buffer start
EndBuff EQU     $+Bytes                 ; Buffer end


;       End of Stay Resident portion of program.
;       ---------------------------------------


THMess  DB      'Too high in memory! No ',07H
Message DB      'TYPEAHED installed',0DH,0AH,24H
Packet  DD      0                       ; Request packet address


;       Initialization or installation routines.
;       ---------------------------------------
```

(CONTINUES)

LISTING 1: Assemble TYPEAHED.ASM to create TYPEAHED.SYS, a dummy device driver that expands your type-ahead buffer to 128 bytes.

```
Strat   PROC    FAR
        MOV     WORD PTR Packet,BX      ; Save Packet info
        MOV     WORD PTR Packet+2,ES
        RET



Intr:
        PUSH    AX                      ; Save registers
        PUSH    BX
        PUSH    CX
        PUSH    DX
        PUSH    DS
        MOV     AX,CS                   ; From this segment address,
        SUB     AX,SEG DATA             ;  subtract the DATA address
        ADD     AX,(EndBuff-Prefix+0FFH)/16     ;  and add buffer size
        PUSH    AX
        CMP     AX,1000H                ; Test within one 64K segment
        JNB     TooHigh                 ; Do not change pointers
        SUB     AX,(EndBuff-Prefix+0FFH)/16     ; Get segment diff.
        MOV     CL,4                    ; Convert to byte difference
        SHL     AX,CL
        MOV     BX,SEG DATA             ; Change info in DATA segment
        MOV     DS,BX
        ASSUME  DS:DATA
        ADD     AX,OFFSET NewBuff+0FFH  ; Calculate offset of beginning
        AND     AX,0FF00H               ; Drop last byte (DOS2.xx fix)
        MOV     BUFFER_HEAD,AX          ; Put into buffer pointers
        MOV     BUFFER_TAIL,AX
        MOV     BUFFER_START,AX         ;  and buffer addresses
        ADD     AX,Bytes                ; Add in buffer byte size
        MOV     BUFFER_END,AX           ;  for buffer end address
        MOV     DX,OFFSET Message       ; OK message
        JMP     SHORT Installed
TooHigh:
        MOV     DX,OFFSET THMess        ; Too High message
Installed:
        PUSH    CS                      ; Make DS = CS for DOS
        POP     DS
        ASSUME  DS:CSEG
        MOV     AH,9                    ; Output message
        INT     21H
        POP     AX                      ; From highest segment
        AND     AX,0FFF0H               ;  rounded down
        MOV     BX,CS                   ;  and this segment address
        SUB     BX,SEG DATA             ;  less the DATA address
        SUB     AX,BX                   ;  find the paragraphs used
        MOV     CL,4                    ; Convert to bytes
        SHL     AX,CL                   ;  to save for buffer
        LDS     BX,DWORD PTR Packet     ; Get packet location
        MOV     [BX+IO_ADDRESS],AX      ; Set memory request
        MOV     [BX+IO_ADDRESS+2],CS
        MOV     [BX+IO_STATUS],0100H    ; Set done bits
        POP     DS                      ; Restore registers
        POP     DX
        POP     CX
        POP     BX
        POP     AX
        RET                             ; Exit installation
Strat   ENDP



CSEG    ENDS
        END
```

LISTING 1: ***(continued)***

Editor's note: I've been using this program for a week or so, and it's now permanently installed on my system. Mr. Vander Yacht's solution to my typically overstuffed type-ahead buffer works like a charm.

*For those readers without an assembler, TYPEAHED.SYS can be created using BASIC. Load BASIC and enter the lines shown in Listing 2, X-MAKER2-.BAS. Save *.*'s program-making program for future *.* items. Next enter the lines shown in Listing 3, TYPEAHED.DAT. Type* **RUN** *and press* **< Enter >** *to create TYPEAHED.SYS. Then follow the installation instructions.*

While booting, be careful not to enter any keystrokes—they could interfere with the program's initialization process. Also, although TYPEAHED's buffer is 128 bytes long, the ROM BIOS can handle only 127 characters before it considers even this oversize key-press reservoir to be full.

dBASE—Front and Center

Do you manually count columns to center lines of text in your *dBASE* application screens? Ever run out of fingers and toes before you get the answer? If so, you might prefer using my simple procedure CENTER.PRG [see Listing 4].

CENTER requires two parameters, the string to be centered (Text) and the screen's row number (Rw). Before calling the procedure, use SET PROCEDURE TO CENTER. Then, to center text on line 10, for example, use the command DO

(continues)

```
10 DEFINT A-Z:CLS:KEY OFF:DEF FNHEX(X$)=VAL("&h"+X$)
20 MSG$="Now testing for data errors...please wait" : GOSUB 190
30 SUM=0:READ LN:IF LN<0 THEN 80
40 READ H$:IF VAL(H$)<0 THEN 70
50 IF LEFT$(H$,1)="*" THEN GOSUB 210 : GOTO 40
60 SUM=(SUM+FNHEX(H$))*2:SUM=(SUM\256)+(SUM MOD 256):GOTO 40
70 READ CKSUM$:IF (SUM MOD 256)=FNHEX(CKSUM$) THEN 30 ELSE GOTO 170
80 MSG$="Press any key except ESC to create "+F$+": "
90 GOSUB 190 : A$=INPUT$(1) : PRINT : IF A$=CHR$(27) THEN END
100 LOCATE 6,1:PRINT "Working...";
110 OPEN F$ AS #1 LEN=1 : FIELD #1,1 AS BX$
120 READ LN:IF LN<0 THEN 160
130 READ H$:IF VAL(H$)<0 THEN READ CKSUM$:GOTO 120
140 IF LEFT$(H$,1)="*" THEN GOSUB 240 : GOTO 130
150 LSET BX$=CHR$(FNHEX(H$)) : PUT #1 : GOTO 130
160 CLOSE:PRINT:PRINT F$;" has now been created.":END
170 PRINT:PRINT "Error in DATA line";STR$(LN);".";
175 PRINT:PRINT "SUM=";SUM
180 PRINT "Check your work.":BEEP:END
190 CLS : LOCATE 3,1 : PRINT "X-Maker II" : RESTORE : READ F$
200 LOCATE 5,1,1 : PRINT MSG$; : RETURN
210 ZZ=VAL(MID$(H$,2)) : FOR I=1 TO ZZ
220 SUM=SUM*2 : SUM=(SUM\256)+(SUM MOD 256)
230 NEXT : RETURN
240 ZZ=VAL(MID$(H$,2)) : FOR I=1 TO ZZ
250 LSET BX$=CHR$(0) : PUT #1 : NEXT : RETURN
```

LISTING 2: Use X-MAKER2.BAS, *.*'s program-making program, with TYPEAHED.DAT (Listing 3).

```
1000 DATA "typeahed.sys"
1010 DATA 1,FF,FF,FF,FF,00,80,43,00,4E,00,54,79,70,65,61,68,-1,2C
1020 DATA 2,65,64,54,6F,6F,20,68,69,67,68,20,69,6E,20,6D,65,-1,40
1030 DATA 3,6D,6F,72,79,21,20,4E,6F,20,07,54,59,50,45,41,48,-1,C4
1040 DATA 4,45,44,20,69,6E,73,74,61,6C,6C,65,64,00,0A,24,*4,2E,-1,3B
1050 DATA 5,89,1E,3F,00,2E,8C,06,41,00,CB,50,53,51,52,1E,8C,-1,E7
1060 DATA 6,C8,2D,40,00,05,21,00,50,3D,00,10,73,26,2D,21,00,B1,-1,36
1070 DATA 7,04,D3,E0,BB,40,00,8E,DB,05,11,01,25,00,FF,A3,1A,-1,C8
1080 DATA 8,00,A3,1C,00,A3,80,00,05,00,01,A3,82,00,BA,2A,00,EB,-1,8A
1090 DATA 9,03,BA,12,00,0E,1F,B4,09,CD,21,58,25,F0,FF,8C,CB,-1,95
1100 DATA 10,81,EB,40,00,2B,C3,B1,04,D3,E0,C5,1E,3F,00,89,47,-1,49
1110 DATA 11,0E,8C,4F,10,C7,47,03,00,01,1F,5A,59,5B,58,CB,-1,73,-1
```

LISTING 3: Using BASIC, merge TYPEAHED.DAT's DATA lines with X-MAKER2.BAS (Listing 2), and run the resultant program to create TYPEAHED.SYS.

```
PROCEDURE Center
PARAMETERS Text, Rw
   @ Rw, 40 - Len( Text ) / 2 SAY Text
RETURN
```

LISTING 4: CENTER.PRG cleverly centers text in dBASE programs.

```
CLEAR
SET PROCEDURE TO Center
DO Center WITH "A Great Data Base Program", 6
DO Center WITH "from Ugly Duckling Software", 8
DO Center WITH "by Cathy Ray Tube", 10
DO Center WITH "(c) 2001.  No Rights Reserved.", 18
CLOSE PROCEDURE
```

LISTING 5: TESTCENT.PRG tests the dBASE CENTER procedure shown in Listing 4.

CENTER WITH "This line is centered",10. The SET PROCEDURE command, which I use frequently, makes CENTER memory resident and therefore very fast.

Alan Patrick Moynihan
Liverpool, New York

Editor's note: I recognize Alan's method for centering text. It's the same technique I learned way back in my high school typing class. To center a string, the procedure cleverly subtracts half the string's length from the display's center column (40), using the result as the column in which to start the string. To test CENTER.PRG, save it on disk along with Listing 5, TESTCENT.PRG. Then, from the dBASE *dot prompt, issue the command DO TESTCENT.*

BASIC Shell Games

Don't overlook BASIC's SHELL command. It can serve as a handy tool for building utilities quickly. The structure of the command is

SHELL *"quoted string"*

The *quoted string* can be any DOS command, program, or batch file. SHELL runs the command in quotes as if you had typed the same command at the DOS prompt. For example, SHELL "DIR" displays a directory of the current drive.

DISKUTIL.BAS [Listing 6] demonstrates how to use SHELL to write a disk utility program. The first part of the program displays a menu and then waits for you to type a key. Type D for a directory of drive

A:. Type F to format a disk. Type P to print that directory. Type E to erase all files. Type Q to quit the program and return to DOS. All these commands operate on drive A:. Be careful with commands F and E—they can destroy files.

BASIC's SHELL command makes it easy to write utility programs like DISKUTIL.BAS in a minimum number of steps. Remember this command the next time you need to run DOS commands from within a BASIC program.

Jack Fine
Davis, California

Breaking a WordStar Logjam

While organizing an alphabetic reference, I discovered a quirk in *WordStar 4.00*. The problem surfaced with the 'change logged drive/directory' command on *WordStar*'s opening menu. My hard disk contains 26 subdirectories named \A through \Z, in addition to others, including *WordStar*'s directory, \WS4. When I tell *WordStar* to log on to subdirectory \A, it switches to drive A: instead.

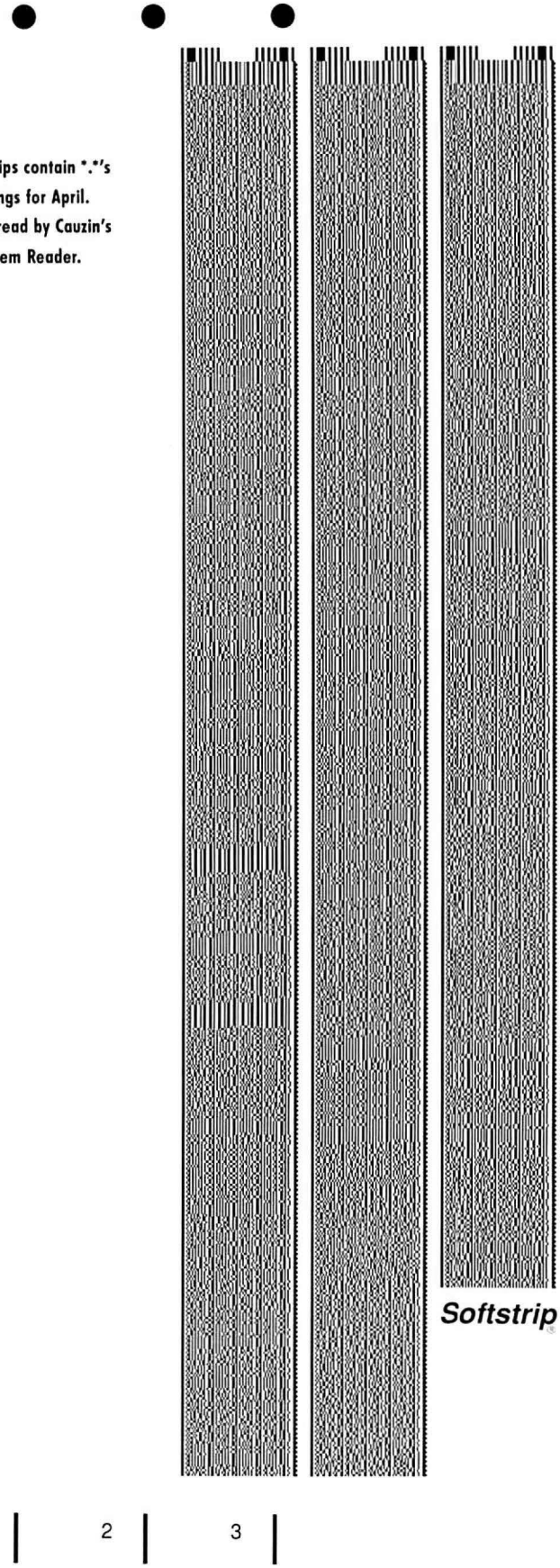
Apparently, *WordStar* is unable to log on to subdirectories with names such as \A, \B, \C, and \D that match the valid drive letters specified when first installing *WordStar*.

By experimenting, however, I learned to break *WordStar*'s logjam. At the same time, I put a seldom-used DOS feature to work. The trick is to specify the current directory with a single period. First type L at *WordStar*'s opening menu and then type .\A to switch to subdirec-

(continues)

```
100 'DISKUTIL demonstrates using SHELL to execute DOS commands from BASIC
110 KEY OFF: CLS
120 LOCATE 5,1,1
130 PRINT "Press D -- for the Directory of the disk in drive A:"
140 PRINT "      F -- to Format the disk in drive A:"
150 PRINT "      P -- to Print the directory of the disk in drive A:"
160 PRINT "      E -- to Erase all the files on the disk in drive A:"
170 PRINT "      Q -- to Quit"
180 PRINT
190 PRINT
200 PRINT "Enter D, F, P, E, or Q: ";
210 CHOICE$=INPUT$(1)                'Get a single key
220 CLS
230 ON INSTR("dDfFpPeEqQ",CHOICE$)/2 GOTO 260,310,350,420,530
240 GOTO 120             'Invalid input; redisplay the menu
250 '  *******     BEGIN DIR A: ROUTINE
260 SHELL "DIR A:/P"
270 GOSUB 570
280 GOTO 110
290 '                END DIR A:                        *******
300 '  *******     BEGIN FORMAT A: ROUTINE
310 SHELL "FORMAT A:/4"          'Add the /4 parameter if needed
320 GOTO 110
330 '                END FORMAT A:                     *******
340 '  *******     BEGIN PRINT DRIVE A: DIRECTORY ROUTINE
350 LOCATE 5,1: PRINT "Turn printer on."
360 GOSUB 570
370 SHELL "DIR A: > PRN"
380 LPRINT CHR$(12);             'Form feed
390 GOTO 110
400 '                END PRINT DRIVE A: DIRECTORY   *******
410 '  *******     BEGIN ERASE A:\*.* ROUTINE
420 LOCATE 5,1
430 PRINT "Press <Esc> to abort; otherwise press <Enter> to"
440 PRINT "erase the files in the root directory of drive A:"
450 K$=INPUT$(1): IF K$=CHR$(27) THEN GOTO 500
460 IF K$<>CHR$(13) THEN GOTO 450
470 SHELL "ERASE A:\"
480 CLS: SHELL "DIR A:"          'Check the disk for subdirectories
490 GOSUB 570
500 GOTO 110
510 '                END ERASE A:\*.*                  *******
520 '  *******     BEGIN QUIT ROUTINE
530 CLS
540 SYSTEM
550 '                END QUIT                          *******
560 '  *******     BEGIN PRESS <Enter> SUBROUTINE
570 LOCATE 25,1
580 PRINT "Press <Enter> to continue.";
590 IF INPUT$(1)<>CHR$(13) THEN GOTO 590
600 RETURN
610 '                END PRESS <Enter>                 *******
620 END
```

LISTING 6: DISKUTIL.BAS shows how to use SHELL to execute DOS commands like DIR and FORMAT from within a BASIC program.



These Softstrips contain *.*'s program listings for April. They can be read by Cauzin's Softstrip System Reader.

tory A. Typing .\B switches to subdirectory B, .\C switches to C, and so on. —*Ed.*

When No Means Yes

FORM.BAT ("Elegance or Simplicity?" *.*, *PCW*, October 1987) is nifty. However, the CR_Y_CR file should be CR_N_CR. To create this file, type

```
COPY CON CR_N_CR < ENTER >
< ENTER >
N < ENTER >
< ENTER >
< F6 > < ENTER >
```

Then in FORM.BAT change each of the two CR_Y_CR file names to CR_N_CR. This answers no to FORMAT's question, 'Format another?' A yes answer formats the same drive. A no answer formats the next drive by letting the batch file continue. In this case, no means yes!

Larry O'Rear
Georgetown, Texas

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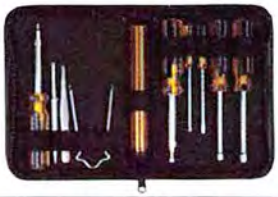

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The Price of Progress

You're dreaming about software, but you're going to have to load up on hardware first—and it's going to cost you. Just remember, no pain, no gain.

Robert M. Carr

You graduated to OS/2 to gain the power of protected mode, the flexibility of bona fide multitasking, the freedom to roam 16MB of directly addressable RAM. You didn't bargain on having to embark on a hardware binge.

Although it's no secret that OS/2 presents a new game in software, it's dealing a new hand in hardware as well. This is a classic good news/bad news tale: OS/2's hardware requirements are substantial, but the payoff—a qualitatively different level of performance—can remove much of the sting from the upgrade imperative.

Unless your current system is outfitted with at least an 80286 or 80386 processor, a 20MB hard disk, a high-density floppy disk drive, and 2MB of RAM, it's simply not ready for OS/2's version of prime time. But the silver lining gleams through: OS/2 has put a welcome end to the era of hardware overkill—RAM chips and storage devices can now go to work as rapidly as you install them.

(For the time being, OS/2's graphics demands are modest. The first release operates in character mode and works with all existing boards and displays. We'll cover OS/2's Presentation Manager when it's available.)

The question is *why* this new-age operating system consumes such copious quantities of RAM and disk storage. OS/2 is hardly a model of finesse. Instead, it embodies versatility and brute strength. It's brawny enough to support a generation of applications that will exploit hardware well beyond the minimum configuration it requires.

OS/2's Swap Meet

OS/2's hearty appetite is evident from the moment you crack open the shrink-wrap. The operating system almost fills 3½ 1.2MB floppies; once installed on a hard disk, it gobbles up over 4MB. In addition to making room for the operating system's files, you'll need to set aside disk space in the form of a "swap file" for OS/2's virtual memory capability, which makes RAM seem roomier than it really is.

In theory, a swap file can extend to many megabytes; a 10MB swap file would make 2MB of RAM feel like 12MB. However, Microsoft recommends that the swap file be about half the size of system RAM to achieve optimum OS/2 performance. Creating a 1MB partition to hold the swap

(continues)

file elevates OS/2's disk storage requirement to over 5MB—and that's before you've loaded a single application or keyed in any data.

Subsequent releases of OS/2—particularly those with the Presentation Manager in tow—will require still more hard disk real estate. Given that most OS/2 applications will be considerably bulkier than those written for DOS 3.*xx*, a 20MB hard disk is the barest minimum; 40MB will provide a much better fit.

Made to Manage RAM

On the memory front, OS/2 nominally requires 512K, with 1MB recommended, but you'll need a good deal more RAM if you choose to run the compatibility box or anything remotely interesting.

The compatibility box must simulate a "traditional" PC environment, with sufficient memory to contain DOS 3.*xx*, the DOS application, and data. The box can be configured to run with varying amounts of memory, up to 640K. All told, running an old DOS application can increase OS/2's *minimum* memory requirement to as much as 2MB.

Even if you skip the compatibility box, 1MB of RAM isn't really a workable starting place. Without big, meaty software—and, in time, without the equally hefty Presentation Manager—the new operating system is simply a highway to nowhere. If you intend to run multiple applications, you'll need at least 2MB to do much more than directory and disk checks.

Under OS/2, these differences in degree ultimately become a difference in kind. Pending the arrival of OS/2 applications, a quick look at the mightiest of the DOS 3.*xx* class provides an inkling of programs to come. Preeminent DOS programs like *Excel*, *dBASE*, and *Paradox* routinely exceed 500K in code alone. The virtues of tight programming aside, it's perfectly reasonable to expect some OS/2 applications to approach or exceed 1MB of program code.

OS/2 nominally requires 512K, with 1MB recommended, but you'll need a good deal more RAM if you want to run anything remotely interesting.

Fortunately, OS/2 knows how to use the protected mode of the 286 processor to manage RAM efficiently. Unlike DOS 3.*xx* software, OS/2 applications won't deal with physical addresses. Instead, programs will manipulate virtual addresses that OS/2 converts to physical addresses at the last possible instant, just as the CPU prepares to call on them.

OS/2 and the 286 are engaged in a tight duet. In it, OS/2—ever mindful that the 286 will advise if memory is needed—writes least-used segments of RAM to the swap file, thereby clearing room for the executing program. OS/2 pulls this assignment off without requiring programmers to labor over various strata of overlays.

Accordingly, if a key portion of RAM has been temporarily swapped to disk (that is, to the swap file), the 286 notifies OS/2, which then retrieves the waylaid code or data. The CPU cycle resumes, the 286 calls on the next virtual address, and the entire process begins anew.

To juggle all these responsibilities, OS/2 uses and maintains a 286 protected mode feature called a descriptor table. This table stores the physical addresses that correspond to the virtual addresses; the CPU, working under OS/2's direction, looks up the virtual address in a descriptor table and substitutes its physical address—without breaking stride.

OS/2's indirect memory-referencing scheme benefits users and applications alike. By managing memory far more efficiently than DOS 3.*xx* can, OS/2 frees applications from work that DOS requires them to perform. Beyond simply making more RAM available, OS/2 also uses that RAM more creatively. It's capable of shifting program code and data throughout memory and (on a temporary basis) to and from the swap file.

No longer must applications reserve all free memory merely because they *might* need it. With an assist from the 286, OS/2 intelligently rations RAM, supplying programs with only the memory they need at the time. All the while, each application can operate within its own virtual address space—a contiguous block of unfettered

memory. That's why software developers writing for OS/2 can pack much more functionality into a given megabyte of system RAM than they can under DOS 3.*xx;* there's no space wasted on reserving data or code buffers just in case they might be needed.

Protected Mode Politics

Street-smart users know that even the most polished software hit isn't bug-free. Fortunately, OS/2's ability to work with 286 memory protection insulates users from the most egregious slips in software quality-assurance testing.

This kind of security is essential, simply because the stakes are now so much higher. Whatever havoc ensues from a frozen or buggy DOS 3.*xx* application, the damage escalates if you're forced to restart a suite of data-filled OS/2 windows. Because the likelihood of a glitch rises dramatically as interaction among applications increases, the virtues of OS/2's hardware-based protection are obvious.

The same descriptor table that converts an OS/2 application's virtual address to a physical address also stores information about the contents of RAM that the application is allowed to access—usually, just its own data. These tables render all other applications and data, along with OS/2 system code and system data, off-limits and inaccessible. The worst a wayward or frozen application can do is shoot itself—not OS/2, and not other applications—in the foot.

For further evidence of OS/2's commitment to system integrity, consider its "castle keep" strategy. Just as medieval castles were built with several rings of

Fortunately, OS/2's ability to work with 286 memory protection insulates users from the most egregious slips in software quality-assurance testing.

defenses, so OS/2 erects a series of enclosing walls and a final, innermost barrier—a kind of castle keep.

OS/2 takes advantage of the 286's four *rings* of hardware security. These rings, numbered 0 to 3 from the inside out, provide the system with ever-greater levels of protection. Every segment of memory in the 286 must be assigned to a ring level. The portion of RAM that claims ring 0—which OS/2 inhabits so it can boot up the system—takes charge of granting privilege levels to applications. The OS/2 kernel performs memory allocation and task scheduling for the remainder of the operating system and for every other program. In this hierarchy, code at levels higher than 0 cannot grant themselves greater access than they already have.

In practice, all applications are treated equally, and all reside in ring 3. Device drivers, which need direct access to hardware such as the screen, execute in ring 1. For the time being, ring 2 remains reserved and unused.

What good are castle walls if the fortification lacks passageways through which insiders can come and go? That was Intel's question precisely, so the chip maker engineered hardware support for *gates* into the 286. Gates control applications' requests for operating system services that lie protected in lower-level rings.

Consider the consequences if there were no gates and one program called a service that then crashed without warning: The application would continue to twist slowly in the wind. Gates implemented in 286 hardware (but acting under OS/2's watchful eye) guard against such mishaps, which would doom a multitasking environment. Gates thus enable OS/2 to quickly return control to you. This system of checks is intricate but indispensable to multitasking—what with hundreds of thousands of instructions from several applications executing every second.

Harking back to the 64K systems and single-sided floppies of yesteryear might soothe the savaged bank account. But OS/2's sophisticated memory-management and multitasking skills simply require a hefty dose of hardware resources. On close scrutiny, it's remarkable that OS/2 handles its affairs as efficiently as it does. ●

Robert Carr is vice president of software for the San Francisco-based Go Corporation, former chief scientist at Ashton-Tate, and the creator of Framework.

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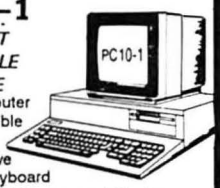

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Circle 65 on reader service card

Taking Over the Knowledge Factory

James Burke

We usually focus on the personal computer as a simple business productivity tool, but its impact on society is far more pervasive, comparable to that of the printing press. Just as the printed word opened up the world to anyone who could read, the power of the PC confers upon the average user greater access to society's collective data banks and greater control over the way knowledge is acquired—the so-called scientific process.

Einstein once observed that science in a sense manufactures the world rather than discovers it. That's because scientists see only what is revealed by the instruments that they themselves design. If a scientist believes that the cosmos is made of omelettes, he or she designs a device to detect intergalactic yolk. Then if no yolk is found, the problem is ascribed to instrument failure, and the search for egg continues.

It's an imperfect process, one that has sometimes yielded cockeyed explanations of natural phenomena—for example, the pseudoscience of phrenology that relates intelligence and character to the shape and size of a person's skull, or Aristotle's picture of the universe with Earth at its center and the Sun and planets revolving around.

In retrospect, such propositions seem mere variations on the omelette theory. But in the absence of more coherent explanations, they often gained devoted followings, making it difficult to substitute new explanations. Apologists have built careers and even religions around the many particulars of such theories. In earliest times, such individuals were priests; later, we began calling them scientists. Their closeness to society's stores of knowledge has always separated them from the average individual.

It took centuries, but the printing press helped diminish those class distinctions. Today, we're experiencing a similar but much accelerated phenomenon as inexpensive personal computers provide us all with virtually unlimited access to information (and the computing power to make sense of it).

Inevitably, we will begin to scrutinize more closely the scientific and technological views we now accept as gospel. The population of the next decade will be able to understand and help determine the direction of scientific investigation rather than simply follow it blindly.

While the process of discovery will remain serendipitous at best, computer simulation and other tools do improve our ability to forecast which areas of scientific investigation will prove socially fruitful and which dangerous or wasteful. Such tools are double-edged, however, and could be a powerful force for evil if concentrated in the wrong hands or inadequately monitored. So it's important that we all learn to use personal computers and assume more responsibility for what science and technology manufacture.

Some people raise the issue that greater public accountability will mean that pure research is sacrificed to populist demands for quick fixes. But arguments against general literacy have been advanced since Gutenberg.

In fact, greater public participation in the process hasn't slowed science one whit. The opposite is true; and, given the current rate of social change, any alternative would effectively disenfranchise us. ●

James Burke is an award-winning author, educator, and television commentator whose credits include Connections, *a ten-part PBS series about technology's impact on society.*

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