SETTING THE STANDARDS
15 YEARS

BYTE

JULY 1990

A McGRAW-HILL PUBLICATION

Special: Computing Without Keyboards FOLLOWS PAGE 202

TOO GOOD TO BE TRUE?

The New Airis Laptop:

High-end features, remarkable price

Page 133

LOW-COST LASERS

BYTE Lab Tests: 18 HP-Compatible Printers

Readers' VIP Awards

The First Windows 3.0 Applications

How Hand-Trackers Work

Inside PostScript

PLUS

Lotus Notes

Two New 486 Systems

FileMaster II vs. Zenith's Z-386/33E

Silicon Graphics' Personal Iris 4D/25

Zortech's new C++

07
02662
0 440235 0

$3.50 U.S.A.
$4.50 IN CANADA
0360-5280

World Radio History

)MFORT.

keyboard of the new Dell System®
ıng becomes clear. This is not

: only is it 25% faster, but it also
similar to most 16 MHz SX's.
lly loaded. With a 40 MB hard drive.
pansion slots, so you can add
X and memory boards, modems
n video boards. It also comes
chrome monitor.
rtable $2,599. The price you'd
16 MHz SX. A price that Dell™ can
ell direct and not through

ncludes next-day deskside service
ion.△ Toll-free technical support
ompany that manufactured the
ear limited warranty. And delivery
t as the system itself.
Not to mention the full attention
of a total solution supplier. A company that's been voted number one in all six *PC Week* Customer Satisfaction Polls for personal computers. An award bestowed by the toughest critics around—the corporate volume buyers.

Our knowledgeable sales representatives are as close as your phone.

So think fast. Call now and order a Dell 320LX.

THE NEW DELL SYSTEM 320LX 20 MHz 386SX.

One of the fastest SX's around.

STANDARD FEATURES:

- Intel® 80386SX microprocessor running at 20 MHz.
- Minimum 1 MB of RAM,* optional 2 MB or 4 MB expandable to 16 MB (8 MB on the system board)
- VGA systems include a high-performance 16-bit video adapter.
- LIM 4.0 support for memory over 1 MB.
- Socket for 20 MHz 80387SX math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- Integrated high-performance hard disk interface and diskette controller on system board (ESDI-based systems include a hard disk controller).
- 1 parallel and 2 serial ports.
- Enhanced 101-key keyboard.
- 200-watt power supply.
- 8 industry standard expansion slots (7 available).
- 12-month On-Site Service Contract provided by Xerox.△

*****Commercial Lease Plan. Lease for as low as $98/month.***
△Xerox Extended Service Plan pricing starts at $261.

40 MB VGA Monochrome System	$2,599
40 MB VGA Color Plus System	$2,899
80 MB Super VGA Color System (800 x 600)	$3,199
100 MB SuperVGA Color System (800 x 600)	$3,399

Prices listed include 1 MB of RAM. 190, 330 and 650 MB hard drive configurations also available.

ANNOUNCING NEW LOWER PRICES ON ALL DELL SYSTEMS.

THE NEW DELL SYSTEM 425E™ 25MHz i486 EISA.
The best value in high performance PCs, combining i486 performance, 32-bit EISA I/O bus, and the industry's top rated service and support.

STANDARD FEATURES:

- i486 microprocessor running at 25 MHz.
- EISA architecture (downward compatible with ISA).
- Standard 4 MB of RAM,* expandable to 16 MB on system board, using optional 1 MB and 2 MB SIMMs.
- VGA systems include a high performance 16-bit video adapter.
- Socket for 25 MHz WEITEK 4167 math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- 5 half-height drive bays.
- Dual diskette and hard drive controller.
- Six 32-bit EISA (ISA compatible), plus two 16-bit ISA expansion slots.
- High performance IDE (80 MB, 100 MB, 190 MB), and ESDI (330 MB, 650 MB) hard disk drives.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- 231-watt power supply.
- 12-month On-Site Service Contract provided by Xerox.△

*****Commercial Lease Plan. Lease for as low as $286/month.***
△Xerox Extended Service Plan pricing starts at $672.

80 MB VGA Monochrome System	$7,899
190 MB VGA Color Plus System	$8,699
330 MB Super VGA Color System (800 x 600)	$9,599
650 MB Super VGA Color System (800 x 600)	$10,799

Prices listed include 4 MB of RAM. 100 MB hard drive configurations also available.

THE DELL SYSTEM 325 25MHz 386 and DELL SYSTEM 310 20 MHz 386.
The best combination of performance and value available in their class.

STANDARD FEATURES:

- Intel 80386 microprocessor running at 25 MHz (Dell 325) and 20 MHz (Dell 310).
- Minimum 1 MB of RAM, optional 2 MB or 4 MB of RAM* expandable to 16 MB (using a dedicated high-speed 32-bit memory slot).
- Advanced Intel 82385 Cache Memory Controller with 32 KB of high-speed static RAM cache.
- Page mode interleaved memory architecture
- VGA systems include a high performance 16-bit video adapter.
- Socket for 25 MHz (325) and 20 MHz (310) Intel 80387 or 25 MHz (325) and 20 MHz (310) WEITEK 3167 math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- Dual diskette and hard drive controller.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- 200-watt power supply.
- 8 industry standard expansion slots (6 available).
- 12-month On-Site Service Contract provided by Xerox.△

*****Commercial Lease Plan. Lease for as low as $131/month (325) and $112/month (310).***
Xerox Extended Service Plan pricing starts at $370 (325) and $251 (310).

	325	310
40 MB VGA Monochrome System	$3,599	$2,999
80 MB VGA Color Plus System	$4,099	$3,499
80 MB Super VGA Color System (800 x 600)	$4,199	$3,599
190 MB Super VGA Color System (800 x 600)	$4,699	$4,099

Prices listed include 1 MB of RAM. 100, 330 and 650 MB hard drive configurations also available.

THE DELL SYSTEM 316SX 16 MHz 386SX and DELL SYSTEM 210 12.5 MHz 286.
The perfect low profile mainstream computers.

STANDARD FEATURES:

- Intel 80386SX microprocessor running at 16 MHz (Dell 316SX) and 80286 microprocessor running at 12.5 MHz (Dell 210).
- Minimum 512 KB of RAM, optional 640 KB, 1 MB or 2 MB of RAM* expandable to 16 MB (8 MB [316SX] and 6 MB [210] on system board).
- Page mode interleaved memory architecture.
- LIM 4.0 support for memory over 640 KB.
- Integrated diskette and high performance 16-bit VGA video controller on system board.
- Socket for Intel 80387SX (316SX) and 80287 (210) math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- Integrated high performance hard disk interface on system board.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- 3 full-sized 16-bit AT expansion slots available.
- 12-month On-Site Service Contract provided by Xerox.△

*****Commercial Lease Plan. Lease for as low as $73/month (316SX) and $62/month (210).***
Xerox Extended Service Plan pricing starts at $196 (316SX) and $158 (210).

	316SX	210
20 MB VGA Monochrome System	$1,949	$1,649
40 MB VGA Color Plus System	$2,449	$2,149
40 MB Super VGA Color System (800 x 600)	$2,549	$2,249
80 MB Super VGA Color System (800 x 600)	$2,749	$2,449

Prices listed include 1 MB of RAM. 2 MB versions of the above systems are available for an additional $200. 100 and 190 MB hard drive configurations also available.

THE DELL SYSTEM 316LT 16 MHz 386SX.
This full-featured, battery-powered 386SX laptop costs less than most 286 laptops.

STANDARD FEATURES:

- Intel 80386SX microprocessor running at 16 MHz.
- Minimum 1 MB of RAM, optional 2 MB of RAM* expandable to 8 MB (on the system board using 1 MB SIMMs).
- LIM 4.0 support for memory over 1 MB.
- Adjustable and detachable 640 x 480 VGA Liquid Crystal Display.
- One industry standard half-size 8-bit expansion slot.
- Socket for 16 MHz Intel 80387SX math coprocessor.
- 3.5" 1.44 MB diskette drive.
- 83-key keyboard with embedded numeric keypad and separate cursor control keys.
- 1 parallel, 1 serial, and external VGA monitor port.
- Connector for 101-key keyboard or numeric keypad.
- Two removable and rechargeable NiCad battery packs utilizing Dell's "Continuous Power Battery System" (patent pending).
- AC Adapter.
- 12-month On-Site Service Contract provided by Xerox.△

*****Commercial Lease Plan. Lease for as low as $120/month.***
Xerox Extended Service Plan pricing starts at $303.

20 MB, 1 MB RAM	$3,199
20 MB, 2 MB RAM	$3,399
40 MB, 1 MB RAM	$3,499
40 MB, 2 MB RAM	$3,699

10. All systems are photographed with optional extras. All prices and specifications are subject to change without notice. Dell cannot be responsible for errors in typography or photography. **Payment based on 36-month, open-end lease. Leasing arranged by Leasing
s. UNIX is a registered trademark of AT&T in the United States and other countries. Other trademarks and trade names are used to identify the entities claiming the marks and names of their products. Dell Computer Corporation
nce Contract, please write to Dell Computer Corporation, 9505 Arboretum Boulevard, Austin, Texas 78759-7299, ATTN: Warranty. ©1990 Dell Computer Corporation. All rights reserved.

AD CODE 11E16

World Radio History

BUILT FOR SPEED.

World Radio History

AND CO

Slip behind the
320LX and one th
your ordinary SX.

At 20 MHz, not
carries a price tag

And it comes fu
Seven available ex
network cards, FA
and high-resolutio
with a VGA monc

All for a comfo
expect to pay for a
offer because we s
a retailer.

Best of all, that i
by Xerox Corporat
directly from the c
computer. A one-y
that's almost as fas

N

*Performance Enhancements: Within the first megabyte of memory, 128 KB (316SX, 316LT and 210) or 384 KB (320LX, 325 and 425E) of memory is reserved for use by the system to enhance performance. Can be optionally disabled on 316SX and 2
Group, Inc. In Canada, configurations and prices may vary. DELL SYSTEM is a registered trademark and Dell and 425E are trademarks of Dell Computer Corporation. Intel is a registered trademark and i486, 486 and 386 are trademarks of Intel Corporatio
disclaims any proprietary interest in trademarks and trade names other than its own. On-site service may not be available in certain locations. For information on and a copy of Dell's 30-day Total Satisfaction Guarantee, limited warranty, and Xerox's Ser

World Radio History

Sure, the Dell System® 320LX is fast. But it's priced to get a quick response, too. Look inside for details.

TO ORDER, OR FOR OUR CATALOG, CALL NOW.
800-365-8811

DELL COMPUTER CORPORATION

FOR NETWORKING OR UNIX* INFORMATION.
800-678-UNIX

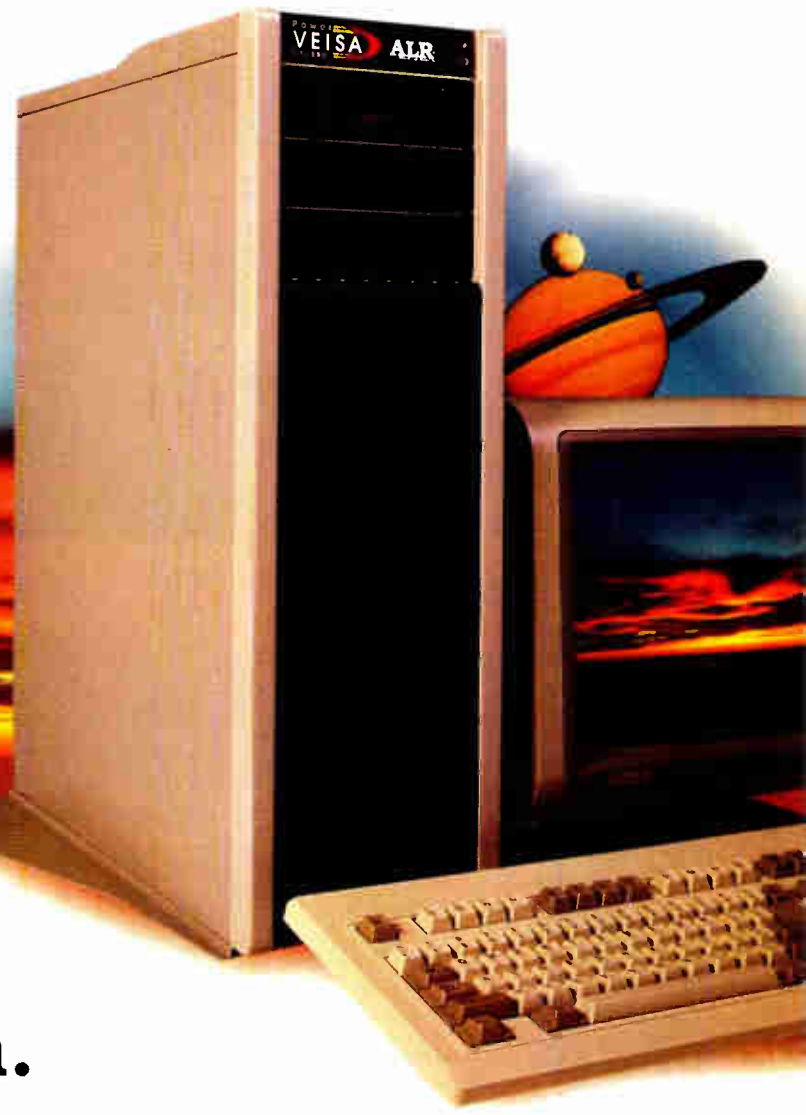
In Canada 800-387-5752. In the U.K. 0800 414535. In France (1) 05.00.33.55. In Germany 061031 701-0. In Sweden 0760-713 50.

Circle 76 on Reader Service Card

World Radio History

Years From Now,

Standard Features at $5995...
EISA
33-MHz 386
64-KB Cache
5-MB RAM
106-MB Hard Disk
What more could you want?



An Honest, Affordable Upgrade Path.

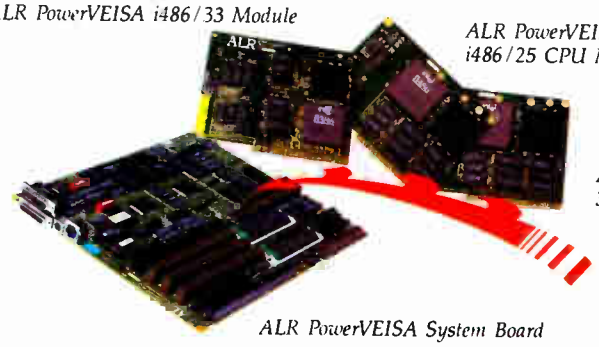
You know what you want from a 386™ PC. ALR's **PowerVEISA 33/386** delivers. Cached 33-MHz performance, plenty of RAM to run even the bulkiest of today's applications, a choice of high performance hard disks, and **EISA** compatibility — all at a price that puts many similarly equipped ISA systems to shame. So what more could you want?

How about the future?

ALR's PowerVEISA 33/386 offers you an honest, affordable upgrade path to 25-MHz, 33-MHz (available second quarter) and future i486™ processors.

ALR PowerVEISA i486/33 Module

ALR PowerVEISA i486/25 CPU Module



ALR PowerVEISA 386/33 CPU Module

ALR PowerVEISA System Board

Prices and configurations subject to change without notice. Shown with optional monitor. Prices based on U.S. dollars

World Radio History

It's Still What You Want...

Introducing the ALR® PowerVEISA 386/33™

	ALR PowerVEISA 386/33 Model 110	AST Premium®386/33 Model 115V
	i386 33-MHz CPU	i386 33-MHz CPU
✓	**5-MB RAM**	2-MB RAM
✓	**64-KB Cache**	32-KB Cache
	106-MB Hard Drive	110-MB Hard Drive
✓	**EISA**	ISA
	Optional VGA	VGA
	add $295	
	$6,290	$8,495
	i486 25-MHz Upgrade add $1995	i486 25-MHz Upgrade add $2995
✓	**EISA Standard**	Optional EISA Upgrade add $1250
	$8,285	$12,740

PowerVEISA costs $2200 less today; over the years, it can save you more than $4400 !

The modular design of this system lets you change processors in about five minutes. More importantly, you can change the CPU module without having to replace cache or system memory, saving you hundreds of dollars when compared to some compet-itive upgrade schemes.

Engineered for the future, the floor-standing chassis of the PowerVEISA 386/33 can accommodate a total of 49-MB of memory and up to 1.2-GB (gigabytes) of fixed disk storage. Its EISA capabilities let you take advantage of the latest in 32-bit I/O and bus mastering technology, while remaining compatible with 8 and 16-bit "AT®" boards.

Even the PowerVEISA's innovative **FlexCache+** memory architecture was built for the future. Based on ALR's award-winning FlexCache architecture, this 64-bit dual-bus design incorporates an advanced "read and write back" 64-KB cache. FlexCache+ has been fine-tuned for optimum efficiency, especially when combined with an i486 processor upgrade.

Add ALR's one year factory warranty, on-line technical support, and optional on-site service from Intel™ to round out one of the best PC investments around.

The PowerVEISA 33/386 -- ready to meet today's needs and tomorrow's challenges.

For more information on the PowerVEISA 33/386 and ALR's complete line of systems, please call: **1-800-444-4ALR**

ALR®
Advanced Logic Research, Inc.
9401 Jeronimo Irvine, California 92718
(714) 581-6770 FAX: (714) 581-9240

ALR is a registered trademark and PowerVEISA is a trademark of Advanced Logic Research, Inc. AST and AST Premium are registered trademarks of AST Research Inc. Intel, 386, i386, and i486 are trademarks of Intel Corporation. AT is a registered trademark of International Business Machines Corporation.

Circle 20 on Reader Service Card (DEALERS: 21)

World Radio History

BYTE

CONTENTS

July 1990
Volume 15, Number 7

COVER STORY

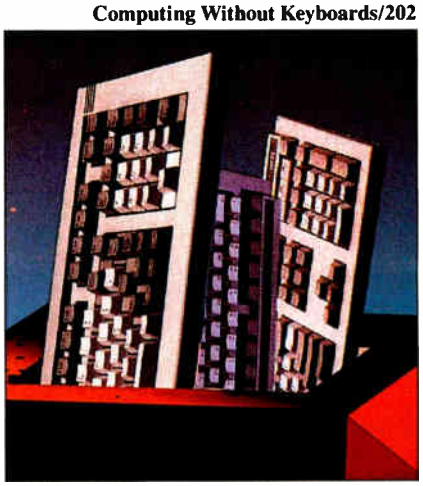
Laser Printers Get Personal

PAGE 138

The era of the personal laser printer is upon us, with this vanguard of Series II compatibles leading the way.

Product Focus/138

Computing Without Keyboards/202



NEWS

19 **MICROBYTES**
Late-breaking technology and industry reports from the BYTE news staff.

42 **WHAT'S NEW**
Product snapshots of recent hardware and software announcements.

FIRST IMPRESSIONS

110 **SHORT TAKES**
Turbo C++, *another landmark product from Borland*

HyperCard 2.0, *Apple greatly improves version 1.2*

Plus, *Spinnaker offers true multiplatform compatibility*

DaynaFile, *lets the NeXT Computer use floppy disks*

FrameMaker 2.0, *Frame Technology's version for the Mac*

116 **WINDOWS SHOPPING: 3.0 Applications Take Shape**
A look at the first crop of Windows 3.0–compatible applications.

133 **Notebook Newcomer**
The VH-286 from Airis offers features, power, and low cost.

REVIEWS

160 **The New 486s: Are Faster FPUs Enough?**
Spear and Dyna Micro's 25-MHz i486-based systems capitalize on the chip's integrated FPU.

167 **Power Servers**
File servers from Zenith and Storage Dimensions face off.

174 **Personal Iris: The Dream Maker**
A living-color look at the Silicon Graphics Personal Iris 4D/25.

186 **C++, Plus**
Zortech's C++ 2.0 may make an OOP believer of you yet.

196 **The Personal Network**
Organize companywide information into personal views with Lotus Notes.

STATE OF THE ART

202 **COMPUTING WITHOUT KEYBOARDS Introduction**

205 **Smoke and Mirrors**
In an industry as new as ours, it's too early to rest on our collective laurels.

215 **Living in a Virtual World**
Head-mounted devices and stereoscopic viewers help add sound, sight, and touch to your computerized toolkit.

225 **The Spoken Word**
Researchers at Carnegie Mellon report on voice interfaces for computers.

237 **Telltale Gestures**
A look at devices that will change how you manipulate 3-D design applications.

238 **Coming Soon to a CAD Lab Near You**
3-Draw lets you sketch out your ideas in 3-D.

243 **Sign Here, Please**
Interactive tablets enable free-form communication between you and your computer.

252 **From Hand to Mouth**
A sampling of recent developments in user interfaces.

COVER PHOTOGRAPHY: PAUL AVIS © 1990

World Radio History

REGIONAL SECTION
begin after page 64

The World According to Micros/256

Down to Business/87

FEATURES

256 **The World According to Micros**
Need to know some exotic geographic facts? Try one of these 24 world atlas packages.

271 **3-D Graphics, from Alpha to Z-Buffer**
The dedicated memory of graphics workstations speeds up their ability to render in three dimensions.

305 **The BYTE VIP Awards**
BYTE's readers have chosen a host of hardware and software as Very Important Products.

HANDS ON

283 **UNDER THE HOOD**
Reach Out and Touch Your Data
Three input devices, ranging from $100 to $15,000, let you "hand it to computers."

293 **SOME ASSEMBLY REQUIRED**
PostScript Insider Secrets
Don Lancaster, a pioneer of the microcomputer revolution, reveals PostScript tricks for better output.

DEPARTMENTS

6 **Spotlight**
A new source of European computer information, and a "virtual environment" expert.

10 **Editorial:** The Software Story of the Year

34 **Letters, Ask BYTE, and Fixes**
Of archives and Coke-can comparisons.

PERSPECTIVES

356 **CHAOS MANOR MAIL**

358 **PRINT QUEUE**
Zen and the Art of Assembly
A remarkable series of books argues that assembly programming is easier than learning to play the piano.

360 **STOP BIT**
Quest for a Mouseball
One man's journey in search of an elusive IBM mouseball.

EXPERT ADVICE

65
COMPUTING AT CHAOS MANOR
Life, Liberty, and the Pursuit of CD-ROMs
by Jerry Pournelle
Jerry examines new CD-ROMs of classics, including the Bible and Shakespeare's works.

81
THE UNIX /bin
Go Ahead, Make My Day
by David Fiedler
Tips on installing freely available Unix software.

87
DOWN TO BUSINESS
Up Close and Personal
by Wayne Rash Jr.
Personal organizers let you calculate, compute, and transfer data on the fly.

91
MACINATIONS
CAD: The Mac Can Do That?
by Don Crabb
With processing power galore and large monitors, Don proves that the Mac can deliver.

97
OS/2 NOTEBOOK
Free at Last!
by Mark J. Minasi
Thanks to OS/2's new memory architecture, you no longer have to squeeze code into 64K-byte segments.

105
NETWORKS
Networks Shouldn't Be This Hard
by Mark L. Van Name and Bill Catchings
Getting PCs up and running on a LAN is too much of a hassle.

READER SERVICE

347 Editorial Index by Company
348 Alphabetical Index to Advertisers
350 Index to Advertisers by Product Category
Inquiry Reply Cards: after 352

PROGRAM LISTINGS

From BIX: See **280**
From BYTEnet: call (617) 861-9764
On disk: See card before **169**

BYTE (ISSN 0360-5280/90) is published monthly with an additional issue in October by McGraw-Hill, Inc. U.S. subscriber rate $29.95 per year. In Canada and Mexico, $34.95 per year. Single copies $3.50 in the U.S., $4.50 in Canada. Executive, Editorial, Circulation, and Advertising Offices: One Phoenix Mill Lane, Peterborough, NH 03458. Second-class postage paid at Peterborough, NH, and additional mailing offices. Postage paid at Winnipeg, Manitoba. Registration number 9321. Printed in the United States of America. **Postmaster:** Send address changes, USPS Form 3579, and fulfillment questions to BYTE Subscriptions, P.O. Box 551, Hightstown, NJ 08520.

World Radio History

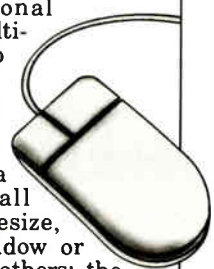
Circle 42 on Reader Service Card

6.0 AND COUNTING!

Integrate sophisticated features into your Microsoft C and QuickC applications with

C TOOLS PLUS/6.0™

C TOOLS PLUS version 6.0 is filled with many advanced routines for developing high-powered C applications, including: virtual, stackable menus and windows with full mouse support and optional "drop shadows"; multiple virtual pop-up help screens; a miniature multi-line editor for gathering user responses in a robust fashion; a single function call which can move, resize, and promote a window or menu on top of all others; the ability to update covered windows automatically when they are written to; support for EGA, VGA, and MCGA text modes including 30-, 43-, and 50-line modes; support for the enhanced (101/102 key) keyboard.



All this and more for only $149!

C TOOLS PLUS/6.0 also contains functions for writing interrupt service routines; creating pop-up memory resident applications; general memory "peeks" and "pokes"; access to the DOS PRINT utility; as well as many other general utility functions and macros.

COMPLETE PROFESSIONAL PACKAGE.

Blaise Computing's function libraries offer easy to use solutions to your programming needs. You get source code, complete sample programs, and a comprehensive reference manual with extensive examples. Supports QuickC and Microsoft C 5.0 and later.

30 DAY GUARANTEE.

If during the first 30 days you are not completely satisfied, we'll refund your money.

Other powerful products from Blaise Computing

C ASYNCH MANAGER™	$189
ASYNCH PLUS™	$189
VIEW232™	$189
POWER SCREEN™	$149
Turbo C TOOLS™	$149
POWER TOOLS PLUS™	$149

Call today for more information

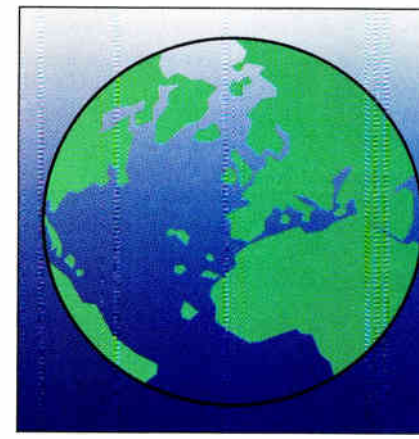
(800) 333-8087

BLAISE COMPUTING INC.

2560 Ninth Street, Suite 316
Berkeley, CA 94710
(415) 540-5441

FAX (415) 540-1938

Trademarks are property of their respective holders.



GROWTH, CHANGE, AND 3-D INTERFACES

A new source of European computer information, and a "virtual environment" expert

This month we throw the spotlight on our London-based senior editor, Colin Barker, who works on our international coverage. (BYTE's International section is sent out to almost 130,000 readers worldwide.) He will also help make sure that the rest of us are aware of the exciting things happening around the world.

Before coming to BYTE, Colin was the editor of *DEC Computing*, the leading British magazine focusing on products from DEC. Before that he spent some time as editor of *Which Computer?*, one of the leading British microcomputer magazines.

Colin is based in McGraw-Hill's new offices in Wimbledon. And, although he is officially based in the U.K., Colin will be spending a good amount of time hopping around Europe, digging out the most important news and developments. He can be reached at BYTE/McGraw-Hill, Wimbledon Bridge House, 1 Hartfield Rd., Wimbledon, London SW19 3RU, UK.

Virtual Environments

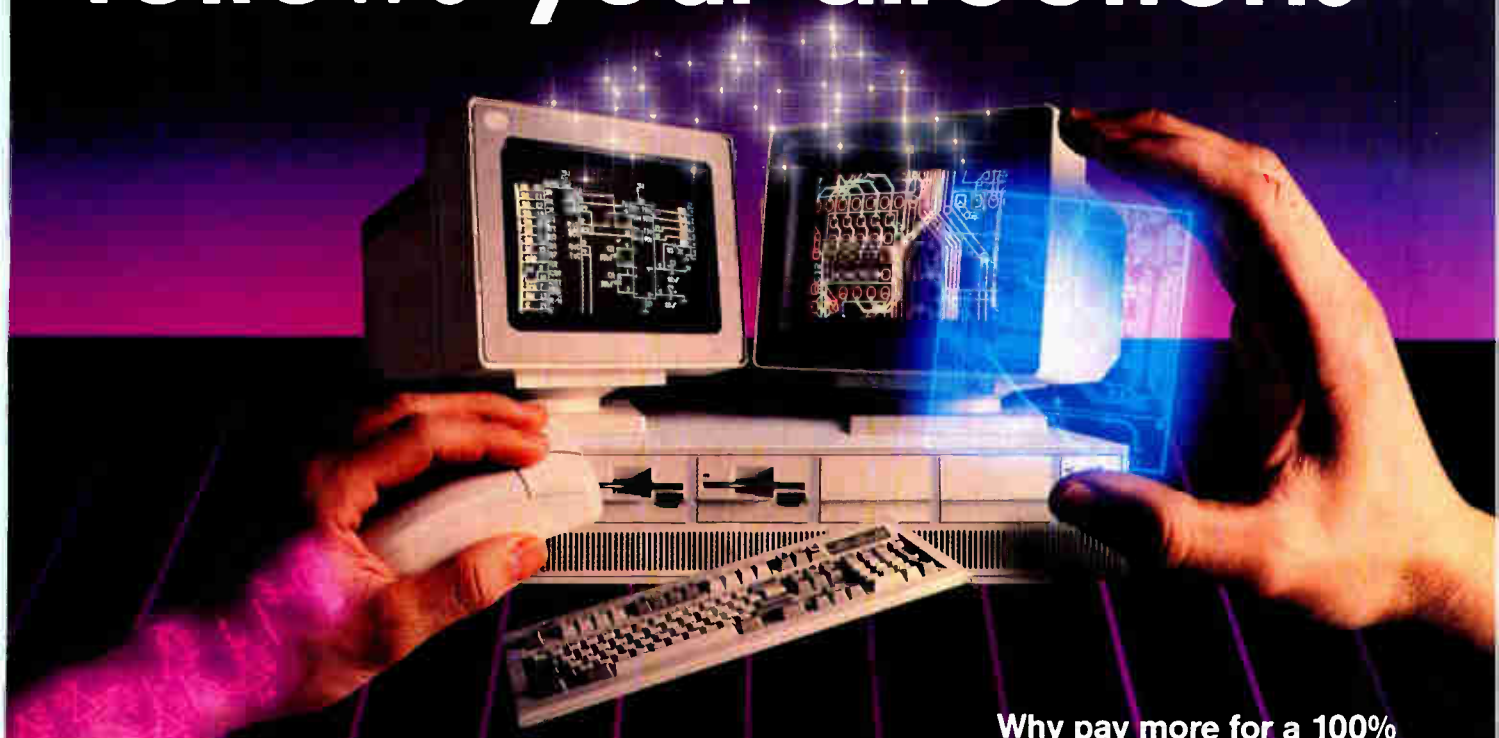
On another topic, we are pleased to have an article in this month's State of the Art section by Scott S. Fisher, the foremost authority on virtual environments (see "Living in a Virtual World" on page 215). Virtual environments provide you with a way to enter three-dimensional space in your computer and interact with it, "one on one."

From 1978 to 1982, Scott was a member of the Architecture Machine Group at MIT, where he helped develop the Aspen Movie Map surrogate-travel videodisk project and several stereoscopic display systems for teleconferencing and telepresence applications. His current research focuses mainly on stereoscopic imaging technologies, interactive display environments, and developing media technology to represent "first-person" sensory experience.

As director of the Virtual Environment Workstation Project at NASA's Ames Research Center, Scott's objective is to develop a multisensory "virtual environment" workstation to be used in space station teleoperation, telepresence, and automation activities. As we look for more creative, efficient, and realistic ways of establishing interfaces between us and our machines, the virtual environment provides an alternative to the 2-D space of a flat screen. ■

World Radio History

At last, an assistant that follows your directions



Wouldn't it be great to delegate your routing?

You can! We know your time is valuable. That's why Wintek pioneered comprehensive and affordable CAD packages for IBM personal computers. HiWIRE-Plus continued that tradition, integrating schematic-capture features and printed-circuit-artwork capabilities into one versatile package.

New autorouter.

The Autorouter for HiWIRE-Plus is powerful enough to handle the most demanding design problems, yet simple enough for a casual user. Just turn it loose on your design. It's hassle free because it works long hours, without supervision or errors.

100% autorouting.

The autorouter for HiWIRE-Plus rips-up, reroutes, and with appropriate design rules, racks up 100% completion.

- ☐ Forget gridded routers. This autorouter places vias and traces anywhere your design rules allow. With 1-mil resolution.
- ☐ Vary trace width and spacing for individual networks. Route 1, 2, 3, or more tracks between IC and connector pins.
- ☐ Set up boards from 1 to 250 layers, up to 60″ × 60″.
- ☐ Specify shape, size, and type of vias, layer-by-layer: through-hole, blind, buried, micro. Specify via types for individual networks.
- ☐ Use fewer vias and layers than comparably priced autorouters.
- ☐ For use on your IBM PC, XT, AT, PS/2, or compatible with 640K RAM.

Why pay more for a 100% autorouter?

Compare the features and performance to packages costing five times more. HiWIRE-Plus and the Autorouter for HiWIRE-Plus sell for $895 each. Both have a no-nonsense, 30-day money-back guarantee. With unlimited, toll-free, no-charge technical support.

Let HiWIRE convince you that it makes a great assistant. Call us toll-free at (800) 742-6809 today and put HiWIRE-Plus and the Autorouter for HiWIRE-Plus to work for you tomorrow.

WINTEK®

Wintek Corporation
1801 South Street
Lafayette, IN 47904-2993
Fax: (317) 448-4823
Phone: (317) 742-8428 or

(800) 742-6809

Australia: Wintek Software. Phone (08) 2720028. Fax (08) 3733145
Europe: RIVA Ltd, England, Phone 0420 22666, FAX 0420 237000 / Brazil: Comicro, Phone (11) 289-7193 / Japan: BEST, Phone: (03) 374-1161, FAX (03) 374-9450

Circle 400 on Reader Service Card

World Radio History

Superior performance in all e

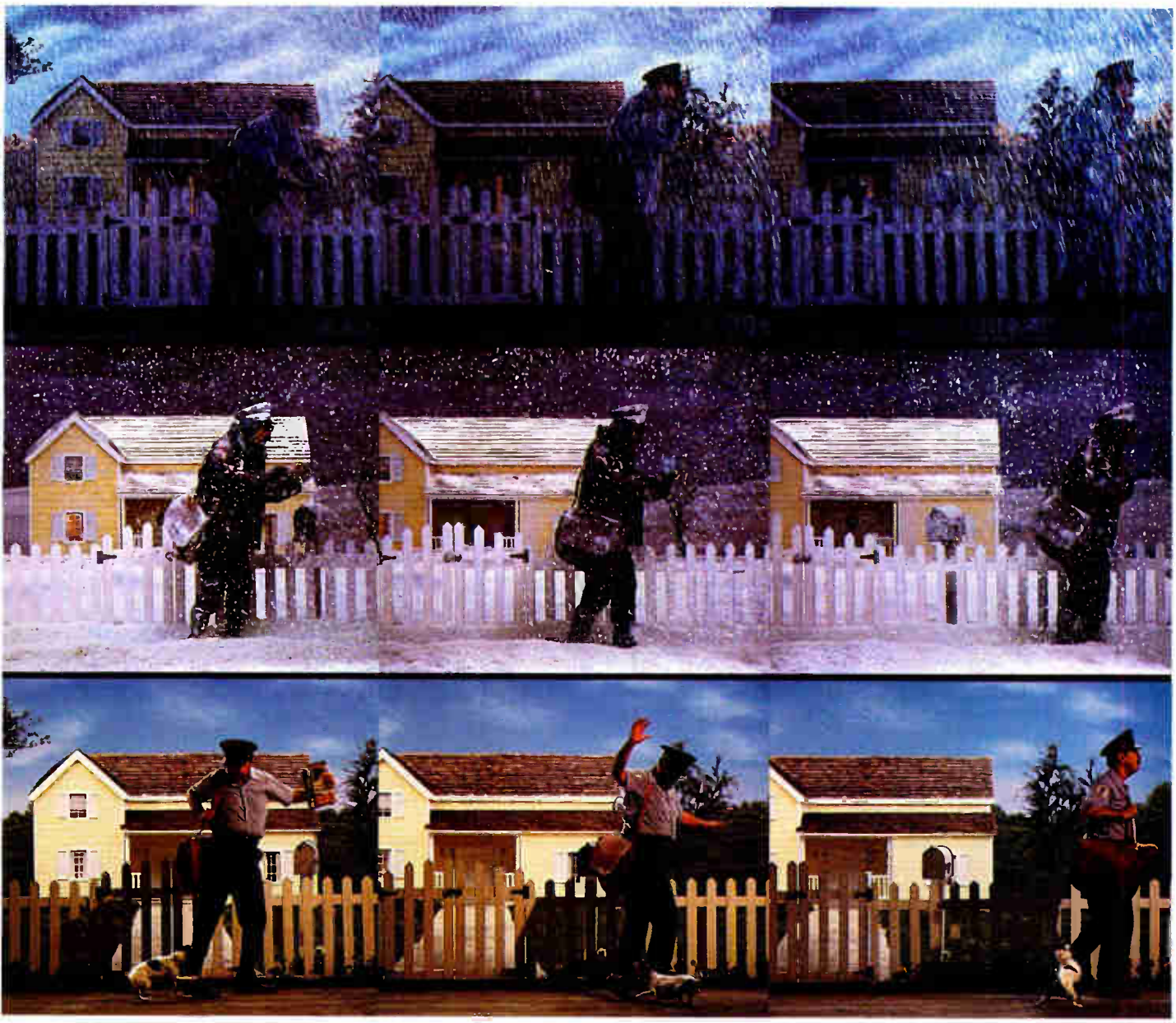
Like your friendly neighborhood mailman, you can always count on Microsoft to deliver. Because no matter what kind of system you're currently using, we offer the best word processing application.

And, quite frankly, we're not the only ones who think so.

Word for Windows,™ our graphics-based PC program, was rated the best word processor by *InfoWorld.* While its character-based counterpart, Word 5.0, was given *Software Digest*'s highest rating. There's a Word 5.0 for XENIX, too. And last, but not least, Word 4.0 for the Macintosh,® which also received

Customers inside the 50 United States, call (800) 541-1261, Dept. L02. In Canada, call (416) 673-7638. Outside the U.S. and Canada, call (206) 882-8661. *© 1990 Microsoft Corporation. All rights reserved*

World Radio History



nvironments is our motto, too.

Software Digest's highest overall rating.

But while they're considered superior individually, few people realize how well our Words work together. They not only read and write to each other, but to other programs as well. So file sharing couldn't be easier.

And switching from your existing program is also painless, thanks to context-sensitive, on-line help and complete file conversion capabilities.

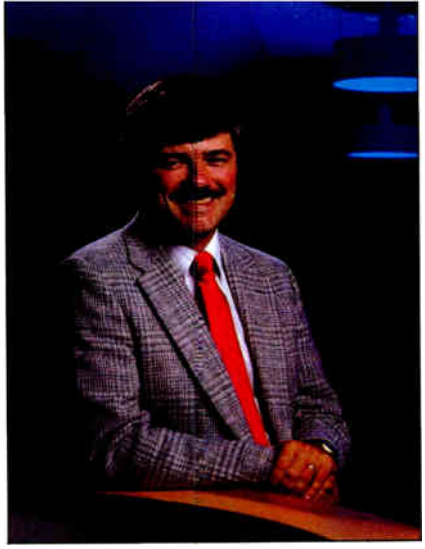
For more information about the Word family, including our soon-to-be-released OS/2 version, call us at (800) 541-1261, Department L02.

We'd ask you to write, but mail carriers work hard enough already.

Microsoft®
Making it all make sense™

Microsoft and the Microsoft logo are registered trademarks and Making it all make sense *is a trademark of Microsoft Corporation. Macintosh is a registered trademark of Apple Computer, Inc.*

World Radio History



THE SOFTWARE STORY OF THE YEAR

Windows 3.0 is a landmark product that will have a profound effect on everything

In last month's cover story, BYTE senior editor (and Windows expert) Jon Udell introduced Windows 3.0, explaining what it is and how it fits into the spectrum that starts at vanilla DOS and ends with 32-bit OS/2. There is much more Windows coverage this month, focusing on applications; and we're planning additional special coverage in August. Why all the fuss?

Because of this: We expect end users and corporations to flock to Windows by the millions. The ripple effects of those millions of copies of Windows will, in turn, be felt in almost every corner of the desktop computing world.

Jon has been using prerelease versions of Windows 3.0 since last year, and based on that extensive experience, he's come up with a staggering list of the implications of Windows. Here are a few highlights from his notes:

286 Systems: Windows 3.0, not OS/2, is the solution for the installed and still-growing 286 base. Windows delivers to 286 machines the three key benefits that it was originally thought OS/2 would provide: large memory, multitasking, and intertask protection. Windows 3.0's cooperative multitasking and memory management rescue the faster 286 machines from obsolescence and make them—for many home and business uses—a reasonable and very inexpensive choice.

386 Systems: Although Windows 3.0 is a 16-bit product, it's going to sell a lot of 32-bit hardware. A 386 running Windows, equipped with a Super VGA board like the Video Seven VGA (640 by 480 by 256 pixels) and a slew of Windows 3.0 applications, is arguably the most cost-effective and versatile desktop machine you can buy today. Windows 3.0 inherits the rich library of existing Windows software, all of which runs much better thanks to Windows' ability to run itself and its applications in extended memory. This makes the 386 very attractive relative to a Mac II: functionally comparable and considerably cheaper.

Macintosh: Windows 3.0 may actually boost sales of Mac systems and software because Apple will almost certainly have to lower prices to compete against increasingly Mac-like, inexpensive DOS/Windows boxes. Lower prices mean that more people will be able to afford Macs.

Memory: As people get used to multitasking and to more powerful applications, adding that extra 2 or 4 megabytes of RAM really starts to make sense. The relationship between added RAM and added productivity will become much more linear for lots of folks.

Networks: Windows 3.0 includes excellent support for a variety of networks, including LAN Manager, Novell NetWare, 3Com, and Vines. Smaller fry, like LANtastic and Grapevine, will almost certainly join the party as well. With good drivers, Windows is better than OS/2 or Unix at hiding much of the complexity of using a network—and, unlike the Mac, Windows encompasses many hardware sources. Expect the combination of Windows and a network to become an overwhelming standard in many corporate settings.

Graphics: Windows 3.0 removes previous limitations on memory and color management, and it also provides single-driver simplicity (no more having to juggle a pile of separate application-specific drivers). Expect Super VGA and powerful graphics accelerators/coprocessors to proliferate.

Software: Windows will finally allow DOS systems to perform well in previous Mac strongholds like desktop publishing, presentation graphics, and image processing; watch for developments there. In fact, demand for all Windows 3.0 applications will be intense; that, in turn, will fuel demand for more and better software development tools.

Watch for additional growth in DOS extender products. Windows 3.0 is itself a DOS extender; that is, while relying on underlying DOS services, it gives applications access to extended memory. Windows will become the premier DOS extender, but it won't kill the other ones.

The forthcoming DPMI (DOS Protected Mode Interface) specification provides hooks so that DOS-extended programs built with the Phar Lap Software, Rational Systems, or Ergo Computing toolkits can run and multitask under Windows 3.0. If this comes to pass, 32-bit applications like AutoCAD 386, built with Phar Lap tools, will theoretically be able to run in 32-bit mode using a flat memory model, yet they'll be able to coexist with Windows 3.0.

In the DBMS arena, Windows is a great platform for the client half of distributed applications. Windows will be a front end to NetWare, OS/2, Unix, and mainframe database servers. Tools like SQLWindows (for the interface development) will be hot, as will Windows implementations of network protocols like TCP/IP for bridging DOS/Windows machines across a variety of network architectures.

Windows 3.0 is a landmark product whose effects we'll all be living with for years to come. Things just got a whole lot more interesting.

—Fred Langa
Editor in Chief
(BIX name "flanga")

World Radio History

New Turbo C++ Professional

When the object is programming

Be Objective

Object-Oriented Programming (OOP) *is* programming in the '90s. It's the next step after structured programming and is the best way to write applications. So Borland combined the power of OOP with the efficiency of C to produce new Turbo C++ Professional.

And Turbo C++ Professional is the first Turbo-charged native code C++ compiler that brings Object-Oriented Programming to your PC. Since Turbo C++ Professional also compiles ANSI C code, you can be productive with C now, and move to C++ at your own pace.

Environment ++

The best compiler deserves the best environment, and our new Programmer's Platform™ environment makes you more productive. It features overlapping windows and mouse support. And sports a new multi-file editor, an integrated debugger, and a smart project manager. Its advanced open architecture lets you integrate the tools you need to feel right at home.

VROOMM adds room

VROOMM™ (Virtual Runtime Object-Oriented Memory Manager) lets you break the 640K barrier. Just select the application code you want to overlay, and VROOMM does the rest—swapping modules on demand. It's fast, easy, automatic.

Another +

Turbo C++ Professional gives you all the tools you need to build fast, reliable C++ programs.

Turbo Debugger® 2.0 debugs your object-oriented programs. This powerful new version is the first and only debugger to support *reverse execution*. Letting you step backwards through your code to find the bugs you might have missed.

New Turbo Profiler,™ the world's first interactive profiler, displays histograms of your program's performance. With it, you

can easily spot execution bottlenecks, and see where improvements or redesign of your code will yield maximum performance gains.

And Turbo Assembler® 2.0 lets you replace time-critical segments of your code using the world's fastest MASM-compatible assembler.

Turbo C++ Professional Compiler
- C++ conforming to AT&T's 2.0 specification
- C++ class libraries
- Full ANSI C compiler
- VROOMM overlay manager
- Complete documentation and tutorials

Programmer's Platform
- Open architecture for integration of your own tools
- Overlapping windows with mouse support
- Multifile, macro-based editor
- Smart project manager provides visual MAKE
- Integrated debugging and hypertext help

Turbo Debugger 2.0
- Class hierarchy browser and inspectors
- Reverse execution provides "true" undo
- 286 protected-mode and 386 virtual-mode debugging
- Keystroke record and playback

NEW Turbo Profiler
- Displays histograms of program execution
- Tracks call history, overlays, interrupts, file I/O

Turbo Assembler 2.0
- Multipass assembler with NOP squishing and 486 support

Special Introductory Offer

The suggested retail price for Turbo C++ Professional is $299.95 ($199.95 for Turbo C++). For a limited time, Borland is offering its dealers and distributors special introductory discounts.* So be objective, and **SEE YOUR DEALER** or call Borland** at **1-800-331-0877** now!

BORLAND

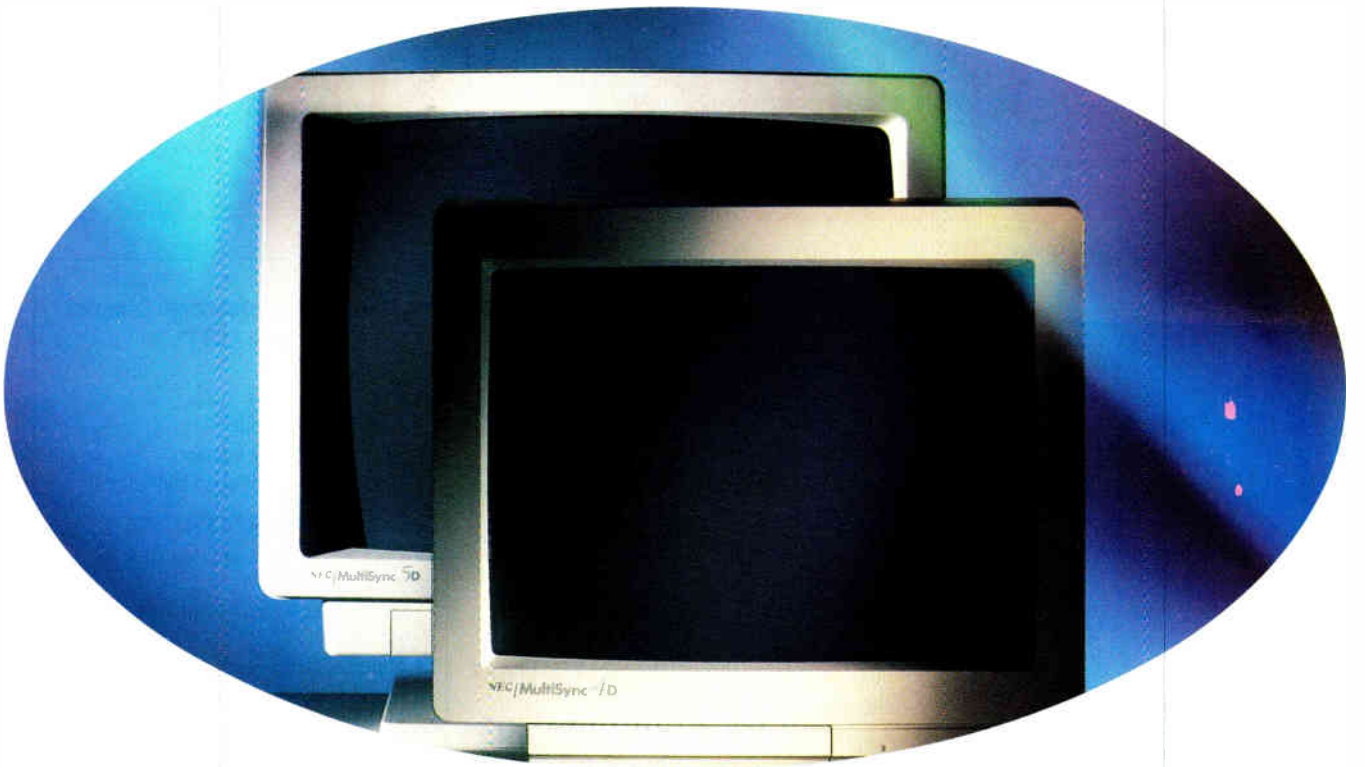
Code: MC68

*Offer expires July 31 1990 or while supplies last. Offer good in United States and Canada only. **Special discounts for registered Turbo C® owners are available from Borland. Mail orders to: Borland, P.O. Box 660001, Scotts Valley, CA 95067-0001. For orders outside the U.S., call (408) 438-5300. Turbo C++, Turbo Debugger, Turbo Profiler and Turbo Assembler are trademarks or registered trademarks of Borland International, Inc. Copyright © 1990, Borland International, Inc. All rights reserved. BI-1333

Circle 43 on Reader Service Card (DEALERS: 44)

World Radio History

Fly in bigger skies.



The 16" MultiSync 4D and 20" 5D monitors.

Our largest high-resolution color monitors. Digitally controlled, the 4D supports VGA through 1024 x 768, the 5D, up to 1280 x 1024.

It's a matter of space. And pace.

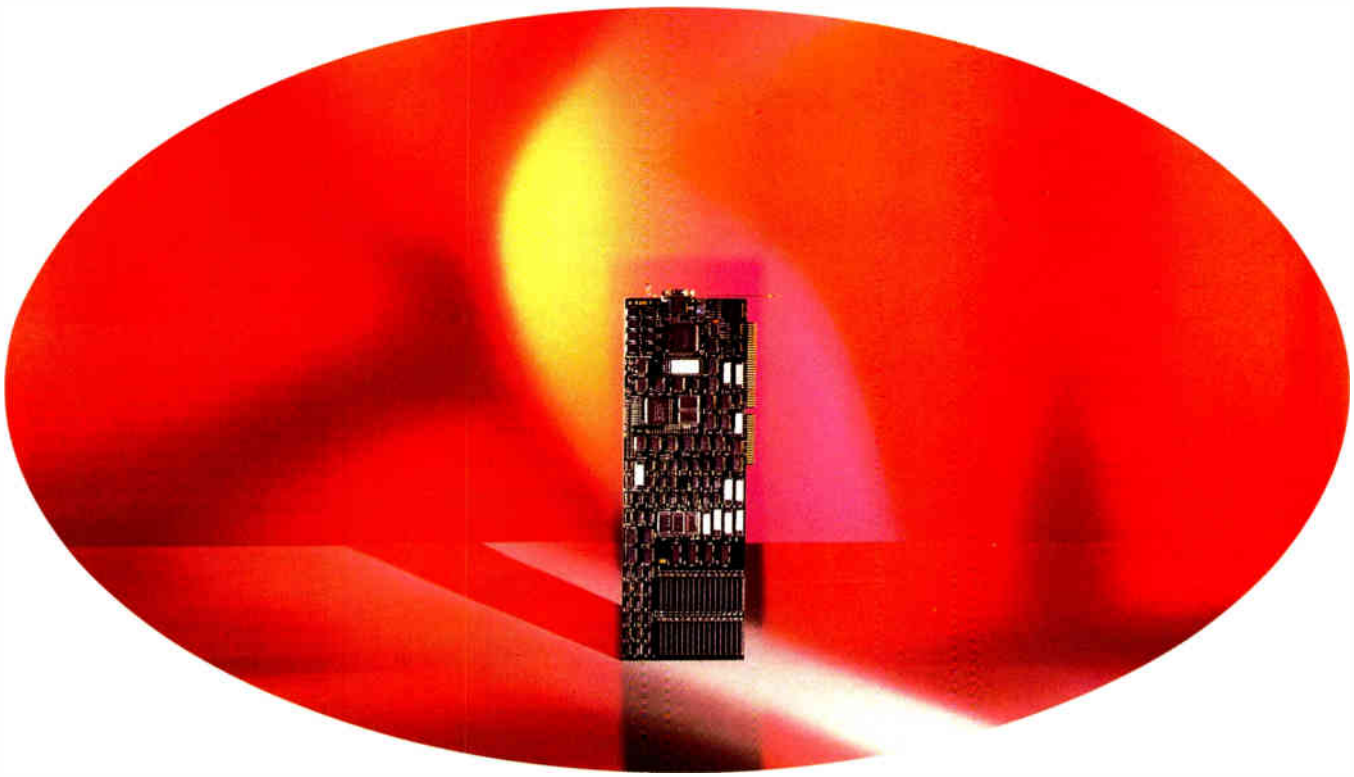
Your ideas could use as much of both as they can get. Which is why you should consider upgrading to one of our larger MultiSync® monitors. Then you can add the best graphics accelerator you can find. The MultiSync Graphics Engine™ Board, to name one prime example.

Together, they'll increase your system's productivity immensely, by

C&C
Computers and Communications

World Radio History

On afterburner.



The MultiSync Graphics Engine Board. Uses 50MHz TMS 34010 graphics processor to accelerate software applications as much as 900%.

allowing you to put far more information on your screen, far faster.

We're talking more windows. More words. More detail.

Above all, more speed.

Interested? Call 1-800-FONE-NEC for technical information. Or

TMS 34010 is a registered trademark of Texas Instruments Inc

1-800-826-2255 for literature. In Canada, 1-800-268-3997. We'll show

MultiSync is a registered trademark of NEC Technologies Inc 1990 NEC Technologies Inc

you how to give your productivity a major boost.

Graphics Engine is a trademark of NEC Technologies Inc

NEC

Circle 180 on Reader Service Card

World Radio History

BYTE

EDITOR IN CHIEF
Frederic S. Langa

MANAGING EDITORS
Operations: Glenn Hartwig
News: Rich Malloy
BYTE Lab: Michael Nadeau

NEWS
New York: *Managing Editor:* Rich Malloy
Associate News Editor: Andrew Reinhardt
Peterborough: *Senior Editor, Microbytes:* D. Barker
Senior Editor, Short Takes: Anne Fischer Lent
Associate News Editors, What's New: Roger Adams, David Andrews, Martha Hicks
Editorial Assistant: Amanda Waterfield
San Francisco: *Bureau Chief:* Nicholas Baran
News Editor: Owen Linderholm
Associate News Editor: Jeffrey Bertolucci
London: *Senior Editor:* Colin Barker

BYTE LAB
Managing Editor: Michael Nadeau
Technical Director: Rick Grehan
Senior Editor: Dennis Allen
Technical Editors: Alan Joch, Robert Mitchell, Tom Yager
Testing Editors/Engineers: Stephen Apiki, Stanford Diehl, Howard Eglowstein, Stanley Wszola

STATE OF THE ART
Senior Editor: Jane Morrill Tazelaar
Technical Editor: Robert M. Ryan

FEATURES
Senior Editor: Kenneth M. Sheldon
Technical Editors: Janet J. Barron, Ben Smith

SENIOR EDITORS, AT LARGE
Tom Thompson, Jon Udell

SPECIAL PROJECTS
Senior Editor: Gene Smarte

SENIOR CONTRIBUTING EDITOR
Jerry Pournelle

CONTRIBUTING EDITORS
Bill Catchings, Don Crabb, David Fiedler, Hugh Kenner, Mark J. Minasi, Wayne Rash Jr., Mark L. Van Name

CONSULTING EDITORS
Jonathan Amsterdam, Laurence H. Loeb, Trevor Marshall, Stan Miastkowski, Dick Pountain, Phillip Robinson, Peter Wayner

COPYEDITING
Chief Copy Editor: Lauren A. Stickler
Copy Administrator: Cathy Kingery
Copy Editors: Susan Colwell, Jeff Edmonds, Judy Grehan, Nancy Hayes, Margaret A. Richard, Warren Williamson

EDITORIAL ASSISTANTS
Office Manager: Peggy Dunham
Assistants: Linda C. Ryan, June Sheldon, Lynn Susan Valley

ART
Director: Nancy Rice
Assistant Director: Joseph A. Gallagher
Art Assistants: Jan Muller, Lisa Nardecchia
Technical Artist: Alan Easton

PRODUCTION
Director: David R. Anderson
Senior Editorial Production Coordinator: Virginia Reardon
Editorial Production Coordinators: Barbara Busenbark, Denise Chartrand, Michael J. Lonsky

TYPOGRAPHY
Systems Manager: Sherry Fiske
Applications Manager: Donna Sweeney
Typesetter: Christa Patterson

ADVERTISING/PRODUCTION (603) 924-6448
Director of Advertising: Lisa Wozmak
Assistant: Christine W. Tourgee
Customer Service Supervisor: Linda Fluhr
Senior Account Coordinator: Lyda Clark
Account Coordinator: Dale J. Christensen
Materials Coordinator: Karen Cilley
Advertising Assistant: Roxanne Hollenbeck
Creative Services Manager: Susan Kingsbury
Production Artist: Lillian J. Wise
Quality Control Manager: Wai Chiu Li
Production Coordinator: Rod Holden

ADMINISTRATION
Publisher's Assistant: Donna Nordlund

MARKETING AND PLANNING
Director: L. Bradley Browne
Marketing Communications Manager: Pamela Petrakos-Wilson
Public Relations Manager: Dawn Matthews
Assistant Promotion Manager: Lisa Jo Steiner
Marketing Art Director: Stephanie Warnesky
Associate Art Director: Sharon Price
Senior Market Research Analyst: Julie Perron
Copyrights Coordinator: Faith Kluntz
Reader Service Coordinator: Cynthia Damato Sands
Marketing Assistant: Carol Pitman

FINANCIAL SERVICES
Director of Finance and Services: Philip L. Penny
Business Manager: Kenneth A. King
Assistants: Marilyn Parker, Diane Henry, JoAnn Walter, Jaime Huber, Agnes Perry

CIRCULATION
Director: Glyn Standen
Subscriptions Manager: Paul Ruess
Assistant Manager, Subscriptions: Margaret Liszka
Subscriptions Assistant: Holly Zilling
Newsstand Manager: Vicki Weston
Distribution Coordinator: Karen Desroches
Back Issues: Louise Menegus
Direct Accounts Coordinator: Ellen Dunbar
Direct Accounts Telephone Sales Representative: Karen Carpenter

BUILDING SERVICES
Manager: Tony Bennett
Assistants: Cliff Monkton, Gary Graham, Ed Codman

PERSONNEL
Human Resources Administrator: Patricia Burke, *Human Resources Assistant:* Fran Wozniak, *Receptionist:* Beverly Goss

PUBLISHER
Philip L. Penny

ADVERTISING SALES
Associate Publisher, Vice President of Marketing: Steven M. Vito

Administrative Assistant: Carol Cochran

Eastern Advertising Director:
Arthur H. Kossack (312) 616-3341
Sales Assistant: Julie Barker
Western Advertising Director:
Jennifer L. Bartel (214) 701-8496
Sales Assistant: Susan Vernon

NEW ENGLAND
ME, NH, VT, MA, RI, CT, ONTARIO, CANADA, & EASTERN CANADA
Daniel D. Savage (617) 262-1160

EAST COAST
NY, NYC, NJ, DE, PA
Kim Norris (212) 512-2645

SOUTHEAST
NC, SC, GA, FL, AL, TN, VA, MS, AR, LA, DC, MD, WV, KY
John Schilin (404) 843-4782

MIDWEST
IL, MO, KS, IA, ND, SD, MN, WI, NE, IN, MI, OH
Kurt Kelley (312) 616-3326

SOUTHWEST, ROCKY MOUNTAIN
CO, OK, TX
Alison Keenan (214) 701-8496

SOUTH PACIFIC
SOUTHERN CA, AZ, NM, LAS VEGAS, UT
Ron Cordek (714) 557-6292
Andrew B. Uphoff (714) 557-6292

NORTH PACIFIC
HI, WA, OR, ID, MT, NORTHERN CA, WY, NORTHERN NV, WESTERN CANADA
Bill McAfee (408) 679-0371
Roy J. Kops (415) 362-4600
Leslie Hupp (415) 362-4600

OUTSERTS
Scott Gagnon (603) 924-2651

INSIDE SALES
Director: Liz Coyman
Administrative Assistant: Susan Boyd

NATIONAL SALES
Mary Ann Goulding (603) 924-2664
Patricia Payne (603) 924-2654
Jon Sawyer (603) 924-2665

BYTE BITS (2x3)
Mark Stone (603) 924-6830

THE BUYER'S MART (1x2)
Brian Higgins (603) 924-3754

REGIONAL ADVERTISING SECTIONS
James Bail (603) 924-2533
Barry Echavarria (603) 924-2574
Larry Levine (603) 924-2637

BYTE POSTCARD DECK MAILINGS
BYTE DECK
Ed Ware (603) 924-6166
COMPUTING FOR ENGINEERS DECK
Ellen Perham (603) 924-2598

INTERNATIONAL ADVERTISING SALES STAFF
See listing on page 349.

EDITORIAL AND BUSINESS OFFICE:
One Phoenix Mill Lane, Peterborough, NH 03458, (603) 924-9281.
West Coast Branch Offices: 425 Battery St., San Francisco, CA 94111, (415) 954-9718; 3001 Red Hill Ave., Building #1, Suite 222, Costa Mesa, CA 92626, (714) 557-6292.
New York Branch Editorial Office: 1221 Avenue of the Americas, New York, NY 10020, (212) 512-3175.
BYTEnet: (617) 861-9764 (set modem at 8-1-N or 7-1-E; 300 or 1200 baud).
Editorial Fax: (603) 924-2550. **Advertising Fax:** (603) 924-7507.
SUBSCRIPTION CUSTOMER SERVICE: Outside U.S. (609) 426-7676; inside U.S. (800) 232-BYTE. For a new subscription—(800) 257-9402 U.S. only, or write to BYTE Subscription Dept., P.O. Box 850, Peterborough, NH 03458-0850. Subscriptions are $29.95 for one year, $54.95 for two years, and $74.95 for three years in the U.S. and its possessions. In Canada and Mexico, $34.95 for one year, $64.95 for two years, $87.95 for three years. £49 for one-year air delivery to Europe. $75 for one-year air delivery to Europe. $50 for fast surface delivery to Europe. Y28,800 for one-year air delivery to Japan, Y14,400 for one-year surface delivery to Japan, $50 surface delivery elsewhere. Air delivery to selected areas at additional rates upon request. Single copy price is $3.50 in the U.S. and its possessions, $4.50 in Canada, $4.50 in Europe, and $5 elsewhere. Foreign subscriptions and sales should be remitted in U.S. funds drawn on a U.S. bank. Please allow six to eight weeks for delivery of first issue.

EDITORIAL CORRESPONDENCE:
Address editorial correspondence to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Unacceptable manuscripts will be returned if accompanied by sufficient postage. Not responsible for lost manuscripts or photos. Opinions expressed by the authors are not necessarily those of BYTE.

PHOTOCOPY PERMISSION:
Where necessary, permission is granted by the copyright owner for those registered with the Copyright Clearance Center (CCC), 27 Congress St., Salem, MA 01970, to photocopy any article herein for personal or internal reference use only for the flat fee of $1.50 per copy of the article or any part thereof. Correspondence and payment should be sent directly to the CCC, 27 Congress St., Salem, MA 01970. Specify ISSN 0360-5280/90, $1.50. Copying done for other than personal or internal reference use without the permission of McGraw-Hill, Inc., is prohibited. Requests for special permission or bulk orders should be addressed to the publisher. BYTE is available in microform from University Microfilms International, 300 North Zeeb Rd., Dept. PR, Ann Arbor, MI 48106 or 18 Bedford Row, Dept. PR, London WC1R 4EJ, England.

OFFICERS OF MCGRAW-HILL, INC:
Joseph L. Dionne, Chairman, President and Chief Executive Officer; Robert N. Landes, Executive Vice President, General Counsel and Secretary; Walter D. Serwatka, Executive Vice President; Frank D. Penglase, Senior Vice President, Treasury Operations; Robert J. Bahash, Executive Vice President and Chief Financial Officer; Thomas J. Sullivan, Executive Vice President, Administration; Mary A. Cooper, Senior Vice President, Corporate Affairs, and Executive Assistant to the Chairman; Ralph R. Schulz, Senior Vice President, Editorial.

Founder: James H. McGraw (1860–1948).

Copyright © 1990 by McGraw-Hill, Inc. All rights reserved. BYTE and BYTE are registered trademarks of McGraw-Hill, Inc. Trademark registered in the United States Patent and Trademark Office.

Member
Audit Bureau of Circulation

BIX BYTE INFORMATION EXCHANGE

DIRECTOR
Stephen M. Laliberte

MANAGING EDITOR
Tony Lockwood

MICROBYTES DAILY
Coordinator: D. Barker *Peterborough*, Rich Malloy *New York*, Nicholas Baran *San Francisco*, Jeffrey Bertolucci *San Francisco*, Laurence H. Loeb *Wallingford, CT*, Stan Miastkowski *Peterborough*, Wayne Rash Jr. *Washington, DC*, David Reed *Lexington, KY*, Andrew Reinhardt *New York*, Jan Ziff *Washington, DC*

EXCHANGE EDITORS
Macintosh Exchange: Laurence H. Loeb, *IBM Exchange:* Barry Nance, *User Group Exchange:* David Reed, *Interactive Game Exchange:* Myrrh Mist, *Amiga Exchange:* Joanne Dow, *Writers Exchange:* Wayne Rash Jr., *Tojerry Exchange:* Jerry Pournelle, *Telecommunications Exchange:* Stephen Satchell

BUSINESS AND MARKETING
Secretary: Patricia Bausum, *Marketing Services Coordinator:* Denise A. Greene, *Billing Services Coordinator:* Tammy Burgess, *Editorial Assistant:* Brian Warnock

TECHNOLOGY
Programmer/Analyst: John Spadafora, *Programmer:* Peter Mancini, *Systems Consultant:* Gary Kendall

World Radio History

Engineered for the office. Designed for people.

The Panasonic® PostScript printer presents word publishing. And spreadsheet publishing.

And just-about-everything-you-want-to-publish publishing.

	Standard
Speed	11 Pages Per Minute
Interfaces	RS-232C/422 Serial, Centronics Parallel, and Appletalk
Fonts	39 Adobe PostScript Fonts
Cassettes	2 250-Sheet Letter-size
Ram	2 Megabytes
Emulation	HP LaserJet* Series II Diablo* 630

Specifications are subject to change without notice. This product may be subject to export control regulations.

Introducing the Panasonic KX-P4455 Laser Partner with Adobe* PostScript.*

It will bring a polished, professional look to everything you print. A new persuasiveness to all your communications.

Now you can enhance every proposal, every report, every memo with multiple fonts, varied type sizes, even graphics rotated and scaled to fit. All at up to 11 pages per minute, and with superb print quality.

You get all the features you need to get the most out of PostScript... standard. Features like dual-bin paper cassettes, and interfaces for MS-DOS,* UNIX* and Appletalk,* standard.

In fact, you'll find this a surprisingly affordable way to make a little publishing history of your own. For more information, and details on how to get up to $475.00 worth of free Adobe typefaces, call toll-free **1-800-742-8086,** extension 190.

Printers, Peripherals, Computers, Copiers, Typewriters and Facsimiles

Panasonic
Office Automation OA

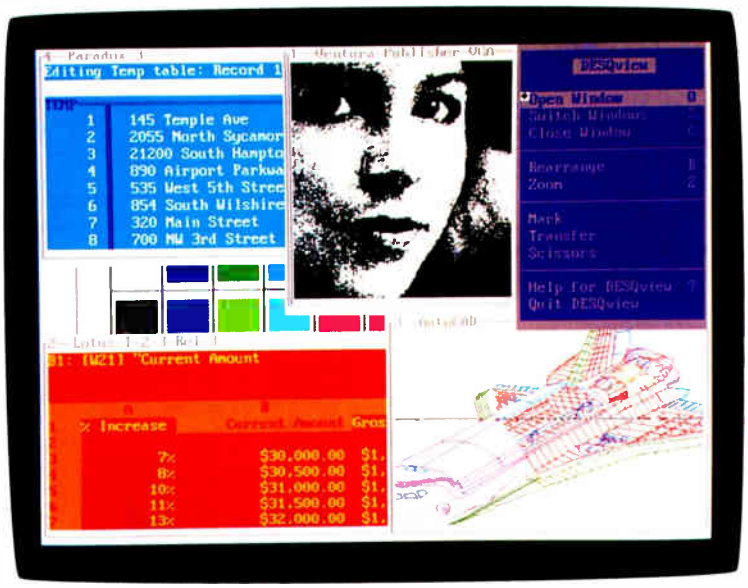
*PostScript, LaserJet, UNIX, Macintosh and Appletalk, MS-DOS and Diablo are registered trademarks of Adobe Systems Inc., Hewlett-Packard Inc., AT&T, Apple Computer Inc., Microsoft Corp., and Xerox Corp., respectively.

LPS-BY

Circle 196 on Reader Service Card

World Radio History

Multitasking



DESQview lets you run all these programs in multiple windows and multitask them—all without major modifications to the computer you own now. And without replacing or even upgrading your favorite programs.

Aren't you glad Windows and OS/2™ aren't the only way to multitask and window on the PC.

It's all very well to look at screen after screen of colorful graphics and new programs. But the brutal truth is that these environments require extensive, expensive hardware upgrades for 80% of PC users. Not to mention new or upgraded software.

It all adds up to $1,200 to $2,500 per PC—and that's for the hardware and software alone. To say nothing about a major investment in the time it will take to learn new ways of working.

If all you want is enhanced productivity from your PC, that's too high a price to pay.

DESQview does it all. For less.

DESQview runs the programs you know and love in multiple windows, multitasks them and even lets you choose whether or not to use a mouse. And it does it all today. In fact, DESQview's been doing it for over four years now.

People all over the world are using DESQview to manage customized work environments like those shown here. They are using it to cut and paste data between programs running in multiple windows, running sorts and recalculations in the background, and they're operating in text and graphics modes in windows side-by-side.

With no drama, no fireworks and no huge memory or disk space requirements.

In fact, DESQview runs on 80386, 80286 and even 8086 and 8088 PCs. Its low memory overhead means you don't have to buy a faster computer to compensate for the demands of a complex, memory-hungry 'graphical' operating system.

And DESQview builds on and extends DOS—the most robust, stable operating system available for your computer.

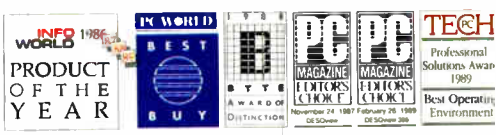
Plus, you don't give up any flexibility in choosing programs. Not only does DESQview run virtually all DOS programs, it runs most Windows programs as well.

No wonder major corporations all over the world have chosen to standardize on DESQview.

Introducing DESQview 2.26. More productive because it multitasks more programs.

The latest generation of DOS programs is getting better. Lotus 1-2-3 v2.2 and Release 3, Metro, Freelance, Microsoft Word, AutoCAD 386, Ventura Publisher Professional—all are smarter about using memory. And DESQview 2.26 makes them work even better.

Mice are steadily becoming more popular, and v2.26 provides improved support for mouse menus within windows. At the same time, for those who just aren't comfortable with mice, it also provides much greater flexibility for assigning and reassigning special keys within windows.



Some of DESQview's recent awards.

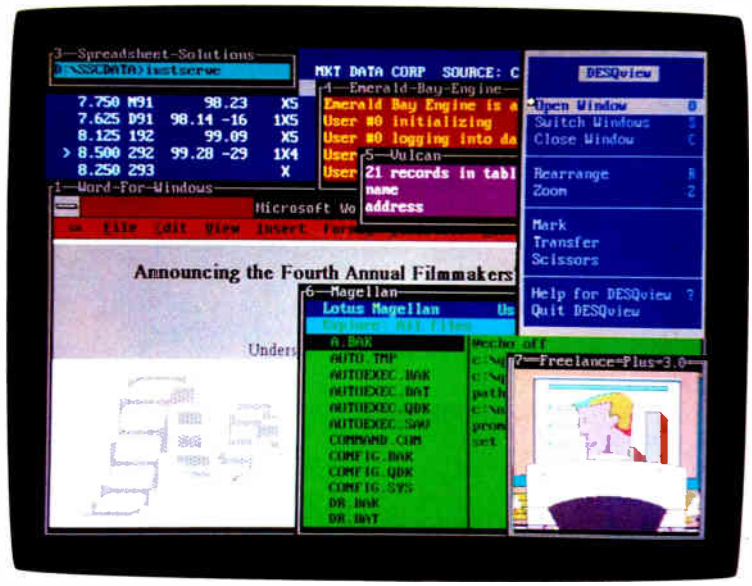
Our users asked for more support for 3270 and other terminal emulation. DESQview v2.26 has it.

You asked for support for a wider range of hardware: CD-ROM, scanners, comm ports, etc., v2.26 has it.

And you asked for help in handling troublesome TSRs. DESQview helps straighten them out.

World Radio History

without tears



The vast majority of programs run in DESQview—even Windows 2.0 programs! And some programs take special advantage of DESQview to enhance their operation. FNN NewsReal and products using Spreadsheet Solutions' @DV 'Hot Links', for example, use windowing, multitasking and interprogram communications.

Quarterdeck's family of products is designed to enhance the way you work.

At Quarterdeck, our philosophy has always been to increase your productivity in logical, economical steps—not to reinvent a system that works for you.

Our best known product, DESQview, has over a million users.

And hundreds of thousands of people use our QEMM, the expanded memory manager for users of 80386 PCs and IBM PS/2™ models 50 and 60 that makes it easy for your programs to break the 640K memory barrier.

Our newest products, Quarterdeck Manifest and QRAM help you understand and optimize the critical first megabyte of your PC's memory.

Manifest does for memory what PC Tools Deluxe does for disks. It guides you 'under the hood' of your PC, showing how your memory is being used; even which parts of RAM are faster. You'll see where TSRs, utilities, drivers and buffers work, and find all the pockets of idle memory. QRAM is our memory optimizing utility to let you move utilities, drivers and TSRs out of 'lower' memory and into idle memory locations 'up high,' giving your programs as much as 130K more elbow room. QRAM makes it easy to optimize your memory. Even if you've never used anything but 1-2-3 before.

Quarterdeck products help you get the most from the software and hardware you own today.

To find out more about our family of productivity enhancement products, return the coupon below with the appropriate boxes checked. Or see your authorized Quarterdeck dealer.

Quarterdeck

Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405 (213) 392-9851 Fax: (213) 399-3802

DESQview System Requirements: IBM Personal Computer and 100% compatibles (with 8086, 8088, 80286, or 80386 processors) with monochrome or color display; IBM Personal System/2 • Memory: 640K recommended; for DESQview itself 0-145K • Expanded Memory (Optional): expanded memory boards compatible with the Intel AboveBoard; enhanced expanded memory boards compatible with the AST RAMpage; EMS 4.0 expanded memory boards • Disk: two diskette drives or one diskette drive and a hard disk • Graphics Card (Optional): Hercules, IBM Color/Graphics (CGA). IBM Enhanced Graphics (EGA), IBM PS/2 Advanced Graphics (VGA) • Mouse (Optional): Mouse Systems, Microsoft and compatibles • Modem for Auto-Dialer (Optional): Hayes or compatible • Operating System: PC-DOS 2.0-4.0; MS-DOS 2.0-3.3 • Software: Most PC-DOS and MS-DOS application programs; programs specific to Microsoft Windows 1.03-2.1, GEM 1.1-3.0, IBM TopView 1.1 • Media: DESQview 2.0 is available on either 5-1/4" or 3-1/2" floppy diskette.

Trademarks are property of their respective holders: IBM, OS/2, PS/2, Interleaf, TopView, Lotus, 1-2-3, Metro, Freelance, AutoCAD, Ventura Professional Publisher, PC Tools Deluxe, Intel, Above Board, AST, RAMpage, Hercules, Mouse Systems, Hayes, Microsoft Windows, Microsoft Word, GEM, FNN NewsReal, Spreadsheet Solutions.

YES! I need increased productivity now!

Qty	Product	√ Send Info	5-1/4	3-1/2	Price Each	Totals
	DESQview 386 v2.26 Multitasking windowing environment	☐			$219.95	
	DESQview v2.26 Multitasking windowing environment	☐			$129.95	
	QEMM-386 version 5.0	☐	☐		$99.95	
	QEMM-50/60 version 5.0	☐	☐		$99.95	
	QRAM with Manifest	☐	☐		$79.95	
	Quarterdeck Manifest	☐			$59.95	

Payment ☐ Visa ☐ MasterCard Expires ____/____ Shipping & Handling $5 in USA / $10 outside USA

Acct # _____ California Residents add 6.75%

Name _____ Title _____ Grand Total

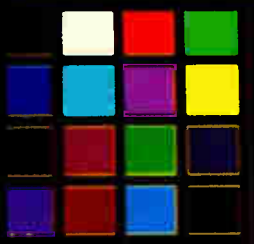
Address _____

City _____ State _____ Zip _____

Circle 238 on Reader Service Card

World Radio History

THE MODGRAPH GX-2386 ULTRA VGA PORTABLES



- 386/33 MHz Power
- 1024x768 Resolution
- 256 Colors
- 3 16-Bit Expansion Slots
- Up to 8 MBytes of RAM

The Modgraph GX-2386 PCs are the only 1024 × 768 resolution, 256 color Ultra VGA portables available today. Powered by an 80386 processor, running at 33 MHz, the GX-2386 PCs are no-compromise portables.

Both GX-2386 color and monochrome models come equipped with 3 16-bit expansion slots,

GX-2386 MONOCHROME

GX-2386 COLOR

internal hard disk drives up to 100 MBytes, and built-in 5.25″ 1.2 MByte and 3.5″ 1.44 MByte diskette drives. Also offered are external monitor outputs, 1 parallel and 2 serial ports, a choice of 8.5″ Sony color or 9″ monochrome flat CRT and optional 80387 math and WEITEK 3167 coprocessors.

All the power and features of a high-resolution, high-powered desktop PC are built into these true portables. No other portable offers this combination of power, resolution, and expandability, built into an attractive package at a very attractive price.

Call toll-free: 1-800-327-9962 for further information.

Dealer/Distributor
VAR/OEM
inquiries invited

Modgraph

149 Middlesex Turnpike
Burlington, MA 01803
(800) 327-9962 (617) 229-4800

World Radio History

MICROBYTES

Research news and industry developments shaping the world of desktop computing

Edited by D. Barker

Microsoft Puts New Spin on Windows, OS/2

Remember when OS/2 was going to kick DOS right off the desktop—sometime during the early 1990s? Well, that tune has been changing lately, particularly with the interest given Windows 3.0, and even Microsoft isn't singing it anymore.

In a recent interview with BYTE, Microsoft's Steve Ballmer, vice president of systems software, said that the company is "trying to kick off a new perception of OS/2." He christened OS/2 with a new nickname: Windows Plus. That designation is a far cry from what we used to hear, which was, in effect, that Windows was "OS/2 Minus."

The new OS/2 and the new Windows will have the same user interface, Ballmer said, but OS/2 will have better security features, better memory protection, and the ability to function as a LAN peer rather than just a client.

What Ballmer and other Microsoft officials have been suggesting is that Microsoft (and, presumably, IBM) is increasingly viewing Windows as the primary graphical environment for individual PC clients, while OS/2, running at the server level, will provide a more robust superset of Windows' capabilities for large networked applications. Applications software houses are adopting this approach, too, with even holdout Lotus Development committing to a Windows-compatible 1-2-3.

This change can be traced to two new capabilities for OS/2 that were officially announced recently. Microsoft said that at some point in the future, perhaps late this year, OS/2 will be able to run Windows programs directly. In other words, you won't have to run Windows applications under OS/2's DOS compatibility box. With this capability, any Windows application would be able to run directly under OS/2 just like a regular OS/2 program. In practice, OS/2's new capabilities would mean that Windows applications could swap data with other Windows or Presentation Manager (PM) applications through OS/2 Dynamic Data Exchange channels or the clipboard, thus eliminating migration penalties between the operating systems for end users and facilitating networked applications involving programs written for both environments.

Microsoft says that this capability will be available in a future edition of OS/2 version 2. Ballmer says that it could appear in the version that will show up by the end of this year, but the company does not want to commit to that date.

The second and related capability is a new Software Migration Kit that could greatly simplify for developers the task of porting Windows applications to OS/2. Using a concept similar to Micrografx's Mirrors—in fact, parts of the technology, though not the code itself, were licensed from Micrografx—this kit provides a set of libraries that developers can link into Windows applications to map their Windows calls into PM calls. Microsoft hopes that using this kit will slow performance down by no more than 10 percent.

Some industry observers have complained that Microsoft has failed to differentiate Windows from OS/2 in a manner understandable to users. Ballmer's comments changed that situation in an unexpected way: For the first time, instead of hearing OS/2 touted as an end-user operating system (which, of course, it can still be) or that the user's CPU and memory configuration should determine which operating system to install, Microsoft appears to be easing into a client/server model at the operating-system level. Software companies that develop DOS applications are adopting that approach, too.

This positioning will help OS/2-based LAN Manager and SQL Server, but the biggest beneficiary will be the corporate computer manager with an installed base of hundreds or thousands of 286-based machines: Now, the pressure to convert from DOS to OS/2 on every desktop has lessened considerably.

—Rich Malloy

continued

NANOBYTES

Now that the legendary **new Windows** has arrived, where is it going next? Some people at **Microsoft** hope to **squeeze it into ROM** and have computer makers pop the chips onto their motherboards. The company has put DOS into ROM (and Digital Research has done the same with DR DOS). There's "no magic" involved in getting the graphical environment into ROM, according to Rich Abel, Microsoft's group project manager for Windows. But considering the amount of RAM that Windows 3.0 requires, somebody might want to put in a call to Blackstone.

Not every big software company is doing the omniplatform thing. **Borland** president **Philippe Kahn** says that the company will develop languages and applications for DOS, Windows, and OS/2 but has **no plans to design new Macintosh or Unix packages**. The company wants to write software that is used by people, not by other machines, he says. "Our goal at Borland is to deal on the client side [of the client/server model]: user tools and development tools."

Smallness has been such a theme in Microsoft CEO **Bill Gates**'s public comments lately that you'd never know he heads a software company that's anything but small. Gates told some users group representatives during a late-night session that he was unimpressed by a competitor's boast in an advertisement that it has 35 programmers working on a product. "**It takes a small team** to do it right," Gates said. "When we started Excel, we had five people working on it, including myself. We have seven people working on it today, and at the maximum we had 15 people working on the program. There's too much that needs to work together to have so many people spread out on a program."

World Radio History

NANOBYTES

ICI ImageData, a British company that makes the substrate used in floppy disks, is working on a new type of optical media. ICI's 4-mm **LaserTape**, based on a technology developed jointly by Sony and Hitachi, uses a technique called *holographic tag recording* to put 1 trillion bytes of data in a single package just slightly bigger than a digital audio tape cartridge. A company official said that the compatible drives will be able to access any piece of data in an average of 28 seconds.

Computer users have been **hesitant to accept optical storage** devices because they represent a "totally new market," says Jim Jones, Hewlett-Packard marketing development manager for optical drives. "One percent of the world's data is stored on disk, 2 percent on tape, 5 percent on microfiche, and 95 percent on paper only," Jones says. It's that 95 percent that represents a "new opportunity," he says.

Peripheral Land (Fremont, CA) has designed a Macintosh RAM drive with its own 68020 processor acting as the disk drive controller. It runs about 500 times faster than a normal hard disk drive, allowing up to **1000 disk accesses per second** and 6-MBps data transfers, PLI says. But be prepared to dig deep into your pockets: An 8-MB RAM drive costs $6995; a 108-MB version costs $60,000. But for a network server where speed is critical, for example, this RAM drive could be cost-effective.

The new version (3.1) of Timbuktu from **Farallon Computing** (Emeryville, CA) lets a user at one Macintosh observe and control multiple Macs on a network simultaneously. This capability is actually a **form of groupware**. Using Timbuktu, multiple users can work on a document at the same time. Timbuktu also allows voice communications over the same phone line as the PhoneNet network. Farallon's Tom Reilly said the company's ambition is to fully integrate voice mail and E-mail over networks.

Motorola's I/O-Driven Media Processor Built to Handle Color Graphics, Stereo Sound

If industry evangelists are right that images and sound will be a big part of computing, systems are going to need more power than what they have in their general-purpose CPUs. Motorola thinks it has the answer with its new 96002 FPU, a 32-bit chip designed to handle the furious calculations and frenzied data shuttling involved in generating colorful graphics and stereo sound. The new processor "is not so much a CPU as a chip to deal with real-time, continuous I/O," said Garth Hillman, applications manager for Motorola's digital signal processor operations (Austin, TX).

The 96002 is a successor to Motorola's 24-bit 56001 DSP (used in the NeXT Computer), but the designers have built in an FPU (conforming to the IEEE-754 standard) to deal with the calculations required by three-dimensional graphics and algorithms for realistic imaging. At the core of the 750,000-transistor chip are four devices: an ALU; a program-control unit; a dual-channel DMA controller, which can work on two data transfer tasks at the same time; and an address-generation unit.

These execution units and the 96002's six on-chip memories (three ROMs, three RAMs) are connected by eight 32-bit buses (five data, three address), with a bandwidth of 266 million bytes per second, Motorola says. With all these execution units, memories, and high-speed buses, Hillman said, the chip can process 10 operations in one instruction cycle.

Motorola has designed the 96002 to work as an "attached processor," Hillman said. It's meant to handle all the chores related to media processing instead of the host CPU (e.g., a 680x0 or 80x86). The chip has two 32-bit ports on opposing sides, by which the processor can directly send and receive commands to and from other processors. Using these two ports, a designer could string multiple 96002s in linear arrays or in symmetrical blocks, Hillman explained.

Because the chip can appear to generate images and sound simultaneously, Motorola says, it will be perfect for multimedia computing machines. However, the 96002 could also find a place in graphics engines, scientific imaging systems, color laser printers, and communications devices.

Motorola says that computers and boards using the new "Media Engine" will arrive later this year. The first company to introduce a 96002 product is Ariel (Highland Park, NJ), which offers an add-in board called the MM-96 for AT compatibles.

Motorola has started offering samples of the 96002. The first version has a clock speed of 33 MHz; a 40-MHz model is in the works. The price for a 33-MHz model is $750. Motorola says that price will tumble; Collins pointed out that the 56000 DSP came out in 1987 at $500 and now sells for $56.

Until now, building a system that can manipulate realistic graphics and CD-quality audio required multiple chips dedicated to those different media. Motorola has developed one device that can handle the billions of computations involved in audiovisual operations. The 96002's dual-bus approach represents "where DSP is going to head," said Ariel president Anthony Agnello. "People who write algorithms are insatiable for power."

—D. Barker

Mac Developers Finally See System 7.0

Apple Computer promised to deliver System 7.0, its major revision of the Mac OS, during the summer of 1990. But the winter of 1991 is a more accurate projection. Apple finally distributed an alpha version with the System 7.0 development kit, on CD-ROM, to independent developers in May. Apparently realizing that software designers can make or break the new Mac OS, Apple officials used the Worldwide Developers Conference to convince them that System 7.0 will be worth their investment.

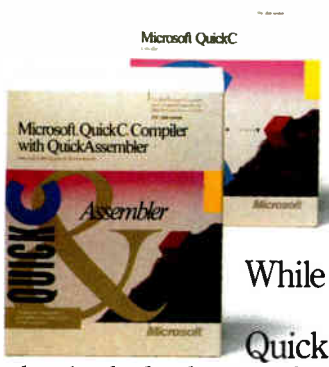
In addition to a totally revamped Finder shell (which, among other things, will actually find a file based on user-supplied search criteria), the new system software will support an interapplication communication (IAC) protocol. IAC will allow implementation of a publish/subscribe mechanism

continued

World Radio History

It takes less to crack C and Assembler than you'd think.

With new Microsoft® QuickC® and QuickC with QuickAssembler,™ mastering the hard-core stuff is so easy it's almost criminal. You see, the Quick environment includes what we call the QuickAdvisor, an interactive, hypertext manual that furnishes answers on demand. As in on-line. While you're programming.



QuickC Compiler and QuickC with QuickAssembler also include the new language features found in the Microsoft C 6.0 Professional Development System. So you'll find yourself in quite a powerful position. And, at the same time, you'll be assured of upward compatibility with both of these products' professional counterparts.

Which means there's no need to trash any of your existing code.

Plus, with the QuickC with QuickAssembler Development System, C and Assembler are totally integrated. Ensuring easy access to the features you need to develop powerful applications.

To find out how easy it is to tap C and Assembler or to upgrade, call (800) 541-1261, Dept. L91. You'll find we offer the right combination.

Microsoft
Making it all make sense™

Customers inside the 50 United States, call (800) 541-1261, Dept. L91. In Canada, call (416) 673-7638. Outside the U.S. and Canada, call (206) 882-8661. *© 1990 Microsoft Corporation. All rights reserved. Microsoft, the Microsoft logo and QuickC are registered trademarks and* Making it all make sense *and QuickAssembler are trademarks of Microsoft Corporation.*

World Radio History

IN THE HIGH STAKES GAME IT'S NICE TO KNOW WHEN

Being in the market for a new computer system is like being a spectator at a high stakes poker game. You're trying to pick the winner from the manufacturers gathered 'round the table. They're all betting as if they held five aces. So how do you tell who's bluffin' and who's got the winning hand?

Take a look at Gateway 2000's cards.

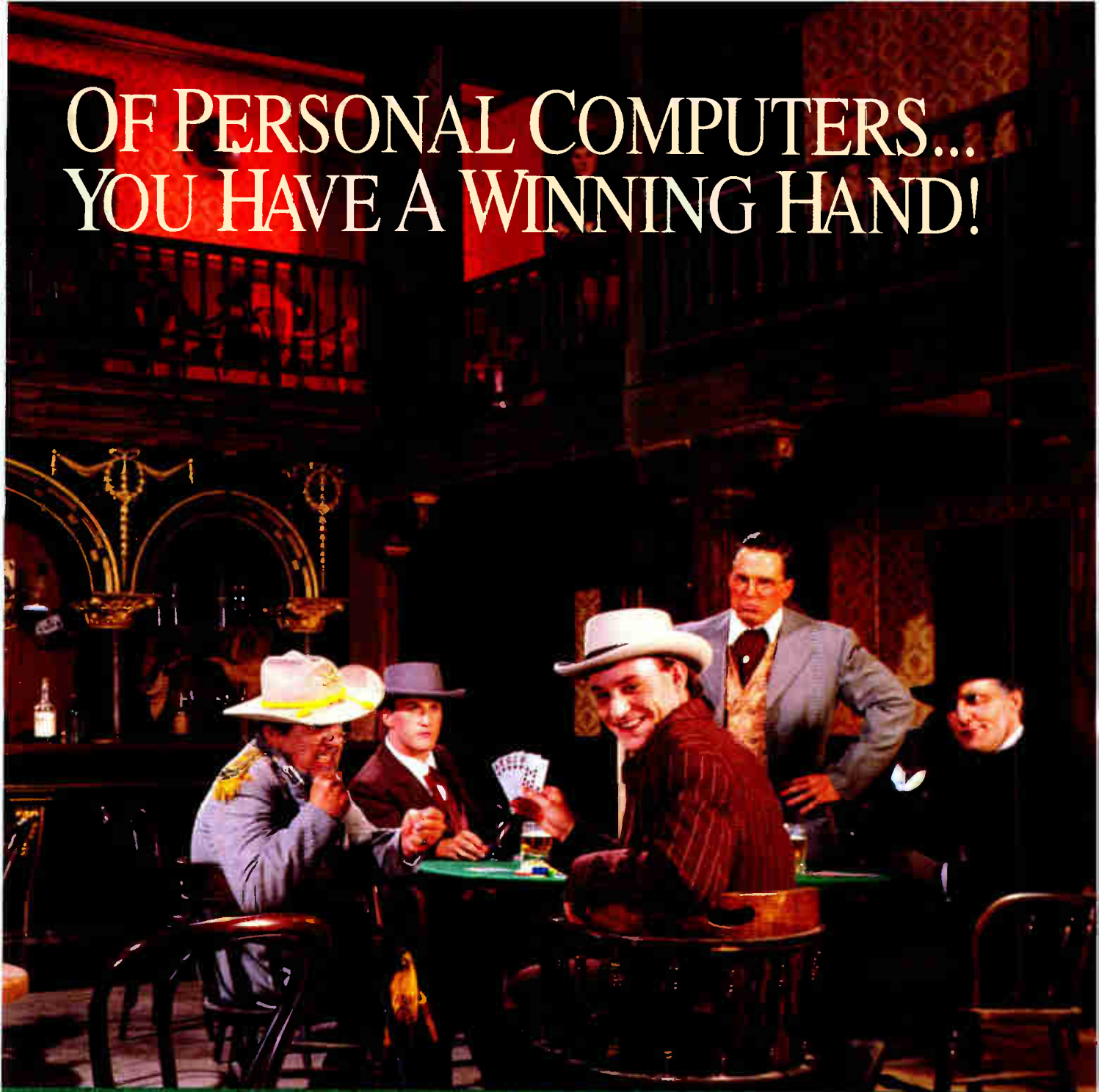
Our royal flush consists of five fully-loaded, high-performance machines (plus a 12 MHZ 286 that wouldn't fit in our hand) at better prices than the competition's stripped-down models.

Then compare Gateway 2000's standard features and services: ♦ Two diskette drives, a 5.25" 1.2 Meg floppy and a 3.5" 1.44 Meg diskette drive. are standard ♦

Due to the volatility of the DRAM market. all prices subject to change

World Radio History

OF PERSONAL COMPUTERS... YOU HAVE A WINNING HAND!



High capacity/high speed hard disk drives and controllers are standard ♦ Two Megs RAM on 286 and 386SX systems, 4 Megs RAM on 386 and 486 machines are standard ♦ 1024 x 768 VGA Color Monitor is standard ♦ All systems can be custom configured to your specifications ♦ 30-day money-back guarantee ♦ One-year warranty on parts and labor ♦ Toll-free technical support for the life of your machine ♦ Free Federal Express shipment of replacement parts ♦ Bulletin board support ♦ Free on-site service to most locations in the country.

For price, quality and service, Gateway 2000 has an unbeatable combination.

Call Gateway 2000 and you're the winner. No bluffin'!

GATEWAY 2000

"You've got a friend in the business."

8 0 0 - 5 2 3 - 2 0 0 0

610 Gateway Drive • North Sioux City, South Dakota 57049 • Telephone 605-232-2000 • Fax 605-232-2023

World Radio History

NANOBYTES

Rembrandt, who was sometimes too broke to buy new brushes, would have liked these guys. **Delta Tao Software** (Sunnyvale, CA) has come up with a 24-bit **color painting program** for the Macintosh that **costs only $99**. **Color MacCheese** offers full-color picture manipulation, regardless of screen depth; waterpaint-like blends and wash effects, like some of the higher-priced art packages; antialiasing on objects, so that their edges look less jagged (this feature requires 32-Bit QuickDraw); full support of color printing through Apple's LaserWriter 6.0 driver; and a help window that displays explanations of the tool icons or menu selections when you put the pointer near them. As for the name, a Delta Tao official said that the people there wanted to develop a "cheesy little color paint program."

Apple Computer recently lowered the price of its Macintosh Portable by $1000. A model with one floppy disk drive and 1 MB of memory retails for $4799; with a 40-MB hard disk drive, it costs $5499. According to marketing manager Dave Rothschild, the price cuts are Apple's response to new products designed to compete in the Mac "laptop" market, including the Outbound Laptop System from Outbound (formerly Wallaby), the Road E Kit from Macadam Computers, and the Stealth Laptop from Colby Systems. Response to the cut was generally determined by religious affiliation: Mac users said it was a good move, and users of IBM-type systems said it was still too expensive.

Advanced Micro Devices (Sunnyvale, CA) and **Vitesse Semiconductor** (Camarillo, CA) are working together on **high-speed circuits** for data communications. The gallium-arsenide chips will be part of "gigabit-speed connections between computers," an AMD official said. The initial joint product will be chips for electronic interfaces to optical systems, the companies said.

that can, for example, update information within an existing document when information changes on another linked document. The ability to use and recognize IAC events will be the hallmark of System 7.0 applications but will certainly require developers to rewrite their existing applications.

Some of the anticipated features of System 7.0 are not yet being released to developers; one of these is the AppleScript language, intended to allow users to customize their environment at a fairly high level. And a few features promised at last year's developers conference will not appear in System 7.0, including asynchronous SCSI protocols (perhaps Apple is waiting for the final implementation of SCSI-2) and the new Print Architecture. Apple personnel said that there wasn't time to implement these functions. "We had to decide what was of the most importance," one said.

Although Apple states that System 7.0 will run on any Mac with 2 MB of RAM and a hard disk drive, quick tests of the alpha version showed it to be unacceptably slow on any machine other than a Mac II. Apple could fix this speed problem before issuing the final software, however.

The question for developers then becomes whether or not it will be worth their time and money to revise their programs. Apple is trying hard to get them motivated, if not intimidated; one company official even said that "if you don't go the System 7.0 route, you'll be out of the Mac software business in a few years." Developers at the conference were generally positive, if somewhat confused.

Regardless of how many Mac software companies migrate to System 7.0, compatible programs will be delayed, because developers can't really get started until they have a beta version of the operating system to work with. Delays could be further extended because System 7.0 is very complex, involving memory management of multiple tasks and interprocess communications (IPC). One veteran Mac programmer, Yung Harvill, said he fears that users will be reluctant to upgrade to System 7.0 until their favorite applications run smoothly under it.

Many existing Macintosh software products will not be compatible with System 7.0, said Harvill, who developed Paracomp's Swivel 3D program and also worked on VPL Research's DataGlove. "A lot of older products fiddled with the high memory bits," he said, "and those won't run on System 7.0." Macintosh software vendors will have to establish "more formal relationships" with each other, Harvill said, since interprocess communications will require integration of programs from different vendors.

Nevertheless, Harvill said he looks forward to System 7.0. "The virtual memory and IPC features will really help us," he said.

— Nick Baran and Larry Loeb

Standard Would Enable Expert Systems to Exchange Knowledge from Different Sources

Major high-technology vendors and users have banded together to formulate an open software standard for expert systems. The standard, which they expect will be used in new expert systems later this year, is designed to facilitate interoperability among knowledge-based programs that run on different hardware and operating-system platforms.

The Initiative for Managing Knowledge Assets was founded by DEC, Texas Instruments, Carnegie Group, Ford Motor Company, and US West. IMKA has just begun to develop the code that it says will be used to write a new generation of expert-system software.

Those new expert systems are expected to run on many major operating systems, including Unix, OS/2, and VAX/VMS, and on all types of machines, from mainframes to personal computers. The programs will not run on DOS-based machines, however.

The new software will allow expert systems residing in many facilities and on different computers to access and analyze data residing anywhere else in the organization, said David Fawcett, manager of expert systems at Ford. For example, Fawcett said, a design engineer using a CAD/CAM workstation equipped with an expert system based on the new standard will be able to import "knowledge" from a different type of computer located at a remote production facility, allowing the designer to access information on manufacturing specifications or even

continued

World Radio History

New FoxPro

Classic Beauty. Legendary Power. A Higher Standard in Relational Databases.

Introducing FoxPro. The *only* relational database management system that combines astonishing performance with a sleek interface of amazing power and beauty.

- FoxPro offers all the elegance and accessibility of a graphic-style interface, yet operates at the stunning speeds possible only with character interfaces.
- FoxPro is so easy to learn and use, even beginners can become productive immediately; yet it's powerful and sophisticated enough to satisfy the needs of the most demanding developers and power-users.
- FoxPro gives you choices instead of limits: use a mouse or a keyboard; type commands or use the object-oriented interface; run in one window, or hundreds.
- FoxPro is so efficient, it runs in a 512K PC-XT, yet it's able to take advantage of the speed, expanded memory and extended video modes of the most advanced machines available. You don't even need a graphics card or special windowing software.

Nothing is Faster

Fox Software products are famous for their unmatched execution speed. FoxPro extends that tradition.

FoxPro is up to eight times faster than dBASE IV—more than 15 times faster than dBASE III PLUS!

And that blazing speed translates into unprecedented power. Now you can efficiently process gigantic databases with hundreds of thousands—even *millions*—of records.

Protecting Your Investment

With FoxPro, your existing FoxBASE+ or dBASE III PLUS programs will run perfectly—first time, every time, no excuses. And FoxPro is language-compatible with dBASE IV.

But FoxPro doesn't stop there. It has over 140 language enhancements not found in any version of dBASE. We've outdone ourselves by adding more than 200 language extensions you won't find in FoxBASE+.

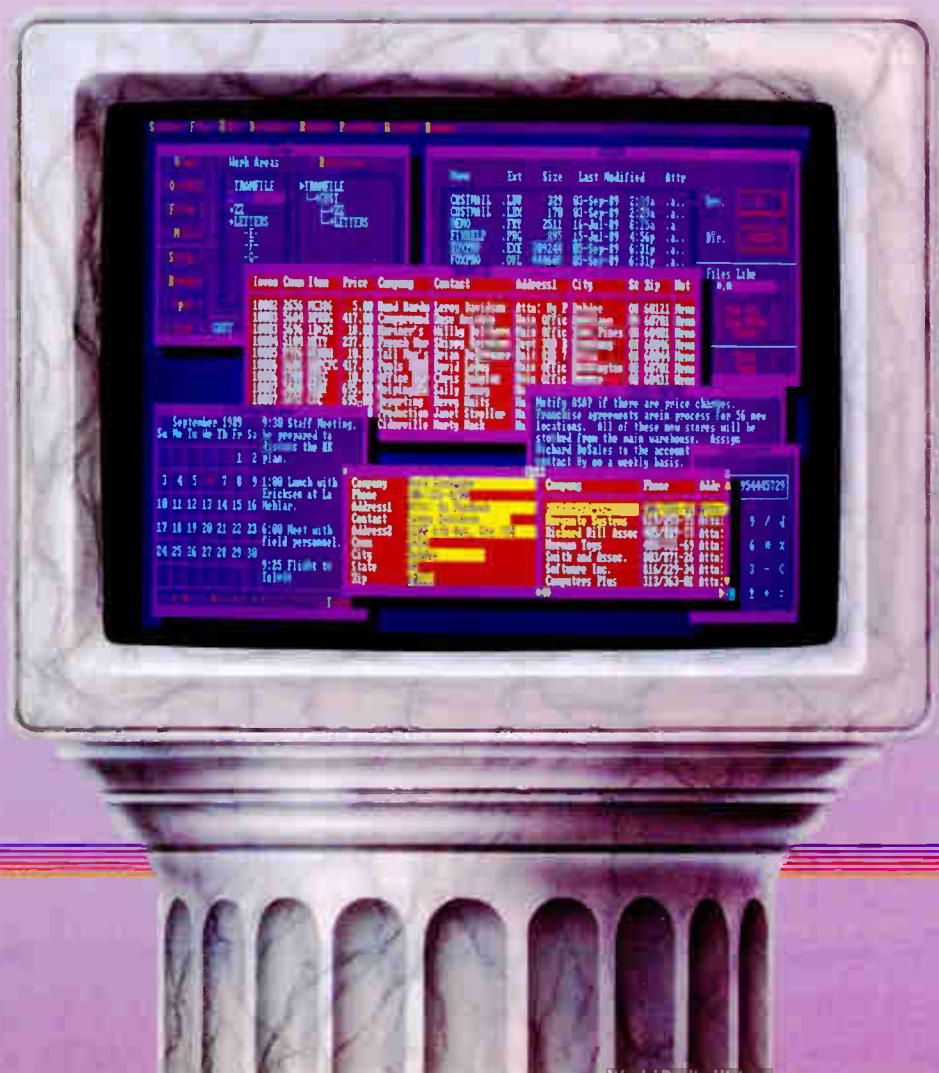
Best of all, FoxPro opens up whole new worlds for your applications by letting you move them onto a variety of different platforms.

The Tradition Continues

Fox Software is committed to excellence—our products prove it.

We've been producing superb database management software since 1983. And our products for both the PC and the Macintosh continue to win awards worldwide.

We've taken everything we know about software engineering, databases and interface design, and focused it into one remarkable product—FoxPro.



FREE Demo Disk

But don't just take our word for it. Try FoxPro for yourself, and see what the higher standard of database management can do for you.

Call (419) 874-0162 now to get your free demo disk. Or ask for the FoxPro dealer nearest you. One look, and we think you'll agree: *Nothing Runs Like The Fox.*

FoxBASE+ Users: Call About Our Liberal Upgrade Offer!

System Requirements: *FoxPro operates in 512K RAM (640K recommended) with MS/PC-DOS 2.0 or greater and an 8086/8088, 80286 or 80386 microprocessor. For optimum performance, FoxPro takes complete advantage of any available EMS (expanded memory) or a math coprocessor.*

Trademark/Owner: FoxPro, FoxBASE+/ Fox Software; dBASE III PLUS, dBASE IV/Ashton-Tate.

Fox Software

Nothing Runs Like The Fox.

Fox Software, Inc.
134 W. South Boundary
Perrysburg, Ohio 43551

(419) 874-0162
FAX: (419) 874-8678
Telex: 6503040827 FOX

Circle 107 on Reader Service Card

World Radio History

Smalltalk/V® PM. Think of it as a bold, "seat-of-the-pants" solution that cuts to the heart of the OS/2 Presentation Manager complexity challenge. Thus unlocking the potential of this powerful operating system.

With the introduction of Smalltalk/V PM, object-oriented programming moves out of the realm of mystery and into a new era of breakthrough applications that promises to be of legendary proportions.

Introducing Smalltalk/V PM. The to fulfill the promise of OS/2.

OS/2 PM is designed to push "user friendly" to a whole new level of sophistication. If you compare it to an orchestra, OS/2 has capabilities no ordinary assemblage of instruments has ever dreamed of possessing. Yet to tap its potential, OS/2 PM demands a conductor capable of true genius. That conductor is Smalltalk/V PM.

You'll find Smalltalk/V PM a perfect language for representing and manipulating high-level information. Because you go from designing to prototyping to delivering a completed application in one seamless step, you cleanly avoid the old costly "crash and burn" delays so common with languages born in the age of mainframes.

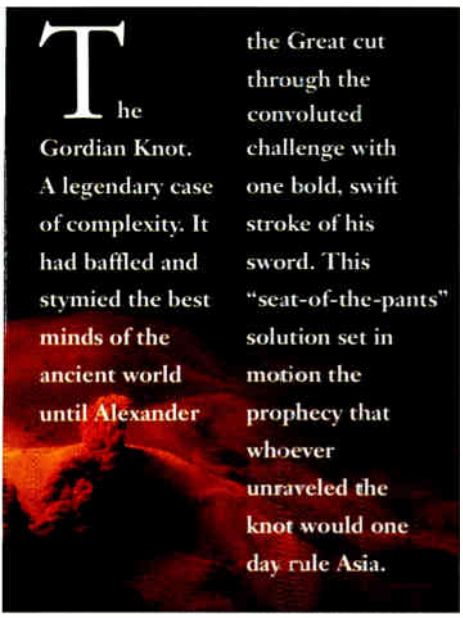
Is The Most Important Part Of Your Developer's Kit Missing?

OS/2 PM offers you a powerful, rich environment loaded with advantages like a Graphics Programming Interface (GPI), a LAN manager, multitasking, SQL, just for starters. And all of these components are accessible in a standard way using Smalltalk/V PM through Dynamic Link Libraries (DLLs). Combined with DDE (Dynamic Data Exchange), you can call and exchange data with other PM services or applications. Seamlessly. Now developers can write truly reusable components, which greatly increases their value. And you'll find Smalltalk/V PM the perfect "glue" between applications written in other languages.

UNLEASHING THE AWESOME POWER OF OS/2 PM

Smalltalk/V PM. It helps stop the natural drift toward vaporware so common in software development today. It lets you dive right in and get to the creative parts without the usual grunt work. For example, if you want to ignore the complexities of understanding OS/2 PM details you can immedi-

World Radio History



The Gordian Knot. A legendary case of complexity. It had baffled and stymied the best minds of the ancient world until Alexander the Great cut through the convoluted challenge with one bold, swift stroke of his sword. This "seat-of-the-pants" solution set in motion the prophecy that whoever unraveled the knot would one day rule Asia.

"THIS IS THE RIGHT WAY TO DEVELOP APPLICATIONS FOR OS/2 PM.
OS/2 PM is a tremendously rich environment, which makes it inherently complex. Smalltalk/V PM removes that complexity, and lets you concentrate on writing great programs. Smalltalk/V PM is the kind of powerful tool that will make OS/2 the successor to MS/DOS."

Bill Gates, Chairman
Microsoft Corp.

fast, seat-of-the-pants way

THE FIRST FULLY-COMPILED SMALLTALK.
Because Smalltalk/V PM is fully compiled it provides you with a more responsive environment than ever before. Now you'll be able to generate stand-alone applications (.EXE).

ately start creating without any limitations on your efficiency.

However, if you're the curious type, we have tools called browsers to help you fathom the masterpiece called OS/2 PM. You'll also find our incremental program development capability and push-button debugger simplifies application development and gives you instant response when you implement an idea. Our extensive user manuals and tutorials have earned us high praise.

SMALLTALK/V PM. THE TALKING HAS ALREADY STARTED.

"Digitalk's Smalltalk/V PM is a masterful implementation of a classical object-oriented programming language and a state of the art graphical user interface. Any programmer struggling with the complexities of Presentation Manager should take a close look at this product."

Charles Petzold, Contributing Editor, PC Magazine

"Digitalk's Smalltalk/V PM is dazzling! This product makes Presentation Manager pay off."

Jeff Duntemann, Contributing Editor, Dr. Dobbs Journal

"Smalltalk/V PM is an excellent tool for rapid delivery of prototypes which have all the functionality and user interface of a complete PM application."

Richard A. Landsman, System Architect, Lotus Development

"Smalltalk/V PM from Digitalk is the greatest! This is an incredible product."

J.D. Hildebrand Editor-in-Chief, Computer Language

THE BEST PM INVESTMENT YOU'LL EVER MAKE

Smalltalk/V PM $499.95

Prices and information on these and other Digitalk products are available on request:
Smalltalk/V, Smalltalk/V 286, Smalltalk/V Mac

Smalltalk/V

Smalltalk/V. A product of Digitalk Inc., 9841 Airport Blvd., Los Angeles, CA 90045. For information or to find a dealer near you call:

1-800-922-8255
1-213-645-1082
CompuServe 71361,1636
FAX 1-213-645-1306

Smalltalk/V is a registered trademark of Digitalk Inc. Prices subject to change without notice. Other product names are trademarks or registered trademarks of their respective holders.

Circle 82 on Reader Service Card

World Radio History

NANOBYTES

After tackling the nuclear-triggered geopolitical situation with Balance of Power, noted **game designer Chris Crawford** has taken on an even more complex subject: the earth's environment. **Balance of the Planet** is a simulation program meant to illustrate the interrelationship between humans, industry, and Mother Earth. You play the United Nations High Commissioner of the Environment. The game starts in 1990; you have until 2035 to straighten out the mess. Be prepared for bad results: Poor policies can contribute to starvation, flooding, and a host of other woes. The simulation is not easy; we know one technical editor who, in the course of a weekend, wiped out the world nearly half a dozen times before determining which industries to tax and which objectives to fund. The program is available for Macs or PCs; it's $49.95 from Accolade (San Jose, CA).

When it comes to user interfaces, there's **too much "breakfast cereal marketing,"** said departing Apple Products president **Jean-Louis Gassée** in a recent speech to Mac users. "We talk about windows and menus and magic-this and hyper-that. Soon we'll have the user interface equivalent of cola wars."

DuPont Imaging Systems (Newark, DE) has designed a hardware/software package that gives Macintosh users **access to Unix through the Mac interface** and file system. The new MacBlitz coprocessing board ($9995) uses a Clipper C300 RISC processor running at 50 MHz.

WordPerfect (Orem, UT) has just started beta-testing its word processor for OS/2 Presentation Manager and expects it on the shelves in November. The company will provide its OS/2 drivers for the hundreds of printers now supported by DOS editions of WordPerfect. The company says that it's committed to a **Windows version** but doesn't think it will be ready until 1991.

financial data that might affect the design.

The code for the new standard is being built using C and C++ and will employ an X Window System–based user interface on all platforms. The expert systems based on the standard will be compatible with Structured Query Language–based database systems, the developers say.

Ford and US West plan to start beta tests of software using the new code in the fourth quarter of this year. Testing of more-advanced software versions is scheduled to start in the fourth quarter of next year.

Cooperation between the companies is limited to the development of the new software code. Each partner will be allowed to use the code to produce and market its own knowledge-based expert systems. IMKA is looking for new recruits, including foreign firms, to contribute funding or technical expertise.

—Rob Calem

Sharp Plans Better-Looking Color LCD This Year

Although Sharp and NEC are now selling portable computers with flat-panel color displays, both companies admit that the screens leave something to be desired. The color is washed out, and the viewing angle is restricted.

But that picture could change soon. Sharp Electronics (Mahwah, NJ) plans to have a color 10-inch LCD panel available to OEMs by the end of September. The color screen could appear in portables by early 1991. The new Sharp display uses the same active-matrix technology as the Macintosh Portable but adds 512 colors and VGA resolution.

Active-matrix color LCDs are now used in tiny TVs and have been heralded as the display technology of the future. But poor manufacturing yields have made panels larger than about 6 inches across unreliable and prohibitively expensive. The difficulties of making even a monochrome active-matrix panel accounted for much of the delay in the Macintosh Portable.

The new thin-film transistor (TFT) Sharp screen represents two innovations. First, each pixel is backed up with two transistors, so if one fails, another is there to take its place. Second, the company has a new manufacturing line that uses laser repair equipment; defective transistors can be fixed or removed before the display leaves the plant.

The Sharp TFT screen has a total of 921,600 pixels, or three for every point of a 640- by 480-pixel VGA array (one each for red, green, and blue). The quality difference between the TFT screen and the passive-matrix display in the Sharp Multi-Color 386 is striking: The TFT's colors are bright, rich, and solid, and the horizontal viewing angle is a wide 120 degrees.

The panel uses a lot of juice—about 12 watts, including hot-cathode backlighting—so for the time being, it's practical only for AC-powered machines. It also weighs 2⅕ pounds, or about half as much as some entire notebook computers.

Sharp estimates that its color LCD panels will cost five to 10 times as much as a conventional monochrome LCD. This could make for an expensive computer, but Sharp, which plans to use most of the displays itself, thinks that it can produce a model in the $10,000 range, or for about the same price as the Multi-Color 386.

—Andy Reinhardt

First of Fatter Floppy Drives Finally Arriving

High-capacity floppy disk drives have been something of a Holy Grail in the personal computer business, but for end users the search could be winding down. Q/Cor (Norcross, GA), a Quadram spin-off, says that it has started shipping floppy disk drives that can pack 21 MB onto special 3½-inch media. The Stor/Mor drives are based on Brier Technology's Flextra subsystem, which uses a proprietary closed-loop servo tracking scheme to boost disk capacity. Flextra was announced more than a year ago and has been in testing since then.

Stor/Mor drives have an embedded SCSI controller and are shipped with an interface board for IBM PC compatibles. An external unit for ATs lists for $895, an internal for ATs is

continued

World Radio History

A T R O N

NOW YOUR SOFTWARE CAN TEST ITSELF.

NOW AVAILABLE IN VGA

AND PS2!!

Your customers expect software that works. All the time. The key to software quality is exhaustive testing. It's also an engineer's worst nightmare. But it doesn't have to be. Because now you can automate your software testing.

Introducing the Atron Evaluator. The first and only non-intrusive automated PC-based software testing tool.

The Atron Evaluator automatically runs your software regression testing programs. All of them. All day. All night. Giving you thoroughly tested, higher quality software.

The Atron Evaluator is hardware-based. And since it's non-intrusive, software behavior is tested without the risk of alteration. Once your tests have run, you can refer to automatically generated test reports to double-check test results.

The Atron Evaluator saves time. And time makes you money. Development cycles are shortened, so your software gets to market sooner. And while your test programs are running, you can be more productive. Start a new project. Or go home.

For more information about the Atron Evaluator, call us at **1-800-283-5933.** And put an end to your worst nightmares. Automatically.

Circle 29 on Reader Service Card

atron
A Division of CADRE Technologies

Saratoga Office Center
12950 Saratoga Avenue
Saratoga, California 95070

In Europe, contact:

Elverex Limited, Enterprise House
Plassey Technology Park, Limerick, Ireland
Phone: 061-338177

QA Training Limited, Cecily Hill Castle
Cirencester, Gloucestershire, GL7 2EF, England
Phone: (0285) 5888

World Radio History

Buy our IBM-compatible color printer and get this Mac-compatible color printer free.

The new Phaser PX Color Printer from Tektronix.

Only $7995

The price is as much of a breakthrough as anything else. The Phaser PX offers PostScript-language compatibility and 300 dpi thermal-wax color that's brighter and bolder than that of pricey competitors. And not only can you hook it up to an office full of PCs via serial or parallel, but it will also accommodate any Macs that might come along. Automatically switching from port to port to keep everybody happy.

Add to that certified PANTONE®* Color that can be printed on paper or transparencies, and you've got a color printer that will do more for less money than ever before.

So call 1-800-835-6100, Dept. 11J to find out how to get your hands on the new Tektronix Phaser PX. Then you can kill two birds with one color printer.

The New Tektronix Phaser PX®

*Pantone, Inc.'s check-standard trademark for color reproduction and color reproduction materials. Copyright © 1990 Tektronix, Inc.

World Radio History

Buy our Mac-compatible color printer and get this IBM-compatible color printer free.

The new Phaser PX Color Printer from Tektronix.

Only $7995

The price is as much of a breakthrough as anything else. The Phaser PX offers PostScript-language compatibility and 300 dpi thermal-wax color that's brighter and bolder than that of pricey competitors. And not only can you hook it up to an office full of Macs via AppleTalk, but it will also accommodate the PCs and workstations that might come along. Automatically switching from port to port to keep everybody happy.

Add to that certified PANTONE** Color that can be printed on paper or transparencies, and you've got a color printer that will do more for less money than ever before.

So call 1-800-835-6100, Dept. 11J to find out how to get your hands on the new Tektronix Phaser PX. Then you can kill two birds with one color printer.

The New Tektronix Phaser PX®

All rights reserved. Phaser is a trademark of Tektronix, Inc. All other trademarks mentioned herein belong to other companies.

Circle 278 on Reader Service Card (DEALERS: 279)

World Radio History

NANOBYTES

MIPS Computer Systems (Sunnyvale, CA) is designing a **new workstation**, currently called the RC6280, that will use the company's new R6000 RISC processor. This is subject to change, but the system will most likely come with 32 MB of main memory (expandable to 256 MB); address up to 4 gigabytes of virtual memory; use multiple VME buses; and have a 655-MB hard disk drive, a SCSI bus, and serial and Ethernet ports. The 66.7-MHz R6000 processor can achieve single-cycle execution time for almost all instructions, MIPS says.

National Information Services (Baltimore) is publishing *Consumer Reports* on **CD-ROM**. The "beginner's" collection dates back to January 1985; the advanced collection, which comes with more sophisticated search tools, dates back to January 1982. Annual subscriptions are priced at $445 and $695, respectively.

Japan's Ministry of International Trade and Industry will spend $46 million on its **Fifth Generation Computer Project** this year, and $9.8 million on its distributed data-processing environment of the future, according to *New Technology Week* (published by King Communications, Washington, DC). MITI will invest $100,000 in neural network research, the newsletter said.

Xircom (Woodland Hills, CA) has **cut the price** of its Pocket Ethernet Adapter by $100. The diminutive device, which works with IBM PC–compatible laptops, now sells for $595.

Senior managers at the nation's 1500 biggest companies **aren't happy** with the way their businesses are using computer technology, according to a survey conducted by **Beta Research** (Syosset, NY). Beta pollsters report that 52 percent of the senior managers polled said that their companies are not using computers and communications to their full potential.

$795, and an external unit for Micro Channel machines is $995. The special disks cost $25 each.

Flextra is one of several emerging technologies to cram greater amounts of data onto 3½-inch removable floppy disks. Most of the new drives are still months from reaching the market, but a 2.88-MB-capacity model made by Toshiba and resold in the U.S. by Pacific Rim Systems could become the next step up from 1.44 MB. Insite Peripherals says that it's redesigning its 20.9-MB Floptical drive (announced last year) for backward compatibility. The company's current I325 model will remain an evaluation unit only, and Insite's first commercial product will be a 1-inch-high drive slated for next year.

The Toshiba, Insite, and Brier systems all use new barium-ferrite disks manufactured by Maxell, Verbatim, and others. These disks have ultrafine metal particles and a smoother surface than conventional ferric-oxide disks, which lets them hold twice as much data per linear inch. In the Toshiba drive, which is compatible with existing 720K-byte and 1.44-MB disks, the media is formatted with the same number of tracks, but each track has twice as many sectors.

The Insite and Brier drives achieve their higher capacity by greatly increasing the number of tracks on the disk. Since the head can be positioned very precisely, the tracks can be narrower and closer together. To encode track information, however, requires that the mass-produced barium-ferrite disks be specially formatted at the factory. As a result, the disks are more costly, and neither drive can read from or write to existing floppy disks.

Brier's "twin-tiered tracking" involves storing data on two levels of the disk media. The bottom layer contains magnetic servo information that defines the location of the tracks, while the top layer holds data.

Flextra disks have an unformatted capacity of 25 MB, or 21.4 MB after formatting. The servo tracks now written onto the disks are dense enough to support capacities of 50 or even 100 MB unformatted, Brier says, but getting to the higher levels will involve further technology refinements and new metal-powder disk media. Brier plans to announce a 43.2-MB-capacity model "within the year."

—Andy Reinhardt

Little Guys: Bill Gates Has Good News for You

Small application programs and small software companies to develop them—that's a wave of the future, according to Microsoft chairman Bill Gates. Gates told the National Apple Users Group conference recently that he bases his forecast on what he sees as a move away from large, multifeatured application programs, like Word and Excel, to small, special-purpose programs that can work together.

"Because things are fairly self-contained today, with simply cutting and pasting, you can have only these large applications. You can't have these nifty little tools that you pull in to manipulate a little bit of data and then move that data onto another application," Gates said. "With an architecture of small- to medium-size applications to attach to larger applications, we allow small software companies to provide specialized packages that will appeal to special audiences that the larger companies like ours cannot address."

The technology that will spur these new programs and small companies is the Dynamic Data Exchange channel in Windows and OS/2, which allows applications to easily exchange information, Gates said.

—David Reed

WE DON'T CARE IF YOU'RE BIG OR SMALL. *We remember when some of the best ideas came from guys working in their garages. If you, your company, or your research group is working on a new technology or developing products that will significantly affect microcomputers and the way people work with them, we'd like to hear about it. Phone the BYTE news department at (603) 924-9281. Or send a fax to (603) 924-2550. Or write to us at One Phoenix Mill Lane, Peterborough, NH 03458. Or send E-mail to "microbytes" on BIX or to "BYTE" on MCI Mail. An electronic version of Microbytes, offering a wider variety of computer-related news on a daily basis, is available on BIX.*

World Radio History

Finding the four best laser printers is easy. Choosing *which* Canon to buy is a little tougher.

Come on, now—we can't do *everything* for you. We've produced a complete line of Canon* Laser Beam Printers for crisp text and stunning graphics. We've given them features unmatched in their price range—such as built-in scalable typefaces that look great from the finest fine print to poster-sized headlines—with legendary Canon quality.

But we can't tell you that what you need is the compact size (and compact price!) of the 4-page-per-minute LBP*-4. You're the only one who knows how convenient its 14″ x 16″ size and quiet operation would be on *your* home or office desktop. And how can we even guess what you'd do with the standard video interface for fast, high-resolution applications?

We're not going to insist that you should get the LBP*-8 Mark III™ for its 8-ppm speed, or for the ability to boost its standard 1.5MB all the way to 4.5MB. Sure, it can accept our IC cards for additional typefaces and capabilities, but so can the others.

Maybe you never need to print letterhead plus second sheets, or long unattended jobs. So why should we brag about the Mark IIIT,™ with dual paper cassettes that can hold up to 400 sheets? Just because it can combine portrait and landscape text? Big deal—that's standard for Canon Laser Beam Printers.

And unless you want the ultimate in capability and convenience, you'd have no interest in the Mark IIIR,™ with dual cassettes and duplex printing for newsletters, and lengthy reports. Even though, like the others (yawn), it supports all popular word-processing and DTP software.

Visit your Canon dealer—call us toll-free at 1-(800) 733-2900 for the one nearest you. We've done our part, with four Canon Laser Beam Printers that set a new standard.

But the hard part is up to you.

Genuine Adobe* PostScript* is now available for the LBP-8 Mark III Series printers. And it will soon be offered on the LBP-4 printer, as well.

POSTSCRIPT* Software From Adobe

A printer driver kit is provided free with each printer containing all printer definition files currently available on diskette, plus complete installation instructions.

Canon

LASER BEAM PRINTERS

Working To Improve Your Image.™

From Top To Bottom LBP*-4, LBP* 8 Mark III,™ LBP*-8 Mark IIIT,™ LBP* 8 Mark IIIR™

Adobe,* PostScript® and the PostScript logo are registered trademarks of Adobe Systems Incorporated in the U.S.A.

Circle 50 on Reader Service Card

World Radio History

LETTERS

and Ask BYTE

Tales from the Archives

While "Saving Space" by Steven J. Vaughan-Nichols (March) is quite informative, I would like to make a few comments. Vaughan-Nichols says that "none of [the archiving programs] bothers to determine whether sufficient space exists. . . before starting." This is true but misleading. It is impossible to predict just how much space will be required for working files. The designer must walk the thin line between the possibility of the program running out of space and that of alerting the user that there is insufficient space when, in fact, there is enough.

It is possible to check the fit as the program proceeds, or to break the job into two or more smaller pieces. But these approaches also have problems—namely, slower compression time, and loss of an unerase utility to recover the previous archive.

Vaughan-Nichols mentions that he has never been able to create a self-extracting archive using LHarc 1.13. I have been using that version for about eight months and have never had a problem with it. Not only does it produce archives that are typically within a few percentage points either way of the size of PKzip archives, but its self-extraction code adds only about 1300 bytes to the size of an archive. It also does not require another file in the same directory—as PKzip 1.01 does, contrary to its documentation. LHarc cannot create a self-extracting archive if there is not enough memory, while PKzip's self-extracting archives work on machines with any memory size. Due to the convenience of LHarc's self-extraction feature, I am currently using it for all my self-extracting archives.

I use PKzip for almost all other archiving because of its significant speed advantage over LHarc. I also use PKzip in its quick compression mode to back up data files and source code, since it is fast, compresses relatively well, and allows multiple file specifications. Another advantage of PKzip is that it detects when it is running on a 386 and uses 386 instructions for a significant performance improvement.

One final point. Zoo is not the only archiving program available on more than one system. I use LHarc and ARC on a

IN DEPTH
LIFE WITHIN 1 MEGABYTE

Saving Space

Data compression can add years to the life of your hard disk for a lot less than the price of a new drive

Steven J. Vaughan-Nichols

Unix machine, and I have heard of a Unix version of PKzip.

Stephen M. Dunn
Brampton, Ontario, Canada

The Coke Standard

You should have told Charles E. Green (Ask BYTE, March) that the computer industry is hard at work searching for alternatives to confusing technology.

Sharp observers, for example, will have noticed the subtle shift toward the adoption of familiar objects as reference standards. Witness the clever use of Coca-Cola cans to define precise height, a move introduced simultaneously in the March BYTE by Flytech Technology (page 96) and Northgate Computers (following page 40). The latter even went so far as to announce that it had broken the full-can height barrier ("standing not even as tall as America's favorite diet cola"). No doubt benchmarks will soon codify this brave lead. Figures such as "1.678 cans," "4.238 cans^2," or even (is it too much to hope for?) "0.0795 cans per second" will soon become commonplace.

It is disturbing to see that full standardization still eludes us, as the two innovators cannot agree on whether the calibration standard should be Diet Coke or regular Coke. But an important first step has been taken, and I think it should be applauded.

Peter Bolton
New Smyrna Beach, FL

WE WANT TO HEAR FROM YOU. *Please double-space your letter on one side of the page and include your name and address. Letters two pages in length or under have a better chance of being published in their entirety. Address correspondence to Letters Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.*

Your letter will be read, but because of the large volume of mail we receive, we cannot guarantee publication. We also reserve the right to edit letters. It takes about four months from the time we receive a letter until we publish it.

Succession Crisis Revisited

I found Bob Ryan's "The Succession Crisis" (March) both informative and useful to those who are considering Unix and OS/2 as an alternative to DOS. I believe that Ryan's advice to postpone the Unix versus OS/2 choice until they both offer the range of applications found under DOS is well taken by those who can afford to wait.

For those who must make the move in the near future, the situation is different. I'd like to point out some of the findings of a comparison between Unix and OS/2 that Andrew S. Tanenbaum makes in his book *Structured Computer Organization* (Prentice-Hall, 1990):

- Unix supports multiple users; OS/2 supports one.
- Unix is portable; OS/2 was designed specifically for the 286.
- Unix has a linear memory model; OS/2 has a segmented memory model.
- Unix supports virtual memory via paging; OS/2 supports it via segmentation.
- Unix allows multiple links to a file; OS/2 does not.
- Unix allows a collection of disks to be mounted on a single tree; OS/2 does not.
- Unix processes make system calls by trapping to the kernel; OS/2 processes make system calls by procedure calls through call gates.
- Unix has only a single level of access—the file system; OS/2 also has I/O subsystems.
- Unix has neither threads nor sessions; OS/2 has both.

continued

World Radio History

Here's what they say about Zortech C++

" Zortech is a truly fine compiler...If you've been waiting for a major player to offer a professional C++ development system for OS/2 and Windows, as well as DOS, wait no longer... Zortech has it! "

Richard Hale Shaw, PC Magazine, p.38, March 13, 1990

" Zortech has done a commendable job with C++ 2.0 and I recommend it highly...The debugger is impressive...Get the Developers version...it's worth the money."

Bruce Eckel, Micro Cornucopia, pp. 8-17, March 1990

" Zortech C++ is one of the best MS-DOS products I've had the luck to use.....I can highly recommend the Zortech 2.0 release."

Scott Robert Ladd, Dr. Dobbs Journal, pp. 64-73, January 1990

"We have devoted virtually a full issue to evaluation of C Compilers. . . .it's an easy choice. We pick ZORTECH."

J. D. Hilderbrand, Editor, Computer Language, p. 7, May 1990

AT&T™ C++ V2 Specification
- ✓ Multiple Inheritance
- ✓ Type Safe Linkage
- ✓ Pointers to Members

Compiler Features
- ✓ Native code compiler with separate global optimzer
- ✓ Improved MSC Source Level Compatibility
- ✓ MS Windows™ Compatible
- ✓ CodeView™ Compatible
- ✓ Fast Graphics Library with C++ interface
- ✓ Easy to use TSR functions
- ✓ Standard Library Source Code included with Developer's Edition
- ✓ Seamless LIM/EMS Support via new handle pointers or directly via EMS library functions.
- ✓ Full MS Mouse Library
- ✓ OS/2 Compiler Option
- ✓ 99% ANSI C Compatible
- ✓ Improved code size/speed

C++ Source Level Debugger
- ✓ Also Debugs C
- ✓ Assembler Debugging with access to registers and memory.
- ✓ 16 Debugging Windows
- ✓ Multiple Statement Lines
- ✓ Break/Trace/Watchpoints
- ✓ Dual Monitor Support
- ✓ Full C++ name unmangling for easy use
- ✓ Block memory write protect

C++ Tools Classes
- ✓ 25 C++ Classes with full source code
- ✓ Includes new Text User Interface Classes
- ✓ Event Queue, BCD Maths, Linked Lists, Money, DOS error handling classes, text windows and editing classes, virtual arrays, time and date handling, directories and filenames, interupt vectors, etc...

PRICES

C++ Compiler	$199.95
C++ Debugger	$149.95
C++ Tools	$149.95
Library Source	$149.95

Save $200 - Get the Developer's Edition for only $450 (includes all the above items).

OS/2 Option	$149.95
C++ Video	$499.95

USA: Zortech Inc.
4-C Gill Street
WOBURN MA01801
Voice: 617-646-6703
Fax: 617-643-7969

EUROPE: Zortech Ltd.
106-108 Powis Street
LONDON SE18 6LU
Voice: 44+ 81-316-7777
Fax: 44+ 81-316-4138

"ANNOUNCING V2.1"

640K Memory Barrier Smashed!

- **New** VCM™ (Virtual Code Manager) technology
- **New** Rational DOS Extender technology for compiling/ debugging massive programs
- **New** Virtual C++ Source Level Debugger requires only 4k RAM!
- **New** Remote Debugging via serial port
- **New** Powerful Environment with Browser
- **New** Completely Revised & Expanded C++ Tools
- **New** Improved Compiler Optimization

Zortech VCM™ for DOS

With Zortech's Virtual Code Manager (VCM) you can compile standard MS-DOS applications containing up to 4Mb of code. VCM is a sophisticated virtual memory system that dramatically improves performance over conventional overlay methods. Naturally, our debugger understands VCM too!

Rational™ DOS Extender Technology...

Version 2.1 incorporates this new technology for compiling and debugging really big programs on 286, 386 or 486 based PC's. You can also use V2.1 together with Rational Systems DOS Extender (purchased separately) to produce your own applications which can access memory beyond the 640k DOS limit.

C++ Debugger in 4k RAM!

Zortech's Virtual C++ Source Level Debugger can now locate itself in extended memory on 386 machines. This requires only 4K of conventional RAM!

STOP PRESS - NEWS FLASH

386 Compiler/Debugger Option (using Phar Lapp DOS Extender), UNIX 386 Compiler and OS/2 Debugger all available soon. Also new C++ Classes and Addison Wesley ZTC++ book.

ORDER/UPGRADE HOTLINE 1-800-848-8408

World Radio History

CD-ROM drives normally come with their own controller (usually an 8-bit, XT-compatible card) and device driver software. To install one, you plug in the card, connect the drive, and install the drivers. That's it. The drives that we've seen here at BYTE have had controllers that are basically SCSI with some modification. Don't plan on daisy chaining hard disk drives or tape drives off the controller, although you should be able to chain multiple CD-ROM drives from the same manufacturer. To be sure, check with the manufacturer before you buy.

Printing color is just as easy. Normal screen printing support on the PC is simply a BIOS call to a function that reads the screen and copies the contents to an ASCII printer. The GRAPHICS.COM program that comes with DOS lets you dump a monochrome graphic to an Epson-compatible printer. You probably knew that; otherwise, you wouldn't have asked about color screen dumps.

Poke around on a local BBS. There are lots of public domain screen dumping programs—you just have to find one that supports both your particular printer and the screen type you have. VGA shouldn't be any problem, but without knowing what kind of printer you have, I can't give you any specific names to look for.

There are commercial alternatives. One choice might be Inset, from Inset Systems (71 Commerce Rd., Brookfield, CT 06804, (203) 775-5866). It's a TSR screen capture/image manipulation package that supports lots of screen modes and lots of different printers. It's probably more than you need, but it's a handy piece of software to have around anyway.—H. E.

Desperately Seeking

Please help me to find ESP Software Systems. Does its product, Command Plus, still exist?

A. R. Kidson
Bromley, Kent, UK

Command Plus still exists. You can contact ESP Software Systems at 6120 Bristol Pkwy., Cover City, CA 90230, (213) 645-3095.—H. E.

The Dream Machine

I would like to buy a computer with the following components:

- a 386 running at 25 MHz with 4 megabytes of RAM
- a 32K-byte cache and controller
- an 80-MB Control Data Corp. (CDC) or Priam hard disk drive
- a Perstor PS180-16FN hard/floppy disk drive controller
- a 512K-byte Super VGA card with 1024- by 768-pixel resolution and 256 colors
- a 3½-inch 1.44-MB floppy disk drive
- a 5¼-inch 1.2-MB floppy disk drive
- an 80387 math coprocessor
- an 8514 IBM monitor
- a Northgate Omnikey keyboard
- an Epson LQ-510 printer
- a mouse

Can all this work in one machine?

Also, which interleave ratio for the hard/floppy disk drive controller is correct—1-to-1, 2-to-1, or 3-to-1? What specification on the hard disk drive is the best—run length limited (RLL), modified frequency modulation (MFM), ESDI, or SCSI?

My ultimate goal is to use CAD software to design bathrooms and kitchens, to take a space and fit it with the optimum equipment. I want to do more than just draw squares and circles. Is there any CAD software available that will help me do this?

Tom Callaghan
Aliquippa, PA

Since you have a specific application in mind, here's a good rule of thumb: Pick the software you like first, then pick the computer to run it on. That way, you're sure to have all the right hardware—not too much or too little. That said, the system you're proposing should more than do the trick. However, a few things about your choices are worth pointing out.

The Perstor controller is designed to work with either MFM or RLL disks only. With the Perstor's data compression, you can expect to get 132 MB out of a 72-MB CDC Wren 86, or 81 MB out of a 44-MB Priam ID45H drive. You specified the 8514 monitor, which is designed for the 8514/A graphics card. Either bag the Super VGA and take the 8514/A, or use any good multifrequency monitor with your Super VGA. The 8514 is a good choice, as it's a well-known standard and is likely to be supported by most CAD software. You might also reconsider the mouse. Most serious CAD software supports graphics tablets, which are considerably more precise and often easier to use than mice. Don't buy either until you've picked out your software. Also, make sure that you have enough serial ports to connect the mouse/tablet and the plotter that you'll eventually need.

As for software, you can hardly go wrong with the big names in CAD. As an alternative, track down some of the field-specific drawing packages. You might find architects in your area who have specific experience in using interior design software. Take them to lunch and pick their brains.

To determine the best interleave, you generally try different interleave factors until you get the best system performance, or use utility software like Gibson's SpinRite to try the combinations for you.—H. E.

Good Things in Small Packages

I am interested in a small, durable, reliable, inexpensive hand-held computer that patients can carry with them during the day. This computer would be preprogrammed to ask the patient a series of questions that he or she could answer with numerical responses. All the hand-held computer would need for input is a numeric keypad. The computer screen would need to be able to display about 30 alphabetical characters in a single-line display. Additionally, I would need to be able to upload programs into the hand-held computer, as well as download patient responses into an IBM compatible. It would be nice if the memory capacity of the hand-held computer was around 64K bytes.

I have read about the Casio BOSS and the Sharp Wizard, and they sound interesting. Could you advise me about the pros and cons of these or similar units?

Daniel J. Cox, Ph.D.
Professor, Department of Behavioral Medicine and Psychiatry
University of Virginia
Charlottesville, VA

Small, reliable, cheap, and with a big display? It's a good thing that you're not picky. One thing I was not clear on, though: You want to upload programs, and I assume that you mean PC programs. Unfortunately, the Wizard isn't PC-compatible, and it's programmed solely through ROM cartridges. For your application, that would seem to be a "con."

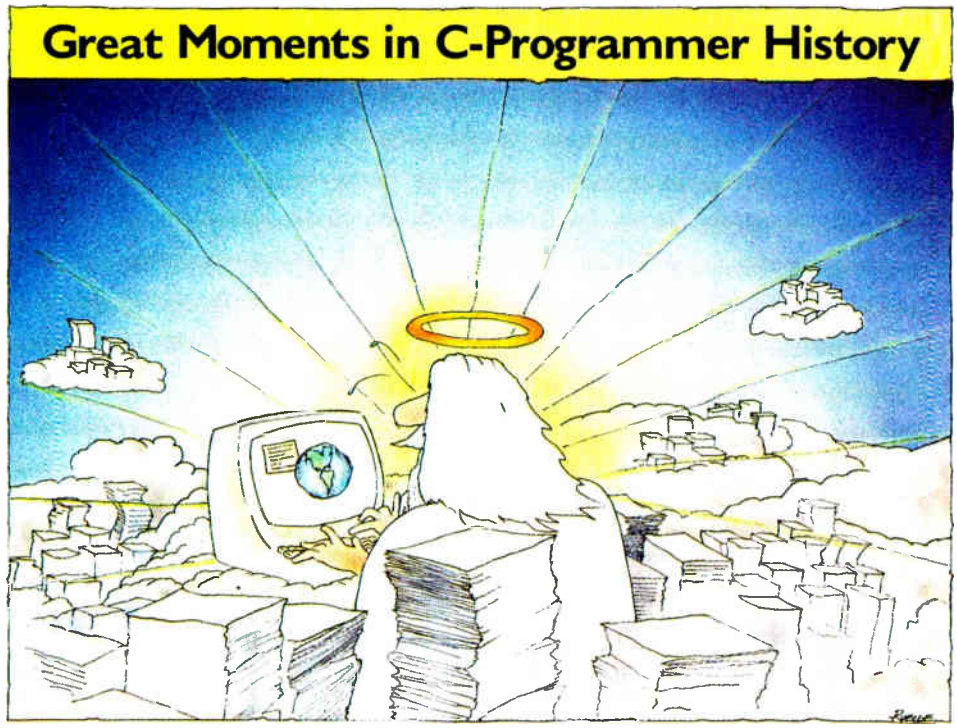
Casio's BOSS might work for you. It has a 32-column by 6-row display and can transfer data to or from both Macintoshes and PCs. To program the BOSS, you'd need to get some detailed information from Casio. Contact the BOSS Products Division at (201) 361-5400, ext. 135 or 132.

A few other possibilities: The Psion Organiser is another non-DOS machine that is fairly rugged and reasonably inexpensive. The Poqet computer and Atari

continued

World Radio History

Great Moments in C-Programmer History

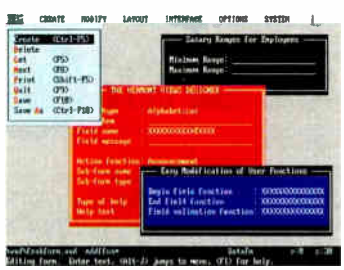


On the third day, He identified the need for an advanced productivity tool.

If you're feeling overwhelmed by impossible deadlines, don't despair. Vermont Views™ 2.0 combines a menu-driven screen designer with a C library of over 550 functions to combat programming stress.

Have Fun Again

Using the **Vermont Views** Designer, you'll visually create user interfaces in a fraction of the time required to code them. Include pull-down menus, window-based data-entry forms with tickertape and memo fields, scrollable regions, choice lists, context-sensitive help, and other state-of-the-art features. Quickly create and refine operational prototypes. Use DOS graphics without GUI hassles.



You'll enjoy interactive development without the limitations of 4GL's. When the extensive capabilities of Vermont Views don't meet special needs, attach your own processing functions to menus, forms, fields, and keys. We've designed it so you won't run into dead ends.

A Better CASE

Rapid prototyping is the latest CASE technology. But, with most systems, you must throw the prototype away when coding begins. With Vermont Views, the prototype becomes the application. Menus and data-entry forms are usable in the final application without change. Names of functions for retrieving, processing, and storing data can be specified as the prototype is created. Notes can be attached to forms and fields to help you complete and document the application. Vermont Views objects are checked for validity when created, so integration and testing go more quickly.

Endless Benefits

Screen generators for most C libraries require you to modify generated source code to create a fully functional interface—after which you must work with the source code. Not so with Vermont Views. Designer forms and menus can incorporate the special capabilities of Vermont Views and still be revised interactively. You'll reap productivity benefits throughout the software lifecycle.

Free Test Drive

Call for a free DOS demo copy of the Designer. See what you've been missing.

Call 800-848-1248
Fax 802-848-3502
Please Mention "037"

A Universal Solution

Create a single interface and port it among PCDOS, OS/2, UNIX, XENIX, and VMS. Use Vermont Views with any database that has a C-language interface (most do). Include DOS graphics in text-based applications (optional). Create interfaces for any roman-based language. Develop safely on networks with our form-locking version.

Sweet Music

"This is the most complete, easiest to use screen package I have ever seen..." —Jim Darragh, Commercial Logic, Inc.

"At a recent field staff meeting, we were able to get a consensus...using the Designer on a big screen TV. Changes can be posted real-time and a functioning prototype results... The form designer is GREAT." —Randy Jones, Beta Tester

No-limit Trial

Reduce stress by ordering Vermont Views now. There is no risk. Return it for a full refund—anytime. We believe in our product.

Vermont Creative Software

Pinnacle Meadows, Richford, VT 05476
Phone: 802-848-7731 Telex: 510-601-4160

World Radio History

Tanenbaum says that an even more important factor is the widespread availability of Unix source code, which allows Unix system developers to rapidly respond to technological changes. The source code for OS/2, on the other hand, is a guarded secret held by IBM and Microsoft. As an example, Tanenbaum points out that when RISC machines were introduced, Unix was the unanimous choice of all the RISC vendors.

Unix is over 20 years old, and it has a rich tradition and culture associated with it. A rich tradition and culture for OS/2 has yet to be established.

Rodney Adams
Cambridge, MA

Multimedia Wars

I think Don Crabb has misled readers and given bad advice in "A Mac Mélange" (March). The Macintosh is a reasonable platform for multimedia, provided you have unlimited funds. It is expensive to provide the Mac with the functionality that the Amiga has right out of the box. The Amiga was designed as a multimedia (and multitasking) machine, and if Crabb does not take it seriously, the people who are using it for digitized images, sound, music, full-motion video, and animation do.

My advice to Crabb's readers is this: If you are interested in multimedia, by all means look at the Mac first. Then buy an Amiga.

Dana S. West
Columbus, OH

East Europeans Seek Correspondents

I am a 36-year-old electronics engineer. I work mostly on projects based on the Intel 8048, 8051, and 8096 single-chip microcontrollers for use in measurement and control. I would like to find someone with whom I can exchange letters on programming hints and hobby applications of these devices.

Lubomir Matystak
Polni 581
742 83 Klimkovice
Czechoslovakia

I have been a reader of BYTE for several years, and I profit greatly from your articles on both hardware and software. I develop information-retrieval software under MS-DOS, OS/2, and Unix, and I try to capture the actual trends in software engineering with the help of your magazine.

The changes here in East Germany have given me greater opportunities for sharing information with the international community. This is why I am writing to you. I'd like to find a colleague to correspond with.

I am 43 years old. My wife is a teacher of Russian and English, and we have a 12-year-old daughter. In addition to my professional interests, I enjoy the cultural events that Dresden and Saxonia are known for (especially the concerts of the Staatskappelle and the exhibitions of the Semper Gallery). My wife and I are interested in English and American literature.

Dr. Peter Naumann
Rosenbergstrasse 21
Dresden 8021
East Germany

Thanks for the Unix Benchmarks

I read Ben Smith's "The BYTE Unix Benchmarks" (March) with great pleasure. Someday, perhaps, BYTE will routinely publish Unix-based performance figures.

In principle, all BYTE benchmarks might be run simultaneously on one Unix system. The total real time would be longer because of multitasking overhead, but the per-process user and system CPU times should be the same as for successive, serial benchmark runs.

The new BYTE shell-script approach should yield portability. However, there are pitfalls in the form of unknown but systematic errors in user time to search the PATH for the script's executables. Below is the data for the old BYTE Sieve of Eratosthenes benchmark program, coded with *times* (*S*) system calls and run under shell timing (using The Santa Cruz Operation's Unix 3.2 running on an IBM AT with an Intel Inboard). It ran 10 iterations to a maximum of 8191 (1899 primes). The average user time in seconds (variation) of six trials on a quiet multiuser system is as follows:

	System call	Time command
C shell built-in time	0.508 (0.04)	0.5 (0)
timex sieve	0.602 (0.16)	0.611 (0.16)
/usr/bin/timex ./sieve	0.468 (0.01)	0.472 (0.01)

These results do not invalidate the BYTE shell-script approach for between-platform comparison, provided that all commands are invoked by a fully qualified path.

John Michael Williams
Senior Software Engineer
Dazix, Inc.
Redwood City, CA

The time utility is not started until all paths and variables have been established and the test is ready to run. In the benchmark tests that return the number of loops (instead of a time), the timing routine is internal to the test itself and is not started until all the internal variables have been set for the specific test. Future tests for BYTE benchmarks will follow this later scheme, since there is no upper limit on performance that can be evaluated this way.

We do, in fact, run some tests concurrently, but with as much control as possible. The system-load test incrementally increases the number of concurrent copies of itself that are running. This is a good indicator of how a system will perform under a variety of process loads. The danger of running benchmarks when the system is in multiuser mode is that there are an unknown number of demon processes associated with being at the multiuser level.

Although it is impossible to have absolutely all the variables dependent on the benchmarks, we think that it is important to try to reach that goal to cross-evaluate divergent Unix versions on the spectrum of Unix hardware. That doesn't mean that benchmarks are invalid when run in other than our standard way (e.g., single-user, no windowing, and full optimization). Our tests can be used for evaluating a single machine under different conditions. In this way, they become a tool for fine-tuning performance.

—Ben Smith

Don't Tell All

I am appalled at Hugh Kenner's review of that wonderful true mystery by Clifford Stoll, *The Cuckoo's Egg* (Print Queue, March). This wasn't a review; it was a retelling of the whole story. How dare he "tell it all" and ruin the excitement of reading it and wondering, "What next? What next?"

B. M. Hutchison
Pendleton, OR

ASK BYTE

CD-ROMs and Printers

What does it take to install a CD-ROM drive in an XT or AT clone? Is a SCSI controller card necessary? Do different ROM drive manufacturers have different requirements?

If you have a color printer, what is the best way to dump screen images for CGA, EGA, or VGA?

Al Sardello
Boulder, CO

continued

World Radio History

DDI 486 ExecuTower

Special Introductory Offer!

Standard Features

- High Performance
  - Norton SI 38.8
  - Landmark 115 MH, 60X
- Quality Brand Name Components
- One Year Warranty Parts & Labor
- 24-Hour Parts Replacement
- Toll-Free Technical Support
- Also Available:
  - Extended Maintenance Contract
  - Corporate Leasing
  - Custom Configurations

486 POWER at 386 PRICES!

$6,792

Complete Standard System*

Standard Configuration Includes:
25 MHz Clock, Zero Wait Operation
4 MB 80ns RAM, expandable to 16 MB
8 KB Internal Cache Memory
(optional 128 KB External Cache)
AMI BIOS
Super VGA Video Card 1024 x 768
Super High Res VGA 14" Color Monitor
1.2 MB 5¼" Floppy
1.44 MB 3½" Micro Floppy
85 MB SCSI Hard Disk Drive
2 Serial, 1 Parallel Ports
200 Watt Power Supply
Microsoft Compatible Mouse
MS DOS 4.01

* Bernoulli drive and 20" color monitor shown are optional.

Order Yours Before Offer Expires!

Call 1-800-331-1090 or 1-401-885-6697

Digital Distributing, Inc.

20 Cavalier Dr., E. Greenwich, RI 02818

Circle 79 on Reader Service Card (DEALERS: 80)

World Radio History

Programmer's Paradise®...

Smalltalk/V PM
Development Environment

Smalltalk/V® PM combines the power of the industry's leading object-oriented programming environment with the richness of Presentation Manager.

Applications written in other Smalltalk/V environments can be ported to Smalltalk/V PM and will take on the look and feel of Presentation Manager.

digitalk inc.

Smalltalk/V PM's compiler generates standalone native code applications (.EXE) for unrestricted distribution, requiring no run-time license fees.

List: $495 **Ours: ~~$399~~** ***Special: $369***

We'll *Beat* The Competition's Advertised Prices!

386 CONTROL PROGRAMS

	LIST	OURS
DESQview 386	190	169
Microsoft Windows/386	195	139
VM/386	245	209
VM/386 MultiUser	895	839
VM/386 MultiUser Starter	395	339

386 DEVELOPMENT TOOLS

Lahey F77L-EM/32 (w/ OS/386)	1090	979
Lattice C 286 (w/ extension)	495	395
Lattice C 386 (w/ extension)	895	715
Novell C Network Compiler/386	995	799
Paradox/386	895	629
PC-lint 386	239	189
Phar Lap 386 ASM/LINK	495	435
WATCOM C 8.0/386 Prof.	1295	1099
WATCOM C 8.0/386 Standard	895	719

ASSEMBLY LANGUAGE

Advantage Disassembler	295	279
ASMFlow	99	89
MS Macro Assembler	150	105
OPTASM	125	109
Re:Source	150	129
Sourcer w/ Pre-Processor	140	125
SpontaneousAssembly	395	369
Turbo Debugger & Tools	150	105
Visible Computer: 80286	100	89

BASIC COMPILERS

MS BASIC Prof. Devel. System	495	349
Power Basic	110	99
QuickBASIC	99	69
True BASIC	100	69

BASIC LIBS/UTILITIES

db/LIB	159	121
DiaLogic	95	85
GraphPak	79	70
GraphPak Professional	149	125
P.D.Q.	129	115
ProBas	135	125
ProBas Toolkit	99	94
ProMath	99	94
QBase and Quickscreen	149	125
QuickComm	149	135
QuickMenu	59	55
QuickPak	79	70
QuickPak Professional	169	149
QuickPak Scientific	79	70
QuickScreen	79	70
QuickWindows Advanced	149	125

C COMPILERS

C Network Compiler	695	559
Lattice C 6.0	250	189
Microsoft C 6.0	495	329
MS QuickC	99	69
MS QuickC w/ QuickAssembler	199	139
Top Speed C	199	179
DOS Professional	399	359
OS/2 Professional	495	445
Turbo C 2.0	100	69
WATCOM C 8.0 Professional	495	419
WATCOM C 8.0 Standard	395	335

C++

C++/Views	495	419
Guidelines C++	395	369
NDP C++	495	479
Turbo C++	200	CALL
Turbo C++ Professional	300	CALL
Zortech C++ Debugger	150	129
Zortech C++ Developer's Edition	200	165
Zortech C++ Tools	450	399
Zortech C++ Video Course	150	129
	500	449

C-COMMUNICATIONS

Breakout II	125	99
C Asynch Manager 3.0	189	139
Essential Communications	329	299
Greenleaf Comm. Library	299	249
Greenleaf ViewComm	CALL	CALL
SilverComm C Async Library	249	209
View-232	189	149

C-FILE MANAGEMENT

AccSys for dBASE or Paradox w/ source	395	335
Btrieve	795	675
Btrieve for DOS 3.1 Networks	245	185
C-Index Plus	595	449
C-ISAM	195	175
Codebase IV	225	209
CQL w/ PASS	295	219
c-tree	395	349
dBC III	395	315
dBC III Plus	250	229
db_FILE Bundle	500	439
Essential B-Tree w/ source	295	249
FairCom Toolbox - Prof. Edition	198	149
FairCom Toolbox - Special	1095	789
Informix Products	695	509
Xtrieve PLUS	CALL	CALL
	595	459

C-GENERAL LIBRARIES

C TOOLS PLUS/6.0	149	109
C Utility Library	249	199
Greenleaf Functions	229	209
Greenleaf SuperFunctions	299	239
Power Search	149	109
Turbo C TOOLS/2.0	149	109

C SCREENS

Greenleaf DataWindows	395	339
Hi-Screen XL	149	129
Panel Plus	495	395
Vermont Views	395	CALL
Vitamin C	225	169
VC Screen	149	115

C-UTILITIES/OTHER

Clear +	200	169
C-Terp	300	219
Code Runner	149	135
Heap Expander	80	70
PC-lint	139	109
PCYACC Professional	495	469
TimeSlicer	295	279
w/ source	1000	899

COBOL LANGUAGE

Micro Focus:		
COBOL/2 w/ Toolset	1800	1499
Personal COBOL	149	129
MS COBOL	900	629
Realia COBOL	995	849
SCREENIO	400	375

CODE GENERATORS

Logic Gem	99	89
Matrix Layout 2.0	200	169
PRO-C	399	339

DATABASE DEVELOPMENT

Clarion 2.1	845	549
Clipper 5.0	795	519
dBASE IV	795	489
dBFast/PLUS	345	295
dGE	195	179
FlashTools!	89	79
Flipper	195	179
FoxPro	795	CALL
FUNCKy Library	195	179
Magic PC	299	249
R&R Report Writer	150	129
R&R Code Generator	150	129
Say What?!	50	45
SilverComm Library 2.0	189	165
Tom Rettig's Library	100	80
UI2 Version Two	595	479

DEBUGGERS (DOS)

MultiScope	179	135
OPTDEBUG	150	129
Periscope I/512K	495	429
Periscope II	175	125
Periscope II-x	145	105
Periscope IV/16, 25 MHz	CALL	CALL
Pfix86plus	295	259
Sherlock	195	175
Turbo Debugger & Tools	150	105

DOCUMENTING/ FLOWCHARTING

Clear+	200	169
C-Clearly	130	115
Flow Charting II+	229	185
Interactive Easyflow	150	125
Paginate	100	79
Source Print	99	89
The Documentor	295	245
Tree Diagrammer	99	89

EDITORS

BRIEF 3.0	199	CALL
Edix	195	165
EDT+	295	275
EMACS	325	265
Epsilon	195	138
KEDIT 4.0	150	125
MKS Vi	149	129
Multi-Edit Professional	179	159
Norton Editor	75	59
SLICK Editor	195	175
Sage Professional Editor w/ Mouse	295	249
SPF/PC	395	335
VEDIT PLUS	245	199
	185	CALL

EMBEDDED SYSTEMS

Link & Locate ++	395	329
Link & Locate ++ Extended	479	395
Paradigm Locate	295	259

FORTRAN LANGUAGE

Grafmatic	135	119
Lahey F77L	595	535
Lahey Personal FORTRAN 77	95	89
MS FORTRAN	450	299
Plotmatic	135	119
RM/FORTRAN	595	499

GRAPHICS LIBRARIES

Baby Driver	250	199
Essential Graphics	399	349
Font-Tools	150	119
Font Window	125	109
Graf/Drive Plus Personal	149	135
Graf/Drive Plus Developer's	299	269
GraphiC 5.0	395	319
Graphics-MENU	195	175
Data Entry Design	99	89
Data Entry Module	59	53
GSS Graphics Devel. Toolkit	595	525
HALO	395	279
HALO Window Toolkit	595	419
Icon-Tools/Plus	150	119
Menuet	325	259
MetaWindow	250	209
MetaWindow Plus	325	289
PCX Effects	99	89
PCX Programmer's Toolkit	195	175
PCX Text	149	135
Turbo Geometry Library	200	179

LINKERS/LIBRARIANS

Plink86plus	495	395
PolyLibrarian II	149	135
RTLink	295	265
.RTLink/Plus	495	419

MACINTOSH

FoxBASE + / MAC	495	299
MacFortran/ 020	495	445
Smalltalk/V MAC	200	169
Think C	249	165
Turbo Pascal	100	75

MODULA-2

LOGITECH Modula-2:		
Compiler Pack	99	75
Development System	249	199
TopSpeed Modula-2:		
B-Tree Toolkit	149	135
Communications Toolkit	149	135
Compiler Kit	100	89
DOS 3-Pack	200	179

OS/2 TOOLS

Brief	199	CALL
CASE:PM for C	1495	1420
Epsilon	195	159
MS OS/2 Pres. Manager Softset	150	105
MS OS/2 Pres. Manager Toolkit	500	349
MultiScope	449	345
PCYACC	395	359
Smalltalk/V PM	495	369
Vitamin C (OS/2)	225	165

PASCAL LANGUAGE

Asynch PLUS	149	115
B-tree Filer	125	109
MS QuickPASCAL	99	69
Object Professional	150	109
Power Tools PLUS/5.0	149	109
Topaz	75	67
Turbo Analyst	99	89
TurboMAGIC	199	179
Turbo Pascal 5.5	150	105
Turbo Pascal 5.5 Professional	250	175
Turbo-Plus 5.5	199	159
Turbo Professional 5.0	125	109

PROTOTYPING

Dan Bricklin's Demo II	195	159
Grasp	199	129
Instant Replay III	150	135
ProtoFinish	300	269
Show Partner F/X	350	319
Soft Demo	80	70

SMALLTALK

Smalltalk-80 (386)	595	535
Smalltalk/V	100	85
Smalltalk/V 286	200	169
Smalltalk/V PM	495	369

WINDOWS (MS) TOOLS

Actor 2.0	695	559
Case:W	795	759
C-Talk/Views	450	375
dBFast/Windows	395	335
DialogCoder	499	435
MS Windows Development Kit	500	349
MultiScope	379	289
ProtoView	595	535
RFFlow	79	69
Whitewater Resource Toolkit	195	169
WindowsMAKER	595	535
WinTrieve	395	339

NEW RELEASES

SpontaneousAssembly
by Base Two Development
Assembly language library with over 700 ready-to-use functions and macros covering everything from string manipulation to dynamic memory management, to windowing. 100% hand-written, hand optimized assembly language routines. Includes 750 page manual.
List: $395 **Ours: $369**

SitBack *by SitBack Technologies*
A memory resident back-up utility which ensures that a user's PC is fully and currently backed up without the user having to lift a finger or exit the application program. Works during computer idle times and/or at pre-set times throughout the day. Works with all popular LAN systems.
List: $99 **Ours: $90**

PC-lint 386 *by Gimpel*
A source code analysis tool for the C programming language, running on Intel 80386 machines under MS-DOS. PC-lint will analyze C programs and report on bugs, glitches and inconsistencies, providing a strong typing facility for C.
List: $239 **Ours: $189**

World Radio History

Portfolio are DOS compatibles. The Poqet isn't exactly cheap, and while both are well built, they may not stand up to serious abuse.

Should you decide to go all out, there is a class of machines specifically designed for data collection. They're not cheap, either, but they're small, reliable, and built to beat the band. National Datacomputer's DC 3.0 is the only DOS-compatible one of these that I know of. It comes standard with 128K bytes of RAM (expandable to 960K bytes), a backlit 26-column by 10-row LCD, a full numeric keypad and a small QWERTY keyboard, a serial port, and a built-in modem. And if that's not enough, the whole thing runs for hours and hours on four AA batteries.

It's not really running DOS, but a reasonable facsimile. You program it on a regular DOS machine and then upload the software into it. Later, you simply reconnect the PC to retrieve your data. If $2000 to $3000 (depending on configuration) doesn't scare you off, contact National Datacomputer (Middlesex Technology Center, 900 Middlesex Tpk., Building 5, Billerica, MA 01821, (508) 663-7677).—H. E.

Memory Serves

I recently purchased a 386SX with 2 megabytes of memory. With DOS 4.01, I have access to EMM.SYS, which enables me to use some of the extended memory to handle many of my Symphony 2.0 files (which are too large for the 640K-byte DOS limit). I can do essentially the same thing using QEMM.SYS as the expanded memory manager, and I have figured out how to install FASTOPEN and buffers in the expanded memory.

There are various other things that I have read about doing in expanded or extended memory, but I need some help from experts. Can you recommend a good, small book on the subject? Do you intend to have any articles soon on what users can do with 1.4 MB of extended or expanded memory? Is it possible to use some of the 384K bytes immediately above the 640K bytes that DOS normally uses?

Milton Feldman
Beaverton, OR

You can find a good overview of EMS in "Expanding the Limits" (March BYTE). Also, you might try Microsoft Systems Journal. *It has done a number of articles on EMS; in particular, its September 1989 issue contains the source code for an EMS library. You can contact MSJ's circulation department at P.O. Box 1903, Marion, OH 44305, (800) 669-1002. Also, look for a copy of* Extending DOS, *available from Addison-Wesley.*

As for actually using expanded memory, you should look to the very company that supplies QEMM.SYS—Quarterdeck. Its DESQview system makes good use of EMS. In fact, since you're running a 386SX, you're actually using extended memory to mimic expanded memory. DESQview can run a portion of itself in extended memory, leaving more room in conventional memory for multiple applications.

You can use the memory above DOS and below the 1-MB memory for RAM disks or disk caching. There are plenty of public domain packages available; check any of the shareware mail-order houses or cruise the BBS circuit (BIX is a good place to start).—R. G.

You Ask a Lot of Questions...

I want to develop serious programs for my own use as well as to release into the public domain market as shareware. However, I am sure that any experienced programmer would turn livid upon viewing my spaghetti-like code. Could you recommend a good book on structured programming?

In addition, I need a book on fast, efficient, and frequently used algorithms such as sorting and searching. Also, I would appreciate it if you could give me the titles of some general books on the following topics: data compression algorithms, image- and sound-processing algorithms, encryption algorithms and general computer security, implementing an interpreter, and algorithms for implementing games such as chess on computers.

Finally, I want to implement the classic game of Life on my computer. The definition of the game calls for an infinite matrix of cells, an obviously impossible requirement. Hence, the resulting corner and edge cells can have only three and five neighboring cells, respectively, as compared to eight for all the others, which contradicts the definition of the game. How do I handle this dilemma?

Stephen J. Scheck
Jamul, CA

For structured programming, try Programming Structures, Vol. 1: Machines and Programs *by Jan Hext (Prentice-Hall, 1990).*

For frequently used sorting and searching algorithms, there is Donald E. Knuth's classic The Art of Computer Programming, Vol. 3: Sorting and Searching *(Addison-Wesley, 1973) and G. H. Gonnet's* Handbook of Algorithms *(Addison-Wesley, 1983).*

For data compression, seek out Data Compression Methods and Theory *by James A. Storer (Computer Science Press, 1988).*

For image and sound processing, look for Two-Dimensional Signal and Image Processing *by Jae S. Lim (Prentice-Hall, 1990). Also, locate* Computer Composer's Toolbox *by Phil Winsor (Windcrest, a division of TAB books, 1990).*

For data encryption, see the bibliography in "Cloak and Data" (June BYTE).

For interpreters, look for Programming Language Translation: A Practical Approach *by Patrick D. Terry (Addison-Wesley, 1986). Also look for Herb Schildt's* Born to Code in C *(Osborne/McGraw-Hill, 1989).*

Finally, as for boundary conditions on the game of Life, I have seen numerous treatments. A public domain version that I've used gives players the option of either treating cells beyond the boundaries as dead, or simply not counting those imaginary cells when determining a border cell's next life cycle.—R. G.

FIXES

- Contrary to the features table in "Multiuser Databases: The SQL" (May, page 139), Oracle does not offer stored procedures, and Ingres does not offer binary large object data types.
- DTK Computer reports that its latest BIOS does indeed work with OS/2 1.1 and 1.2. The BIOS version used by Mark J. Minasi (OS/2 Notebook, April) apparently was not up to date.
- The correct telephone number for Jameco Electronics, mentioned in "The Heart and Soul of a PC Compatible" (April), is (415) 592-8097. Also in that article, the correct dimensions of the Atronics International ATI-386/B motherboard are 8½ by 12 inches. The ATI board does indeed have a connector for an external battery, as well. ATI says that it has upgraded its BIOS for faster caching; the upgrade is free to customers with the older BIOS.
- In "Not Quite As Simple As 1-2-3" (September 1989), the speed comparison between Lotus 1-2-3 releases 3.0 and 2.1 should read, "Lotus 3.0 is 59 percent as fast as 2.1 on a 386-based system and 52 percent as fast on a 286-based system."
- The acronym LCD in the review of the NEC ProSpeed CSX ("Color Hits the Streets," April) refers to a liquid crystal display. ■

World Radio History

Guaranteed Best Prices! (800) 445-7899

SAGE / MICROSOFT BUNDLE OFFER

Order the new Sage Professional Editor, the programmer's editor for the 90's, along with any Microsoft Compiler, and ***Programmer's Paradise*** will give you an additional $25 off the combined price!*

* Offer good through July 31, 1990.

	LIST	OURS
XENIX/UNIX		
Epsilon	195	169
Interactive 386/ix Complete	1239	929
Interactive 386/ix Comp. M/U	1735	1299
Interactive (All other products)	CALL	CALL
LPI-BASIC	695	569
LPI-COBOL	1495	1199
LPI-FORTRAN	995	799
MKS RCS	395	335
MKS Trilogy	119	105
SCO 286 Complete	1495	1195
SCO 386 Complete	1595	1275
SCO (All other products)	CALL	CALL
VEDIT PLUS	285	249
ADDITIONAL PRODUCTS		
APL*PLUS	695	549
Janus Ada/Compiler System	300	269
Lattice RPG	1600	1285
Meridian AdaStudent	50	45
Meridian Ada Developer's Kit	1095	985
MKS AWK	99	85
Personal Rexx	150	139
Softprobe 86/TX	395	CALL
APPLICATION SOFTWARE		
COMMUNICATIONS		
BLAST II	250	225
Carbon Copy Plus	199	129
Laplink III	150	99
PC Anywhere III	145	99
Procomm Plus	75	50
SideTalk	120	90
DESKTOP PUBLISHING		
Adobe Illustrator	695	409
Corel Draw!	595	399
Gem Desktop Publisher	299	183
HALO DPE	195	139
Lattice HighStyle	375	319
MKS SQPS	495	479
PageMaker	795	509
Ventura Publisher	895	525
MATHEMATICS		
Derive	200	179
MathCAD	495	315
Mathematica 386	695	625
SCIENCE & ENGINEERING		
AutoCAD Release 10	3000	CALL
AutoSketch	150	95
ChiWriter	150	129
Control System Toolbox	495	375
CSS	495	469
DADiSP	895	759
Design CAD 3-D	400	292
Drafix Windows CAD	695	CALL
EXACT	475	380

Our Guarantee...

Products listed here are backed by the following guarantee*:

Should you see one of these products listed at a lower price in another ad in this magazine, CALL US! We'll beat the price, and *still* offer our same quality service and support.

Terms of Offer:

- Offer good through July 31, 1990
- Applicable to pricing on current versions of software listed; July issue prices only.
- Offer does not apply towards obvious errors in competitors' ads.

* Subject to same terms and conditions.

	LIST	OURS
SCIENCE & ENGINEERING *(continued)*		
Generic CADD Level 3	350	209
LABTECH Acquire	195	179
LABTECH Notebook	995	779
MICRO-CAP III	1495	1269
Orcad PCB	1495	CALL
PC TEX	249	229
SCHEMA II+	495	449
STATGRAPHICS	895	586
Tango PCB Series II	595	559
TECH*GRAPH*PAD	395	319
T³	595	479
SPREADSHEETS		
Lotus 1-2-3 Release 3.0	595	389
Lucid 3-D	149	99
Microsoft Excel	495	319
Quattro Professional	495	329
SuperCalc5	495	319
UTILITIES		
386 MAX	75	66
386 MAX Professional	129	115
above DISC	119	84
DOS Partner	99	89
Dr. Switch DeveloperPak	99	89
FASTBACK Plus	189	109
HeadRoom 2.0	130	109
Help Build	249	179
MACE GOLD	149	129
Magellan	195	CALL
Memory Mate	70	47
MKS Toolkit	249	199
Move'em	89	79
Norton Commander	149	98
Norton Utilities	100	65
Norton Utilities Advanced	150	99
PC Tools Deluxe	149	95
Pizazz Plus	149	79
SitBack	99	90
Software Carousel	90	72
SpinRite II	89	75
XTreePro	129	109
WORD PROCESSING		
Ami	199	129
Microsoft Word for Windows	450	279
WordPerfect 5.1	495	CALL
WordStar	495	275
SOFTWARE FOR SUN WORKSTATIONS		
Basmark QuickBASIC	CALL	CALL
C Programmer's Toolbox/ Sun	495	449
Edix	425	339
EMACS for Sun	395	369
Eroff	CALL	CALL
Informix	CALL	CALL
Lotus 1-2-3 for Sun	695	CALL
Lotus 1-2-3 for Sun Server	995	CALL
Lotus 1-2-3 for Sun Node	495	CALL
Mathematica for Sun	CALL	CALL
NeuralWorks Professional II	4095	CALL
Panel Plus (Sun 3)	1595	1355
WordPerfect for Sun	495	CALL

Programmer's Policies

Phone Orders
Hours 8:30 AM-7 PM EST. We accept MC,Visa, AMEX. Domestic shipments, please add $5 per item for shipping/ handling by UPS ground. For domestic COD shipments, please add $3. Rush service available.

Mail or FAX Orders
POs are welcome. Please include phone number.

International Service
Phone number required with order. Call or FAX for additional information.

Dealers and Corporate Accounts
Call for information.

Unbeatable Prices
We'll beat the competition's advertised prices. Prices subject to change without notice.

Return Policy
30 days. Due to copyright laws, we cannot take back software with the disk seal broken unless authorized by the manufacturer. Returned product must include R.A. number.

Sage Professional Editor

The Sage Professional Editor is the world's best programming editor, designed to create the applications of the 90's. It has an advanced windowed user interface, integrated mouse support, on-line help, menu-driven commands and is highly configurable. Turnkey emulations for Vi, Brief, EMACS/Epsilon and WordStar get you up and running fast. The virtual memory system gives you the ability to edit huge files (up to 100 MEG) in as many as 256 windows--over two billion lines. MS-DOS, OS/2 and Dual Mode versions are all included on both 3.5 and 5.25 inch diskettes.

List: $295 Ours: $249
w/ Mouse ***List: $395 Ours: $335***

SAGE SOFTWARE

Link & Locate ++ V6.0

SYSTEMS & SOFTWARE

Link & Locate ++ is a firmware development package for development on IBM-PC hosts for Intel 8086/87/ 186/286 microprocessors. Its features include: accepts object files as input produced by the Microsoft C Compiler and the Microsoft Macro Assembler; generates cross reference listing among input object files and library files; maintains object libraries; incremental linking with type checking of symbols; accepts debugging records in Microsoft OMF (CodeView compatible or Intel OMF); full control of placement of segments and groups anywhere in the physical memory. Works with Microsoft C 5.1 and Microsoft C 6.0. Requires 640K memory and a hard disk.

List: $395 Ours: $329

Lahey F77L-EM/32

This is a fast and powerful 32-bit FORTRAN compiler that lets users write and port programs up to 4 GigaBytes on 80386's. F77L-EM/32 was the winner of PC Magazine's 1988 Technical Excellence Award for Compilers/ Languages. Version 3.0 includes: Weitek support for faster processing, easier mainframe porting with DO WHILE and DO END DO statements, Video Graphics, Editor, Full 77 Standard, VAX and IBM VS mainframe extensions, fast compilation, excellent diagnostics, and a powerful debugger. Another outstanding product from the FORTRAN experts. New OS/386: Includes Virtual Memory Support, DESQview Support, and free Unlimited Runtimes.

List: $895 Ours: $719

Lahey Computer Systems Inc

ATTENTION CORPORATE CUSTOMERS,

Call Your Corporate Hotline

(800) 422-6507

- Select from over 4,500 titles–and we special order too!
- Get quick delivery at great prices on Microsoft, Borland, Lotus...etc. (We buy software directly from all the major publishers, and keep plenty of stock on hand.)
- Ask about volume purchase agreements, contracts, and personally assigned inside and outside sales representatives (CORSOFT Division).

International: **201-389-9228**
Customer Service: **201-389-9229**
Fax: **201-389-9227**

Corporate: **800-422-6507**
Canada: **800-445-7899**

Call or Write for Latest Free Catalog!

1-800-445-7899

Programmer's Paradise

A Division of Voyager Software Corp
1163 Shrewsbury Ave., Shrewsbury, NJ 07702

World Radio History

Programmer's Paradise (800) 445-7899

BLAISE

	LIST	OURS
C Asynch Manager	189	139
ASYNCH PLUS	189	139
C Tools PLUS/ 6.0	149	115
EXEC	95	75
Key Pilot	50	39
Pascal TOOLS	125	109
Pascal TOOLS 2	100	89
Pascal TOOLS / TOOLS 2	175	135
Power Search	149	109
Power Screen	149	109
Power Tools Plus	149	109
RUNOFF	50	45
Turbo C TOOLS	149	109
View 232 1.0	189	149

BORLAND

Eureka: The Solver	167	117
Paradox 3.0	725	507
Paradox LAN Pack	995	697
Paradox OS/2	725	507
Paradox 386	895	625
Quattro Professional	495	329
Reflex v. 2.0	250	175
SideKick	85	60
SideKick for OS/2	250	175
SideKick Plus	200	139
Sprint	200	139
Turbo Assembler/Debugger	150	105
Turbo Basic	100	69
Database Toolbox	100	69
Editor Toolbox	100	69
Turbo C 2.0	150	105
Turbo C 2.0 Professional	250	175
Turbo Lightning	100	69
Lightning Word Wizard	70	49
Turbo Lightning and Lightning Word Wizard	150	105
Turbo Pascal 5.0	150	105
Turbo Pascal 5.0 Professional	250	175
Database Toolbox	100	69
Editor Toolbox	100	69
Gameworks Toolbox	100	69
Graphix Toolbox	100	69
Numerical Methods Toolbox	100	69
Turbo Pascal Developer's Library	395	279
Turbo Prolog	150	105
Turbo Prolog Toolbox	100	69

DIGITALK

Smalltalk/V	100	85
Communications	50	45
EGA/VGA Color Extension	50	45
Goodies #1, #2 or #3	50	45
Smalltalk/V 286	200	169
Smalltalk/V MAC	200	169
Smalltalk/V PM	500	399

FAIRCOM

c-tree	395	315
w/ r-tree	650	519
w/ r-tree, d-tree	CALL	CALL
d-tree	495	395
r-tree	295	239
FairCom Toolbox Prof. Edition	1095	789
FairCom Toolbox Special Edition	695	509

GREENLEAF SOFTWARE INC.

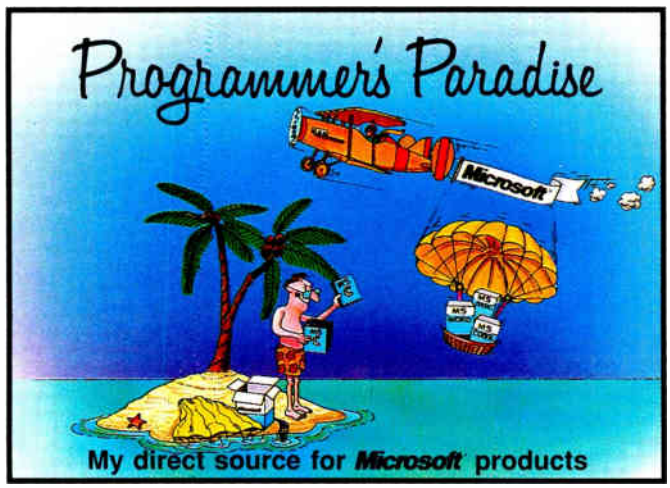
Greenleaf Business MathLib	395	339
Greenleaf CommLib	299	249
Greenleaf DataMath Interface	75	69
Greenleaf DataWindows	395	339
Greenleaf DataWindows, OS/2	395	339
Greenleaf Functions	229	209
Greenleaf MakeForm	125	119
Greenleaf SuperFunctions	299	239
Greenleaf ViewComm	559	489

IGC

VM/386	245	209
VM/386 MultiUser	895	839
VM 386 MultiUser Starter	395	339
VM/386 NetPak	150	129

LAHEY

A.I. Developer's Kit OP/SYS	495	459
Lahey F77L	595	535
Lahey F77L-EM/16 (w/ OS/286)	895	799
Lahey F77L-EM/32 (w/ OS/286)	1090	979
Lahey Personal FORTRAN 77 w/ Toolkit	95 / 119	89 / 105



***Programmer's Paradise** offers the complete software product line for publishing giants such as Microsoft, Borland, Lotus, and Software Publishing, as well as dozens of other important software publishers. Most of these products are stocked items.*

Call for immediate delivery!

LATTICE

	LIST	OURS
68000 C X-Compiler	900	769
Curses	125	109
dBC III	250	229
dBC III Plus	500	439
HighStyle	375	319
Lattice 80286 C Develop. System	495	395
Lattice 80386 C Develop. System	895	715
Lattice C Compiler 6.0	250	189
Lattice Communications Library	250	209
RPG 3.0	1600	1285
SecretDisk II	125	109
SecretDisk II Administrator	500	429
SideTalk	125	109
SSP/PC	350	299
Z80 C X-Compiler	500	449

LOTUS

Agenda	395	299
Freelance Plus	495	347
Lotus 1-2-3 2.2	495	329
Lotus 1-2-3 3.0	595	389
Magellan	195	CALL
Manuscript	495	326
Symphony 2+	695	499

MEDIA CYBERNETICS

Dr. HALO III	140	99
HALO DPE	195	139
HALO	395	279
HALO for OS/2	695	489
HALOvision III	495	349
HALO Window Toolkit	595	419
HALO for Microsoft Developers	595	419

MICROGRAFX

ClipArt Collections	250	189
ClipArt Special Editions	150	109
Designer v3.0	695	455
Draw Plus v1.0	395	258
Graph Plus v1.3	495	324
XPort v1.0	395	258

MICROSOFT

M5 BASIC Prof. Devel. System	495	349
M5 C 6.0	495	329
MS Chart	395	277
MS COBOL	900	629
MS Excel	495	319
MS FORTRAN for DOS or OS/2	450	299
MS Learning DOS	50	35

MICROSOFT *(continued)*

	LIST	OURS
MS Mach 20	495	329
MS Macro Assembler	150	105
MS Mouse Bus or Serial:		
w/ Paintbrush & Mouse Menus	150	105
w/ Paintbrush & Windows	200	149
MS Multiplan	195	136
MS OS/2 Presentation Mgr. Tlkt.	500	349
MS Pascal for DOS or OS/2	300	209
MS Presentation Manager Softset	150	105
MS Programmer's Library-CD	395	277
MS Project	495	329
MS QuickBASIC 4.5	99	69
MS QuickC 2.0	99	69
MS QuickC w/ QuickAssembler	199	139
MS QuickPASCAL	99	69
MS Sort	195	139
MS Windows	99	69
MS Windows/386	195	136
MS Windows Development Kit	500	349
MS Word	450	279
MS Word for Windows	495	349
MS Works	149	105

MORTICE KERN SYSTEMS

MKS AWK	99	85
for OS/2	179	159
for DOS & OS/2	199	179
MKS LEX:YACC	249	199
for OS/2	349	295
for DOS & OS/2	399	339
MKS MAKE	149	129
for OS/2	249	199
for DOS & OS/2	299	259
MKS Programming Platform	665	565
for OS/2	995	839
for DOS & OS/2	1149	989
MKS RCS	189	159
for OS/2	289	245
for DOS & OS/2	339	289
MKS Software Mgmt. Team	299	255
for OS/2	449	399
for DOS & OS/2	499	429
MKS SQP5	495	479
MKS Toolkit	249	199
for OS/2	349	295
for DOS & OS/2	399	339
MKS Trilogy	119	105
MKS Vi	149	129
for OS/2	199	159
for DOS/OS/2	229	199

NOVELL

	LIST	OURS
Btrieve Single-User	245	185
Btrieve for DOS 3.1 Networks	595	459
Btrieve for OS/2	595	459
Btrieve for XENIX	595	459
C Network Compiler	695	559
C Network Compiler/386	995	799
NetWare C Interface for DOS	295	239
NetWare MHS	100	79
NetWare MHS Interface Guide	145	129
NetWare RPC	950	749
NetWare RPC for OS/2	1700	1359
Netware SQL	595	459
NetWare System Calls for DOS	195	159
XQL	795	597
Xtrieve PLUS	595	459
Xtrieve PLUS for OS/2	595	459

SAGE SOFTWARE

C Beautifier	50	42
PFinish	295	259
Pfix86plus	295	259
Plink86plus	495	399
PolyAWK	99	85
OS/2 Version	199	179
PolyBoost II	80	72
PolyDoc	199	169
PolyLibrarian	99	85
PolyLibrarian II	149	125
PolyMake 3.0	149	125
PolyShell	99	85
PolyXRef	99	85
Professional PVCS (Corporate)	495	419
w/ PolyMake for OS/2	695	589
PVCS/MAKE for OS/2	395	335
Sage Professional Editor	295	249
w/ Mouse Support	395	335

SOFTWARE PUBLISHING

Harvard Graphics	495	339
Harvard Graphics Draw Partner	149	99
Harvard Project Manager	695	489
OfficeWriter	495	339
OfficeWriter LAN (3 users)	995	699
PFS:First Choice	169	105
PFS:First Choice LAN Pack	475	325
PFS:First Graphics	149	99
PFS:First Publisher	129	89
Professional File	299	199
Professional Plan	99	69
Professional Write	229	149

SOUTH MOUNTAIN

Breakout-II	125	99
C Utility Library	249	199
Essential B-Tree	199	149
Essential Communications	329	299
Essential Graphics	399	349
w/ source code	1398	1119
Hold Everything	129	109
/*resident C*/ w/ source	249	199

TURBOPOWER SOFTWARE

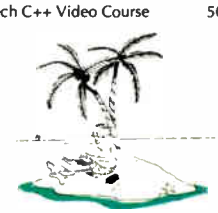
B-tree Filer	125	109
Multi-user w/ Network Support	175	145
Object Professional	125	109
Turbo Analyst 5.0	99	89
Turbo Professional	125	109

THE WHITEWATER GROUP

Actor	695	559
Language Extensions I	99	85
Whitewater Resource Toolkit	195	169
WinTrieve	395	339

ZORTECH

Zortech C Video Course	300	269
Zortech C++ Compiler V2.0	200	165
w/ source	300	259
Zortech C++ Debugger V2.0	150	129
Zortech C++ Developer's Edition	450	399
Zortech C++ Tools V2.0	150	129
Zortech C++ Video Course	500	449

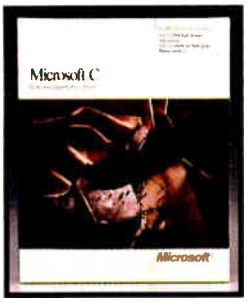


World Radio History

Programmer's Paradise (800) 445-7899

Microsoft is once again at the forefront of technology with two new products for professional programmers, appropriately entitled ***Professional Development Systems****. Programmer's Paradise, the world's leading source of development software, is stocked with a plethora of these products... ready to ship to you!*

Call and order today!



Microsoft® C Professional Development System 6.0

The ideal environment for creating sophisticated, large-scale C applications. The newest version of the industry standard C Compiler is faster than ever. DOS, Windows, or OS/2 PM programmers can all benefit from this product's new development environment, the Microsoft Programmer's Workbench. Integrated tools within the environment include a powerful programmer's editor, compiler, linker, NMAKE facility, CodeView window-oriented debugger, Source Browser, and hypertext-based documentation. The Programmer's Workbench also offers mouse support, and all the tools are accessible from one easy-to-use interface. Microsoft C, the natural choice for any professional C programmer.

Microsoft® BASIC Professional Development System 7.0

Everything the serious BASIC programmer has been looking for. Create dramatically smaller and faster executables. Handle LARGE programs because there's more room for data, source code, and compiled code. EMS 4.0, far strings and run-time overlays are now supported. Create fast, powerful database applications with the ISAM package Microsoft has completely integrated into the language. Also save time with toolboxes for user-interface development, presentation graphics and matrix math work. This is the high productivity programming solution BASIC programmers have been looking for.

FREE T-Shirt...

Buy any Microsoft product from us this month, and ***as a bonus,*** receive a free ***Programmer's Paradise*** T-Shirt. These top quality T-Shirts are available in Medium, Large or X-Large (while supplies last).

Don't be seen at the pool or beach without one!!!

Offer good through July 31, 1990.

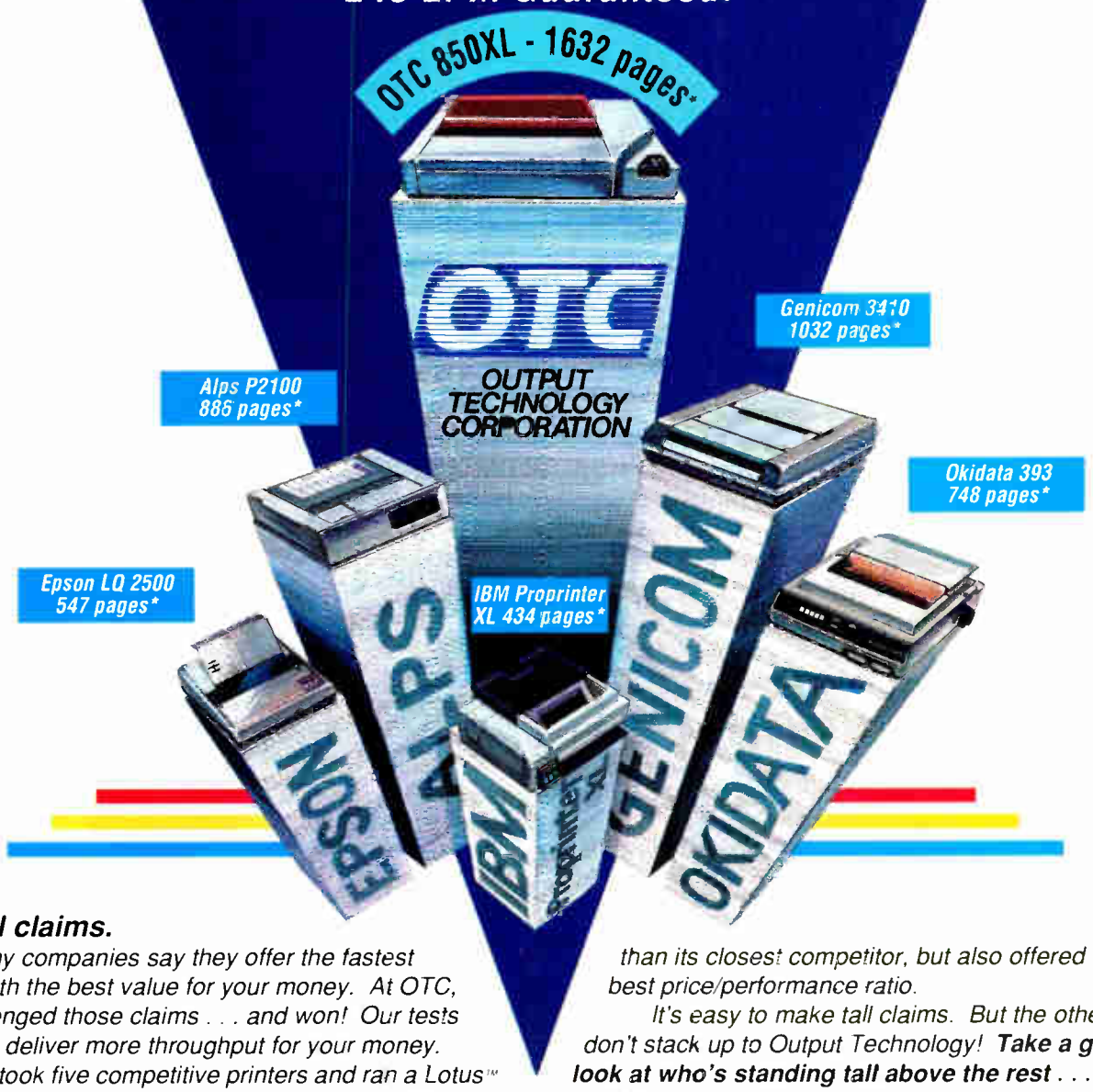
THE MICROSOFT PRODUCT LINE

	LIST	OURS
MS BASIC Prof. Development System 7.0	495	349
MS C Professional Development System 6.0	495	329
MS Chart	395	277
MS COBOL	900	629
MS Excel	495	319
MS Excel (MAC)	395	279
MS FORTRAN for DOS or OS/2	450	299
MS Learning DOS	50	35
MS Macro Assembler	150	105
MS Mouse Bus or Serial		
w/ Paintbrush & Mouse Menus	150	105
w/ Paintbrush & Windows	200	149
MS Multiplan	195	136
MS OS/2 Presentation Manager Softset	150	105
MS OS/2 Presentation Manager Toolkit	500	349
MS Pascal for DOS or OS/2	300	209
MS PowerPoint (MAC)	395	279
MS Programmer's Library - CD ROM	395	277
MS Project	495	329
MS QuickBASIC 4.5	99	69
MS QuickC 2.0	99	69
MS QuickC with QuickAssembler 2.1	199	139
MS QuickPASCAL	99	69
MS Windows 3.0	149	99
MS Windows Software Development Kit	500	349
MS Word	450	279
MS Word (MAC)	395	279
MS Word for Windows	495	349
MS Works	149	105

World Radio History

SPREAD SHEETS FASTER!

OTC's 850XL Prints Spreadsheets Faster Than Its Competition! 240 LPM Guaranteed!



Tall claims.

Many companies say they offer the fastest printer with the best value for your money. At OTC, we challenged those claims . . . and won! Our tests prove we deliver more throughput for your money.

We took five competitive printers and ran a Lotus™ 1-2-3 spreadsheet under the exact same conditions. The OTC 850XL not only delivered 58% more throughput than its closest competitor, but also offered the best price/performance ratio.*

It's easy to make tall claims. But the others just don't stack up to Output Technology! ***Take a good look at who's standing tall above the rest . . . call OTC for a free copy of our Benchmark test today! Over 300 Service Centers Nationwide.*****

1-800-4-OUTPUT

(468-8788)
(8 am — 5 pm PST)

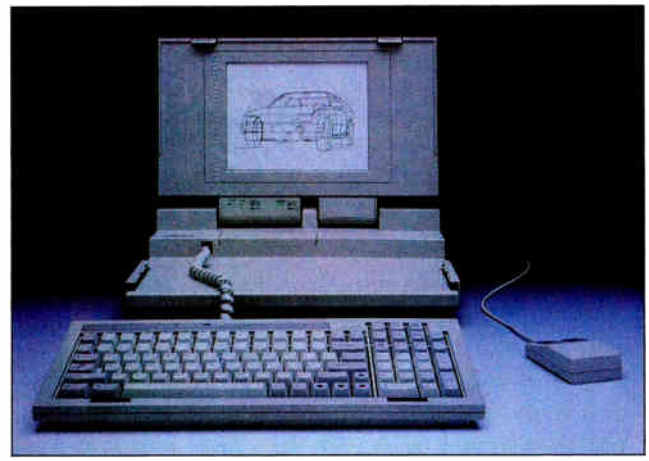
**Calculated for 8-hour day, based on actual 50-page print test. All printers run in 10 CPI, 6 LPI, 136 columns.*
***Call for availability in your area.*
IBM, Epson, Alps, Genicom, Okidata, and Lotus are trademarks of others and do not belong to OTC

OUTPUT TECHNOLOGY CORPORATION

E. 9922 Montgomery Drive, Suite #6
Spokane, WA 99206-4199
(509) 926-3855 (800) 4-OUTPUT (468-8788)
Telex: #15-2269 OUTPUTSPOK FAX: (509) 922-4742

Call me, I'm interested, circle 191 on Reader Service Card

World Radio History



The Altima Two is a 16-MHz 286 laptop with VGA resolution and a removable full-size 101-key keyboard.

A No-Compromise 15-Pound Laptop

The Altima Two is a 16-MHz 286-based laptop that includes VGA paper-white graphics on a backlit LCD, internal hard and floppy disk drives, an internal 2400-bps modem, and a full-size 101-key detachable keyboard. The system measures 15 7/10 by 11 1/5 by 3 9/10 inches and weighs 15 pounds.

The Altima Two also includes 1 MB of RAM (expandable to 5 MB), a two-button mouse, DOS 4.01, a half-length 8-bit expansion slot, an AC adapter, and a carrying case. The drives are a 3½-inch 1.44-MB internal floppy disk drive and a 40-MB 25-ms internal hard disk drive. Interfaces include a VGA monitor port, a parallel port, a serial port, and an external keyboard port.

An external 4-pound, 2½-hour battery is optional.
Price: $4499; battery, $199.
Contact: Altima Systems, Inc., 1390 Willow Pass Rd., Suite 1050, Concord, CA 94520, (800) 356-9990 or (415) 356-5600.
Inquiry 1139.

DTK Joins the Laptop Brigade

DTK, a company that has specialized in motherboards, has announced its first complete system, a 386SX laptop. Features include VGA graphics on a paper-white backlit LCD screen and a detachable keyboard.

Standard hardware includes 1 MB of RAM (expandable to 5 MB), an internal battery that lasts 15 minutes, a serial port, a parallel port, a 3½-inch 1.44-MB floppy disk drive, an AC adapter, and a power-saver feature. You can upgrade with a three-quarter-length 16-bit expansion slot and an 80387SX coprocessor socket. Bundled software includes DOS 3.3 and LapLink. The BIOS is DTK's own. The 386SX weighs 10½ pounds and measures 11 1/10 by 4 by 12 1/10 inches.

A system option package includes a 2400-bps internal modem (occupying a separate modem slot), an internal 40-MB 28-ms hard disk drive, an external battery pack that extends power to 3 hours and weighs about 3 pounds, and a carrying case. An optional Expansion Station, enclosed in a minitower case, can accommodate two 5¼-inch half-height drives, one 5¼-inch full-height drive, and three full-length 16-bit expansion cards.
Price: Under $3000; system option package, $500; Expansion Station, $295.
Contact: DTK Computer, Inc., 15711 East Valley Blvd., City of Industry, CA 91744, (818) 333-7533.
Inquiry 1140.

Fortron Unveils Complete SX for $1495

The NetSet 386SX is one of the few 16-MHz 386SX systems that costs less than $1500. After you include the high-capacity 5¼- or 3½-inch floppy disk drive and a video card, you still have two open 16-bit slots and two open half-height 5¼-inch drive bays. The system has one parallel and two serial ports, 1 MB of RAM (expandable to 8 MB), and a 150-W power supply.

Standard equipment on the basic system includes a VGA card and a 101-key keyboard but no monitor. You can specify the monochrome system with a monochrome video card, a 12-inch monitor, and a 40-MB 28-ms hard disk drive. You can also opt for a 14-inch color VGA monitor and a 40-MB hard disk drive. DOS 3.3 or 4.01 is an option.
Price: Basic system, $1295; monochrome system, $1390; VGA system, $2050; DOS, $105.
Contact: Fortron/Source, 6818-G Patterson Pass Rd., Livermore, CA 94550, (800) 821-9771 or (415) 373-1008.
Inquiry 1141.

NEC's ProSpeed 386SX Designed to Communicate

NEC's ProSpeed 386SX laptop features a proprietary expansion slot for a line of communications cards. The proprietary Laptop Expansion Slot, the LTX, houses optional cards for local area networking, several types of synchronous terminal emulation, and a modem. The ProSpeed 386SX laptop also includes one non-LTX proprietary slot for memory and another for a modem or fax modem.

Standard features include a backlit VGA display, an 82-key keyboard, 1 MB of RAM (expandable to 9 MB), a 3½-inch 1.44-MB floppy disk drive, and your choice of an internal 40-MB (29 ms) or 100-MB (25 ms) hard disk drive. Standard interfaces include one serial port, one parallel port, a floppy disk drive expansion port, an RGB video output port, an external keyboard port, an RJ-11 modem port, and a DC power port.

LTX cards are available for Ethernet, Token Ring (4 Mbps), ARCnet, 3270 emulation, 5250 emulation, send-and-receive faxing, additional serial ports, SCSI devices, and memory. The laptop measures 12 by 14 9/10 by 3 3/5 inches and weighs 14 pounds.
Price: With 40-MB hard disk drive, $5799; with 100-MB hard disk drive, $6599; battery cartridge, $199.
Contact: NEC Technologies, Inc., 1255 Michael Dr., Wood Dale, IL 60191, (800) 826-2255 or (708) 860-9500.
Inquiry 1142.

World Radio History

Hewlett-Packard Shows Mac Printers, One with Color

Hewlett-Packard has introduced a color printer for Macs on an AppleTalk network and added an AppleTalk interface to its DeskWriter.

On or off AppleTalk, the HP PaintWriter XL prints a page of color graphics in about 1½ minutes. It uses all QuickDraw-compatible software and lets your Mac II print on letter- and tabloid-size (11- by 17-inch) paper from a palette of up to 16.7 million colors. Your Mac Plus, SE, or Portable can print from a palette of up to eight colors. The PaintWriter XL also features background printing with a spooling capability and has scalable outline fonts, including CS Times, CS Triumvirate, CS Courier, and CS Symbol.

The PaintWriter XL can print in portrait and landscape orientations and has an automatic sheet feeder that will handle up to 200 paper pages or 70 sheets of overhead-transparency film. The PaintWriter measures 9 by 29½ by 17⅓ inches.

The enhanced DeskWriter is a thermal ink-jet printer with a print resolution of 300 dpi. It measures 17⅜ by 8 by 14⅘ inches.

Price: $2995; DeskWriter, $1195.
Contact: Hewlett-Packard, Company Inquiries, 19310 Pruneridge Ave., Cupertino, CA 95014, (800) 752-0900.
Inquiry 1143.

HP's PaintWriter XL is designed for your Mac, and it functions on an AppleTalk network.

20-pound Device Projects VGA and Mac Color Images

The MagniView 800 VGA multisync data projector lets you project up to eight shades of simulated color from any VGA or Mac-compatible video source, according to the manufacturer. And because it's equipped with a 250-W lamp, a fan, and a projection lens, you don't need a separate overhead projector.

The maximum graphics resolution is 640 by 480 pixels; the maximum text resolution is 720 by 400 pixels. Controls on the front of the 13- by 17½- by 6-inch unit let you adjust color, contrast, synchronization, and positioning and let you clear the screen and reverse the video.

Price: $1895; Macintosh interface, $20.
Contact: Dukane Corp., 2900 Dukane Dr., St. Charles, IL 60174, (708) 584-2300.
Inquiry 1146.

Panasonic Offers 8514/A and VGA Color Monitor

The PanaSync C1381 is an inexpensive 14-inch color monitor with a resolution of 1024 by 768 pixels.

It automatically adjusts to the signal frequencies of 8514/A, VGA, CGA, and Macintosh graphics (you need an optional adapter for a Mac). The dot pitch is 0.28.

Price: $699; Macintosh adapter cable, $43.
Contact: Panasonic Communications and Systems Co., Two Panasonic Way, Secaucus, NJ 07094, (800) 742-8086 or (201) 348-7000.
Inquiry 1145.

SPREAD THE WORD

Your new product is important to us. Please address information to New Products Editors, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Better yet, use your modem and mail new product information to the microbytes.hw or microbytes.sw conferences on BIX. Please send the product description, price, ship date, and an address and telephone number where readers can get more information.

This 3½-inch Floppy Disk Drive Holds 21 MB

Using specially made floppy disks, the Stor/Mor drive stores as much data as a 21-MB hard disk drive, its manufacturer says. It holds up to 21 MB of formatted data on what looks like a standard 3½-inch floppy disk. The drive's average access time is 35 ms.

The Stor/Mor system uses a closed-loop servo tracking mechanism, as opposed to the open-loop stepper motor found in conventional disk drives. The floppy disk contains two strata: a top layer where data is stored, and an underlying layer of unerasable magnetic rings used to position the head. To further boost capacity, the Stor/Mor uses multizone recording, in which the outer tracks contain more sectors than those nearer the center.

There are three Stor/Mor models. One internal drive is a 5¼-inch half-height drive that comes complete with a SCSI adapter, software utilities, and cabling. An external unit (which measures 5½ by 8¾ by 2¼ inches including an internal fan) is packaged with a SCSI adapter and a separate 3- by 3- by 4½-inch 12-W power supply. A third unit, for PS/2 systems, is an internal subsystem that includes a Micro Channel SCSI adapter.

Price: Internal, $795; external, $895; Micro Channel, $995; each disk, $25.
Contact: Q/Cor, One Meca Way, Norcross, GA 30093, (800) 548-3420 or (404) 923-6666.
Inquiry 1144.

continued

World Radio History

Backup Power Supply Fits in a Slot

The VIP PowerSave 500 is a backup power supply on an extra-wide 8-bit board with accompanying software for your DOS system.

You install PowerSave in a single slot when adjacent to a short board. On-board nickel-cadmium batteries are included, as is battery-backed-up RAM that contains real-time software for operation.

PowerSave provides a power capacity of 200 W: 200 VA for up to 90 seconds or 50 VA for up to 15 minutes; it then automatically shuts your system down and saves your work. The company claims that if there's a 2-second power outage, you won't notice it. If power goes out for 2 to 20 seconds, PowerSave performs a complete system backup that lasts up to 30 seconds and lets you continue work after the backup is complete.

Finally, if the power goes out for more than 20 seconds—even if you power down the system yourself—PowerSave performs the complete system backup and shuts down your system. When AC power returns, or when you return to power up your system, your application is restored.

Price: $329.
Contact: ITT PowerSystems Corp., 3400 East Britannia Dr., Suite 122, Tucson, AZ 85706, (602) 889-7600.
Inquiry 1149.

ITT PowerSystems' VIP PowerSave 500 is a backup power supply with software for saving your work and automatically shutting down your system.

Make Your Mac a Signal Processor

The NB-DSP2300 digital-signal-processing accelerator board from National Instruments, which features the Texas Instruments TMS320C30 floating-point DSP, enables your Mac II to process signals in real time. Coupled with the company's NB-A2100, a 16-bit audio A/D converter board, the DSP board gives the Mac II audio-processing capabilities for applications such as speech recognition, vibration analysis, and other acoustical research.

When used with National Instruments LabView2 software, the company says, the boards rival stand-alone signal analyzers that are three times the price.

The DSP board and the 16-bit audio board let you process sounds at a rate of up to 33 MFLOPS. They sample analog input from two different channels at several software-programmable rates, including 44.1 kHz (the rate of compact disk players) and 32 and 48 kHz (the rates used in digital audio tape recorders).

Price: NB-DSP2300, $4995; NB-A2100 board, $1595; LabView2 software, $1995.
Contact: National Instruments, 6504 Bridge Point Pkwy., Austin, TX 78730, (800) 433-3488 or (512) 794-0100.
Inquiry 1150.

Shift Your SQL Queries into High Gear

The dBASE Query Accelerator speeds up SQL database queries by as much as 100 times. The accelerator consists of a SCSI disk drive controller and a database coprocessor. SCSI drives attach to the board with a ribbon cable. When the CPU issues a database query to the disk drive, the request is intercepted by an Advanced Micro Devices RISC processor on the card and is processed locally before answers are returned to the CPU.

The benefit of this approach, ADS says, is that communication between the drive and the coprocessor occurs at fast SCSI disk transfer speeds and only the final query results are returned to the CPU across the slower AT bus. The RISC processor is also optimized for database work, so it works faster than the host CPU could.

Price: $1995.
Contact: Advanced Data Servers, P.O. Box 4937, Boise, ID 83711, (208) 322-7800.
Inquiry 1152.

Hercules Bundles VGA and 34010 Graphics

The Graphics Station Card is an inexpensive VGA and 34010 graphics board from Hercules that produces 16- and 24-bit color graphics on VGA color monitors. It includes a full megabyte of video memory.

You can drive the Graphics Station Card with 32,768 colors at 640 by 480 pixels and at a special 512- by 480-pixel resolution. Or you can opt for 24 bits with 16.7 million colors. The 512- by 480-pixel resolution, though displayable on a VGA, is also appropriate for broadcast use (with analog RGB signal output) when run through a scan converter.

Price: $1024.
Contact: Hercules Computer Technology, Inc., 921 Parker St., Berkeley, CA 94710, (415) 540-6000.
Inquiry 1151.

Turn Your Z-241 or Z-248 into a 25-MHz 486

The Z-Master 486 is a processor upgrade board designed for the Zenith Z-241 and Z-248 286-based desktop computers.

Both those systems have passive backplanes. The new Z-Master processor replaces the old CPU board with a one-slot 25-MHz i486 and adds a 32-bit memory slot for an optional capacity of 16 MB in single in-line memory modules.

Price: $4995.
Contact: Aox, Inc., 486 Totten Pond Rd., Waltham, MA 02154, (617) 890-4402.
Inquiry 1153.

continued

World Radio History

DBMS Case Study:

Security for the Goodwill Games™*

The Problem

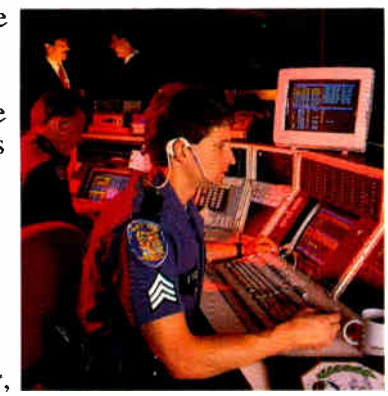
The 1990 Goodwill Games: 2500 athletes in 22 events at 15 locations, drawing hundreds of thousands to watch them perform. A show-place for international goodwill. A potential target for terrorists. A challenge for security agencies.

With only 3,000 off-duty officers to fill 30,000 assignments, there's no room for confusion in scheduling. And scheduling must respond to last minute changes, as event times slip, as dignitaries arrive on short notice, or as threats arise. Hand-scheduling can't meet the challenge. But the Games' Integrated Police Planning Group (IPPG) found that no automated system had ever been developed for securing such events.

The Application

Running on a VAX, Automated Manpower On-line Scheduling (AMOS) matches personnel to scheduling requirements, taking into account special training, language skills, and other factors. AMOS prepares an assignment sheet for each individual, explaining the assignment, when and where to report, how to get there – even where to park.

AMOS responds to changes quickly. The database is large and complex, yet thanks to the innovative combined technology of the underlying db_VISTA database engine, search, match, and update times are negligible. Data integrity is assured by avoiding data redundancy. That means the information is reliable.



Command center personnel can adjust schedules without delay or confusion, thanks to db_VISTA III's ability to handle large volumes of data with speed and accuracy.

The Solution

AMOS was created by Raima's services subsidiary, Vista Development Corp., using the db_VISTA III DBMS. "We looked for months for a database that was fast, flexible, and could handle a huge volume of data while still maintaining speed," said Sgt. Alan Bernstein of the IPPG. "We also wanted to find a company that could not only furnish the product, but provide the development services. Then we discovered Raima and db_VISTA III."

Your end users may not be fighting terrorists, but they still need fast, reliable information to get their jobs done. If you develop applications for VMS, UNIX, QNX, OS/2, MS-DOS, MS Windows, Macintosh, and other environments, db_VISTA III is the solution.

db_VISTA III™

Database Management System

Specifications: ***High performance. C language portability. Complete C source code available. No royalties.***

Network data model. Relational B-tree indexing. Relational SQL query and report writer. Single & multi-user. Automatic recovery. Built-in referential integrity. Complete schema revision capability. **Supports:** VMS, UNIX, QNX, SunOS, XENIX, Macintosh, MS-DOS, MS Windows, OS/2 compatible. **Most C Compilers and LANs supported.**

Call 1-800-db-RAIMA **(1-800-327-2462)**

Circle 322 on Reader Service Card

RAIMA™ CORPORATION

Raima Corporation 3245 146th Place S.E., Bellevue, WA 98007 USA **(206)747-5570** Telex: 6503018237 MCI UW FAX: (206)747-1991

International Distributors: U.K.: (44) 0992 500919 **W. Germany:** (49) 07127 5245 **Switzerland:** (41) 064 517475; (33) 01725 0410 **France:** (1)46092784 **The Netherlands:** 31 02159 46 814 **Sweden:** (013)124780 **Italy:** 39 45 584711 **Norway:** 47 244 8855 **Denmark:** 45 42 887249 **Japan:** 81 3 473 7432 **Taiwan:** 886 2 552 3277 **Mexico:** 52 83 57 35 94 **Central America:** (506) 28 07 64 **Argentina:** 54 1 313 5371 **Chile:** 56 2 398399 **Uruguay:** 598 2 92 09 59 **USSR:** 01 32 35 99 07; 812 292 19 65; 0142 437952

Copyright © 1990 Raima Corporation GWG790 BY070

* *"Goodwill Games" is a trademark of the Turner Broadcasting Company.*

World Radio History

PC Magazine says, "Northgate™'s SlimLine 320 ...

- Smallest full power 386™ system ever
- 386/20 Microprocessor
- No larger than a typewriter
- 2Mb Ram
- 40Mb Hard Drive
- 1.2 and 1.44 Floppy Drives
- NEC VGA Color Monitor
- 16 Bit VGA
- *OmniKey*™/PLUS Keyboard
- MS-DOS 4.01/GW BASIC
- THE NEW Microsoft® WINDOWS™
- PLUS a genuine Microsoft Mouse!

All this for an incredible:

$2899.00 Delivered to Your Home or Office

More Storage! More Performance!

Upgrade to our new super fast Super Maxtor™ 200Mb Hard Drive with 15ms Access.

ADD ONLY **$699.00**

You want maximum performance and value in a space-saving desktop case. You get it in a Northgate SlimLine 320. It packs all the power of a full-size 386 into a performance package only 4.25" high and 16.5" square. And, at just 23 pounds, you can move it with ease.

PC Magazine said: "(SlimLine) doesn't take up a lot of room...but it delivers plenty of computer for a price you might expect to pay for a 286 system."

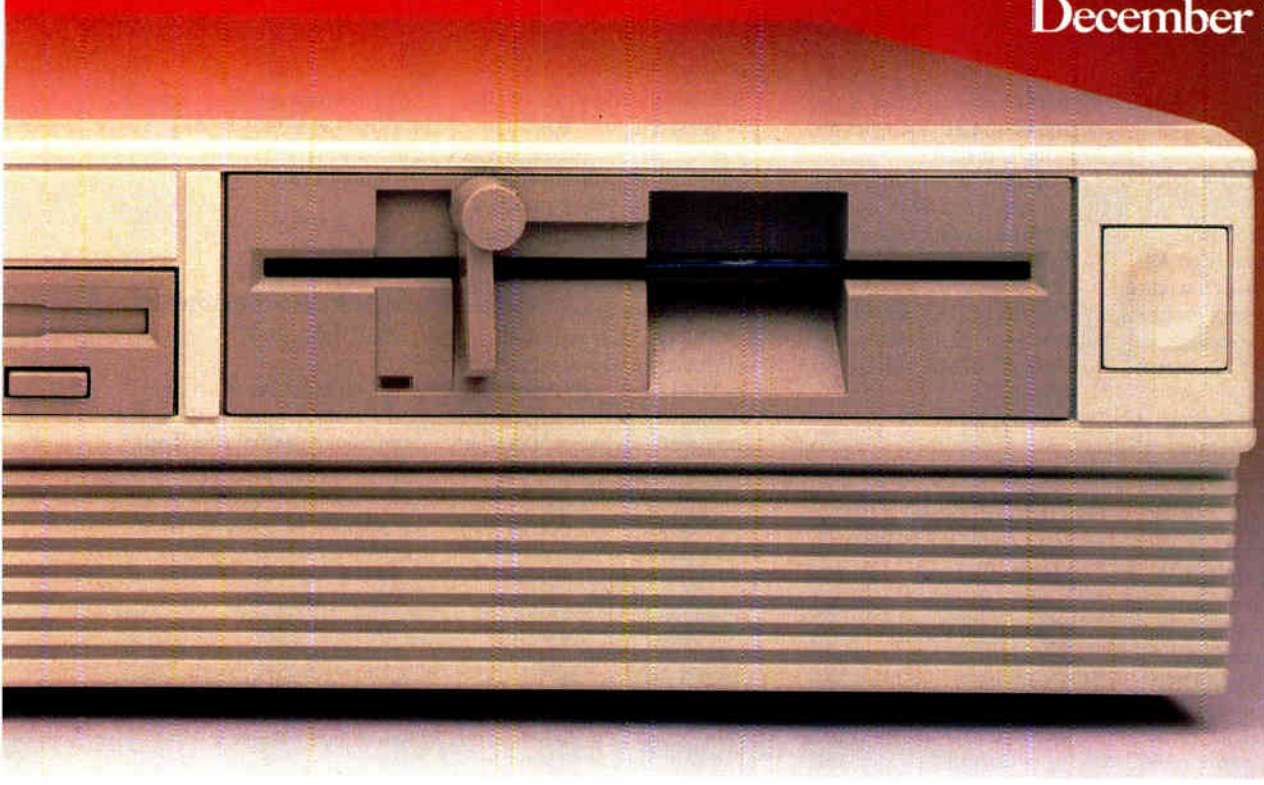
The heart of the system is a new Northgate proprietary motherboard with built-in hard and floppy disk controllers, 2 serial and 1 parallel port and 16-bit VGA video. Smaller than a sheet of legal paper. It gives you a host of features that are add-ons in others' systems. Even our clock/calendar method is guaranteed for 5 years without using old-fashioned batteries. And with five expansion slots, you have plenty of room for all your peripherals.

Use it at office or home. Run the latest multi-tasking applications under Microsoft Windows™ or Northgate's OS/2®. Crunch numbers on the biggest spread sheets. Sort, search and select data in your databases at the blink of an eye. And if you're looking for high performance terminals in a network environment, SlimLine 320 is an ideal solution.

World Radio History

When it's this good, this cheap, why buy less?"*

December 26, 1989



And remember... your Northgate SlimLine 320 is backed by expert technical support any time you need it. Call toll-free, 7 days a week, 24 hours a day. On-site deskside service is available 5 days a week (to most locations).

SYSTEM FEATURES

- Intel 80386-20MHz microprocessor
- 2Mb of RAM; expandable to 8Mb on motherboard
- 40Mb hard drive with built in cache
- 3.5" 1.44Mb and 5.25" 1.2Mb Floppy Disks (reads, writes and formats low density diskettes)
- Page mode memory system
- Integrated high performance 16-bit VGA color controller with 256K video RAM supporting 800x600 resolution
- Integrated high performance floppy and hard disk controller on the motherboard
- 1 parallel and 2 serial ports
- 5 expansion slots (3 full-size 16-bit I/O boards; 2 half-length 8-bit)
- 14" NEC 2A VGA Color Monitor
- Exclusive *OmniKey*/PLUS Keyboard
- MS-DOS 4.01 and GW Basic Software Installed
- FCC Class B Certified

TEST A SLIMLINE 320 AT NO RISK FOR 30 DAYS

**PC Magazine* December 26, 1989 reviewed the Northgate MicroStation 386/20. This system has been upgraded and is now named the "SlimLine 320."

Of course, SlimLine 320 comes with a 1-year limited warranty on parts and labor; 5-years on the *OmniKey* keyboard. If a part fails, we'll ship a replacement to you overnight at our expense before you return your part.

Test a SlimLine 320 at no risk for 30 days. If you are not 100% satisfied, return it for a full refund. No questions asked. To place your order, call sales toll-free 24 hours everyday. Be sure to ask about custom configurations, leasing and financing options.

FINANCING: Use the Northgate Big 'N' revolving credit card. We have millions in financing available. We accept Visa or MasterCard, too. Lease it with Northgate, up to five-year terms available.

CALL TOLL FREE 24 HOURS EVERYDAY

800-548-1993

NORTHGATE COMPUTER SYSTEMS™

"We hear you!"

P.O. Box 41000 Plymouth, MN 55441

Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability.

©Copyright Northgate Computer Systems, Inc. 1990. All Rights Reserved.
Northgate, *OmniKey* and the Northgate Big 'N' logo are trademarks of Northgate Computer Systems, Inc. All other product and brand names are trademarks of their respective companies. Microsoft and Windows are registered trademarks of Microsoft Corporation. "386" and "i386" are registered trademarks of Intel Corporation.

Circle 184 on Reader Service Card

...developed over the past decade and you'll see something they all have in common:

An integrated UNIX® System environment.

Now take a look at the vast majority of businesses that have put computing power directly onto their office desktops over the past decade, and you'll see something they all have in common:

Industry-standard personal computers.

It doesn't take a computer to forecast the platform that's going to put graphical workstations on the vast majority of business and engineering desktops in the next decade:

An integrated UNIX System environment for industry-standard personal computers.

And that's what Open Desktop™ is all about.

Open Desktop is the complete graphical operating system that's built on the most popular UNIX System platform of all time—SCO™. And it lets you create your own networked, icon-driven workstation environment using the industry-standard 386 or 486 computers and peripherals of your choice.

...integrated—package, Open Desktop delivers:

- the full 32-bit, multitasking computing power of SCO UNIX System V/386
- compliance with POSIX™ and X/Open® standards
- an OSF/Motif™-based, Presentation Manager-compatible, graphical user interface
- distributed SQL database management services
- compatibility with existing DOS, XENIX®, and UNIX System applications and data files
- NFS™, TCP/IP, and LAN Manager networking facilities

And all at an unbelievably affordable price.

Discover the complete graphical operating system that leading companies worldwide are choosing as their development platform for the '90s—and using to turn their 386 and 486 PCs into instant workstations today.

Open Desktop from SCO.

OPEN DESKTOP™
The Complete Graphical Operating System

SCO™
THE SANTA CRUZ OPERATION

For more information, call SCO today and ask for ext. 8400

(800) SCO-UNIX (726-8649) (408) 425-7222 FAX: (408) 458-4227 E-MAIL: . . . !uunet!sco!info info@sco.COM

SCO, the SCO logo, Open Desktop, and the Open Desktop logo are trademarks of The Santa Cruz Operation, Inc. UNIX is a registered trademark of AT&T in the USA and other countries. POSIX is a trademark of The Institute of Electrical and Electronics Engineers (IEEE). X/Open is a registered trademark of X/Open Company Ltd. OSF/Motif is a trademark of The Open Software Foundation, Inc. XENIX is a registered trademark of Microsoft Corporation. NFS is a trademark of Sun Microsystems, Inc. 10/89
© 1989 The Santa Cruz Operation, Inc. All Rights Reserved. The Santa Cruz Operation, Inc., 400 Encinal Street, P.O. Box 1900, Santa Cruz, California 95061 USA The Santa Cruz Operation, Ltd., Croxley Centre, Hatters Lane, Watford WD1 8YN, Great Britain, +44 (0)923 816344. FAX: +44 (0)923 817781, TELEX: 917372 SCOLON G

Circle 249 on Reader Service Card

World Radio History

Hand Scanner Supports 256 Colors

ECA C&C Products claims that its Hico A4 Color Scanner, which scans a 4-inch-wide swipe of graphics, can recognize 256 colors. Accompanying DOS-compatible software lets you perform the standard desktop publishing functions of other black-and-white and 64-color scanners and lets you change the value, saturation, and hue of each color picture.

Key functions include merging scanned pictures, importing ASCII text, and support for file formats like .PMC, .VMG, and .SCF. The software supports more than 30 editing tools, includ

bytes of RAM. There's also support for HP LaserJet and PaintJet printers.

A minimum system configuration has 640K bytes of RAM, a mouse, and a hard disk drive.
Price: $699.
Contact: ECA C&C Products, Inc., 38 Route 46 E, Lodi, NJ 07644, (201) 478-0302.
Inquiry 1155.

Inexpensive Film Recorder Makes High-Quality Slides

Polaroid says that its entry-level high-resolution film recorder produces presentation-ready photos and transparencies at one-third

data for several kinds of film is housed in the CI-3000's ROM to deliver predictable results across different film types. The color response of the internal CRT is accounted for as well, as are the changes that take place as the tube grows older.

The CI-3000 exposes slides at a maximum resolution of 2048 lines, half that of competing mid- to high-priced recorders. However, Polaroid says that, at typical conference-room distance, the eye is not sensitive enough to discern the difference between 4096-line and 2048-line images. Like other film recorders, this device delivers 24-bit color from a palette of 16.7 million colors.

An auto-winding 35mm film holder is included with

575 Technology Sq., Cambridge, MA 02139, (617) 577-2000.
Inquiry 1156.

MicroSpeed Trackball Replaces Mac Mouse

The MacTrac is a Macintosh-compatible three-button trackball that's designed as a plug-and-play replacement for the Macintosh mouse, according to MicroSpeed. It measures 3¾ by 6¾ by slightly more than 2¼ inches (the diameter of the trackball).

MacTrac features a resolution of 200 dpi and has a cursor-drag lock button that

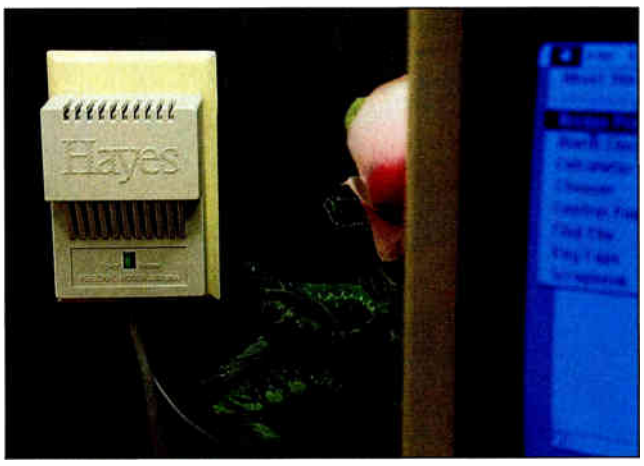
First Low-Priced Modems from Hayes

New Hayes products include a 2400-bps modem, the Personal Modem 2400plus, and the software to make it run: Smartcom for the Mac and Smartcom EZ for DOS systems. Another software package in the series, HayesConnect, lets your Mac share its modem capabilities with other Macs on an AppleTalk network.

For simplicity, Hayes bundles the modem circuitry with an AC adapter in a single 13-ounce 2¾- by 3¾- by 1¾-inch case. Included are cables for the phone line and your computer's serial port.

Smartcom for the Mac and Smartcom EZ include a database for often-called numbers and associated dial-up parameters. They also include the industry-standard XMODEM protocol for uploading and downloading files.

When you're ready to use the Mac version of the Personal Modem 2400plus as a shared resource on your AppleTalk network, you use HayesConnect. The server software, which doesn't require a dedicated Mac system, does need 256K bytes of available RAM. The workstation version of HayesConnect requires 64K bytes of available RAM. It also works across multiple AppleTalk zones.
Price: Personal Modem 2400plus with Smartcom, $199; HayesConnect, $79.
Contact: Hayes Microcomputer Products, Inc., 705 Westech Dr., Norcross, GA 30092, (404) 449-8791.
Inquiry 1160.



The Hayes Personal Modem 2400plus is a 2400-bps modem in an AC adapter.

Watchdog Keeps an Eye on Small Networks

Network General, maker of the Sniffer Network Analyzer for large-scale networks, has announced a less expensive analyzer for networks of 20 to 30 nodes.

Watchdog has monitoring features that include station and network alarms, statistics for performance analysis, report generation utilities, and cable- and active-station testing. Watchdog's network-wide alarms alert you to problems of too much or too little network usage, activity by an unknown station, or broadcast storms (i.e., when the network is filled with broadcast messages). Alarms also signal other problems, such as an "unresponsive" station or one that uses too much of the network resources.

Watchdog displays statistics in real time to track network activity, including usage and error frequency rate. You can save this data, and you can print out tabular or graphical reports that summarize network activity.

The Watchdog Network Monitor offers Racal InterLAN AT or Micro Channel Ethernet boards for thick and thin coaxial cabling and unshielded twisted-pair cabling. Watchdog requires a dedicated PC unless you use a second network adapter card.
Price: Watchdog, $1995.
Contact: Network General, 4200 Bohannon Dr., Menlo Park, CA 94025, (415) 688-2700.
Inquiry 1161.

continued

Remote Control for DOS and Apple Systems

Takeover is DOS-compatible remote-control software that features pull-down menus with keyboard or mouse control and all the functions of SoftKlone's Mirror III communications software. Microcom's Carbon Copy Mac is remote-control software that works over serial (including modem) and AppleTalk networks.

Both products feature their own communications software, background file transfers, a disable function to keep the host safe from unfriendly guests, and a "chat" function for real-time communication.

Takeover (for DOS systems) includes automatic callback, session recording with variable-speed playback, and an activity log. It has its own data-compression and error-correction protocols.

Takeover occupies 55K to 70K bytes of RAM on the host system and 480K bytes on the remote system (of which 375K bytes is the Mirror III communications package). The company says that the package works with all asynchronous modems, synchronous modems, and minicomputer and mainframe terminal-emulation packages. The standard package includes one guest and one host interface.
Price: $295; each additional host, $150; each additional guest, $195.
Contact: SoftKlone, 327 Office Plaza Dr., Suite 100, Tallahassee, FL 32301, (904) 878-8564.
Inquiry 1162.

Carbon Copy Mac comes with an identical 200K bytes of software for a host and a remote Macintosh.

You can use a queue to transfer multiple files from one Mac to another. The file transfer works with most modems (Microcom bundles over 20 modem scripts), and it will work across multiple AppleTalk zones and Token Ring and Ethernet networks.

For security, you can temporarily or permanently block remote Mac users from watching your screen, and a "peephole" function lets you identify remote Mac users before you allow them to view your screen. The minimum system requirement is a Mac Plus.
Price: $299; for each additional Mac, $199.
Contact: Microcom, Software Division, 500 River Ridge Dr., Norwood, MA 02062, (617) 551-1000.
Inquiry 1163.

World Radio History

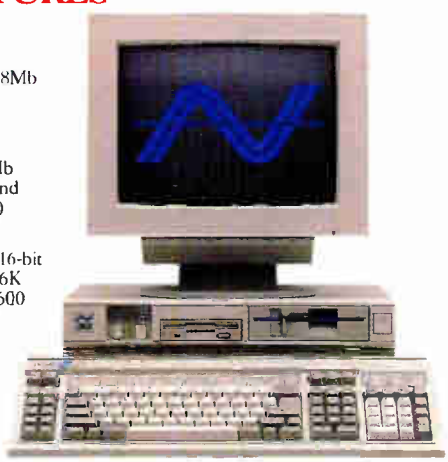
When it's this good, this cheap, why buy less?"*

December 26, 1989

And remember... your Northgate SlimLine 320 is backed by expert technical support any time you need it. Call toll-free, 7 days a week, 24 hours a day. On-site deskside service is available 5 days a week (to most locations).

SYSTEM FEATURES

- Intel 80386-20MHz microprocessor
- 2Mb of RAM; expandable to 8Mb on motherboard
- 40Mb hard drive with built in cache
- 3.5" 1.44Mb and 5.25" 1.2Mb Floppy Disks (reads, writes and formats low density diskettes)
- Page mode memory system
- Integrated high performance 16-bit VGA color controller with 256K video RAM supporting 800x600 resolution
- Integrated high performance floppy and hard disk controller on the motherboard
- 1 parallel and 2 serial ports
- 5 expansion slots (3 full-size 16-bit I/O boards; 2 half-length 8-bit)
- 14" NEC 2A VGA Color Monitor
- Exclusive *OmniKey*/PLUS Keyboard
- MS-DOS 4.01 and GW Basic Software Installed
- FCC Class B Certified



TEST A SLIMLINE 320 AT NO RISK FOR 30 DAYS

PC Magazine December 26, 1989 reviewed the Northgate MicroStation 386/20. This system has been upgraded and is now named the "SlimLine 320."

Of course, SlimLine 320 comes with a 1-year limited warranty on parts and labor; 5-years on the *OmniKey* keyboard. If a part fails, we'll ship a replacement to you overnight at our expense before you return your part.

Test a SlimLine 320 at no risk for 30 days. If you are not 100% satisfied, return it for a full refund. No questions asked. To place your order, call sales toll-free 24 hours everyday. Be sure to ask about custom configurations, leasing and financing options.

FINANCING: Use the Northgate Big 'N' revolving credit card. We have millions in financing available. We accept Visa or MasterCard, too. Lease it with Northgate, up to five-year terms available.

CALL TOLL FREE 24 HOURS EVERYDAY

800-548-1993

NORTHGATE COMPUTER SYSTEMS™

"We hear you!"

P.O. Box 41000 Plymouth, MN 55441

Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability.

©Copyright Northgate Computer Systems, Inc. 1990. All Rights Reserved.

Northgate, *OmniKey* and the Northgate Big 'N' logo are trademarks of Northgate Computer Systems, Inc. All other product and brand names are trademarks of their respective companies. Microsoft and Windows are registered trademarks of Microsoft Corporation. "386" and "i386" are registered trademarks of Intel Corporation.

Circle 184 on Reader Service Card

World Radio History

Hand Scanner Supports 256 Colors

ECA C&C Products claims that its Hico A4 Color Scanner, which scans a 4-inch-wide swipe of graphics, can recognize 256 colors. Accompanying DOS-compatible software lets you perform the standard desktop publishing functions of other black-and-white and 64-color scanners and lets you change the value, saturation, and hue of each color picture.

Key functions include merging scanned pictures, importing ASCII text, and support for file formats like .PMC, .VMG, and .SCF. The software supports more than 30 editing tools, including line, circle, move, rotate, enhance, air spray, area fill, scissors, copy, move, rotate, enhance, fade, reverse, outline, and undo.

The A4 Color Scanner, which includes an 8-bit scanner interface card, works with VGA adapter boards to display 640- by 480-pixel resolution and with EGA adapter boards that have at least 512K bytes of RAM. There's also support for HP LaserJet and PaintJet printers.

A minimum system configuration has 640K bytes of RAM, a mouse, and a hard disk drive.

Price: $699.

Contact: ECA C&C Products, Inc., 38 Route 46 E, Lodi, NJ 07644, (201) 478-0302.

Inquiry 1155.

Inexpensive Film Recorder Makes High-Quality Slides

Polaroid says that its entry-level high-resolution film recorder produces presentation-ready photos and transparencies at one-third the price of its competition.

The Digital Palette CI-3000, which interfaces through a Centronics parallel port, is about half the size of a nine-pin printer. You use it to make 35-mm slides with presentation-graphics software like Ashton-Tate's Draw Applause and Software Publishing's Harvard Graphics.

The color and exposure data for several kinds of film is housed in the CI-3000's ROM to deliver predictable results across different film types. The color response of the internal CRT is accounted for as well, as are the changes that take place as the tube grows older.

The CI-3000 exposes slides at a maximum resolution of 2048 lines, half that of competing mid- to high-priced recorders. However, Polaroid says that, at typical conference-room distance, the eye is not sensitive enough to discern the difference between 4096-line and 2048-line images. Like other film recorders, this device delivers 24-bit color from a palette of 16.7 million colors.

An auto-winding 35mm film holder is included, with optional holders accommodating various other film types up to 4 by 5 inches. The CI-3000 recognizes the type of film holder installed and adjusts the image size accordingly. You can also program the film recorder with custom film characteristics and image sizes.

Price: $3995.

Contact: Polaroid Corp., 575 Technology Sq., Cambridge, MA 02139, (617) 577-2000.

Inquiry 1156.

MicroSpeed Trackball Replaces Mac Mouse

The MacTrac is a Macintosh-compatible three-button trackball that's designed as a plug-and-play replacement for the Macintosh mouse, according to MicroSpeed. It measures 3¾ by 6¾ by slightly more than 2¼ inches (the diameter of the trackball).

MacTrac features a resolution of 200 dpi and has a cursor-drag lock button that eliminates the need to hold the button in order to drag the cursor.

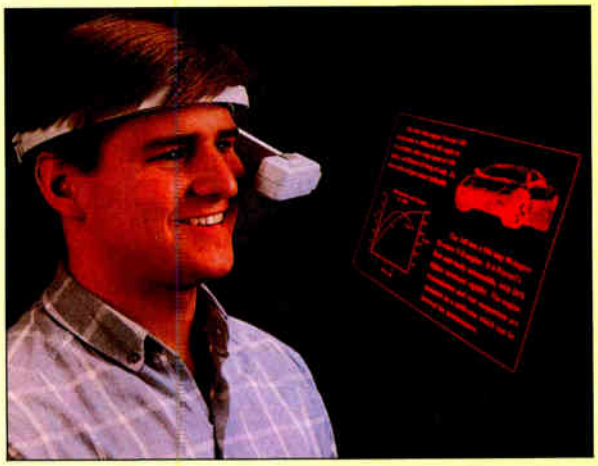
Price: With ADB connector, $119; with DB-9 connector, $99.

Contact: MicroSpeed, Inc., 44000 Old Warm Springs Blvd., Fremont, CA 94538, (800) 232-7888 or (415) 490-1403.

Inquiry 1157.

continued

For Privacy, Wear Your Monitor on Your Head



Reflection Technology's Private Eye is a virtual 12-inch CGA computer monitor with a lightweight headset.

The Private Eye is a 1-inch-wide monitor attached to a headband. You obviously use it differently than you do other monitors; you look into a postage-stamp-size window and see a legible image of a 12-inch 720- by 280-pixel screen superimposed on your field of vision and apparently floating in space 2 feet in front of you. The unit measures 3½ by 1⅛ by 1⅓ inches.

Mechanically, Private Eye consists of a column of LEDs, a magnifying lens, a resonating spring-mounted mirror, and a counterbalancing weight.

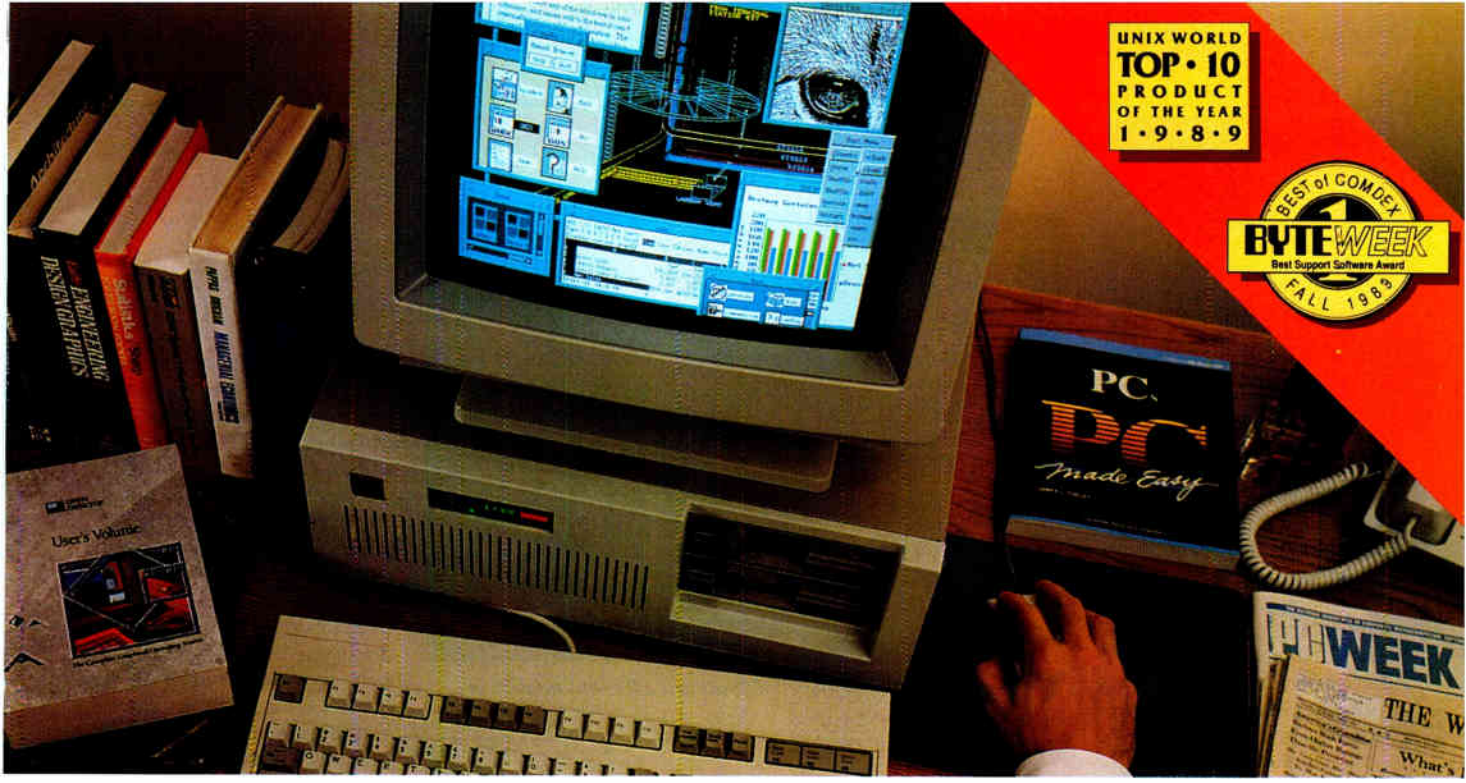
The operation draws less than half a watt of electrical power. The LED generates one 280-pixel line of the 720- by 280-pixel image every 1/36,000 second. The mirror oscillates every second to project 720 different versions of the 280-character horizontal line. And each image, which is red (from the red LEDs) on a black background, is made 50 times per second.

Price: $495.

Contact: Reflection Technology, 240 Bear Hill Rd., Waltham, MA 02154, (617) 890-5905.

Inquiry 1154.

World Radio History



INSTANT WORKSTATION. JUST ADD OPEN DESKTOP.

Take a look at the vast majority of graphical workstations developed over the past decade and you'll see something they all have in common:

An integrated UNIX® System environment.

Now take a look at the vast majority of businesses that have put computing power directly onto their office desktops over the past decade, and you'll see something they all have in common:

Industry-standard personal computers.

It doesn't take a computer to forecast the platform that's going to put graphical workstations on the vast majority of business and engineering desktops in the next decade:

An integrated UNIX System environment for industry-standard personal computers.

And that's what Open Desktop™ is all about.

Open Desktop is the complete graphical operating system that's built on the most popular UNIX System platform of all time—SCO™. And it lets you create your own networked, icon-driven workstation environment using the industry-standard 386 or 486 computers and peripherals of your choice.

In a single, easy-to-use, fully supported—and completely integrated—package, Open Desktop delivers:

- the full 32-bit, multitasking computing power of SCO UNIX System V/386
- compliance with POSIX™ and X/Open® standards
- an OSF/Motif™-based, Presentation Manager-compatible, graphical user interface
- distributed SQL database management services
- compatibility with existing DOS, XENIX®, and UNIX System applications and data files
- NFS™, TCP/IP, and LAN Manager networking facilities

And all at an unbelievably affordable price.

Discover the complete graphical operating system that leading companies worldwide are choosing as their development platform for the '90s—and using to turn their 386 and 486 PCs into instant workstations today.

Open Desktop from SCO.

OPEN DESKTOP™
The Complete Graphical Operating System

SCO™
THE SANTA CRUZ OPERATION

For more information, call SCO today and ask for ext. 8400

(800) SCO-UNIX (726-8649) (408) 425-7222 FAX: (408) 458-4227 E-MAIL:. . .!uunet!sco!info info@sco.COM

SCO, the SCO logo, Open Desktop, and the Open Desktop logo are trademarks of The Santa Cruz Operation, Inc. UNIX is a registered trademark of AT&T in the USA and other countries. POSIX is a trademark of The Institute of Electrical and Electronics Engineers (IEEE). X/Open is a registered trademark of X/Open Company Ltd. OSF/Motif is a trademark of The Open Software Foundation, Inc. XENIX is a registered trademark of Microsoft Corporation. NFS is a trademark of Sun Microsystems, Inc. 10/89
©1989 The Santa Cruz Operation, Inc. All Rights Reserved. The Santa Cruz Operation, Inc., 400 Encinal Street, P.O. Box 1900, Santa Cruz, California 95061 USA The Santa Cruz Operation, Ltd., Croxley Centre, Hatters Lane, Watford WD1 8YN, Great Britain, +44 (0)923 816344, FAX: +44 (0)923 817781, TELEX: 917572 SCOLON G

Circle 249 on Reader Service Card

World Radio History

First Low-Priced Modems from Hayes

New Hayes products include a 2400-bps modem, the Personal Modem 2400plus, and the software to make it run: Smartcom for the Mac and Smartcom EZ for DOS systems. Another software package in the series, HayesConnect, lets your Mac share its modem capabilities with other Macs on an AppleTalk network.

For simplicity, Hayes bundles the modem circuitry with an AC adapter in a single 13-ounce 2¾- by 3¾- by 1¾-inch case. Included are cables for the phone line and your computer's serial port.

Smartcom for the Mac and Smartcom EZ include a database for often-called numbers and associated dial-up parameters. They also include the industry-standard XMODEM protocol for uploading and downloading files.

When you're ready to use the Mac version of the Personal Modem 2400plus as a shared resource on your AppleTalk network, you use HayesConnect. The server software, which doesn't require a dedicated Mac system, does need 256K bytes of available RAM. The workstation version of HayesConnect requires 64K bytes of available RAM. It also works across multiple AppleTalk zones.
Price: Personal Modem 2400plus with Smartcom, $199; HayesConnect, $79.
Contact: Hayes Microcomputer Products, Inc., 705 Westech Dr., Norcross, GA 30092, (404) 449-8791.
Inquiry 1160.

The Hayes Personal Modem 2400plus is a 2400-bps modem in an AC adapter.

Watchdog Keeps an Eye on Small Networks

Network General, maker of the Sniffer Network Analyzer for large-scale networks, has announced a less expensive analyzer for networks of 20 to 30 nodes.

Watchdog has monitoring features that include station and network alarms, statistics for performance analysis, report generation utilities, and cable- and active-station testing. Watchdog's network-wide alarms alert you to problems of too much or too little network usage, activity by an unknown station, or broadcast storms (i.e., when the network is filled with broadcast messages). Alarms also signal other problems, such as an "unresponsive" station or one that uses too much of the network resources.

Watchdog displays statistics in real time to track network activity, including usage and error frequency rate. You can save this data, and you can print out tabular or graphical reports that summarize network activity.

The Watchdog Network Monitor offers Racal InterLAN AT or Micro Channel Ethernet boards for thick and thin coaxial cabling and unshielded twisted-pair cabling. Watchdog requires a dedicated PC unless you use a second network adapter card.
Price: Watchdog, $1995.
Contact: Network General, 4200 Bohannon Dr., Menlo Park, CA 94025, (415) 688-2700.
Inquiry 1161.

continued

Remote Control for DOS and Apple Systems

Takeover is DOS-compatible remote-control software that features pull-down menus with keyboard or mouse control and all the functions of SoftKlone's Mirror III communications software. Microcom's Carbon Copy Mac is remote-control software that works over serial (including modem) and AppleTalk networks.

Both products feature their own communications software, background file transfers, a disable function to keep the host safe from unfriendly guests, and a "chat" function for real-time communication.

Takeover (for DOS systems) includes automatic callback, session recording with variable-speed playback, and an activity log. It has its own data-compression and error-correction protocols.

Takeover occupies 55K to 70K bytes of RAM on the host system and 480K bytes on the remote system (of which 375K bytes is the Mirror III communications package). The company says that the package works with all asynchronous modems, synchronous modems, and minicomputer and mainframe terminal-emulation packages. The standard package includes one guest and one host interface.
Price: $295; each additional host, $150; each additional guest, $195.
Contact: SoftKlone, 327 Office Plaza Dr., Suite 100, Tallahassee, FL 32301, (904) 878-8564.
Inquiry 1162.

Carbon Copy Mac comes with an identical 200K bytes of software for a host and a remote Macintosh.

You can use a queue to transfer multiple files from one Mac to another. The file transfer works with most modems (Microcom bundles over 20 modem scripts), and it will work across multiple AppleTalk zones and Token Ring and Ethernet networks.

For security, you can temporarily or permanently block remote Mac users from watching your screen, and a "peephole" function lets you identify remote Mac users before you allow them to view your screen. The minimum system requirement is a Mac Plus.
Price: $299; for each additional Mac, $199.
Contact: Microcom, Software Division, 500 River Ridge Dr., Norwood, MA 02062, (617) 551-1000.
Inquiry 1163.

World Radio History

Our Foolproof Desktop Tools Make Anyone Look Smart.

Logitech's foolproof desktop tools let anyone turn out smart looking documents. And now with Logitech's special prices, there's never been a smarter time to buy them.

ScanMan® Plus. *Scans images up to 4" wide into any document instantly. Works with all major applications. Adjusts to 400 d.p.i., 32 shades of gray, with three photo settings. Suggested Retail Price (SRP): $339.*

CatchWord™ Intelligent O.C.R. *Lets you use text scanned with ScanMan in applications, just as if you'd typed it in. CatchWord accurately recognizes type from 6-20 points in virtually any typeface at speeds of up to 2,000 characters a minute. SRP: $249.*

Finesse™ Desktop Publishing *lets you design brilliant documents effortlessly with direct scanner support, pre-designed page formats and automatic text wraparound. The only inexpensive DTP software to include Bitstream® Fontware™ absolutely free (a $545 value). SRP: $179.*

Logitech™ Series 9 Mouse. *Awarded rave reviews for its comfortable shape, adjustable resolution and ballistic drivers for flick-of-the-wrist control. Includes Pop-Up DOS™ and mouse menus to mousify almost any application. SRP: Serial-$119, Bus-$139, PS/2-$119, Serial & PS/2-$149.*

TrackMan.™ *Ingenious thumb-operated stationary mouse offers comfort and precision without desktop motion. Guaranteed compatible with all PC applications supporting Logitech or Microsoft® mice. SRP: Serial-$139, Bus-$149.*

SAVE A BUNDLE ON A BUNDLE!

Until the end of July, save up to $99 on these product bundles, at participating dealers.

Logitech Mouse (serial version) and Finesse DTP software
Suggested bundled price: **$199**
*(***Save $99** *on suggested retail price!)*

ScanMan Plus and CatchWord O.C.R. software
Suggested bundled price: **$499**
*(***Save $89** *on suggested retail price!)*

For more information call:
800-231-7717Ext. 346.
In California:
(800) 552-8885
In Canada:
(800) 283-7717
In Europe:
++41-21-869-9656

LOGITECH

© 1990 Columbia Pictures Industries, Inc. All Rights Reserved. "THE THREE STOOGES" is a trademark of Norman Maurer Productions, Inc. ®/™ trademarks of registered owners.

Circle 149 on Reader Service Card (DEALERS: 150)

World Radio History

LANtastic Incorporates Voice

Artisoft's LANtastic 3.0 network operating system, which occupies only 30K bytes of RAM, now supports voice chat and voice mail with LANtastic-compatible network adapter cards and new 8-bit add-in cards called Voice Adapters. With both cards, you can use LANtastic's voice capabilities on the company's 2-Mbps network and on LANtastic-compatible Ethernet hardware.

Each Voice Adapter, which is cabled to a telephone handset, digitizes spoken messages or music and preserves them. It features simultaneous record and play, ports for importing and exporting audio, 8-bit D/A and A/D conversion, and background operation.

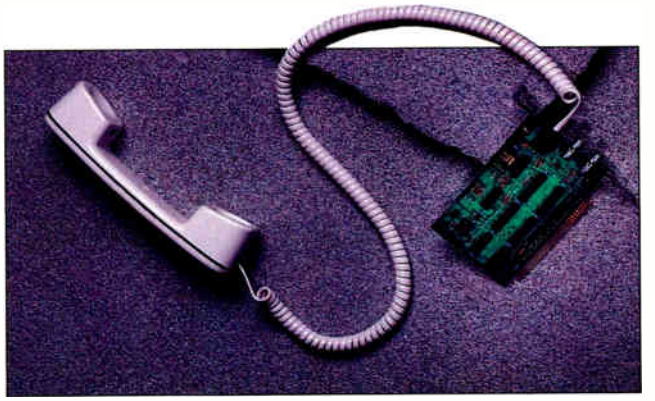
Power requirements are 12 V at 33 mA, sampling rate is 7990 Hz, and bandwidth is 200 to 3400 Hz.

The Voice Programmer's Interface lets you add sound effects, including speech and music, to network application programs.

Price: LANtastic 3.0, $495; Voice Adapter, $149; Voice Programmer's Interface, $195.
Contact: Artisoft, Inc., Artisoft Plaza, 575 East River Rd., Tucson, AZ 85704, (602) 293-6363.
Inquiry 1166.

New Windows Package Simplifies Use of PROFS

SmartScreen is a graphical E-mail interface that makes it easier for PC users to access IBM's notoriously arcane PROFS mail system.



Artisoft's Voice Adapter works with LANtastic 3.0 and supports voice chat and voice mail.

It runs under Microsoft Windows (including 3.0) on PCs. It presents a panel of icons that symbolize typical PROFS activities such as messages, documents, mail, calendar, notepad, and alarm clock. By clicking on an icon, you can access that part of the PROFS system without knowing its commands or syntax.

SmartScreen isn't, however, a terminal emulator in itself; it sits on top of an installed 3270 package such as Attachmate or Digital Communications Associates' IRMA.

The main benefit of the software—aside from eliminating the need to remember PROFS commands—is that it can improve E-mail by exploiting the PC, the manufacturer says. SmartScreen lets you prepare messages with PC text editors, off-line from the host, which reduces connect time; SmartScreen gives access to the Windows clipboard, which simplifies actions such as pasting a piece of a spreadsheet into a mail message; and because a PC is a lot smarter than a terminal, the software can do things like check for PROFS mail at a set time and notify the user if any has arrived.

Price: $495 per user.
Contact: Capella Systems, Inc., 8601 Dunwoody Place, Suite 632, Atlanta, GA 30350, (404) 552-9910.
Inquiry 1170.

Inexpensive Fax Software Requires Dedicated Mac

Zap Fax is send-only fax server software for the Macs on your AppleTalk network.

You need to dedicate a Mac 512 or higher with a hard disk drive, and you need a fax modem. Host software is RAM-intensive, so you can't run any other software on this server. But Sunrise Services replaces print drivers on the networked Macs and therefore has no RAM overhead on these nodes.

You access the fax print driver through your Mac's PICT files within QuickDraw.

Price: $295.
Contact: Sunrise Services, 705 West Valley Dr., Suite 1, Campbell, CA 95008, (408) 377-3753.
Inquiry 1169.

Cardinal Introduces 2400-bps Modems with MNP 5

Cardinal Technologies' 2400 Series MNP modems feature the 2400-bps data transmission speed of the CCITT V.22bis standard and the 4800-bps speed of the de facto MNP 5 data compression standard. The modems are also backward compatible with 1200-bps (and lower) standards.

Both the external and the internal units feature automatic dialing and answering and a configuration view that lets you view the current and stored telephone numbers and associated telecommunications settings. The internal unit is an 8-bit half card, and the external unit measures 1½ by 5½ by 9⅗ inches and weighs 4 pounds.

Price: Internal, $279; external, $299.
Contact: Cardinal Technologies, Inc., 1827 Freedom Rd., Lancaster, PA 17601, (800) 233-0187 or (717) 293-3000.
Inquiry 1168.

continued

D-Link Introduces Pocket Ethernet LAN Adapter

The D-Link Ethernet Pocket LAN Adapter kit gives you a parallel-port interface to coaxial Ethernet networks.

The kit includes a 4-ounce adapter (without battery) that measures 4½ by 2½ by 7/10 inches, a 5-ounce wall-mount AC adapter, and your choice of t-connectors for thin or thick coaxial cabling.

D-Link Systems says that the parallel-port interface kit is compatible with all the popular network operating systems.

Price: $495.
Contact: D-Link Systems, Inc., 5 Musick, Irvine, CA 92718, (714) 455-1688.
Inquiry 1167.

World Radio History

"I was looking for a graphic example of what could be done with a laptop PC... Zenith Data Systems showed me two."

ZENITH DATA SYSTEMS INNOVATES AGAIN™

SupersPort 286e

SupersPort SX

Today's laptop leader* offers the clear choice in portable VGA graphics: SupersPort® 286e and SupersPort SX.

Zenith Data Systems brings you *two* advanced laptop PCs that can run today's sophisticated color VGA applications, using 16 corresponding shades of gray for superior graphics presentations.

First, there's the number-crunching SupersPort 286e with its dazzling backlit LCD display. Then there's the SupersPort SX with a *Page White* screen that virtually duplicates the printed page... plus Intel386SX™ power to handle tomorrow's graphical user interfaces.

And each features our *Intelligent Power Management System,*™ which puts power usage in *your* control for hours of battery life.

So, if you want the ultimate in portable screen clarity and contrast, see our leading VGA-enhanced laptops in action. For your nearest Zenith Data Systems Medallion Reseller, call: *1-800-523-9393.*

ZENITH data systems

Groupe Bull

*Source: Dataquest

Graphics simulate Microsoft® *Windows*™ *3.0,* a product of Microsoft Corporation.

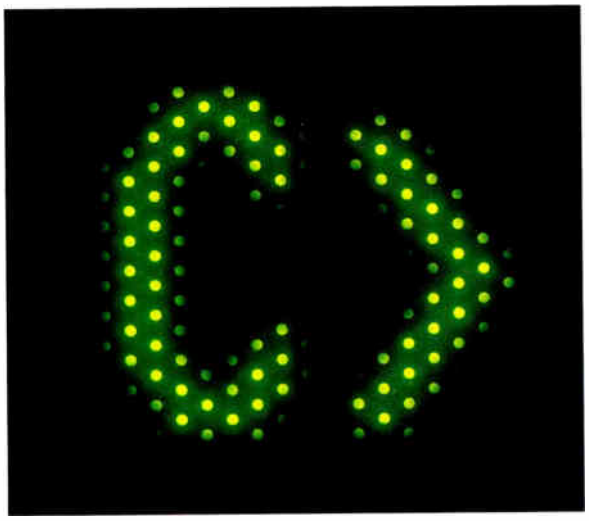
Intel386SX is a trademark of Intel Corporation.

© 1990, Zenith Data Systems

Circle 313 on Reader Service Card

World Radio History

Kiss it goodbye.



Introducing new Windows 3.0.

The graphical user interface (GUI) environment on an MS-DOS® PC, and subsequent demise of the "C" prompt, is a reality today. Sure, you say.

Microsoft realizes you may have heard this one before. And we agree that you have every reason to be skeptical.

Well, all of this was before new Microsoft® Windows™ version 3.0. A GUI environment that will forever transform the way you use your PC.

Now, before you wonder what to do with all of your existing DOS applications (to say nothing about your existing DOS experience), the Windows environment works within your MS-DOS system. This is not a traumatic thing.

As a matter of fact, once you see the environment created by Windows 3.0, you'll think quite the contrary.

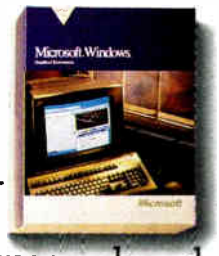
The first time you see it, you won't believe it. Archaic characters, mundane instructions, and even entire command sequences, have been replaced by a program manager full of clear, friendly icons. You're immediately comfortable.

When you work on more than one thing at a time, you'll quickly reap the benefits. Because the program manager welcomes on-screen multitasking of large Windows applications. Of course, without ever visiting the "C" prompt.

Through something with the complicated name of Dynamic Data Ex-

World Radio History

change (DDE), you can simplify your life. For example, with DDE, you can change information in a Microsoft Excel spreadsheet, and have those changes automatically show up in a "linked" table in a word processing document. Or vice versa.



You can also easily access a network from within Windows. So, no matter how big the rivalry between research and accounting is on the softball field, everybody's on speaking terms in the office.

Even the setup program is graphical, only needing a few easy steps.

At this point, you probably think your machine will slow to a crawl the first time you try any of this.

We thought about that, too. So new Windows 3.0 breaks the 640K memory barrier that saddles other DOS programs. Giving you access to all the memory and power your 286 or 386 PC can muster.

It all sounds incredible. Which it is. And, it's taking place in an intuitive, consistent graphical environment.

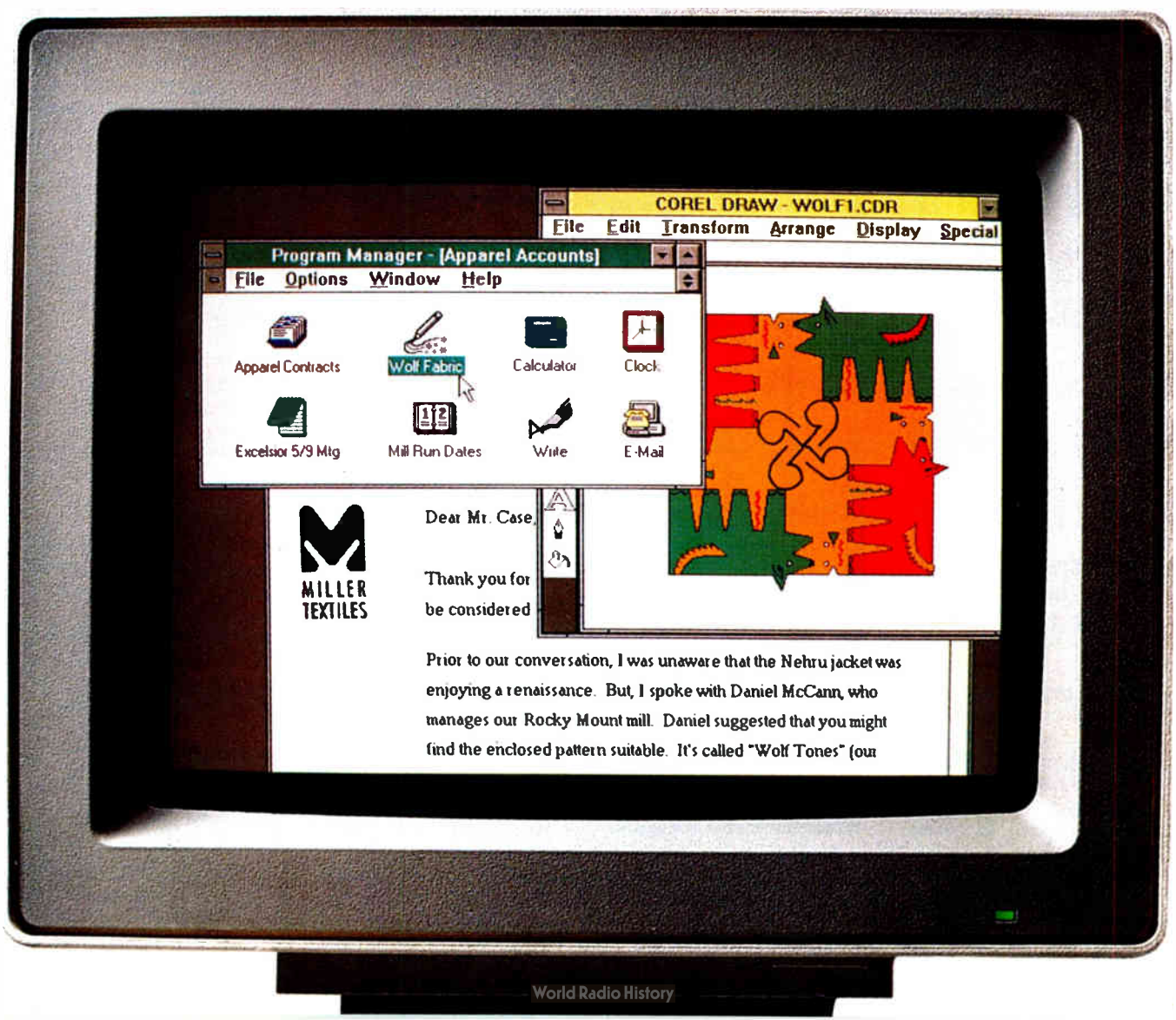
For more information or to learn about upgrading your current Windows version, call (800) 323-3577, Dept. L83.

Graphics-based software is how people will run their PCs in the 1990s.

And there's no better way to get yourself acquainted than Windows 3.0.

Microsoft
Making it all make sense®

Microsoft Windows 3.0 is optimized for 1-2MB 286 and 386 personal computers. 640K RAM required. Customers inside the 50 United States, call (800) 323-3577, Dept. L83. In Canada, call (416) 673-7638. Outside the U.S. and Canada, call (206) 882-8661.
© 1990 Microsoft Corporation. All rights reserved. Microsoft, MS-DOS and the Microsoft logo are registered trademarks and Making it all make sense *and Windows are trademarks of Microsoft Corporation.*



World Radio History

Code Generator and Transformer for Windows 3.0

dAnalyst for C, a development environment that now supports Windows 3.0, features a documentation facility that takes unintelligible scraps of C code and transforms them into structured code that complies with the standard specified by Kernighan and Ritchie. According to Buzzwords International, the transformed code compiles, links, and executes just as it did in its original form.

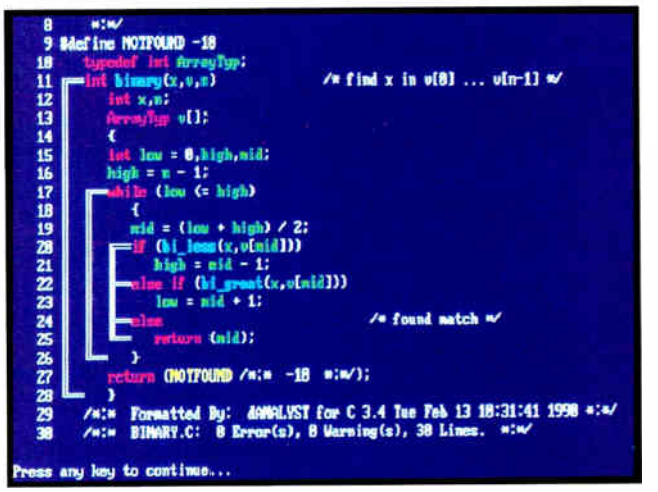
Working in or out of the Windows environment, you can use dAnalyst's screen painter and report writer to generate portable C source code that supports multiuser dBASE, FoxPro, and Clipper data files, Paradox table interaction, and spreadsheets. While the program automatically generates multiuser applications, you can run an application on single-user systems without modification.

Other features of the program include a debugger, a linker, and a Make facility.
Price: $295.
Contact: Buzzwords International, 2879 Hopper Rd., Cape Girardeau, MO 63701, (314) 334-6317.
Inquiry 1120.

Full-Screen Text Editor for Windows 3.0

The new version of Bradford Business Systems' SpeedEdit provides a full-screen text editor for Windows 3.0 programmers. A Windows application itself, SpeedEdit supports scroll bars, pull-down menus, list boxes, and multiple windows.

The editor supports Dynamic Data Exchange, keyboard macros, and search and modification of multiple files as if they were one file, the company reports. You can compile and test the program without leaving SpeedEdit, and the program includes Undo and Redo facilities. SpeedEdit provides more than 150 editing functions. A remote program facility lets you work on files that reside on the host system.
Price: $295.
Contact: Bradford Business Systems, Inc., 25301 Cabot Rd., Suite 201, Laguna Hills, CA 92653, (714) 859-4428.
Inquiry 1121.

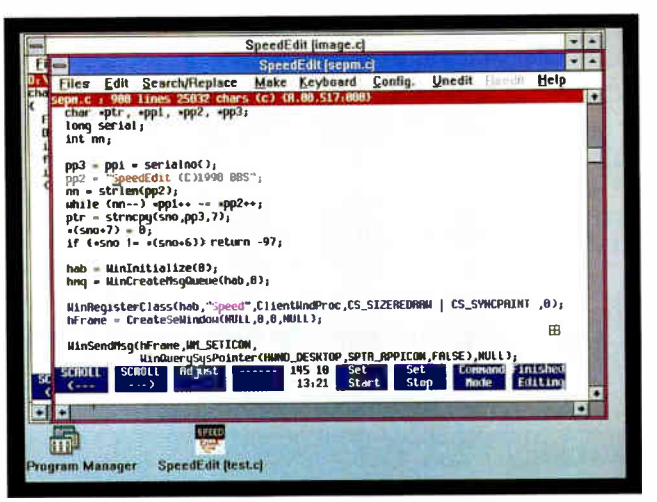


A portion of C code that's been transformed by dAnalyst for C. The different colors help with readability: Here, variables are green and # defines are yellow.

Prologs for the Mac and OS/2

Arity now offers Delphia Prolog, the platform that's used on many systems in Europe, for the Macintosh. With Delphia Prolog, you can write HyperCard scripts that make calls to Prolog, giving you a hyper-Prolog development environment.

Delphia Prolog includes an optimized version of the Edinburgh syntax; an interpreter, a debugger, and a compiler; an application manager; a lexical analyzer generator; and tools for connecting to other languages, graphics packages, and Oracle and Ingres. The program is sold without royalties or run-time fees and requires a Mac Plus.
Price: $395.
Contact: Arity Corp., 29 Domino Dr., Concord, MA 01742, (508) 371-1243.
Inquiry 1122.



Two overlapping SpeedEdit text windows running under the Windows 3.0 program manager. SpeedEdit can handle up to eight windows at a given time.

PDC Prolog now supports network file sharing in its external database system, allowing you to use the database in a networked or multitasking environment, such as OS/2 or Unix, Prolog Development Center says. The OS/2 version, with which you can create text-mode applications that run in Presentation Manager, supports the exchange of Prolog terms among multiple Prolog processes over named pipes.

PDC says that because its Prolog is typed, requiring you to declare data types of variables and data structures, it lets you create applications with executable speeds comparable to those of programs written in C. Version 3.2 lets you embed its editor in the application you're creating. A new command-line feature of the program lets you compile or make programs from within batch files or from the command line, without having to enter the development environment.

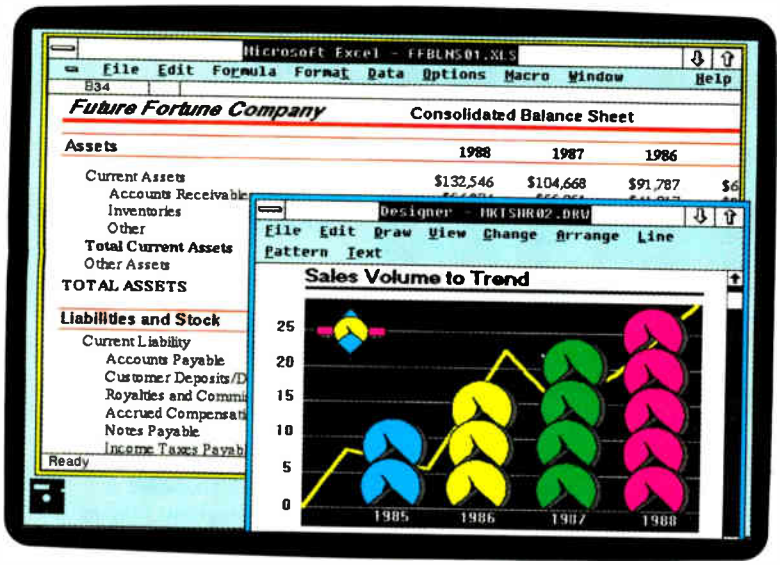
The DOS version of Prolog requires DOS 3.0 or higher on an IBM PC with 512K bytes of RAM. For OS/2, you'll need version 1.1 or 1.2. The Unix version should be available later this summer.
Price: $249; OS/2 version, $599.
Contact: Prolog Development Center, 568 14th St. NW, Atlanta, GA 30318, (404) 873-1366.
Inquiry 1123.

continued

World Radio History

Look familiar?

Then this $50 upgrade will look great.



If this looks like your current version of Windows, you can upgrade for just $50.

You may have received Microsoft Windows with your hardware. If you did, you can save $99 with this upgrade offer.

Check out your software because if it works within a Windows environment, you're in luck.

If you are using Microsoft® Windows,™ the best thing about this offer, besides the special upgrade price, is that you'll now have access to all the memory in your PC. Not to mention that you can keep using your existing MS-DOS® applications, multitask with other Windows applications, and network more easily.

All the popular Windows applications have already been updated to utilize Windows 3.0's powerful capabilities. And most are offering low-cost or free updates. So if you have any version of Windows—including runtime Windows—give us a call. We'll upgrade your copy of Windows, help you update your applications, and answer any questions you may have.

But make sure and call for your $50* Windows upgrade before September 15, 1990. You'll save $99 off the suggested retail price of $149. And you'll be using Windows 3.0. Which will make you look great.

To get your Windows upgrade for just $50, call (800) 323-3577, Dept. L53.

Microsoft
Making it all make sense™

© 1990 Microsoft Corporation. All rights reserved. Microsoft, the Microsoft logo and MS-DOS are registered trademarks and Making it all make sense and Windows are trademarks of Microsoft Corporation. *Offer good only in the 50 United States. Payment in U.S. funds (plus a $5.50 shipping/handling fee and applicable sales tax). Please allow two to four weeks for delivery.

World Radio History

Project Manager Offers E-Mail, Graphics Interface

The latest version of Primavera Project Planner has a new graphical user interface that lets you edit and review project networks with up to five levels of zoom. Other additions include file and record locking on Novell networks and an integrated E-mail system and BBS.

When it runs on a network, a project administrator establishes access rights with multiple levels of security, including read-only and exclusive access to specific projects. The program's P-Mail feature allows private electronic messaging, and the BBS lets you post public messages.

Primavision, the graphics system that works with Primavera Project Planner, supports the plotting of resource and cost graphics as combined histograms and cumulative curves. You can compare up to two target projects plus a current project simultaneously, the company reports.

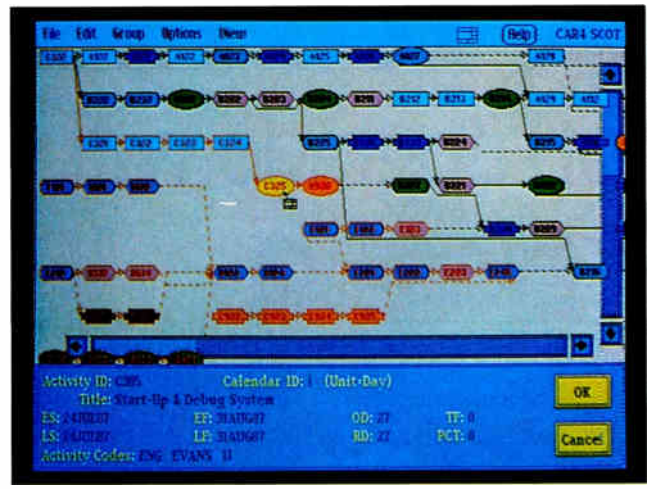
Primavera Project Planner 4.0 runs on the IBM XT with 640K bytes of RAM, a hard disk drive, and a mouse. The program now supports PostScript output devices.
Price: $4000.
Contact: Primavera Systems, Inc., Two Bala Plaza, Bala Cynwyd, PA 19004, (215) 667-8600.
Inquiry 1125.

Database of Venture Capitalists

Whether you're planning to start a new company or expand an existing one, the search for venture capital can take a long time. To help businesses quickly locate and qualify potential sources of financing, a company called DataMerge offers the Financing Sources Databank.

The program lets you search for venture firms by several different criteria. Once you've narrowed the search, it provides information on what types of financing and companies the potential source prefers, the kind of information you'll need to supply, and other policies.

The program runs on the IBM PC with 256K bytes of RAM and a hard disk drive.
Price: $199.
Contact: DataMerge, Inc., One Cherry Center, 501 South Cherry St., Suite 500, Denver, CO 80222, (303) 320-8361.
Inquiry 1128.



The Primavera Project Planner proprietary graphical interface lets you add activities and relationships in interactive mode.

Scitor's Project Scheduler for the Mac

Project Scheduler 4 for the Macintosh lets you open up to eight windows for entering, editing, and viewing data, Scitor says. Other features of the midrange project scheduler include support for multiple projects, the ability to automatically account for resource-cost inflation, and what-if scenarios.

You can use the program to create presentations and reports with up to 10 levels of information. Like the version for the IBM PC, Project Scheduler 4 for the Mac lets you identify each task with a code for Work Breakdown Structure and Organizational Breakdown Structure.
Price: $685.
Contact: Scitor Corp., 393 Vintage Park Dr., Suite 140, Foster City, CA 94404, (415) 570-7700.
Inquiry 1127.

Office Automation Software for Unix

Enable/OA (for office automation) software in its new version 4.0 for Unix and Xenix offers an improved character-based user interface with windows, pull-down menus, and mouse support.

The company says that the word processing module has been enhanced with improved column handling and a collapsible outline feature. The spreadsheet (which already offered three-dimensional worksheets) now has colored cells, hidden ranges, and external links to other applications. Version 4.0 has a page preview option.
Price: $695.
Contact: Enable Software, Northway Ten Executive Park, Ballston Lake, NY 12019, (518) 877-8600.
Inquiry 1126.

A Guide to Accounting Software

To help companies identify, analyze, and select the PC-based accounting systems that best suit their needs, Solutions has developed The Accounting Library, a compendium of books and software that covers more than 70 DOS- and Unix-based accounting programs ranging from inexpensive single-user systems to more sophisticated ones. Solutions says that it will soon start compiling information on accounting programs for the Macintosh.

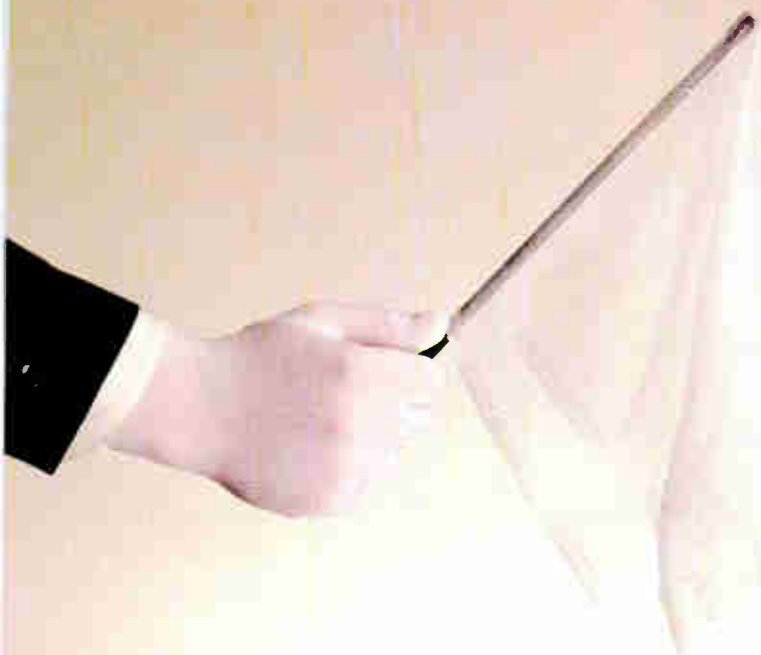
The software portion of the library consists of 10 modules containing more than 900 processing features. You identify the features that pertain to your company and rank them on a scale. You end up with a weighted average, which the program then uses to recommend the best accounting programs for you. As vendors add features to their accounting programs, you receive new disks as the changes are implemented, rather than quarterly or yearly updates.

The Accounting Library runs on the IBM PC with 640K bytes of RAM and a hard disk drive.
Price: $479.
Contact: Solutions, 8630 Claypool Rd., Richmond, VA 23236, (804) 745-5361.
Inquiry 1129.

continued

World Radio History

THE FLYTECH MAGICIAN UNVEILS THE WORLD'S FIRST & ORIGINAL BOOKSIZE LANSTATION



CARRY-I

ARCNET & ETHERNET DISKLESS LANSTATION

FLYTECH TECHNOLOGY (U.S.A), INC.
3008 SCOTT BLVD., SANTA CLARA, CA. 95054 U.S.A.
TEL: (408)727-7373, 727-7374 FAX: (408)727-7375

FLYTECH TECHNOLOGY HANDELS-GMBH
MENDELSSOHNSTRASSE 53,
6000 FRANKFURT AM MAIN 1, WEST GERMANY
TEL: (069)746-081, 746-453 FAX: (069)749-375

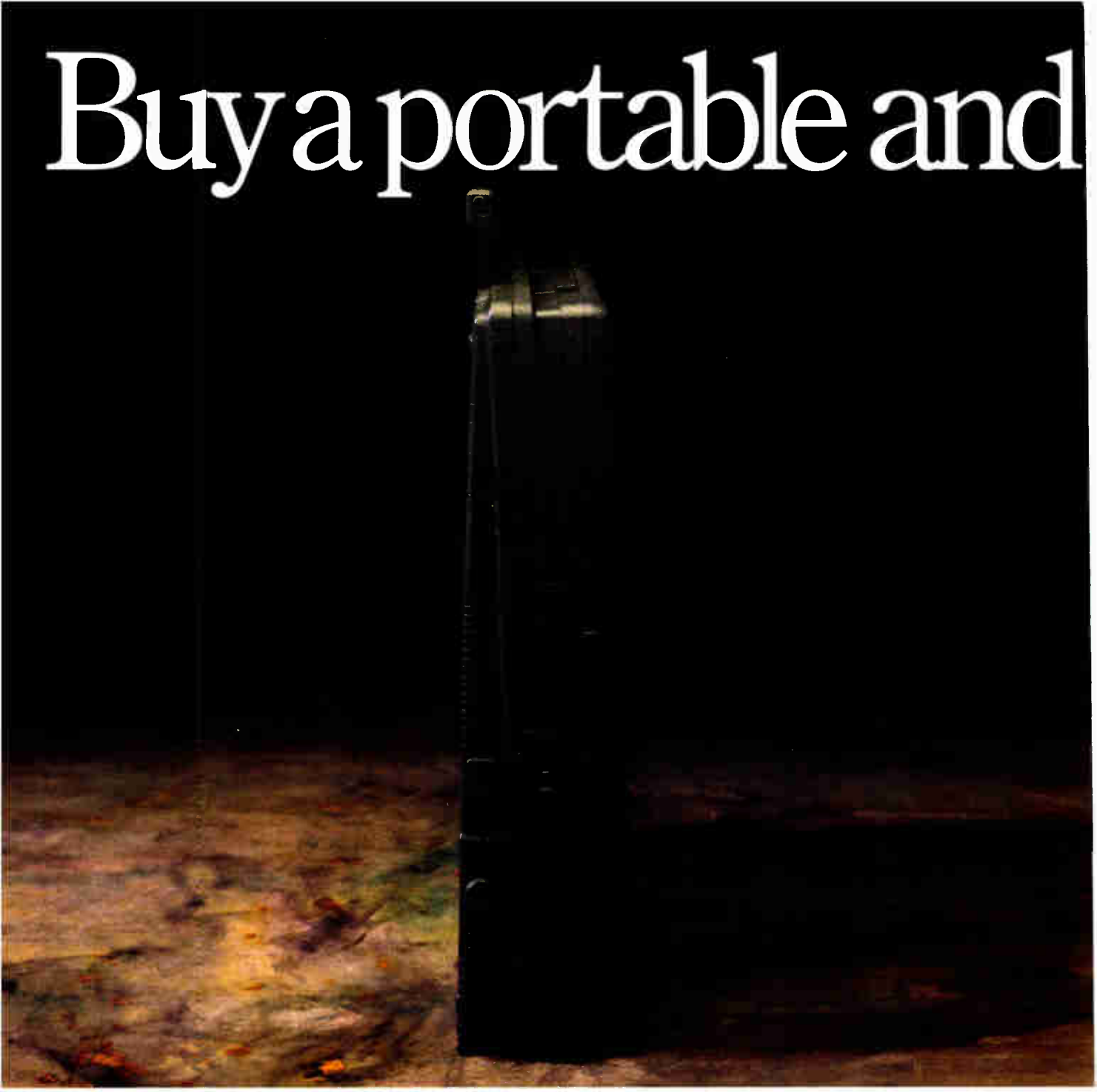
FLYTECH TECHNOLOGY (H.K.) LTD.
B12, 8 FL., BLOCK B, TONIC INDUSTRIAL CENTRE,
19 LAMHING ST., KOWLOON BAY, KOWLOON.
HONG KONG
TEL: 305-1268 FAX: 796-8427

FLYTECH TECHNOLOGY CO., LTD.
(HEAD OFFICE)
2 FL., NO. 8, LANE 50, SEC. 3,
NAN-KANG RD., TAIPEI TAIWAN, R.O.C.
TEL: (02)785-2556 FAX: (02)785-2371 783-7970
TELEX: 22233 FLTCO

Circle 104 on Reader Service Card

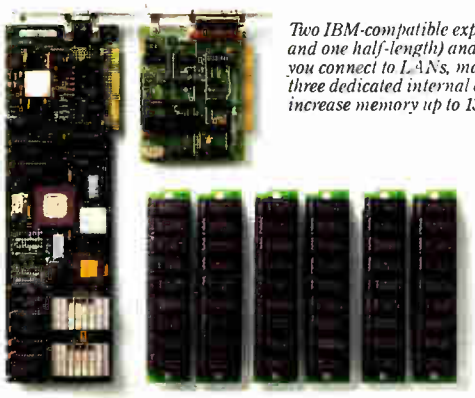
World Radio History

Buy a portable and



T3200SX: 17.0 pounds, 16MHz 386SX with 80387SX-16 coprocessor socket, 5 built-in ports, 40MB hard disk with 25msec access, 1MB RAM expandable to 13MB, gas plasma VGA display with 16 gray scales, 1.44MB 3½" diskette drive. IBM is a registered trademark of International Business Machines Corp. 386 is a trademark of Intel Corporation.

For more information call 1-800-457-7777.



Two IBM-compatible expansion slots (one full-length and one half-length) and an internal modem slot let you connect to LANs, mainframes and more. Plus, three dedicated internal expansion slots let you increase memory up to 13MB.

World Radio History

get a desktop free.

At first glance what you see is a sleek, 17.0-pound portable.

But looks can be deceiving. Because with a powerful 386™SX microprocessor, 6 internal expansion slots and 5 built-in ports, our new T3200SX easily replaces desktop computers.

Which means it does everything a bulky desktop computer can do. Like networking, computer aided design, data bases or even complex spreadsheet analysis — anywhere you can plug into an AC outlet.

It has a built-in VGA gas plasma display system that lets you connect an external color monitor. And it can even accommodate an optional 101-key enhanced keyboard.

So you can take advantage of today's and tomorrow's most powerful new 386 applications, wherever you think best.

The new Toshiba T3200SX. Take it. See how far you can go.

In Touch with Tomorrow

TOSHIBA

Toshiba America Information Systems Inc., Computer Systems Division

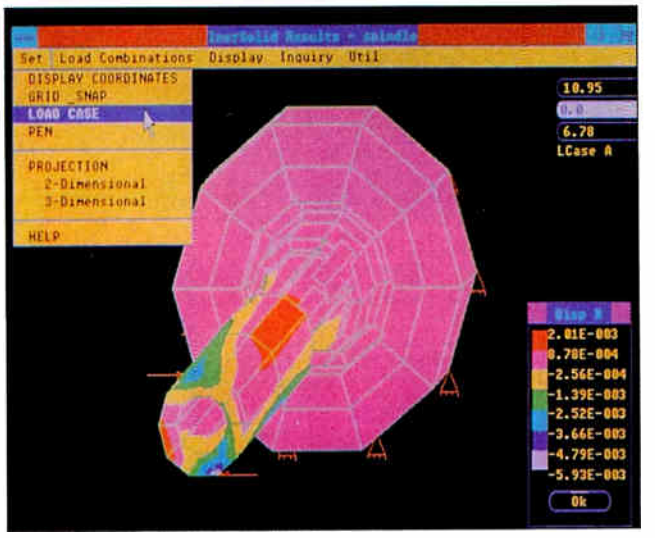
Circle 290 on Reader Service Card (DEALERS: 291)

FEA and Dynamics Analysis for Windows 3.0

Inertia, the software package that integrates finite element analysis (FEA) and large displacement kinematics and dynamics analysis in one system, is now available for Windows 3.0.

With Inertia 3.0, you can construct a complex mechanical model consisting of flexible elements, integrating dynamics analysis with FEA, without having to perform each type of analysis in sequence or transfer data between the two applications. The program includes design rulebases to help you comply with design code specifications, and customizable libraries.

The program comes in several modules for stress analysis, heat transfer, kinematics, architectural design, structural vibration, and sectional properties calculations.
Price: $1000 to $9995.
Contact: Modern Computer Aided Engineering, 1231 Cumberland Ave., Suite A, West Lafayette, IN 47906, (317) 497-1550.
Inquiry 1130.



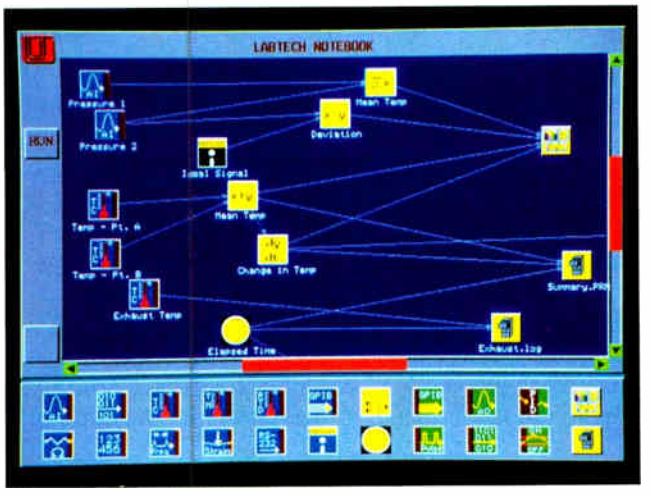
InerSolid, the stress-analysis module of Inertia, shows the results of analysis on a spindle.

It Slices! It Dices! It's Spyglass

Spyglass has introduced four new programs for bringing data exploration capabilities to the Mac II.

Spyglass Transform converts floating-point numbers resulting from calculations or simulations to a two-dimensional color raster image. Spyglass View lets you customize the color image so that you can conceptualize the data set and reveal aspects that were previously hidden.

With Spyglass Dicer, you can display volumetric data as a cube of colors from which you can slice or dice portions to reveal any aspect of the interior, displaying a series of horizontal, vertical, and parallel slices of data. Spyglass Format lets you generate animations and layouts for presentation output.
Price: Spyglass Transform, $395; Spyglass View, $395; Spyglass Dicer, $495; Spyglass Format, $195.
Contact: Spyglass, Inc., 701 Devonshire Dr., C17, Champaign, IL 61820, (217) 355-1665.
Inquiry 1131.



By double-clicking on an object in Iconview, you pop up a menu for detail work, such as choosing the type of I/O or engineering conversion unit.

An Icon Interface for Notebook and Control

A new graphical user interface that's now bundled with Laboratory Technologies (Labtech) Notebook and Control data acquisition programs lets you build your data acquisition application by manipulating objects with a mouse instead of using pull-down menus, the company says. Iconview provides a common GUI for Labtech products running under DOS, OS/2, and Unix.

Notebook, for general-purpose data acquisition, and Control, for continuous manufacturing applications, along with Iconview for DOS, each require 640K bytes of RAM and DOS 3.0 or higher. The OS/2 versions require an AT with 4 MB of RAM. The Unix version requires a PS/2 running AIX, a DECstation 2100 or 3100 running Ultrix, or an Apollo 3000 or 4000 running Domain/OS.
Price: Notebook, $995 and up; Control, $3995 and up.
Contact: Laboratory Technologies Corp., 400 Research Dr., Wilmington, MA 01887, (508) 657-5400.
Inquiry 1133.

Image Processing and Visualization in Unix

BDS Systems' Xcalibur image-processing software supports integer pixel types of up to 64 bits and warps of any order with any number of tie points, allowing you to use it for complex applications in medical imagery or satellite and aerial reconnaissance. The program consists of a PixScript-based user interface engine that supports the X Window System/Motif environment, an Image Processing engine, and libraries of algorithms.

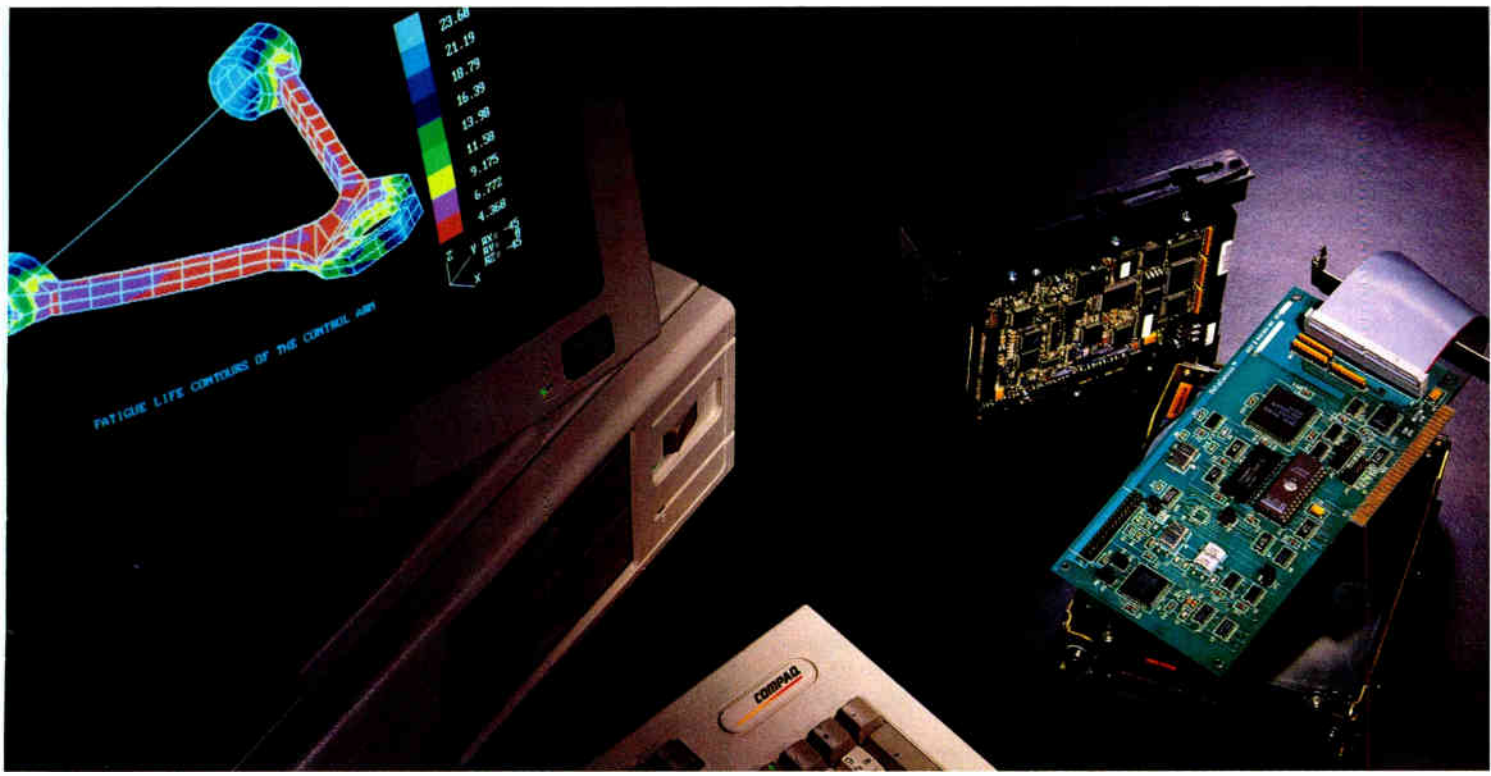
Some of the program's capabilities include multiple image objects per image, data fusion from multiple sources, and unlimited image sizes and dynamic range.

Xcalibur runs on a 386 or higher machine.
Price: $3000 to $8000.
Contact: BDS Systems, Inc., 105 Carpenter Dr., Sterling, VA 22170, (703) 437-7651.
Inquiry 1132.

continued

World Radio History

Smaller Computers. Bigger Applications.



Storage To Match.

The dimensions of computing are changing. Today's lower profile, higher-end 286 and 386 computers are taking up less desktop space and taking on much bigger applications. Matching these new computing dimensions with new dimensions in storage has never been more important. And once again, it is a company called Storage Dimensions that is doing that matching.

We call it *performance matching,* actually. And our new 100, 200 and 320 megabyte internal SpeedStor® subsystems are three solid examples of how we put you well in front of today's 286/386 power curve. Because you get smartly engineered half-high storage matched not only to the new smaller computer enclosures, but to their larger performance demands. With our proprietary SCSI-based architecture, host bus adaptor and on-board look-ahead caching for added speed. Plus an optional floppy port for cost effective installation and expansion.

Whether you measure your storage needs in square inches, megabytes or milliseconds, you'll find the dimensions you require are the ones we deliver. The ones that have put our products on more desktops than any other storage solution. Call us at (408) 879-0300. Storage Dimensions, 2145 Hamilton Avenue, San Jose, CA 95125.

STORAGE DIMENSIONS

SpeedStor is a registered trademark of Storage Dimensions © 1990 Storage Dimensions

B-SS2

Call me, I'm interested, circle 270 on Reader Service Card.

Please send literature, circle 271 on Reader Service Card.

World Radio History

Image Management for OS/2

Inner Media says that its Collage PM desktop image handler for OS/2 Presentation Manager (PM) includes a preview function for eliminating the trial and error associated with importing images into desktop publishing and paint programs.

Collage PM has several tools for previewing, capturing, manipulating, and converting bit-mapped or raster images. You can convert files from or into the PCX, TIFF, metafile, and system clipboard image formats. Basic editing tools let you crop, reverse, and dither images. As you view, a telescope-like window provides a magnified view of a segment of the image. You can also view images by filename or by using wild cards.

Collage PM runs on the IBM AT with OS/2 and PM 1.1 or higher and 2 MB of RAM.
Price: $199.
Contact: Inner Media, Inc., 16 Proctor Hill Rd., Hollis, NH 03049, (800) 962-2949 or (603) 465-2990.
Inquiry 1134.

Ask God at the Speed of Sound

Ask God is the first retail product to incorporate a search-and-retrieval engine called IQ Text that combines hypertext with AI. Using the engine, you can find any occurrence of a word or words in a 4-gigabyte ASCII text file in just two disk seeks. Business Solutions also says that Ask God can find the more than 22,500 occurrences of the word *the* in the Bible in 70 ms on a 35-ms hard disk drive.

Once Ask God finds all occurrences of a text string, you can save the matches to a study file. Other vertical applications in which the company might incorporate the IQ Text engine include programs for the legal, medical, and accounting sectors.

Ask God runs on the IBM PC with 384K bytes of RAM and 4.5 MB of free disk space. IQ Text itself can run on DOS or Unix systems.
Price: Ask God, $129; IQ Text, phone the company for prices.
Contact: Business Solutions, Inc., 15395 Southeast 30th Place, Suite 310, Bellevue, WA 98007, (800) 648-6258 or (206) 644-2015.
Inquiry 1135.

Collage PM's telescope-like window, shown in the lower right of the screen, displays a magnified view of an image in real time.

Multilingual Spelling Checkers, Thesauri

Word Finder Plus is a 120K-byte TSR multilingual spelling checker that includes support for English, German, and French in its core product and for Spanish and Italian as options. The program runs on the IBM PC, and all five languages require about 3.2 MB of disk space for a total of about 1.5 million words.

You can pop up the thesaurus or spelling checker over most word processing programs to look up words, and you can change from one language dictionary to another.
Price: $199; additional languages, $79 each.
Contact: Microlytics, Inc., Two Tobey Village Office Park, Pittsford, NY 14534, (716) 248-9150.
Inquiry 1137.

With Linguist, you can translate word to word from Russian to English and vice versa. Although microTrans says that the program is not a substitute for a professional translator, you can use it to translate article abstracts or technical documents.

The Linguist system includes a bilingual text editor, a translator, and dictionary editing routines. Linguist itself is language independent; you add modules to add language capabilities. The company says that new modules in addition to the English-Russian and Russian-English ones will be available later this year.

As you give Linguist new translations, it updates the dictionary. The program runs on the IBM PC with 512K bytes of RAM and a hard disk drive.
Price: $385.
Contact: microTrans, 348 Turnstone Dr., Livermore, CA 94550, (415) 447-0596.
Inquiry 1138.

Guide for Windows 3.0

With Guide 3.0, a publishing tool that allows you to create and distribute electronic hypertext documents, you can combine text, graphics, maps, video images, sound, and animation running under Windows 3.0. The program also supports the Macintosh.

Owl International says that Guide is the solution for organizing documents that contain thousands of pages. The program provides four types of link origins: reference, note, expansion, and command links. Links are located at specific points in a document, and the form in which information is displayed depends on the type of link you activate.

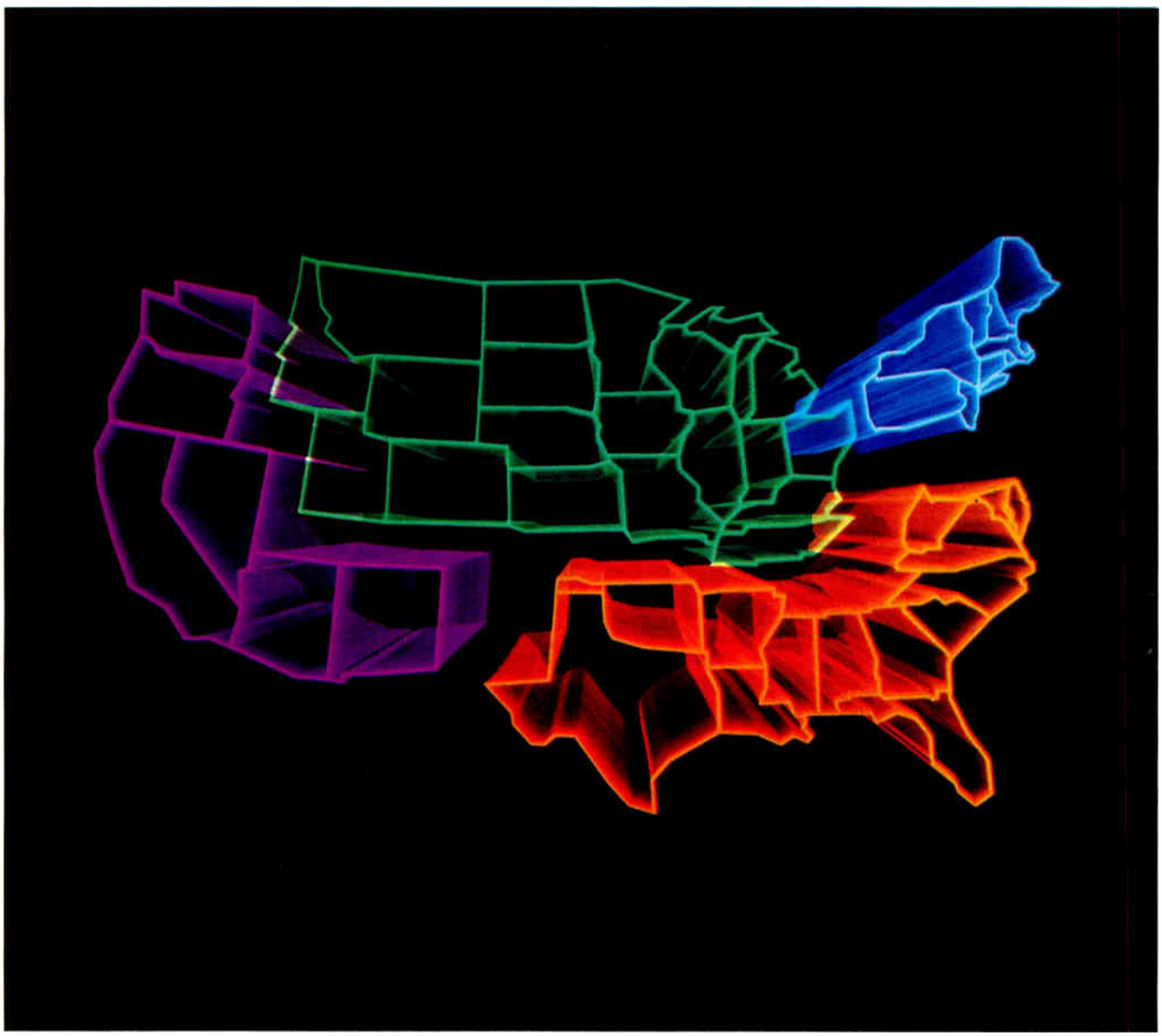
Guide 3.0 directly supports TIFF, PCX, Windows Paint, bit-mapped, and metafile formats. It supports video and sound through external functions. On the IBM AT, it requires Windows 2.03 or higher, 640K bytes of RAM, and a hard disk drive. On the Mac, you need 512K bytes of RAM and a hard disk drive.
Price: $495; Mac version, $295.
Contact: Owl International, Inc., 2800 156th Ave. SE, Bellevue, WA 98007, (206) 747-3203.
Inquiry 1136.

World Radio History

BYTE

REGIONAL

NORTHEAST



PHOTOGRAPHIC IMAGE: ALEX PIETERSEN © 1989

World Radio History

WHAT'S NEW

REXX: The Macro Language of the Future?

Speaking to the Boston Computer Society's OS/2 technical special-interest group, Kevin Kearney of Mansfield Software Group contended that REXX—a macro language originally developed for IBM VM/CMS systems as an alternative to the old EXEC and EXEC2 batch languages—could become the universal macro language used on all systems and by most applications. To support his argument, Kearney discussed both the technical and political issues surrounding REXX and rival macro languages.

Most macro languages, according to Kearney, were added to programs as an afterthought, with limited functions, little attention paid to design, and marginal or nonexistent debugging facilities. When each application has its own little language, it becomes difficult for the user to learn any of the languages well. By contrast, a universal macro language would be common to many applications and operating systems, and it would be carefully designed.

REXX was specifically designed as a macro language for CMS systems and has been in use for over 10 years. In addition to CMS, REXX is currently implemented on MVS, OS/400, Amiga, Unix, PC-DOS, and OS/2 systems. Mansfield Software Group developed and markets Personal REXX for PC-DOS and OS/2. The Amiga implementation of REXX has gained wide acceptance and will become part of the standard Amiga operating system this summer.

"If I had designed REXX and it was proprietary to Mansfield Software, it wouldn't have a chance, even if I did a better job than IBM did," Kearney said. "But as an IBM-supported part of SAA [Systems Application Architecture] with good implementations outside of IBM as well, it's a good candidate to be everybody's macro language. Of course, Microsoft is still proposing Object Basic, so maybe the issue isn't decided yet."

According to Kearney, REXX is powerful enough to perform most repetitive processing, while simple enough for novices to learn readily. He cited the language's interpreted nature, character-string orientation, automatic typing, automatic memory management, and powerful control and debugging features. These features have made REXX the teaching language for beginning programmers at several universities.

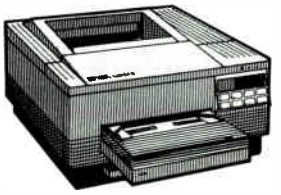
IBM OS/2 Extended Edition 1.2 includes an SAA-compliant version of REXX, which works with the EE 1.2 Query Manager, the IBM Dialogue Manager, OfficeVision, Mansfield's own KEDIT programming editor, and Quercus Systems' REXXTerm communications package. OS/2 Standard Edition does not include IBM's REXX, but Mansfield's

continued

When It Comes To Output, Good Looks Run In The Family.

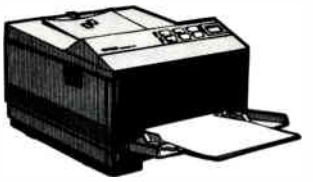
We're your source for the whole family of HP LaserJet printers–including the new HP LaserJet III printer with Resolution Enhancement technology.

- Sharp publication-quality output
- Backed by HP quality and reliability
- From the leader in desktop laser printing

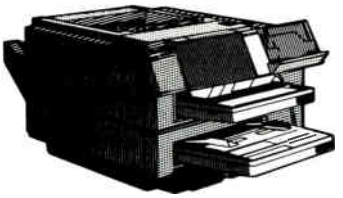


New HP LaserJet III Printer With Breakthrough Print Quality

HP LaserJet IIP Printer For Affordable, Personal Use



HP LaserJet IID Printer With Two-Tray Flexibility



$75 HP Rebate! Call for details!

Deerfield Data Systems INC.

"New England's HP Specialists Since 1981"

HEWLETT PACKARD Authorized Dealer

Deerfield Data Systems is an IIP Authorized Service Center for all LaserJets, DeskJets, PaintJets and desktop plotters. We perform warranty repairs and offer a variety of service contract options. Call for more information!

Toll Free: (800) 444-5049

Western Mass. (413) 665-3742

■ Sunderland, MA ■ Hartford, CT

Circle 501 on Reader Service Card

World Radio History

HARMONY COMPUTERS

1801 FLATBUSH AVE.. (BET. AVES. J & K) BKLYN. NY 11210

ORDER DEPT. ONLY 800-441-1144 OR 718-692-3232 — INFORMATION 718-692-2828

SALES DEPT. OPEN SUNDAY

10th Anniversary Specials

TOSHIBA T-1000SE LAPTOP **$1099.00**

★ ★ ★

H.P. LASERJET IIP **$919.00**

PANASONIC 1124 **$289.00**

★ ★ ★

IBM PS/2 #30 (286) 20 Meg **$1689.00**

WORD PERFECT 5.1 **$244.00**

★ ★ ★

NEC MULTISYNC 3D **$569.00**

"PRINTER SPECIALS"

Apple Image Writer II	429
Citizen 200 GX	199
Diconix Ink Jet 150 plus	314
Epson LX810	179
Epson FX 850	299
Epson FX 1050	**439**
Epson LQ 510	289
Epson LQ 1010	399
Epson LQ 850	489
Epson LQ 950	489
Epson LQ 1050	629
Epson LQ2550	899
Hewlett Packard Desk Jet Plus	659
Hewlett Packard Laser Jet II P	**919**
Hewlett Packard Laser Jet III	**1499**
Hewlett Packard Deskwriter (Apple Macintosh)	**789**

IBM Proprinter 3	399
IBM Proprinter X24E	599
IBM Proprinter 3XL	559
IBM Proprinter XL24E	729
NEC P2200XE	294
NEC P5200	489
NEC P5300	599
Okidata 172	199
Okidata 182 Turbo	219
Okidata 183 (Wide Carriage)	229
Okidata 320	324
Okidata 321	469
Okidata 380	299
Okidata 390 Plus	469
Okidata 391 Plus	639
Okidata 393 Plus	979

Panasonic 1180	159
Panasonic 1191	219
Panasonic 1624	**389**
Panasonic 1124	289
Panasonic 1695	399
Panasonic 1524	499
Panasonic 4420 Laser	979
Seiko Smart Label Printer	189
Star NX 1000 II	159
Star NX 1000R (Color)	189
Star NX 1500	**289**
Star NX 2410	**259**
Toshiba 301 (24 Pin Portable Printer)	**249**
T-301 Carry Case	**29**
Toshiba 311	**299**
Toshiba 321 SL	**299**
T-321SL Cutsheet Feed	**99**

IBM AND COMPATIBLES

IBM PS/2 #30 (286), 1 44 Meg Dr	1399
As above w IBM 20 Meg	1689
As above with IBM 30 Meg	1799
As above with Seagate 50 Meg Drive	1799
IBM PS 2 Model 50Z (30 Meg)	1949
IBM PS2 Model 50Z (60 Meg)	2349
2 Meg Upgrade (PS 2-30 (286) 50Z,55SX,70,80	399
IBM PS 2 #55 SX 30 Meg (3865X)	2599
IBM PS 2 #55 SX 60 Meg (3865X)	2989
IBM P S 2 Mono Monitor (8503)	199
IBM P S 2 Color (8512) Monitor	449
IBM P S 2 Color (8513) Monitor	539
TURBO 386 SYSTEM (20 MHZ) 1.2 Meg Drive Serial Parallel, 1 Meg, Video Card, Monitor	1199
TURBO 386SX (16 MHZ) 1.2 Meg Drive Serial Parallel, 1 Meg, Video Card and Monitor	849
TURBO AT 286 SYSTEM 12 MHZ, 1.2 Meg Drive Serial Parallel, 512K w/Monitor	679
TURBO XT SYSTEM 10 MHZ, Drive 640K Video Card and Monitor, PAR, SER, M.S. Dos	449
Wyse AT 286 (10 MHZ), Meg. RAM, 1.2 Meg Drive	649
Everex Step Systems	Call for Pricing

MONITORS

Amdek 410A	109
Amdek 738 (VGA)	529
IBM 8503 Monochrome VGA	199
IBM 8512 Color VGA	449
IBM 8513 Color VGA	539
Panasync C1381	399
Princeton VGA Paperwhite	129
Princeton Max 15	209
Princeton Ultra Sync (16 inch)	849
Princeton Ultra Sync (14 inch)	**459**
NEC Multisync G.S.IIA (Paperwhite)	**209**
NEC Multisync 2A (VGA)	439
NEC Multisync 3D	**589**
Sony 1304 Multiscan (1024x768)	**649**
Sony 1302 Multiscan	**599**
Sony 1320 VGA	**469**
Seiko #1440 (Res. 1024 x 768)	569
Zenith 1492	589
Mitsubishi 1429 (VGA)	389
Mitsubishi Diamondscan #1381A	479
Golostar Superscan#1440 (800 x 600)	429
Goldstar #1430 VGA	359
Goldstar 1420 EGA	349
Packard Bell TTL Amber 12 Inch	89
Packard Bell TTL Amber 14 Inch	129
Packard Bell (RGB) Color Monitor	219

VIDEO CARDS

Hercules Monographic Plus w/Ramfort	154
Hercules Graphic Station	**339**
Genoa Super Hi Res Plus	99
Genoa 6400 VGA w/512K	199
Video 7 VGA	149
Video 7 VGA 1024i 256K	209
Video 7 VGA 1024i 512K	259
Video 7 VGA VRAM (512K)	399
Orchid Pro Designer (VGA) 256K	149
Orchid Pro Designer (VGA) Plus 512K	199
STB VGA Extra EM 16 256K	189
STB VGA Extra EM 16 512K	239
ATI VGA Wonder 256K	179
ATI VGA Wonder 256K w/Mouse	199
ATI VGA Wonder 512K	229
ATI VGA Wonder 512K w/Mouse	249
Paradise Auto Switch (480)	99
Paradise VGA Plus	159
Paradise VGA Plus (16 bit)	189
Paradise VGA Professional 512K	229
Paradise VGA 1024	209
Paradise VGA 1024 (512K)	259
Paradise VGA 85145A	529
Everex Auto Sync (480) Deluxe	99
Everex Viewpoint VGA 256K	179
Everex Viewpoint VGA 512K	229
Harmony VGA (800 x 600)	99
Harmony VGA (1024 x 768)	129

PC BOARDS, DRIVES, MEMORY CHIPS

IBM Original 5¼ Disk Dr (360k)	89
Toshiba 5¼ Floppy Disk Dr (360 K)	89
Toshiba 3½ Floppy Disk Dr (720 K)	89
Toshiba 3½ Floppy Disk Dr (1.44 Meg)	99
Toshiba 5¼ Floppy Disk Dr (1.2 Meg)	99
PS/2 5¼" 360K External Drive	199
PS/2 5¼ 1.2 Meg External Drive	249
EVEREX MULTIFUNCTION (PCXT)	89
EVEREX EMS MEMORY CARD (PCXT)	79
EVEREX RAM 3000 EMS MEMORY CARD (AT)	99
AST Six Pack Plus 64K	119
AST Rampage Plus (286) 512K	359
AST Rampage II EMS (PCXT)	99
AST Advantage 512K	199
Intel above board 286 plus w/512K	349
Intel above board 286 Plus I/O Parallel Serial	399
Intel above PS/2 (50,60)	299
AST Rampage PS/2 (50,60) 512K	439
64K DRAM chips	Call
256K DRAM chips	Call
256K Simm Module	Call
One Meg. DRAM chips	Call
One Meg. Simm Module	Call

MICE

Microsoft Mouse	99
Microsoft Mouse with Windows	139
Logitech Hi Rez Mouse	84
Logitech Scanman Plus	179
Logitech Trackman	89
Genius 3 Button Hi Rez Mouse	59

IBM SOFTWARE

Aldus Pagemaker 3 0	479
Lotus 123 Release 3	369
Lotus 123 Version 2 2	329
D Base 4	459
Borland Paradox 3 0	429
Microsoft Excel	299
Microsoft Word for Windows	299
Microsoft Word 5 0	209
Microsoft Windows 3 0 (Latest Release)	99
Microsoft Flight Simulator Rel 4 0	44
Word Perfect 5 1	244
Word Perfect Library 2 0	69
Q & A 3 0	219
PFS Professional Write (2 1)	129
PC Tools Deluxe 6 0	84
Norton Utilities 4 5	54
Norton Utilities Advanced 4 5	84
Copy 2 PC Deluxe Board	109
Wordstar Professional Rel 6 0	199
Ventura Desk Top Publishing ver 2.0	**499**
Managing Your Money - Release 6	119
Fast Lynx (Data Transfer Software and cables)	**99**
MS DOS 3.3 w/Basic	89
MS DOS 4.01 w/Basic	89

INTEL MATH COPROCCESORS

Intel 8087-3 (PC, PC XT up to 6 MHZ)	89
Intel 8087-2 (PC, PC XT up to 8 MHZ)	119
Intel 8087-1 (PC, PC XT PS 2 10 MHZ and faster)	159
Intel 80287-3 (PCAT up to 6 MHZ)	129
Intel 80287-8 (PCAT PS 2 up to 8 MHZ)	189
Intel 80287-10 (PCAT, PS 2 up to 10 MHZ)	224
Intel 80387-16 (PCAT, PS 2 up to 16 MHZ)	339
Intel 80387-20 (PCAT, PS 2 up to 20 MHZ)	379
Intel 80387-25 (PCAT, PS 2 up to 25 MHZ)	479
Intel 80387-33 (PCAT, PS 2 up to 33 MHZ and faster)	569
Intel 80387 SX (For 80387 SX Computers)	299
Intel 80C287	274

LAPTOPS

NEC Prospeed 286 20 Meg.	**2699**
NEC Prospeed 286 40 Meg	2849
Panasonic CF-150	669
Toshiba T 1000	629
T-1000 768K Upgrade Card	269
Toshiba T-1000SE	1099
Toshiba 1200 2 Drive (Backlit)	1399
Toshiba 1200 20 Meg (Backlit)	1899
Toshiba T-1000XE (20 Meg)	1849
Toshiba T-1200XE (20 Meg)	2699
Mitsuba Ninja 12VGA (40 Meg)	2599
Zenith 184 1 Supersport (2 Drive)	1269
Zenith 184-2 Supersport 20 Meg	1749
Zenith Supersport 286 (20 Meg)	2499
Zenith Supersport 286 (40 Meg)	2749
Mitsubishi 286L (20 Meg) with Case, Modem, M S Works	1699
Mitsubishi 286L (40 Meg) with Case, Modem, M S Works	2149
Sharp MZ100 (2 Drive)	849
Toshiba 301 (24 Pin Portable Printer)	249
Diconix 150 Plus Portable Ink Jet Printer	314
Fast Lynx (Data Transfer Software 3½ to 5 ¼)	99
Laptop Modem 1200 Baud	129
Laptop Modem 2400 Baud	159

FAX MACHINES

Sharp UX-110	479
Sharp UX 170	669
Sharp FO 230	619
Sharp FO 215	679
Sharp FO 333	819
Sharp UX 350	999
Sharp FO 510	979
Sharp FO 550	1349
Panasonic KXF100	599
Panafax #120 w Answering Machine	789
Panafax #140	559
Panafax #145	559
Panafax #250	1199
Panafax #260	1349
Epson Priority Fax 1000	579
Epson Priority Fax 2000	599
Epson Priority Fax 3000	799
Harmony SendFax with 2400 Baud Modem	119
98 Foot Fax Paper (6 Rolls)	29
164 Foot Fax Paper (6 Rolls)	49
328 Foot Fax Paper (6 Rolls)	79
Faxswitch (Automatically Direct Call to Fax or Telephone)	119

MODEMS

Hayes 1200 External	269
Hayes 1200B Internal	149
Hayes 1200B w/Smartcom 2	179
Hayes 2400 External	324
Hayes 2400B Internal	199
Hayes 2400B w Smartcom 2	259
Hayes 2400P (PS 2 50,60,70,80)	389
ATI 2400 Internal	169
ATI 2400 External	199
Everex Internal 1200B	69
Everex 2400 Plus Internal	159
Everex 2400 E Plus External	199
Everex 2400 Internal PS 2 50,55,60,70,80	199
Everex Faxboard Internal	269
Everex Fax Board External	329
Emerson 1200 External	79
Harmony 2400 Internal	89
Harmony SendFax with 2400 BD Modem	119
Harmony 2400 External	99
Laptop Modem 1200 Internal	129
Laptop Modem 2400 Internal	159

HARD DRIVES

Seagate 20 Meg. w/controller	**249**
Seagate 30 Meg. w/controller	269
Seagate 40 Meg #251-1	299
Seagate 80 Meg #4096	559
Seagate 80 Meg #296N SCSI	389
Seagate 120 Meg	649
AT Hard Drive Controller	119
PCXT Hard Drive Controller	69
Seagate 30 Meg Hard Drive Card	334
Seagate 20 Meg Hard Drive Card	264
Plus Hardcard 2 40 Meg (AT,PS2,-25,30)	579
Plus Hardcard 2 80 Meg (AT,PS2,-25,30)	669
Seagate 20 Meg 3½ inch #125N SCSI	279
Seagate 20 Meg 3½ inch #125 MFM	239
Seagate 30 Meg 3½ inch #138N SCSI	319
Seagate 30 Meg 3½ inch #138MFM	299
Seagate 50 Meg 3½ inch #157NS SCSI	339
Seagate 50 Meg 3½ inch #157	339
Host Adapter for SCSI Drives	49

Visa, Master Card and Discover welcome at no additional charge. For your protection we check for stolen credit cards. Shipping & handling extra. Defective merchandise will be replaced or repaired at our discretion within the terms of our warranty. Price and availability subject to change without notice. We do not allow non defective returns. For defective merchandise inquiries call customer service at 718-692-2823. We are not responsible for typographical errors.

World Radio History

Personal REXX for OS/2 runs on the SE as well as the EE.

"I don't want you to think I'm giving you a sales pitch so that you'll go out and buy our product," Kearney added. "So, I've brought copies of Personal REXX, KEDIT, and REXXTerm for OS/2 for all of you. Please don't let it get around—I don't want people calling us up to say they intended to attend the meeting but couldn't get here."

—Reported by Martin Heller

Kahn Spills Beans About Turbo C++ and New Paradox

At the April general meeting of the New York PC Users Group, Borland president and founder Philippe Kahn revealed the company's plans to announce a new Windows version of its Paradox database and a Turbo C++ programming language.

The revelations, which Kahn described as inadvertent, came as he discussed Borland's target platforms and core applications. Kahn told the audience that Borland had identified DOS, Windows, and OS/2 as its "strategic" operating systems and Paradox and Quattro Pro as its core applications. To demonstrate Borland's commitment to extending the applications packages and Turbo languages, Kahn cited Turbo C++ and Paradox for Windows—and then he said, "Whoops, I guess I just preannounced."

Kahn didn't provide any details about the new packages but did indicate they will be formally unveiled sometime this summer (see Dick Pountain's Short Take in this issue). C++ is an extension of the C language that adds object-oriented programming and data abstraction. Originally developed by AT&T Bell Labs, it is becoming popular among programmers and is now available in a commercial compiler from Zortech.

The new package may not be a piece of cake, however: Kahn said that C++ is "a tough language" and that in working with it on his own computer he had found it "pretty cryptic."

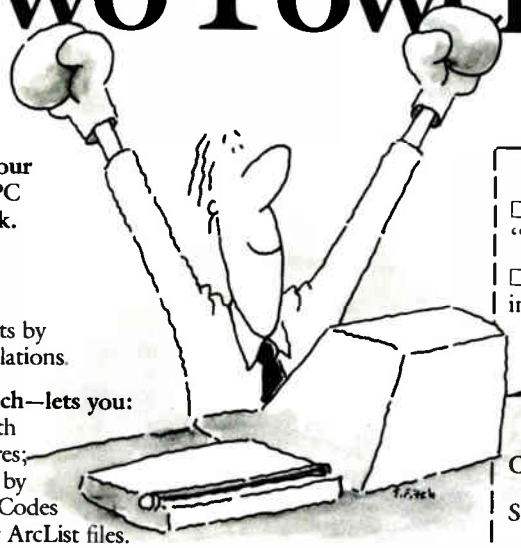
Paradox, a fast-growing player in the PC database market, is now available in versions for DOS, Extended DOS, and character-mode OS/2. In addition to a Windows package (presumably for Windows 3.0), Kahn promised to deliver a rumored Presentation Manager implementation, although he did not specify a time frame.

During his presentation, Kahn said Borland will focus only on DOS, Windows, and OS/2 applications and languages and has no plans at this time to enter the Macintosh or Unix markets. Furthermore, he said, the company wants to write software that is used by people, not by other machines. "Our goal at Borland," he said, "is to deal on the client side [of the client/server model]: user tools and development tools. We're not interested in the server side."

—Reported by Andrew Reinhardt

Mail smarter and save money on your PC using the

One-Two Power Punch



ArcList® —your first punch— lets you professionally manage your list *on your* IBM or compatible PC with 640K RAM and a hard disk.

SAVE MONEY:

■ *eliminate* duplicates from dBase®, ASCII or ArcList files;

■ *take* advantage of postal discounts by presorting according to USPS regulations.

AccuMail™ —your second punch—lets you:

■ easily *knockout* undeliverables with automatic address correction features;

■ *quickly* knock down postal costs by inserting carrier route and ZIP+4 Codes into your existing dBase, ASCII or ArcList files.

Find out more about *ArcList* and *AccuMail*! *For a* FREE copy of "How to Manage Your Mailing List" *call* 1-800-368-5806 or write:

Group 1 Software, Inc.
Washington Capital Office Park
6404 Ivy Lane, Dept. P-BR70
Greenbelt, Maryland 20770-1400

GROUP 1®
GROUP 1 SOFTWARE
The Direct Marketing Software Company

☐ Please rush me a FREE copy of "How to Manage Your Mailing List."

☐ I'm ready to see ArcList and AccuMail in action. Please contact me at once.

Name _____

Title _____

Organization _____

Street _____

City _____

State _____ Zip _____

Telephone (_____) _____

©1989 Group 1 Software, Inc. P-BR70

Call for the dealer nearest you.

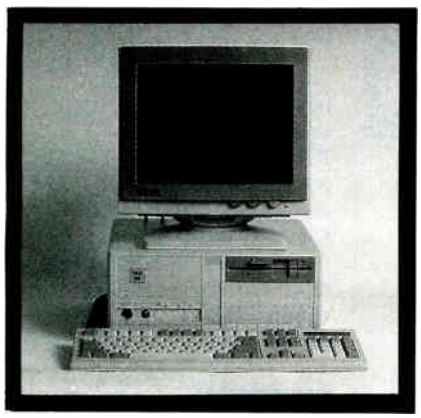
Circle 507 on Reader Service Card (DEALERS: 508)

World Radio History

It's hard to be humble when we have so much to offer for so little...

MADE IN THE USA

A higher standard of standard features



TECH™ 386SX

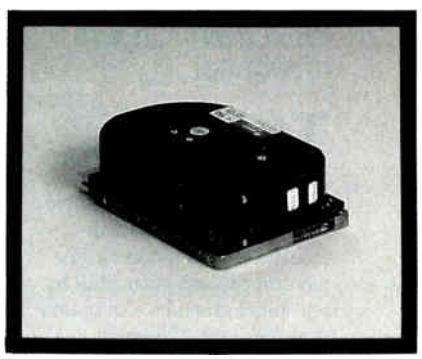
- 80386SX processor running at 16MHz.
- 512KB RAM expandable to 8MB on motherboard.
- 0 wait state page mode memory.
- Built-in dual IDE hard drive interface.
- Built-in dual diskette drive controller.
- Built-in parallel printer port.
- Two built-in serial ports.
- Seven expansion slots (6 available).
- Socket for 80387SX coprocessor.
- 5.25" 1.2MB or 3.5" 1.44MB diskette drive.
- Enhanced 101-key keyboard.
- 14" flat screen high res. monochrome monitor with graphic adaptor.

WITH 40MB HARD DRIVE SYSTEM AND 14" MONITOR

ONLY $1,295

OPTIONS

100MB hard drive system	$1,595
200MB hard drive system	$2,095
20MHz version	add $ 120



MAXTOR™ 769MB 16.5ms.. $2,555

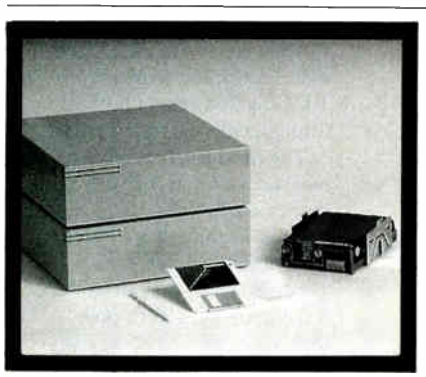
HIGH PERFORMANCE 5.25" HARD DRIVES

Model	Capacity	Access Time	Drive Only	Drive w/Kits
XT-1085	85MB	28ms	625	715
XT-1140	143MB	27ms	1,200	1,285
XT-2190	191MB	29ms	1,370	1,470
XT-4170E/S	179MB	14ms	1,145	1,285
XT-8380E/S	410MB	14.5ms	1,595	1,765
Tahiti Optical	1.2GB	35ms	5,925	6,075
LXT200A/S (3.5")	202MB	15ms	895	925/1,035

CONNER™ HIGH PERFORMANCE 3.5" HARD DRIVES

AT/SCSI

Conner 40MB	$ 375
Conner 80MB	$ 545
Conner 100MB	$ 665
Conner 200MB	$1,065



MACINTOSH™ HARD DRIVE SUBSYSTEM

200MB External Drive $1,049

18ms, 3MB/sec Data Transfer Rate, Complete with Formatting Software, Manual, SCSI and Power Cables!

	Internal	External
40MB, 29ms	$ 419	$ 539
80MB, 25ms	$ 599	$ 719
100MB, 25ms	$ 699	$ 819
200MB, 15ms	$ 919	$1,049
380MB, 14ms	$1,649	$1,739

SYSTEM OPTIONS

512KB RAM upgrade	add $ 65
2MB RAM upgrade	add $195
VGA monochrome monitor	add $110
VGA color monitor (720x480)	add $410
VGA color monitor (1024x768)	add $500
Mini tower case version	add $ 50

TECH CITY™

800-828-3110

(714) 385-1219 FAX (714) 937-5414
6 A.M.-6 P.M. PACIFIC STANDARD TIME
1300 E. KATELLA AVE., ANAHEIM, CA 92805

BUY WITH CONFIDENCE FROM TECH CITY™

- 30-Day Money-Back Guarantee!
- 1 Year Warranty
- Full Technical Support
- In Business Since 1984
- No Additional Charges for Credit Card
- No Credit Card Charge Until Shipment
- Prices subject to change without notice.

Circle 521 on Reader Service Card (DEALERS: 522)

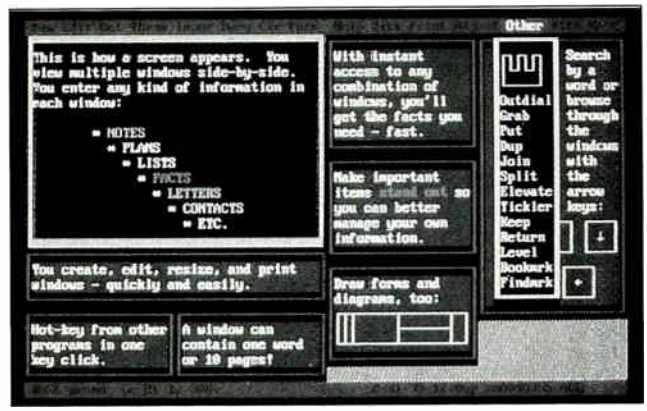
World Radio History

Manage Bits of Information Selectively

Micro Logic's Info Select is based on Tornado, one of the first personal information managers (PIMs) for the IBM PC, and it adds several features, including hypertext linking, mail merge, sorting, dialing, fuzzy searching, support for information bases of up to 10 MB, and appointment ticklers, to name but a few. With Info Select, you can plan projects, draw forms, track sales leads, organize names and addresses, and manage people, Micro Logic says.

Unlike other PIMs, Info Select doesn't provide you with endless views of information. Instead, the program displays in multiple windows memos, multipage reports, and other bits of information. You can cut and paste among windows and join several windows into one, the company says.

You can install Info Select as a TSR program, and it requires just 7K bytes of RAM when running as a TSR. It requires about 128K bytes of RAM when running as a standard application.
Price: $99.95.
Contact: Micro Logic Corp., P.O. Box 70, Hackensack, NJ 07602, (800) 342-5930 or (201) 342-6518.
Inquiry 1026.



The Info Select screen lets you organize data in multiple windows. You can apply a command-like search and replace or a fuzzy text search to all the windows.

Compare What You Eat with What You Should Eat

A program for the Macintosh called MacDine lets you track the foods that you eat and compare them to the calories and nutrients recommended using numerical analysis and charts and graphs. You can tailor the program to suit special situations (e.g., diabetics), and you can configure the program to work on a daily, weekly, or monthly basis.

Once you've entered your actual eating record, the program rates your diet and tells you if you're within your dietary guidelines. The program can also account for physical activity.

MacDine requires a Mac Plus or higher.
Price: $199.
Contact: Dine Systems, Inc., Five Bluebird Lane, Amherst, NY 14228, (716) 688-2492.
Inquiry 1029.

Smaller Sharp Laser Printer Prints Faster

The JX-9500, a small-footprint 6-ppm laser printer, comes with five printer emulations, including Hewlett-Packard LaserJet Series II, Epson FX-80, IBM Graphics Printer, IBM Proprinter, and Diablo 630. Print resolution is software-selectable up to 300 dpi.

Also standard are two slots for Sharp's five proprietary font cartridges, 512K bytes of RAM (upgradable to 4.5 MB), and 250-sheet input and output trays. Options include the RAM cards, a 40-piece automatic envelope feeder, a second 250-sheet paper cassette, and input trays for legal, letter, and executive-size (7¼- by 10½-inch) paper. The printer measures 13⅜ by 14$^{3}/_{16}$ by 10½ inches; the second (optional) paper tray has the same footprint.
Price: $1795; 1.5-MB RAM card, $599; 2.5-MB RAM card, $999; 4-MB RAM card, $1899.
Contact: Sharp Electronics Corp., Sharp Plaza, Mahwah, NJ 07430, (201) 529-9500.
Inquiry 1030.

Portable 33-MHz 386 Offers Choice of Monitor

The Modgraph GX-2386 is a 33-MHz 386-based portable computer that resembles the Compaq Portable.

Standard equipment includes a 9-inch monochrome monitor that supports 800- by 600-pixel graphics. An option is an 8½-inch 256-color monitor that also displays 800- by 600-pixel graphics.

You can use the embedded video controller to display 1024- by 768-pixel graphics through external video ports.

The Modgraph GX-2386 measures 17½ by 14$^{1}/_{10}$ by 6⅘ inches and weighs 26 pounds, including a 40-MB hard disk drive, a 5¼-inch 1.2-MB floppy disk drive, a 3½-inch 1.44-MB floppy disk drive, and an 86-key keyboard. Three 16-bit slots and a math coprocessor socket are also provided.
Price: $4995; color model, $6995.
Contact: Modgraph, Inc., 149 Middlesex Tpk., Burlington, MA 01803, (800) 327-9962 or (617) 229-4800.
Inquiry 1028.

Mac Accounting Program Notices the Details

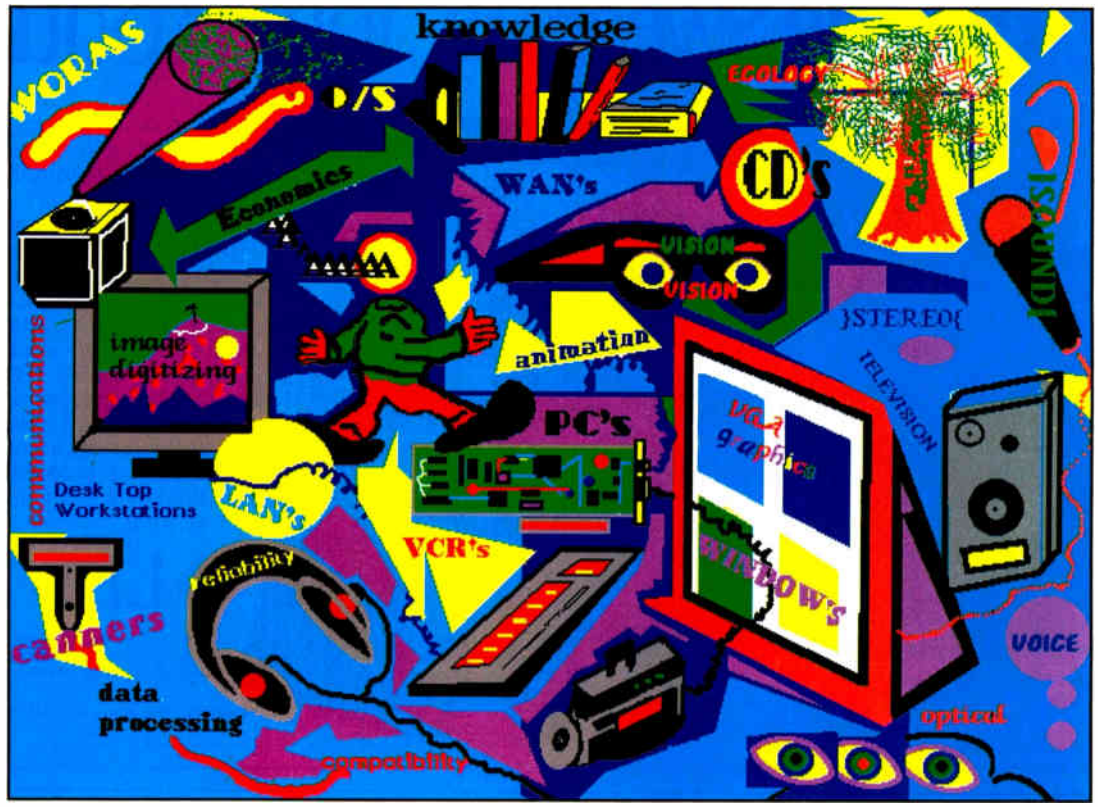
The Insight Expert General Ledger 2.20 accounting module for the Macintosh lets you keep detailed records of postings, allowing you to examine not only numbers, but the facts behind them, Layered reports. The module also supports detailed postings from the Insight A/P (accounts payable) module and financial statements with up to 12 columns.

You can add international flavor to the accounting module by tailoring the program to support different types of currencies, languages, and date formats, Layered says.

When creating a new data set, you can choose from several charts of accounts customized for a particular type of business. A historical journal can act as a business diary by letting you store all posted general journals for up to 99 months.
Price: $695 per module.
Contact: Layered, Inc., 529 Main St., Boston, MA 02129, (800) 622-4436 or (617) 242-7700.
Inquiry 1027.

World Radio History

What could all these acronyms and technologies have in common?



just one thing...

Info/Optics

Dedicated to Business Excellence and Vision in Multi-Media Technology

presents

Integrated Information, Voice and Image Management System Solutions

Inquiry welcome from:
System Integraters, Value Added Resellers,
Value Added Distributors, System Consultants
and Corporate MIS Directors.

Call 1- 800 - 999 - 0638

Info/Optics
231 E. Millbrae Ave. Suite 212
Millbrae, CA 94030
Phone: 415-692-7811
Facsimile: 415-692-7815

Circle 511 on Reader Service Card (DEALERS: 512)

World Radio History

You Really Don't Need To Advertise If Everyone Swears By Your Product.

With hundreds of thousands of loyal users, RM/FORTRAN has become somewhat of a household word among scientists and engineers—without the benefit of advertising.

That's because it's an ANSI-standard Fortran package for DOS and OS/2 (also known as IBM Fortran/2) that's loaded with mainframe capabilities. It includes RM/Forte, a development environment which integrates editing, compiling, linking and debugging. Since this environment is built-in, you save hundreds of dollars. And now that RM/FORTRAN is part of the LPI family of products, look for more great updates and support.

For a 60-day trial with a money-back guarantee, call **1-800-833-FORT.** RM/FORTRAN. It's software you'll swear by, not at.

LPI

Language Processors, Inc. (LPI), is one of the Liant companies and specializes in scientific and engineering programming systems.

959 Concord St., Framingham, MA 01701, 508-626-0006.

Sixty-day trial guarantee good through August 31, 1990.
Only applies to direct sales from LPI.

Attention U.S. BYTE Subscribers

Watch for the next BYTE DECK mailing that will be arriving in your mailbox soon!

Use this as a fast, convenient tool to purchase computer products and services. It's loaded with essential hardware and software products that you should be aware of when making your buying decisions. . .and it's absolutely FREE!

If you have a computer product or service, and would like to reach 275,000 influential BYTE magazine subscribers, please give Ed Ware a call today at (603) 924-2596.

BYTE DECK

Here's what a BYTE Deck advertiser has to say:

"Galacticomm does a lot of card-deck advertising, and the BYTE Deck has consistently out-pulled every other deck we have ever used."

Timothy Stryker, Galacticomm, Inc., Fort Lauderdale, FL

World Radio History

UNIX® Applications Aren't Just For Eggheads Anymore.

Introducing UNIX SOLUTIONS—The New Exposition and Conference Where the Power of UNIX and Open Systems Gets Down to Business.

If you think that UNIX is only good for a few, exclusive technical applications, think again. The fact is, everyday, more and more serious applications are being hatched for business. With financial and functional advantages that deserve a second look.

Now, MIS managers and executives from corporate America can see more products, meet more experts and learn more about these important applications than ever before. Thanks to UNIX SOLUTIONS.

Presenting an exhibition floor showcasing the hardware, software, networking equipment, peripherals and services the business world needs to get up and running with UNIX. And featuring a special emphasis on horizontal and vertical applications for business.

Announcing a conference program specifically identifying the questions and topics of interest to the business and technical communities. Hear independent software vendors (ISVs), top analysts, end-users and systems specialists in over 30 sessions and panel discussions. Learn about porting, migration and the many other issues that affect your company on a daily basis.

Whether you currently use UNIX, are in the process of installing UNIX, or have come to realize that UNIX should be a part of your strategic business plan, this is the forum that can put you on the fast track to business solutions.

To receive your brochure detailing this exciting expo and conference, return the coupon. Or for immediate action, call (617) 449-6600; fax (617) 449-6953; or telex 951176.

I'm convinced. I need UNIX SOLUTIONS to get down to business.

☐ Please send me attendee information.
☐ Please send me exhibitor information.

Name _____

Title _____

Company _____

Address _____

City _____

State _____ Zip _____

Phone (_____) _____

Best time to call _____ BM07

Mail to: UNIX SOLUTIONS 300 First Ave., Needham, MA U.S.A. 02194

UNIX SOLUTIONS
EXPOSITION AND CONFERENCE™

October 3–5, 1990
Anaheim Convention Center
Anaheim, CA

Produced by ☒THE INTERFACE GROUP, Inc. ® 300 First Ave., Needham, MA U.S.A. 02194
UNIX SOLUTIONS Exposition and Conference • October 3–5, 1990 • Anaheim Convention Center • Anaheim, CA © 1990 • UNIX is a registered trademark of AT&T.

Circle 513 on Reader Service Card

World Radio History

Display's Industrial-Strength Color Monitor

Display Technologies' new 7½- and 9-inch VGA-compatible Color Pix.L monitors can withstand temperatures of up to 140°F, shocks of up to 30 g's, and vibrations of up to 2.5 g's on all axes. Both monitors use Trinitron CRTs, which provide the sharp images and bright colors necessary for use in test instrumentation, medical, and process control applications, the company reports.
Price: 7½-inch monitor, $1050; 9-inch monitor, $1169.
Contact: Display Technologies, Inc., 1355 Holmes Rd., Elgin, IL 60123, (708) 931-2100.
Inquiry 1015.

Test ROM Images Without Burning EPROMs

ROM-IT, a ROM emulation system that lets you test ROM images without having to burn EPROMs, lets you emulate up to eight 1-Mb EPROMs from one host serial port through the addition of ROM-IT cards. The ROM-IT system itself measures 5 by 5 by 1⅜ inches and connects to any serial port capable of 9600-bps operation. The card supports host serial interfaces that transmit at up to 38,400 bps. You can also connect the stand-alone system through the computer's parallel port.

Incredible Technologies says that the system can download 128K bytes in less than 11 seconds when used with a parallel interface. The system provides ROM emulation of most types of EPROMs in use today, from 64,000 bits to 1 Mb.

The Color Pix.L monitor includes a self-compensating 85- to 264-V power supply, making it compatible with any voltage input in the world.

Price: ROM-IT with 256,000-bit emulation, $395; with 512,000-bit emulation, $415; with 1-Mb emulation, $455. Additional 256,000-bit RAM, $135; 512,000-bit RAM, $155; 1-Mb RAM, $195.
Contact: Incredible Technologies, Inc., 709 West Algonquin Rd., Arlington Heights, IL 60005, (708) 437-2433.
Inquiry 1018.

Give Your Atari Workstation Performance

The Atari Color Isac is a graphics board for the Atari ST that touts a 1024- by 768-pixel display resolution with 16 colors from an extended palette of 4096. (The standard Atari palette is 512 colors with 320- by 200-pixel resolution in a 16-color mode.)

The Image Systems Atari card is fully compatible with the Atari blitter (a graphics accelerator) and supports GEM programs like Page Stream and Calmus Publishing. A socket for a 68881 coprocessor lets you speed graphics processing.

The Isac works with autosynchronous monitors that often boast 48 kHz for enhanced display resolution. It also works with multisync monitors with resolutions as high as 50 kHz horizontal.
Price: $800.
Contact: Image Systems Corp., 11543 K-Tel Dr., Hopkins, MN 55343, (612) 935-1171.
Inquiry 1017.

Automate Batch-File Menu Creation

The Batch'in utility from Leber Enterprises combines an expert system and a screen painter to automate the process of making batch-file menus. By answering a set of files, you can create a menu screen file that's compatible with the ANSI.SYS screen driver and MS-DOS-compatible batch files.

The batch-file writer supports up to 10 environmental variables and 10 program parameters per batch file, and it automatically cleans up after itself by removing environmentals and restoring changes to the path after the program executes, Leber reports. The program also provides for calling a batch file from another batch file.

Leber says that the menus are ideal for a network environment and other situations where secondary shells are undesirable. The number of submenus and separate menu systems is limited only by disk space.

Batch'in runs on the IBM PC and requires 512K bytes of RAM.
Price: $40.
Contact: Leber Enterprises, P.O. Box 9149, Peoria, IL 61614, (309) 693-0634.
Inquiry 1016.

Contact Management for Under $100

A contact management program called Sales Machine includes a built-in word processor, up to 30 definable fields in its database, and the ability to automatically print daily follow-up correspondence and automatically construct daily call lists.

According to Advanced Marketing Concepts, these automatic functions differ from the tickler capabilities of the program. The program tracks where each prospect and customer is in his or her individual sales cycle and which ones are due for correspondence or calls on a given day. You can create up to 99 different marketing tracks for different types of customers.
Price: $99.
Contact: Advanced Marketing Concepts, Inc., 515 Ogden Ave., Downers Grove, IL 60515, (800) 888-5340 or (708) 969-4400.
Inquiry 1019.

World Radio History

HICO

Bring Your Desktop to Life

Get Color in One Pass

PC WORLD

1989 WORLD CLASS AWARD

"This is a true one-stop solution to companies involved in desktop publishing, text inputting or graphics design. Everything we need to scan, edit, save, convert and print photos, drawings and text is included in one package. We don't get the headache of incompatibility in converting file formats that can occur when using products written by different companies"

Daniel Janal, President, Janal Communications

HICO A4SCAN SYSTEM

- A4SCAN Hand-held Scanner AS-8000P
  A 4.1-inch hand scanner, offers 400 dpi resolution and 32 halftone scales.
- IMAGE72 Paint Program
  Written in assembly programming language for speed and low system requirement, lets users edit and merge multiple images.
- AI-OCR Trainable OCR Software
  Can be trained to read printed pages with an accuracy rate of 98 percent. Files can be imported to WordPerfect, MS-Word, WordStar and ASII compatible files.
- AS-8000 Plus Controller Card
  A half-sized, 8-bit, XT/AT slot card.

Features:

■ The ability to merge several sections of color or black and white scanned images into one picture ■ Three compress scanning modes (1:1, 1:4, 1:9) give users flexibility in scanning images ■ Import and export picture files to any combination of 72 files formates, including TIFF PCX, CUT, GRX, IMG, MSP, PCC, PUT ■ Universal driver supports any mouse ■ Real-time scanning for fast, accurate scans ■ Ruler on the scan window ensures accurate sizing ■ Large (1728 × 1300) pixel working area ■ Adjustable scanning width (5mm to 105mm) allows users to exclude extraneous material and conserve disk space ■ 32 hatch styles, 16 colors ■ 3 fonts with 8 zoom degree, with horizontal or vertical displays ■ Support most color and mono 9- & 24-pin dot-matrix and laser printers ■ 36 graphics tools, including outline, slant, rotate, enhance, inverse, fade, mirror, flip, shadow, fatbit editor, full-page preview & edit, cut, paste, overlap, erase, store, copy, undo, circle, line, rectangles, circle, area fill, air spray, and etc. ■ AIOCR, Artificial Intelligent Optical Character Reconition software can be trained to read monospaced, proportional spaced, typeset and laser output fonts with 98 percent accurancy ■ AIOCR only has to be trained once to understand a font set. It will recognize those fonts on very other document and import the material instantly ■

See us at PC EXPO Booth #160

HICO A4COLOR SYSTEM

- A4COLOR Hand-held Scanner AC-4096
  A 2.5-inch hand scanner, offers 90 dpi resolution and 256 out of 262,144 colors.
- IMAGE 256 VGA Paint Program
  Written in assembly programming language lets users edit and merge multiple 256 colors images.
- A4SLIDE Slide Show Utility
  For business users to create professional presentations.
- A4COLOR Interface Card
  A half-sized, 8-bit, XT/AT slot card.

Now Supports TIFF & PCX Formats also

Features :

■ Instantly transfer pictures or images from the page to the computer screen ■ Pick up 256-color pallettes out of 262,144 colors automatically ■ Pop-up menu with highlight easy to use ■ Allow users to change the value, saturation and hue of each picture ■ Multi-scan/multi-merge from 2.5 scanned images to full screen picture in seconds ■ Support PMC, VMG, SCF file formats ■ 32 Changeable patterns ■ Super fatbit 256-color editing ■ Pallette color can be modified by color bars ■ Slide utility enables you to flash images onto the screen in any sequence, display form or for any length of time you choose ■ 5 slide show forms of display, horizontal scrolling, vertical scrolling, diagonal scrolling, blocks and flash ■ Slide presentation can run endless as desired ■ Adjustable scanning scales ■ Support dot matrix, HP Laser Printer and Color Paintjet ■ Read ASCII text files ■ More than 30 editing tools, including line, circle, rectangle erase, air spray, area fill, scissors, copy, move, rotate, enhance, fade, reverse, outline, shadow, text, fatbit, edit, preview, retrieve/save/delete file, change directory, undo and clear picture ■

ECA C&C PRODUCTS, INC.

38 ROUTE 46 EAST, LODI, NJ07644

(800)HICO-USA, (201)478-0302

Circle 502 on Reader Service Card (DEALERS: 503)

World Radio History

How To Get The Top Rated, Best Supported American Made Systems At The Lowest Prices

proteus®
THE INTELLIGENT CONCLUSION

386 sx 16MHz

"Excellent value. We strongly recommend the 40 MB system." Awarded "BEST BUY"

Editor, **BUSINESS COMPUTER GUIDE**

Proteus 386/16sx features:

- Intel 80386 sx processor 16MHz
- 1MB 32-bit RAM
- Zero wait state 16/8MHz switchable
- Two serials & one parallel port
- Choice of 5.25" or 3.5" floppy drive
- 200W power supply, real time clock
- 101-key enhanced keyboard
- 15-month onsite service free
- 30-day money back guarantee

40MB Monochrome graphics system $1449
40MB VGA color (16-bit) graphics system $1849
80MB system add $287

386MX 25MHz

"... solid 25 MHz performance, the Proteus/25mx is an attractive machine"

Editor, **PC MAGAZINE**

"An excellent bargain for power users," "BEST BUY"

Editor, **BUSINESS COMPUTER**

Proteus 386/25MX features:

- Intel 80386 dx processor 25MHz
- 1MB 32-bit RAM
- 32K/256K cache, zero wait state
- Intel 82385 cache controller
- Two serials & one parallel port
- High speed dual controller
- Choice of 5.25" or 3.5" floppy drive
- 200W power supply, real time clock
- 101-key enhanced keyboard
- 15-month onsite service free
- 30-day money back guarantee

40MB Monochrome graphics system $2489
80MB VGA color (16-bit) graphics system $2728
100MB/150MB/220MB/340MB "zero defect drives"

Guaranteed compatibility with DOS, UNIX, NOVELL, 3-COM and PICK

PROTEUS 386/33MHz (8.7MIPS) $2495
PROTEUS 486/25MHz (15.8MIPS) $4695
PROTEUS Diskless Workstations $ 695

ADD-ONS:
3.5" 1.44MB floppy $107, Each additional meg RAM $109, Mouse $69
80387 coprocessors - call for price, 2400B internal modem $98, 40MB tape backup $375
ATI wonder card, Paradyse VGA, NEC Multisync, 3D options - call for price

Every Proteus machine is designed and manufactured in the USA using the highest quality components. All systems are completely factory configured and thoroughly tested for 48 hours.

To Order Call Us Direct 1-800-TRU-MICRO (1-800-878-6426)
(201) 614-7000

Proteus Technology Corporation • 75 Kingsland Avenue, Clifton, New Jersey 07014

TERMS: VISA/MC, C O D , Prepayment with cash.discounts. Net terms to qualified accounts. All prices and terms subject to change without notice.

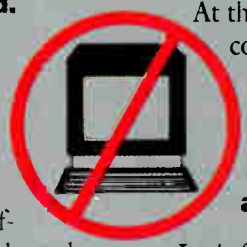
Circle 520 on Reader Service Card

World Radio History

PLUG-N-PRINT™

Just plug LANPORT into any connector on your LAN and print. No print server PC is needed.

National magazines are calling LANPORT a breakthrough. *LAN MAGAZINE* calls it *The Product of the Year*. No wonder. It's the only self-contained print server – the only way you can locate printers anywhere on your LAN network without using bulky PCs or an expensive file server.



Plug-N-Print without buying additional software.

LANPORT is 100% compatible with Novell NetWare®. Plus, you don't even have to install a VAP or purchase any additional spooling software. It's already there, in ROM.

All the network access essentials of a PC in a Walkman-size case.

Believe it or not, LANPORT houses RAM, ROM, a LAN interface card and one parallel or up to 2 serial ports in a compact 4" x 7.5" x 1" case. At that size, LANPORT's convenience and flexibility are unbeatable.

PRODUCT OF THE YEAR LAN MAGAZINE 1990

Plug-N-Print with more confidence and less money.

Let's face it, PCs can go down. And they're expensive, especially when you have to add spooling software. LANPORT comes complete. It has no moving parts, no noisy fans, no power supply heat to dissipate and no on/off switch to disrupt workflow.

LANPORT installs easily on any network.

LANPORT is shipped with everything you need for fast, simple installation, including a self-test disk. And don't worry, LANPORT *will work with your network regardless of it's complexity.* Thin Ethernet, Thick Ethernet, LattisNet®, Twisted Pair and other popular LAN systems are currently supported.

To Plug-N-Print, call 800-526-9675.

To order LANPORT, get more information or the name of your nearest dealer, call now. LANPORT will give you more network accessibility and flexibility than you ever thought possible.

Microtest
Innovative LAN Solutions
3519 E. Shea Blvd., Suite 134,
Phoenix, AZ 85028
602.971.6464
800.526.9675
Fax 602.971.6963

Distributed in Europe by M•Trade
44-1-877-1711
Fax 44-1-874-7265

©1990 Microtest, Inc.
Microtest and LANPORT are trademarks of Microtest, Inc.

Circle 516 on Reader Service Card (DEALERS: 517)

World Radio History

Anchor's 24E5 Modem Secures Your Computer

Anchor Automation's 24E5 Secure modem includes MNP-level-5 error correction and three levels of security in its hardware to prevent someone from accessing your computer's files through the modem.

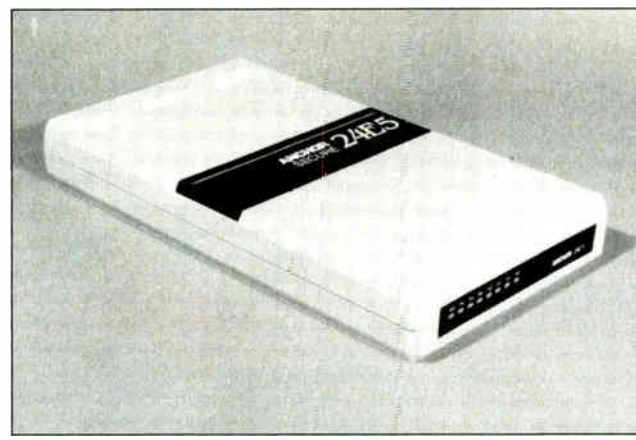
At the first level, you can program the modem to require a correct password. For added security, you can program the modem so that once you provide the correct password, it hangs up and calls a predetermined number, say, your home phone number, that corresponds to the password. The third level of security requires you to provide another passsword once the modem calls you in return.

The 24E5 is Hayes-compatible and supports the extended AT command set. The program is downward-compatible with other modems that support error correction from MNP levels 1 to 4.

Price: $499.

Contact: Anchor Automation, Inc., 20675 Bahama St., Chatsworth, CA 91311, (818) 998-6100.

Inquiry 1031.



You can program Anchor's 24E5 Secure modem to support passwords and other security features for up to 64 users. Operating in MNP-level-5 mode with data compression, throughput speed can approach 4800 bps.

Back Office Retailing with the Macintosh

Houlberg Development has released a Retail Engine Sales Recorder module for its family of retail sales programs that lets you enter daily sales transactions at the end of the day. The program works with the company's Retail Engine Manager and supports bar code reading for scanning tags with SKU (Stock Keeping Unit) or UPC (Universal Product Code) information.

Other products available from the company include Retail Engine Accounting ($395), Point of Sale ($3145 with the Engine Manager), and a cash drawer ($497.50).

The program runs on the Mac Plus with a hard disk drive.

Price: $1690 (includes Engine Manager); Bar Code Reader, $595.

Contact: Houlberg Development, 4533 Contour Blvd., Suite 4, P.O. Box 151501, San Diego, CA 92115, (619) 287-7444.

Inquiry 1033.

What Day Is It?

Calendar Master 1.0 is a simple calendar that lets you zoom from month to week to day to hour at the touch of one key.

You can schedule any number of items per hour at any interval up to 1000 items per month. And you can attach notes to any item or to any day, the company reports. You can pop up any hour and see all scheduled items listed for that hour with notes. An edit window lets you edit or reschedule events.

The program runs on the IBM PC with DOS 2.1 or higher.

Price: $69.

Contact: Software Marketing Enterprises, Inc., P.O. Box 2965, Vista, CA 92083, (619) 758-2580.

Inquiry 1034.

FORTRAN Editor for the Mac

Freditor 1.5 for the Mac now handles files of up to 32,000 lines. It lets you open up to 12 files at once and simultaneously scroll up to five windows, Battelle reports. The editor lets you launch source code out of Freditor and into your compiler, a feature that's handy if you're not running MultiFinder.

Freditor 1.5 lets you draw vertical dotted lines in columns 6, 72, and 132. You can manually or automatically split long lines (more than 80 characters) with the extra portion wrapped and indented with a continuation mark in column 6. Print formatting options include two columns to a page and page breaks after each FORTRAN end statement. The program also contains a form of grep for text searching.

The program runs on the Mac 512KE or higher. You can run the editor under A/UX and MultiFinder.

Price: $99.95.

Contact: Battelle, Pacific Northwest Laboratories, Battelle Blvd., P.O. Box 999, Richland, WA 99352, (509) 375-2360.

Inquiry 1035.

Lines Turn into Numbers with Forecaster

A new version of the Sales and Market Forecasting Toolkit for the Macintosh will convert a line on a graph that has nothing but high and low values and horizontal tick marks into numbers for a spreadsheet. According to Palo Alto Software, this feature lets you do practical business forecasting of common expense and revenue items when there isn't enough data for rigorous data analysis. By converting graphs to numbers—the opposite of the usual spreadsheet method of converting numbers to graphs—the Forecaster tool makes business forecasting less rugged.

The Toolkit itself includes Excel worksheets, charts, macros, and other tools to help in business forecasting with a spreadsheet. The Forecaster tool generates output for the Clipboard, so you can use it with any Mac spreadsheet. Version 2.0 of the program requires a Mac Plus and works best with MultiFinder.

Price: $129.95.

Contact: Palo Alto Software, 260 Sheridan Ave., Suite 219, Palo Alto, CA 94306, (415) 325-3190.

Inquiry 1032.

World Radio History

MYODA

MYODA computers are manufactured by PAO-KU Group, a highly respected, public-held corporation. The MYODA product line includes a full selection of desktop and laptop computers. Myoda is the one source supplier for costumer looking for quality, service & price.

"I would like to show our latest laptop to you at Comdex-Spring '90. Be there!"

"A serious business-man never leaves home without it..."

LT3500 $1999

- INTEL 80286-12cpu
- 0 wait state
- 80287 coprocessor socket
- 1MB on board (expand able to 4MB)
- Gas Plasma 640 x 480 EGA mode, 4 Gray scale
- 40M HDD (28 ms)
- 1.44MB FDD
- 2 serial, 1 parallel port
- 1 EGA/CGA /MGA CRT port

Options for LT-3500
Memory expansion board(2MB/4BM)
Expansion chassis(4 external expansion slots)
33 key keypad
External FDD(360KB/1.2MB)
Coverter (12V-110V) for use in car
5hr external battery

LT5200CD $3799

- INTEL 80386-25cpu
- 0 wait state
- 80387 coprocessor socket
- 1MB on board(expandable to 8MB)
- 32KB CACHE memory
- Gas Plasma640/480
- VGA mode, 16 gray scale
- Other configrations are as same as LT5200sx

LT5200NV $2599

- INTEL 80286-16 cup/0 wait state
- 80287 coprocessor socket
- 1MB on board (expandable to 8MB
- Other configrations are same as LT5200CD (no CACHE memory)

LT5200SX $3099

- INTEL 80386-SX
- 0 wait state
- 80387-SXcoprocessor socket
- 1MB on board(expandable to 8MB)
- Gas Plasma640/480
- VGA mode, 16 gray scale
- 40M HDD(28ms)
- 1.44MB Floppy Drive
- 2 serial, 1parallel port
- 1VGA/EGA CRT port
- 2 full size expansion slots
- 90-260V auto switch power supply

Option for all models:
External FDD(360KB/1.2MB)
Coverter (12V-110V) for use in car
5hr external battery

MD286-12
40MB VGA
$1499

- INTEL 80286-12cpu
- 0 wait state
- 80287 coprocessor socket
- 1MB on board (ex panable to 4MB on motherboard)
- 1:1 interleave HFDC
- 1.2 MB Floppy Drive
- 40MB hard drive(28MS)
- 2 serial, 1parallel, 1 game port
- 16 bit, 512K VGA card
- 8 expansion slots
- 14" VGA monitor
- 180W power supply
- Baby AT case
- 101enhanced keyboard

MD386sx-16
65MB VGA
$1799

- INTEL 80386SX-16cpu
- 80387SX coprocessor socket
- 1MB on board (expand able to 8MB on mother board)
- 1:1 interleave HFDC
- 1.2 MB Floppy Drive
- 65MB Hard Drive(28MS)
- 2 serial, 1parallel, 1game port
- 16bit, 512K VGA card
- 14" VGA monitor
- 8 expansion slots
- 200W power supply
- 101 enhanced keyboard
- MS DOS 4.01
- Mini vertical case

MD386-25
Super VGA
$3499

- INTEL 80386-25cpu
- 0 wait state
- 80387 coprocessor socket
- AMI CACHE386-25 MarkII
- 64 KB cache memory
- 4MB on board (expand able to 16MB)
- 1:1 interleave HFDC
- 1.2 MB Floppy Drive
- 1.4 MB Floppy Drive
- 120MB hard drive
- 2serial, 1parallel, 1game port
- 16bit, 512K VGA card
- 14" super VGA monitor (resolution 1024 x 768)
- 8 expansion slots
- 220W power supply
- 101 key enhanced keyboard
- MS DOS 4.01
- Large vertical case

Options can be changed according to customer's requirments

MD8088
20MB Mono.
$699

Price & availability subject to change without notice

- 8088-1(10MHZ) Micropro cessor
- 4.77/10 MHZ Clock Speed
- 512KB installed, Expand able to 640KB on Board
- One 360 KB Floppy Drive
- Four 1/2 Height Drive Bays
- Turbo Switch & LED
- Reset Switch
- 20MB Hard Drive(65MS)
- Hard Drive Access LED
- MGP Card
- 12" Monochrome Monitor
- 150W Power Supply
- 101 enhanced Keyboard

"A streak of Hi-Tech performance, for the pratically minded business..."

Dealer Account Welcome. Please call: **1-800-562-1071**

pao-ku international co., ltd.

1053 Shore Rd. Naperville IL 60563 Tel.(708) 369-5199 Fax: (708) 369-6068

Circle 518 on Reader Service Card
(DEALERS: 519)

World Radio History

HELP THE AMERICAN FOUNDATION FOR THE BLIND HELP YOU!

The American Foundation for the Blind's National Technology Center (NTC) maintains a Job Index/User Network which features information from over 1,100 blind and visually impaired people who use adaptive equipment in a variety of jobs.

The NTC is looking for additional participants. Blind and visually impaired individuals of all ages who have hands-on experience with computers, low vision aids, talking products, or other adaptive devices are needed as resource people and/or evaluators.

As a resource person, other users may contact you to share your knowledge and experience. As an evaluator, you may be asked to evaluate both existing and newly developed or adapted devices. Evaluations are published in the "Random Access" section of the *Journal of Visual Impairment & Blindness.*

If you are interested, please fill out the form below or call our hotline, 1-800-232-5463 (New York residents call 212-620-2147). Tell the operator you wish to be part of the Job Index/User Network.

Your response will be followed by a brief, confidential telephone survey. The information you provide will be used for NTC purposes only and will include the equipment you use, your experience with it, training and employment.

Your assistance will enable the Job Index/User Network to continue as a major information and support system for blind and visually impaired people nationwide.

Mail to: American Foundation for the Blind, National Technology Center, 15 West 16th Street, New York, NY 10011, Attn: A. Hypolite

Name _____

Address _____

City _____ State _____ Zip _____

Best time to contact _____ Telephone _____

World Radio History

Call for Outstanding Pricing on Tailored Computer Systems

ALWAYS AT A DISCOUNT

MOTHERBOARDS • XT • 286 • 386 • 486

XT, 8mhz Turbo, 0k, 640k Max, 8 Slots, w/BIOS & CPU ... 62
XT, 8mhz Turbo, DTK, 0k, 640k Max, 8 Slots, w/BIOS & CPU ... 70
XT, 10mhz Turbo, 0k, 640k Max, 8 Slots, w/BIOS & CPU ... 74

OUR BEST SELLING VLSI 12mhz MOTHERBOARD
12mhz 286, 0ws, to 4mb, 8 Slots, AMI BIOS, Baby Size ... 139

AT, 286-12, Baby Sz, 0ws, 0k to 4mb, NEAT CHIP, EEMS, Shad ... 238
AT, 286-12, Baby Sz, 0ws, 0k to 8mb, NEAT CHIP, EEMS, Shad ... 245
AT, 286-16, Baby Sz, 0ws, 0k to 8mb, NEAT CHIP, EEMS, Shad ... 269
AT, 286-20, Baby Sz, 0ws, 0k to 8mb, NEAT CHIP, EEMS, Shad ... 309
AT, 386-16sx, Baby Sz, 0ws, 0k to 8mb, NEAT CHIP, EEMS, Shad ... 365
AT, 386-20/25, Baby Sz, 0ws, to 16mb, 8 Slots, AMI BIOS ... 699/809
AT, 386-25/33, 32k Cache, Baby Sz, 0ws, to 16mb, 8 Slots, AMI BIOS ... 1139/1375

THE FASTEST PC MOTHERBOARDS IN THE WORLD

AT, 486-25, Full Sz, 0ws, 0k to 16mb, 8 Slots, Opt 128k Ext Cache, or,
AT, 486-25, Baby Sz, 0ws, 0k to 16mb on Memory Card ... 3595

CONTROLLERS

FDC-2, 360K / 720K, XT Only ... 13
LONGSHINE FDC+, 360K/720K/1.2mb/1.44mb, XT/AT ... 31

SUPER FDC+, Control 4 Internal Drives, XT/AT, All Drive Types ... 39

COMPATICARD I, 4 Drives, 360K/720K/1.2mb/1.44mb ... 94
COMPATICARD II, Co-Exist, Ctrls 2 Drives, All Types ... 75
COMPATICARD IV, 4 Drives, All Types, Co-Exist or Stand Alone, Boot From Any Drive, Easy Installation ... 112
LONGSHINE 6210D, Ctls 2 Hard Drives, MFM, XT Only ... 43
WESTERN DIGITAL XT-GEN, Ctls 2 Hard Drives, MFM, XT ... 53
WESTERN DIGITAL 27X, Ctls 2 Hard Drives, RLL, XT ... 61
WESTERN DIGITAL 1003-MM2, 2FD/2HD, 2:1, MFM, AT ... 102
WESTERN DIGITAL 1006-MM2, 2FD/2HD, 1:1, MFM, AT ... 116
WESTERN DIGITAL 1003-SR2, 2FD/2HD, 2:1, RLL, AT ... 142
WESTERN DIGITAL 1006-SR2, 2FD/2HD, 1:1, RLL, AT ... 129
LONGSHINE 6220, 2FC/2HD, XT ONLY ... 75
LONGSHINE 6622, 2FD/2HD, 1:1, MFM, AT ... 79
WA-3, 2FD/2HD, 2:1, MFM, AT ... 75
WA-6, 2FD/2HD, 1:1 RLL, AT ... 85
WA-16, 2FD/2HD, 1:1, MFM, AT ... 77
DTC 7280, 2FD/2HD, 1:1, MFM, AT ... 99
DTC 7287, 2FD/2HD, 1:1, RLL, AT ... 131
ASM 1100-SM4, 4FD/2HD, 1:1, MFM ... 90
ASM 1100-SR4, 4FD/2HD, 1:1, RLL ... 116

HIGHPERFORMANCE CONTROLLERS

SPECIAL ARLL Controller, Increases Drive Capacity by 90% ... 269
Prestor PS180-16F, 2FD/2HD, 16 Bit
TENTIME Intelligent Caching Floppy/Hard Disk Controller, 5ms Access Time, Increases thruput, Increase Disk Life, Disk Mirroring Option, MFM, RLL & ESDI Models Available ... CALL FOR PRICING

POWER SUPPLIES

150w XT, Standard Size for PC/XT Systems ... 38
150w XT, UL Approved ... 45
200w XT, Standard Physical Size for PC/XT ... 48
200w XT, UL Approved ... 52
220w AT, Standard Physical Size for IBM AT ... 54
220w AT, UL Approved ... 62
270w AT, Standard Physical Size for IBM AT ... 69
220w AT, For Floor Stand Vertical Cases ... 58
220w AT, UL Approved, For Floor Stand Vertical Cases ... 65
280w AT, For Floor Stand Vertical Cases ... 109
SPECIAL 220w Floor Stand Type P/S with Built-in UPS, 5–30mn, EMI Filter, Rechargeable Battery, Optional S/W ... 365

FLOPPY DISK DRIVES

TEAC 360K, 5 1/4, FD55BR, Black/Biege, (Best) ... 66/68
TEAC 1.2mb, 5 1/4, FD55GFR, Biege/Black, (Best) ... 78/80
TEAC 720K, 3 1/2, FD235F, with 5 1/4 Kit, Biege Only ... 66
TEAC 1.44mb, 3 1/2, FD235HF, with 5 1/4 Kit, Biege ... 78
FUJITSU 360K, 5 1/4, M2551A, Black/Biege ... 63/65
FUJITSU 1.2mb, 5 1/5, M2553K, Biege ... 73
TOSHIBA 720K, 3 1/2, ND352S, w/Kit, Black/Biege ... 69
TOSHIBA 1.44mb, 3 1/2, ND356S, w/Kit Black/Biege ... 80
MINI MICRO 1.2mb, 5 1/4, MMFD560K, BIEGE, Mfg Samsung ... 74

HARD DISK DRIVES

40mb, RLL, Mini-Micro—Mfg. by Samsung, 3.25 HH w/5.25 kit, 35ms ... 239
40/60mb, MFM-RLL, MITSUBISHI MR535, 5.25 HH, less than 28ms Shockmounted, Voil Coil, Surface Mounted Technology ... 347

SEAGATE

20mb, MFM, ST-225, 5.25 HH, 65ms * Dr Only/ w/ctlr ... 205/259
20mb, MFM, ST-125, 3.5 HH w/5.25 kit, 40ms/28ms ... 235/280
20mb, RLL, ST-225R, 5.25 HH, 70ms * Dr Only/ w/ctlr ... 199/249
30mb, RLL, ST-238R, 5.25 HH, 65ms * Dr Only/ w/ctlr ... 219/282
30mb, RLL, ST-138R, 3.25 HH w/5.25 kit, 40ms/28ms ... 288/299
30mb, MFM, ST-138, 3.25 HH w/5.25 kit, 40ms/28ms ... 294/312
40mb, RLL, ST-250R, 5.25 HH, 70ms with controller (XT) ... 312
40mb, MFM, ST-251, 5.25 HH, 40ms/28ms ... 315
40mb, MFM, ST-151, 3.25 HH w/5.25 kit, 24ms ... 394
60mb, RLL, ST-277R-1, 5.25 HH, 28ms (65mb) ... 388
80mb, MFM, ST-4097, 5.25 HH, 28ms ... 585

Dealers Wanted

MEMORY CARDS & CHIPS

576K Memory Exp Card From 128K TO 640K ... 25
384K Multifunction Card, 0K, Ser, Par, Game, Cal/Clk ... 69
EVEREX RAM-3000 0K 3mb Max, Uses 256K Chips ... 99
EVEREX RAM-10000 0K 10mb Max, Exp 2mb Increments Min ... 149
64K 150ns, 1 X 64K DRAM (4164) ... 1.50
64K 120ns, 1 X 64K DRAM (4164) ... 1.95
64K 100ns, 1 X 64K DRAM (4164) ... 2.50
64K 120ns, 4 X 64K DRAM (4464) ... 3.00
64K 100ns, 4 X 64K DRAM (4464) ... 3.75
256K 150ns, 1 X 256K DRAM (41256) ... 2.25
256K 120ns, 1 X 256K DRAM (41256) ... 2.50
256K 100ns, 1 X 256K DRAM (41256) ... 2.75
256K 80ns, 1 X 256K DRAM (41256) ... 3.50
1meg 100ns, 1 X 1mb, DRAM (41000) ... 9.00
1meg 80ns, 1 X 1mb, DRAM (41000) ... 10.00
MEMORY PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE

VIDEO DISPLAY CARDS

MONOCHROME GRAPHICS Card, w/ Parallel Port, LPT1, Good ... 21
MONOCHROME GRAPHICS Card, Parallel Port, LPT1-2 or 3 ... 29
DUAL VIDEO Card, Allows 2 Mon to Run On a Single Card ... 75
DUAL MONO/COLOR Graphics Card, 2 In One Card ... 35
CGA, Color Graphics Adapter, No Printer Port ... 24
CGA, Color Graphics Adapter, w/ Printer Port ... 26
EVEREX ENHANCER, 640x350, No Printer Port ... 117
EVEREX ENHANCER, 640x350, w/ Printer Port ... 119
SUPER EGA OEM, 800x600, Auto Switching ... 75
VGA GRAPHICS 800x600 SUPER VGA 1024x768 16 Bit
V I P 481, 800x560, 8Bit 256 ... 112
PARADISE VGA +, OEM, 800x600, 8Bit, 256K ... 179
PARADISE VGA +, OEM, 800x600, 16Bit, 256K ... 189
ATI VGA, OEM, 1024x768, 16Bit, 256K, (VIEW PERFECT) ... 149
ATI VGA, OEM, 1024X768, 16Bit, 256K, w/ Mouse, (VP) ... 205
SOTA VGA/16, 1024x768, 16Bit, 256K/512K ... 230
VGA 800 x 600 (Oak) ... 235
... 90

MONITORS

ALL OEM MONITORS ARE MANUFACTURED BY SAMSUNG

MONOCHROME

12" MM OEM 1252, 720x350, Amb., Tilt & Swivel ... 76
14" MM OEM 1457, 720x350, Amb./Whi, Flat Scr, T/S ... 112
14" VOLTRON GM-1489, 720x350, Amb./Whi, T/S, T/S ... 110
14" EVERVISION, 720x350, Amb., Flat Screen, T/S ... 130
14" MM OEM MM1464K, 640x200, 52 Dot, Tilt & Swivel ... 229
14" MM OEM MM1464W, 640x200, 41 Dot, Tilt & Swivel ... 244
12" TAXAN Composite, 640x200, Amber, Works w/CGA Adp ... 96
14" MM OEM 1453M, 640x350, .31 Dot, Tilt & Swivel ... 349
14" RELYSIS RE-5154, 640x350, .31 Dot, (Best Value) ... 379
14" NEC 30, 1024x768, .28 Dot, Analog/TTL, T/S ... 649
14" VIEW PERFECT, 1024x768, .29 Dot, SONY Tube, Sharp ... 539
14" RELYSIS RE-5155, 800x600, .31 Dot, A/TTL, T/S ... 495

VGA - COLOR

14" VIEWPERFECT V1-7, 640x480, .29 Dot, Analog, T/S ... 349
14" RELYSIS RE-9513, 720x480, .31 Dot, Analog, T/S ... 379
14" MM OEM 1468I, 720x400, .31 Dot, Analog, T/S ... 379
14" NEC 2A, 800x600, .31 Dot, Analog, Tilt & Swivel ... 545

CAD MONITORS

16" NEC 4D, 1024x768 ... 1275
16" NANAO 9070S, 1024x768, .31 Dot, TTL/ANALOG, T/S ... 1069
16" MITSUBISHI FL6605, 1280x1024, .26 Dot, Analog ... 1375
20" MITSUBISHI 3905, 1024x1024, .31 Dot, Analog ... 1875
20" NEC 5D, 1280x1024 ... 2548
20" MITSUBISHI 6905, 1280x1024, .31 Dot, Analog/TTL ... 2595

INPUT/OUTPUT • MULTIFUNCTION CARDS

SERIAL Card, 2 Ports, 2nd Port Opt, COM 1 & 2 (for XT) ... 13
SERIAL Card, 2 Ports, 2nd Port Opt, COM 1-4 (XT/AT) ... 18/21
SERIAL Card, 4 Ports, 3rd & 4th Port Opt, COM 1-8 (XT/AT) ... 59/95
2nd SERIAL Port Opt—Cable & Chip Set—Pin Connector Config Needed to Cable) ... 10/15
PARALLEL PRINTER Card, LPT1 Only/LPT 1-2-3 (XT & AT) ... 9/15
GAME CARD, 2 Ports, Allows Attachment of 2 Joysticks ... 11
CLOCK Card, Calendar & Clock Only, Fits into A Slot (primarily XT) ... 12
AT I/O #1, 1 Ser, 1 Par, 1 Game, COM 1-4, LPT 1-2 ... 22
AT I/O #3, 2 Ser, 1 Par, 1 Game, COM 1-4, LPT 1-2 ... 27
AT I/O #4, 2 Serial, 2 Parallel, COM 1-2, LPT 1-3 ... 35
I/O PLUS, Clock, Calendar, Parallel, Serial, Game (for XT) ... 37
384K MULTI I/O, 0K, To 384K, Cal, Clk, Ser, Par, Game (XT) ... 69
MULTI I/O, w/Floppy Ctlr, Cal, Clk, Ser, Par, Game (XT) ... 33
JUKO G7-ASH, Mono or CGA Video, 1 ser, 1 par, 1 game (AT) ... 75

SUPER MULTI I/O, w/Floppy Ctlr—Controls 360, 720K, 1.2 and 1.44mb FDD, Cal, Clk, Ser, Par, Game Ports (XT) ... 59

BARE BONES

XT

10mhz Desktop Barebone System, XT/AT Like Case, 101 K/B, 150W P/S, Floppy Ctlr, 360 Floppy Drive, 256K Memory ... 279

AT 286

12mhz 286 Desktop Barebone System, 0 To 4mb M/B, 0K, Full Size AT Case, 220w P/S, 101 Enhanced Keyboard, Floppy / Hard Drive Controller, 1.2mb Floppy Disk Drive ... 499

MODEMS

1200 GVC, Internal, with PC TALK III Software ... 45
1200 EVEREX, Internal, with BITCOM Software ... 74
1200 GVC, External, with PC TALK III Software ... 59
1200 GVC, External Packet Modem ... 70
2400 OEM, with PROCOMM Software, U.S. Mode, Com 1-4 ... 70
2400 OEM 200M, Internal with PROCOMM Software ... 79
2400 GVC, Internal with PC TALK III Software ... 98
2400 EVEREX, Internal with BITCOM Software ... 138
2400 EVEREX Internal w/WAPS & Bitcom Software ... 175
2400 OEM 200M, External with PROCOMM Software ... 105
2400 GVC, External, with PC TALK III Software ... 109
2400 GVC, External, with PC TALK III MNP Class 5 ... 185
2400 EVEREX, External, with BITCOM Software ... 199
2400 E-TECH, External, MNP Class 5 ... 349
2400 GVC, External, Packet Size For Portables/Laptops ... 132

ACCELERATOR CARDS

SOTA 286i XT/ COMPAQ/ AT&T/ ZENITH CACHE MEMORY SUPPORT LIM 4.0 NORTON SI = 13.3 See opt memory card ... 275

SOTA 386i XT/ COMPAC/ AT&T/ ZENITH CACHE MEMORY SUPPORT LIM 4.0 NORTON SI = 19.7 ... 415

SOTA 16i Memory Upgrade For 286i w/OK exp to 8mb total ... 275

BACK UP TAPES

COLORADO JUMBO +, Int, 40 - 120mb, 5 1/4 ... 275
COLORADO JUMBO +, Ext, 40 - 120mb, KIT ... 389
COLORADO AB-10 Controller, Co-Exist w/Present FDC ... 89
COLORADO 40 / 80 Tape ... (ea) 18
Quantity 5 ... 85
COLORADO 60 / 120 Tape ... (ea) 28
Quantity 5 ... 135
ARCHIVE DC-600A Tape ... (ea) 29
TEAC CT-600H Tape ... (ea) 20

SOFTWARE

MS DOS 3.3 W/ GW Basic, OEM Ver ... 59
MS DOS 3.3, Actual MICROSOFT ... 84
MS DOS 4.01 W/ GW Basic, OEM Ver Slim—No Basic Manual ... 68
MS DOS 4.01 W, Actual MICROSOFT Slim—No Basic Manual ... 82
CHECK-IT V2.0, XT/AT/386 Complete Diagonistic ... 95
UTILITY SOFTWARE To Run 1.44-used with Hi Density Ctlr ... 18

SPINRITE - The Best Reformatting/Pre-Crash Program on the market, Non-Destructive low level formatting, instant interleave change, fully Auto analysis, work with 4.01 and large Hard Drives ... 70

PC SUPERKWIK Disk Caching, K/B & Screen Accelerator ... 52
HEADROOM, Memory Management, Rated High by PC MAG ... 79
PC KWIK POWER PACK Ultimate in Disk Caching, S/W & Utilities, Print Spooler, RAM Disk, Keyboard Accelerator, Screen Accelerator, Supports Lim 3.2/4.0 EMS Managers ... 94
HYPERPAD, Simular to HYPERCARD in an APPLE ... 99
386 MAX, Unleash the Power and Potential of 386s ... 43
386 MAX PROFESSIONAL, Enhanced Version ... 75
TURBO EMS for PC/XT/AT/386 ... 89
WORDPERFECT 5.0, Top Rated Word Processor ... 250

MOUSE • TRACKBALL • SCANNERS

QMOUSE X-30M Stream Line 2 Button Serial ... 24
QMOUSE X-30M Stream Line 2 But Ser Deluxe w/ DR Halo ... 31
QMOUSE X-30S Stream Line 3 Button Serial ... 25
QMOUSE X-30S Stream Line 3 But Ser Deluxe w/ DR Halo ... 33
GENIUS GM-6000, DR. Halo III, 2 or 3 Button Operation, 350-1050 Res., 9-25 Pin Adaptor ... 38
GENIUS GM-6X, DR. Halo ... 25
LOGITECH C-9, Pop-Up DOS S/W, 50-19,000 Res, Ser/Bus ... 75/85
FT-100, MICROSOFT Compatible ... 59
MIGHTY TRACKBALL, OTRONIX, DR. Halo s/w, 9-25 port adaptor ... 49
LOGITECH TRACKMAN, 50-15000+ DPI, 3 But., S/W, Ser/Bus ... 95
Mouse Pocket, Store Your Mouse When Not in Use ... 3.00
Mouse Pad, Soft or Hard ... 3.00
Mouse Stage, Paded Stage Placed over K/B for Mouse Use ... 9.50
PS/2 Mouse Adapter ... 4.00
GENIUS GS-4500 4" Hand Scanner, 4 Disk, Scan Edit S/W, 400 DPI, Dr. Genius S/W ... 195
GENIUS GS-4500 4" Hand Scanner, w/ OCR Software ... 235
Joystick Magic 909 IBM & Compatible/Magic 909A IBM/Apple ... 15/17

MATH CO-PROCESSORS

8087-2 8mhz, XT ... 139
80287-8 8mhz, 286-8/10/12 ... 215
80287-10 10 mhz, 286-10/12 ... 239
80387-16 16mhz, 386-16 ... 349
80387-20 20mhz, 386-20 ... 399
80387-25 25mhz, 386-25 ... 495
80387-33 33mhz, 386-33 ... 629
80387SX-16 16mhz, 386SX-16 ... 329

KEYBOARDS

MAXI-SWITCH 84 Key (The Best) ... 40
MAXI-SWITCH 101 Key (The Best) AT Only ... 50
KEYTRONICS 101 Key (Excellent) ... 48

NTC SPECIAL 101 KEYBOARD Tactile/Click 12 Function Keys on Left Side, Other Suppliers AD Price $99 Keyboards Our Price ... 565

84 KEY KEYBOARD, Non-click ... 29
84 KEY CHICONY, Tactile / Click ... 45
101 KEY Non Click Capacitive Tactile 12 Function Keys ... 40
101 KEY KEYBOARD, Tactile / Click, 12 Function Keys ... 43
KT-30 101/102 KEY with Microsoft Compat. (Serial or Bus)
Trackball Mouse, 20 DPI 6400 Variable Resolution ... 95

Special—OMNIKEY/PLUS KEYBOARD from NORTHGATE—too many features to list, call or write for feature listing ... 99

CASES

DESKTOP CASES

XT SLIDE, Standard PC/XT, 4 Exposed Drive Bays ... 29
XT/AT Like, 2 Exp Dr, 2 Int Dr, LED/Reset/Key/Turbo ... 33
XT/AT Like, Flip-Top Case (Same as Above) ... 44
BABY AT, 3 Exp Drive, 2 Int Dr, LED, Reset, Key, Turbo, XT sz P/S w/Digital Display ... 50
AT STD Desktop, 3 Exp / 2 Int Dr, LED/Reset/Key/Turbo ... 52
AT DELUXE DT, Same as Above, Heavier Duty, Better Qual w/Digital Display ... 54
MINI AT DT, Attractive, w/200w P/S, 3 x 5 1/4 & 1 x 3 1/2 Exp Dr, Bays + 1 Int 3 1/2 Hd Dr Bay, Fits AT & XT Size Motherboards ... 62
w/Digital Display (Less Int 3 1/2 Hd Bay) ... 109

FLOOR STAND VERTICAL CASES

VERT, w/220w P/S, 6 x 5 1/4 Exp Drives, Non Digital ... 210
w/260w UL Approved Power Supply ... 239
VERT, w/200w P/S, 2 x 5 1/4, 2 x 3 1/2 EXP DR, 2 x 5 1/4 Int Hard Drive Bays, Digital Display ... 199
VERT, w/220w P/S, 3 x 5 1/4 Exp Dr, 4 x 5 1/4 1/2 Ht Internal Drives, Digital Display ... 215
w/285w P/S ... 259
MID Size VERT, w/200w P/S, 3 x 5 1/2 & 2 x 3 1/2 Exp Dr, 2 x 3 1/2 Int Bay, Fits XT & AT Size M/B, Digital ... 149
MINI VERT, w/200w P/S, 2 x 5 1/4 & 1 x 3 1/2 Exp, 2 x 3 1/2 INT, Fits XT Size Motherboard Only ... 125

SPECIAL - PORTABLE

LCD Lunch Box, CGA Double Scan, 640 x 400, 200w Power Supply, 86 Key K/B, Case, Video Card, LCD Display ... 789
E G A Version, 640 X 350 ... 1185
GAS PLASMA, 640x200 CGA K/B, 180W P/S, Plasma Display ... 1100
GAS PLASMA, 640x480 VGA K/B, 180w P/S, Plasma Display ... 1599

CABLES • MISC • ACCESSORIES

XT Hard Drive Cable Set, 1 34 Pin & 1 20 Pin Cable ... 3.95
XT Hard Drive Daisy Chain Cable, for 2 HD Connections ... 4.95
XT Hard Drive Data Cable, 20 Pin Data Cable Only ... 3.00
XT Floppy Drive Cable, for 2 Floppy Drive Connections ... 3.95
AT Cable Set, 3 Cables, 1 for FDD, 2 For Hard Drive ... 5.95
Parallel Printer Cable 6' ... 3.95
Parallel Printer Cable 6', Molded ... 4.95
Parallel Printer Cable 10', Molded ... 5.95
Parallel Printer Cable, Centronic to Centronic, 6' ... 5.95
Serial Modem Cable, 6', Male to Female ... 4.95
Serial Modem Cable, 10', Male to Female ... 6.95
AC POWER CORD, For Power Supply to AC Outlet ... 3.00
Y Cable, Adaptor To Expand No. of Power Outputs of P/S ... 3.00
Keyboard Extention Cable, 6' / 10' ... 2.95/3.95
Monitor Expansion Cable, 6' / 10' ... 3.95/6.95
Serial Port Adaptor, 9 Pin Female to 25 Pin Male ... 5.00
Gender Changer, Female to Female ... 3.50
Gender Changer, Male to Male ... 5.00
VGA Cables, 9 Pin to 15 Pin or 15 Pin to 25 Pin ... 10.00
VGA Expansion Cable, Universal for Sony, NEC ... 9.00
Surge Protector, 6 Outlet Power strip, UL App ... 6.95
Power Center with Surge Protection, Sits Under Monitor ... 18
Battery Pack For AT Computer, Hold 4 AA Size Batteries ... 3
Speaker, 2 1/2" ... 3
Speaker Holder ... 2
AC Power Cord, Connects Between P/S and AC Outlet ... 3
AT Rails, For Mounting Floppy / Hard Drives, Set of 2 ... 3
XT Face Plates (Black), Covers Empty Drive Bay ... 2
AB Switch Box, Specify Type of Connections ... 14
Disk Drive Cleaning Kit For 5 1/4 Drives ... 6
Disk Drive Cleaning Kit For 3 1/2 Drives ... 6.50
Printer, Keyboard, Mouse, Cleaning Kit ... 6.50
Printer Stand, Universal, Fits All Printers ... 6
Printer Stand With Paper Tray, Heavy Duty Wire Const ... 11
Printer Stand With Enclosed Paper Tray ... 17
CPU Adj. Stand, Set Desktop sys on Floor in Vert Posn ... 9

APO, FPO, International, & Term Orders Welcome

Quality Service to the Smart Mail Order Shopper for 4 Years

XT® AT® & IBM® Are Registered Trademarks of International Business Machines. • Prices are subject to change without notice.

$1 Rebate per $100 on all phone orders (ex., $5.00 rebate for $500 order)

GEMS computers, inc.

2115 Old Oakland Road
San Jose, California 95131

408-432-7380

TECH SUPPORT 408-432-7557
FAX 408-432-8622

In Business Since 1985
A member of the Chamber of Commerce

VISA MasterCard

Call or write for shipping details. A $3.00 handling charge is applied to all orders plus a minimum of $4.00 freight. GEMS will ship UPS, FED EX, or any other recognized freight service.

World Radio History

A Graphical Interface for IBM's PROFS

Capella's SmartScreen graphical interface, which replaces the character-based terminal interface of IBM's Professional Office E-mail system, lets you cut and paste from your Microsoft Windows application directly into a PROFS message, the company says. A Windows application, SmartScreen includes an editor for creating and editing E-mail off-line, saving time and money normally spent on the mainframe.

In addition to converting all PROFS commands into Windows' icon-oriented interface, SmartScreen provides a scheduler that can check for mail at a predetermined time, notify you when you've received mail, and automatically send and receive messages.

SmartScreen is not a terminal-emulation program and requires a 3270-emulation program. It runs on the IBM AT or higher with 640K bytes of RAM and a hard disk drive. The program includes a run-time version of Windows.

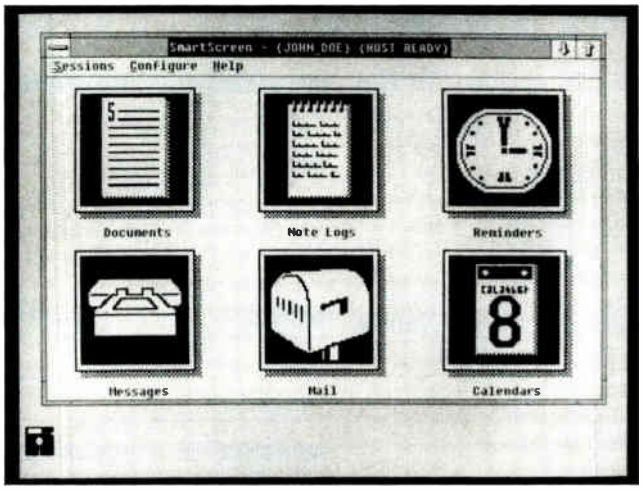
Price: $495.

Contact: Capella Systems, Inc., 8601 Dunwoody Place, Suite 632, Atlanta, GA 30350, (404) 552-9910.

Inquiry 1021.

Point of Sale for Retailers

With Storekare, you can control point of sale, cash management, inventory control, and back-office accounting of retail stores that use IBM PCs or PC-compatible cash registers running under DOS, OS/2, Xenix, or Unix.



SmartScreen replaces the arcane text-based screen of IBM's PROFS E-mail system with icons.

Developer SK Technologies says it designed the program so that new personnel can quickly learn how to ring up a retail transaction, which is important for stores with a high incidence of personnel turnover.

When you install the program, it automatically configures itself to work with your particular bar code scanner, magnetic card reader, and other peripherals.

To run the program, you need 640K bytes of RAM and a minimum of a 20-MB hard disk drive for your server. A hard disk drive is not required for remote PCs.

Price: $2495.

Contact: SK Technologies Corp., 1650 South Dixie Hwy., Boca Raton, FL 33432, (407) 393-7540.

Inquiry 1023.

Organizational Chart Drawing on the Mac

MacOrg lets you draw organizational charts with up to nine boxes across and nine boxes down, Claybrook says. You can export charts to Microsoft Word, PageMaker, MacPaint, and other Macintosh applications. The program lets you link up to two assistants or secretarial boxes per department head.

MacOrg runs on the Mac 512KE.

Price: $109.

Contact: The Claybrook Co., P.O. Box 744182, 7306 Claybrook Dr., Dallas, TX 75374, (214) 341-9438.

Inquiry 1024.

Two VGA-Compatible Graphics Cards

STB Systems has introduced two VGA-compatible graphics cards for advanced graphics applications.

The VGA EM-16 Plus features support for Interactive Systems' 386/ix operating system and version 11 of the X Window System. It supports up to 256 colors and is designed to display resolutions of up to 1024 by 768 pixels with multiple-frequency analog monitors.

The lower-end VGA 800/16 card supports 256-color Super VGA (800- by 600-pixel) resolution and the X Window System, and it includes drivers for Microsoft Windows, AutoCAD, GEM, Lotus 1-2-3, Ventura Publisher, WordPerfect, and Framework II.

Price: VGA EM-16 Plus, $499; VGA 800/16, $249.

Contact: STB Systems, Inc., 1651 North Glenville Dr., Suite 210, Richardson, TX 75081, (214) 234-8750.

Inquiry 1022.

User Interface Library Supports Watcom C 386

Magna Carta Software says that its user interface library for C programmers, C Windows Toolkit, now supports the Watcom C 386 compiler, letting you use its functions in programs that execute in 386 protected mode using the 32-bit instruction set. Programs can be up to 4 gigabytes in size.

The C Windows Toolkit includes routines for adding windows, help screens, pop-up menus, and spreadsheet-style menus to any application. To convert a program to run in 386 mode, you simply recompile code developed with Microsoft C, Borland Turbo C, or Watcom C under Watcom C 386, the company says.

Watcom C 386 requires a DOS extender and tools from Phar Lap Software or Ergo Computing.

Price: Watcom C 386 version of C Windows Toolkit, $199.90; if you already have the standard C Windows Toolkit, $99.95.

Contact: Magna Carta Software, P.O. Box 475594, Garland, TX 75047, (214) 226-6909.

Inquiry 1025.

World Radio History

CHINON presents

Office Automation Technology

Computer Integration Center

We Have You In Mind

Never before has it been this easy to complete the automation of your office. Computer Integration Center provides valuable assistance in moving your business into the world of computers or in upgrading your present system with continually advancing technology.

At CIC we pride ourselves on providing exactly what you need to make your computer system the best for your business. CIC will design the best network, display, and high capacity subsystems to satisfy your demands, and provide helpful technical support after installation. In such a saturated market it is necessary to discuss your needs with an expert who can clarify your options. By treating each customer as an individual and designing for specific needs, we help you to create a comfortable computing environment.

NOVELL NETWORKING ETHERNET/ARCNET

UNIX & OS/2 ENVIRONMENTS

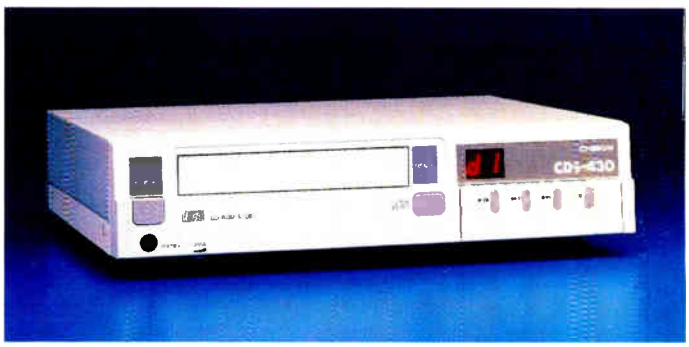
LARGE CAPACITY STORAGE
HARD DISK SYSTEMS/OPTICAL DRIVES/CD-ROM/TAPE BACKUP

SUPER-HIGH RESOLUTION DISPLAY

MEMORY EXPANSION

A NEW WORLD: CHINON CD-ROM DRIVES

Imagine the 42-million-word Oxford English Dictionary being reduced to just one CD-ROM diskette. That's only one of the millions of feats the Chinon CD-ROM Drives can perform. Each CD holds over 600MB!



Chinon lets you take advantage of CD-ROM technology two ways: the CD-ROM external drive and the new CD-ROM internal drive. They even read standard audio CDs and have headphone jacks and volume control.

The new CDS-431 optical drive fits in the space of a 5¼" floppy disk drive, but insert a CD-ROM and get the capacity of 1,500 floppy disks. This new read-only optical drive accesses data in an average of only 380 ms.

The included SCSI interface board allows the daisy-chaining of up to seven hard, tape, and optical drives.

EXT. $649
INT. $549

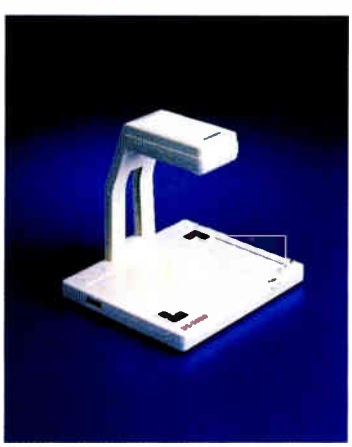
TRUE FAX AUTOMATION: DS-2000 + SCANFAX

Now 9600-baud fax transmission is available using the innovative Chinon desktop scanner, a simple add-in board and easy-to-use software.

It's much more convenient than a conventional fax machine because you print only the messages you want—*no more junk faxes!* And with the DeskScan, you can fax pages from books without photocopying, plus lots of other things that won't fit through a fax machine.

$579

With ScanFax you get:



- High-speed transmission—up to 9600 baud.
- Flat bed design—nothing is pressed flat or dragged through.
- Easy high-volume faxing— incoming or outgoing.
- Security—print faxes only if you want to.

OPTICAL CHARACTER RECOGNITION: DS-3000 + READRIGHT

OCR Package PC MAGAZINE EDITORS' CHOICE PC MAGAZINE EDITORS' CHOICE

If you could input almost anything into your computer almost instantly, without using the keyboard, would it make your life easier?

The Chinon OCR package bundles a DS-3000 with the powerful ReadRight™ 2.0 OCR software, which can scan text into your computer with the accuracy of the average typist—up to 20 times faster. ReadRight's patented character recognition system can even deal with crooked lines, bold or underlined text, multiple columns—practically any document you're likely to encounter. And ReadRight is compatible with most popular application software.

No wonder ReadRight and the Chinon DS-3000 were both chosen *PC Magazine*'s Editor's Choice in March 1989. Together they can help take the drudgery away from data input.

SPECIAL $779

Computer Integration Center

The Systems Integration Experts

CIC/New York: 450 Seventh Avenue Suite 1003, New York City 10123 ... (212) 967-7683
CIC/New Jersey: 111E Corporate Boulevard, So. Plainfield, NJ 07080 ... (201) 757-6342

Circle 504 on Reader Service Card (DEALERS: 505)

World Radio History

MANCHESTER EQUIPMENT COMPANY

HEWLETT PACKARD

A NEW BREAKTHROUGH IN LASER PRINTER TECHNOLOGY!

THE HEWLETT-PACKARD LASERJET III PRINTER

NEW FEATURES:

- HP LaserJet Printer Compatibility
- 8 Page Per Minute Laser Printer
- Faster Graphic Throughput
- Resolution Enhancement Technology Creates Breakthrough Print Quality
- 600 dpi Emulations
- 8 Scalable Typefaces
- 14 Bit Mapped Fonts
- Special Effects Such As Shadowing, Mirror Imaging and Multiple Print Directions

Authorized HEWLETT-PACKARD Dealer

MANCHESTER EQUIPMENT CO., INC.

"The Computer Supply and Equipment Experts"

SYSTEMS INTEGRATION ■ NETWORKING ■ CONNECTIVITY ■ CAD/CAM ■ DESKTOP PUBLISHING

50 MARCUS BOULEVARD ■ HAUPPAUGE, NEW YORK 11788

(516) 435-1199 ■ (516) 434-8700 ■ FAX (516) 435-2113

New York City (212) 629-6969 ■ **Ft. Lauderdale** (305) 491-7660 ■ **Tampa** (813) 962-8088 ■ **Boston** (617) 739-1555

For additional information, ask for Dan Kalata

Circle 515 on Reader Service Card

World Radio History

LIFE, LIBERTY, AND THE PURSUIT OF CD-ROMS

Jerry celebrates the Fourth with a look at graphics, maps, and the Constitution on a CD-ROM

I am writing this in an Anaheim motel room. In a few minutes, we'll walk over to the Anaheim Convention Center to rush through the exhibits at the National Computer Graphics Association (NCGA) show. Then it's home to finish this column a week early, because in two weeks we're going to Moscow.

I've never been to Russia before. I don't really know anyone over there, either, except Arkady Borkovsky, a programmer for the Soviet Academy of Sciences, whom you've heard of here before. I do have some acquaintances there, and I have letters of introduction to people in the Academy as well as the Soviet Union of Writers. And you may recall that last year the Soviet Programmers' Association voted me the most popular computer columnist in the U.S.S.R.; apparently, BYTE is circulated widely over there, so perhaps someone will know who I am. Anyway, the trip should prove interesting; meanwhile, I have a lot of work to catch up on.

NCGA

It's easy to summarize NCGA: graphics capabilities are getting *much* better, but they're still pretty expensive.

Some of the exhibits were spectacular. AT&T is moving into the field with a vengeance. You'll recall that AT&T's PC 6300 had graphics superior to EGA before anyone else had EGA. That was their low end. Their high-end imaging is nothing short of amazing.

One outfit that isn't expensive but has great stuff is Sota, which is rapidly becoming one of my favorite companies; they have done some wonderful things with VGA. I've said this before, but it's worth repeating: if you're interested in the state of the art, you ought to be familiar with what Sota is doing.

One system at NCGA that used the Sota OEM 340i video board was the Cheetah 486, which was on display in the Sterling Microsystems (3164 East La Palma Ave., Anaheim, CA 92806, (714) 632-7429) booth. This is the new name of Larry Aldridge's Sterling Solutions; longtime readers will recall that he sells a lot of customized high-end PCompatibles, and he installed the Distributed Processing Technology hard disk drive controller in my Cheetah 386. Incidentally, Big Cheetah remains my main machine; I've had no problems with either it or the DPT controller.

The Cheetah 486 with the Sota video board on display at the Sterling booth was blindingly fast; it could redraw the Autodesk San Antonio Riverwalk project, a huge CAD drawing, in under a second; I've seen supposedly fast systems take nearly 15 seconds to do that. Aldridge has updated the box built around the Cheetah motherboard to include a Perceptive Solutions hard disk drive controller that can handle data at throughput rates of 12 megabytes per second. That's *fast*. I'm scheduled to get one of the new Cheetah 486s with a Perceptive Solutions controller and a Siemens hard disk drive about the time that I get back from the Soviet Union.

We mostly went to NCGA to see what is going on; I've arranged for quite a lot of stuff to be sent here, including superfast Super VGA boards, new input devices, and a low-cost box that can add color to your Macintosh Plus; with any luck, some things will arrive while we're overseas and I can report on them next month.

On that score, I have installed VideoLogic's DVA-4000 video board in the Premier 33-MHz 386. I do not lightly use the word *awesome*; but I think it fits here. The VideoLogic board lets you have full-motion video graphics—for example, the *MacNeil, Lehrer Newshour*—in one corner of the Zenith Flat Technology Monitor, with the rest of the screen devoted to Q&A Write, or a Windows application, or whatever you use your computer for. Getting the VideoLogic board to run was a bit tricky, but it can be done by a user. I will give a full report in BYTE's *IBM Special Edition*, which will be out this fall.

The VideoLogic board has audio output, but it also works with Ad Lib's Personal Computer Music System, which adds jukebox, composition, and musical editing capabilities with multivoice synthesis. I've only just got this installed, and at the moment the only thing I'm doing with it is games; it, too, will be in the *IBM Special Edition*, where I expect to compare it with the Canadian M-Sound board recommended by Aldridge.

Battle Chess

VGA and Super VGA have pretty well caught up, but for many years the Amiga was the real state of the art for low-cost graphics systems; there are still things done with it that I haven't seen anywhere else. Remember the movie *Star Wars*, in which the characters play a form of chess, and when one piece takes another, there's an animated battle. I'm not sure, but I think that was done by ordinary film animation techniques. Now, however, you can do the same thing on your Amiga.

Battle Chess is a beautifully animated game that can be played by two people or by one person against the computer. The computer is not all that good a chess player; for that, you want Chessmaster 2000 from The Software Toolworks. Battle Chess is confoundedly *slow*, and by slow I mean minutes, sometimes, while the computer is thinking about

continued

World Radio History

what to do at higher levels of play. What is outstanding about Battle Chess is the graphics.

When you move a piece, it actually moves. If it's a knight (they're on foot, not mounted), the other pieces move out of the way as he lumbers past. When the queens move they slink, and the Red queen has the figure to do it, too. The rooks at rest look like castles, but when they move they turn into rock monsters. The bishops are very clerical. Kings are tired old men (with young queens like those, it's no wonder).

If a capture is made, the pieces battle. The Society for Creative Anachronism once had live chess games, with real people in full armor as the pieces, who fought it out in similar fashion. Unlike the SCA game, though, Battle Chess is standard chess, so the "attacker" always wins. Each piece uses a different fighting technique. Knights use their swords. Pawns have spears. Bishops use their shepherd crooks. The queens use magic. It's really fun to watch.

Having said all that, I can't really recommend Battle Chess beyond the graphics. The view of the board is from a low angle, so it's difficult to see what square your piece is standing on; it's even more difficult to see what squares an opponent's piece threatens. Playing Battle Chess is a little like playing while blindfolded. You can switch to a two-dimensional overhead view of (nicely drawn) conventional chess pieces, but that defeats the whole purpose of Battle Chess, doesn't it?

If normal chess isn't your bag, there's also a new version of Leong Jacobs's Xian, which is Chinese chess for the IBM PC.

Anyway, what with the slowness of the program at any but the most elementary levels, I fear you won't *play* the game very often; on the other hand, if you have it, you'll drag it out to show to every visitor you have, and once in a while just to look at it yourself. Also, it's bound to be a hit at any party. Sure is pretty.

Xian

If normal chess isn't your bag, there's a new version of Leong Jacobs's Xian, which is Chinese chess for the IBM PC. The new version can make use of VGA in full color if you have it; otherwise, it works with what you've got, including Hercules and CGA.

Chinese chess is similar to Western chess, but not very. The rules are a bit more complex, with more powers and restrictions on the pieces. Jacobs's program comes with a complete tutorial and help files; you can learn the game in an afternoon.

The program plays well enough to be challenging; in fact, I haven't beaten it yet. Although few Anglos know (or have even heard of) the game, Chinese chess

continued

Frequent Flyers.

If a portable computer has improved the way you do business away from the office, think what a portable modem can do for you. With it, you'll be able to send and receive data, and even faxes, anytime you want. In or out of the office.

The WorldPort family gives you a choice of four portable modems, including an MNP® error-correcting modem and an electronic fax/data modem.

Each is no more than 8 ounces and can fit in a shirt pocket. They're small but tough and capable, built for the rigors of business on the road.

They connect to practically any telephone, public or private, via standard RJ-11 jacks or an optional acoustic coupler. They adhere to Bell and CCITT standards world-wide so you can connect to other modems (or fax machines) almost anywhere. They're powered by a single 9-volt battery or through an AC outlet, whichever is more convenient. And, they're easily shared as external peripherals among co-workers.

The WorldPort family of modems. They're built for travel, whether it's to extreme environments, to exotic locations or just down the hall.

Call us today for the dealer nearest you:

800-541-0345.

(In New York, 516-261-0423.)

Touchbase Systems, Inc.
160 Laurel Avenue
Northport, NY 11768
(516) 261-0423
Fax (516) 754-3491

MNP is a registered trademark of Microcom, Inc. WORLDPORT and TOUCHBASE SYSTEMS are trademarks of Touchbase Systems, Inc. © 1989 Touchbase Systems, Inc.

Circle 292 on Reader Service Card

World Radio History

THE NEW STANDARD FOR HIGH PERFORMANCE STATISTICAL SOFTWARE

CSS

COMPLETE STATISTICAL SYSTEM
WITH DATA BASE MANAGEMENT
AND GRAPHICS

A powerful, comprehensive, elegant, and super-fast statistical package for IBM (PC, AT, PS/2) and compatible computers. ■ The CSS optimized user interface with fast hierarchical menus incorporates elements of artificial intelligence; even complex analyses require only a few keystrokes (batch processing is also supported). ■ CSS features comprehensive, state of the art implementations of: *Basic statistics, Multi-way frequency tables, Nonparametric statistics, Exploratory data analysis with analytic graphs, Multiple regression methods, Time series analysis with modeling and forecasting (incl. full ARIMA), General ANOVA/ANCOVA/MANOVA, Contrast analysis, Discriminant function analysis, Factor analysis, Principal components, Multidimensional scaling, Item analysis/Reliability, Log-linear analysis, Cluster analysis, Non-linear estimation, Logit/Probit analysis, Canonical analysis, Survival and Failure Time analysis (Censored data), Quality Control analysis, and much more.* ■ All statistical procedures are integrated with fast data base management and instant, presentation quality graphics (over 100 types); full support for all mono and color graphics boards (incl. VGA) and over 100 plotters and printers (incl. the HP and Postscript standards). ■ All CSS screen output is displayed via customized Scrollsheets™ (i.e., dynamic, user controlled, multi-layered tables with cells expandable into pop-up windows); all numbers in a Scrollsheet™ can be instantly converted into a variety of presentation quality graphs; contents of different Scrollsheets™ can be instantly aggregated, combined, compared, plotted, printed, or saved. ■ The flexibility of the CSS input/output is practically unlimited: CSS offers an intelligent interface (read/write) to all common file formats (Lotus, Symphony, dBII, dBIII+, DIF, SYLK, . . .) and special utilities to easily access data from incompatible programs; graphics can be saved in files compatible with desktop publishing programs (Aldus, Ventura). ■ CSS data files can be as large as your operating system (DOS) allows; OS/2 version coming soon. ■ CSS precision exceeds the standards of all common precision benchmarks. ■ *Technical note: The CSS user interface and all I/O were written in Assembler and bypass DOS; graphics and data management were written in Assembler and C; the computational algorithms were written in Assembler and optimized Fortran.* ■ $495 (plus $5 sh/h); 14-day money back guarantee.

Circle 267 on Reader Service Card

StatSoft

2325 East 13th Street ■ Tulsa, OK 74104 ■ (918) 583-4149
Fax: (918) 583-4376
Overseas Offices: StatSoft of Europe (Hamburg, FRG), ph: 040/4200347, fax: 040/4911310, **StatSoft UK** (London, UK), ph. 0462/482822, fax. 0462/482855, **StatSoft Pacific** (Melbourne, Australia), ph: 613-497-4755, fax: 613-499-7410, **StatSoft Canada-CCO** (Ontario), ph: 416-849-0737, fax: 416-849-0918 **Available From:** CORPORATE SOFTWARE and other Authorized Representatives Worldwide: Holland: Lemax BV 02968-94210; France: Conceptel (1) 45669700; Sweden: AkademiData 018-240035; Korea: Geul Bang (02) 272-1973.

World Radio History

Circle 109 on Reader Service Card

VEDIT PLUS

#1 PROGRAMMABLE EDITOR

NEW Integrated environment for compilers, assemblers, linkers, debuggers and MAKE.

- Mouse support
- Pull-Down Menus
- Columnar Blocks
- 1000 Level Undo
- Regular Expressions
- Small 70K size, fast
- DOS, UNIX/XENIX and FlexOS
- Also VEDIT $69, VEDIT Jr. $29

FREE Evaluation Copy
Call 1-800-45-VEDIT

The new VEDIT PLUS is the productivity breakthrough programmers have been looking for. You can run not only popular compilers, but all of your favorite tools from within the editor with a single keystroke or from the menu system.

VEDIT PLUS gives you the advantages of an exceptionally powerful and flexible editor without giving up the convenience of an integrated environment.

VEDIT offers stunning performance, versatility and ease of use. Completely written in assembly language it's lightning fast and small. Other features include multiple file editing, windows, unlimited keystroke macros, context sensitive help, word processing, automatic indenting and total configurability.

Only VEDIT lets you quickly edit large files of up to 8 million lines and 8000 chars/line. Installation is easy; VEDIT.EXE is all you need—no overlays and no environment variables.

VEDIT PLUS adds a powerful macro programming language, complete with source level debugging.

Since VEDIT hit the pages of BYTE magazine in May 1980, nearly 100,000 programmers, engineers and writers have been enthusiastic users.

VEDIT PLUS—$185 for DOS, $285 for UNIX/XENIX. Call for a free demo today.

Greenview

P.O. Box 1586, Ann Arbor, MI 48106
(313) 996-1299 • Fax (313) 996-1308

is still quite popular in China and in some communities in the U.S.

I have only one real complaint: Xian employs key-disk copy protection. It's the mildest form, meaning that when you first invoke the game, you must have the original disk in any floppy disk drive. Since I can never find floppy disks—this really is *Chaos* Manor—I haven't played as much Chinese chess as I might. This is a pity, because it really is interesting, and someday I may accept an invitation to lecture at Beijing University, assuming the government ceases shooting its students.

Better-organized people probably will not have a problem with the copy protection. I think Jacobs is making a mistake, by the way: what he ought to wish for is for Chinese chess to become popular so that he can sell updates of his programs to a larger market base; in other words, while he shouldn't encourage piracy, he should try to expose a lot of people to the game. But then it's easy for me to have an opinion; I didn't invest any time in developing the program.

Anyway, it's an interesting game.

ScanMistress

Logitech's new ScanMan Plus page scanner can be set up and installed by users. I can say that with some authority because Roberta did hers all by herself. It required her to open up the Zenith Z-386/15 and install a board—she'd never done that before—and then install the software, which she says goes in fairly automatically. It took her about an hour, and I deliberately didn't watch.

ScanMan Plus can work at various resolutions. It can be used as an optical character reader (such a program came with the package), but it's not terribly reliable for any input but good, clean typescript. It will read printed (kerned) text, but there are enough errors, particularly if your printed version has broken letters or ink runs, to require some editorial work.

If you have a lot of scanning to do and your time is worth anything at all, I recommend that you make contact with one of the professional outfits that can get the job done. For us, ScanMan Plus is basically a way to get visual images into the machine for incorporation into desktop publishing or, in Roberta's case, as graphics for computer programs; she's revising the graphics on her reading instruction system programs.

The software for ScanMan Plus was largely written by Mrs. Enrica Zappacosta, causing Roberta to wonder why Logitech president Pierluigi Zappacosta

If you have a lot of scanning to do, I recommend that you make contact with one of the professional outfits that can get the job done.

insists it has to be called Scan*Man* Plus. Misnamed or not, it works as advertised, and it's easy enough to get running. My only complaint is that they don't have a version that will work through a serial port; slow as that would be, it would be useful to be able to go to a library with, say, the Zenith SupersPort SX and get images. ScanMan Plus would easily fit into a briefcase. Maybe the solution is to get Zenith to come up with a small portable box that can hold the ScanMan Plus bus card.

Recommended.

Vopt

We installed the ScanMan Plus on the Z-386/15 because that's the machine Roberta uses to work on her reading program. It's also the machine John Carr uses for our science fiction stuff; Baen Books is reissuing some of my older works, and many of them have maps we can scan in for revision with a paint program. Roberta's main machine, though, is the Kaypro 386i, one of the earliest 386 systems, but with Quarterdeck's newest versions of QEMM-386 and DESQview, the machine's still thoroughly useful.

A few months ago (see my March column), we installed a Perstor PS180-16FN hard disk drive controller on the Kaypro 386i, effectively doubling the hard disk capacity. This controller works with most hard disk drives, although if you have a very old one, it might be best to check to be sure it works with yours. Certainly Roberta's has worked well.

Her only complaint was that Golden Bow's Vopt wouldn't work with the Perstor controller. Vopt is a disk optimizer program. When you use a hard disk a lot, the data files tend to become more and more fragmented until they're scattered all over the place, like a gerrymandered

continued

World Radio History

Another New Product from the makers of Soft-ICE & MagicCV

ANNOUNCING BOUNDS-CHECKER

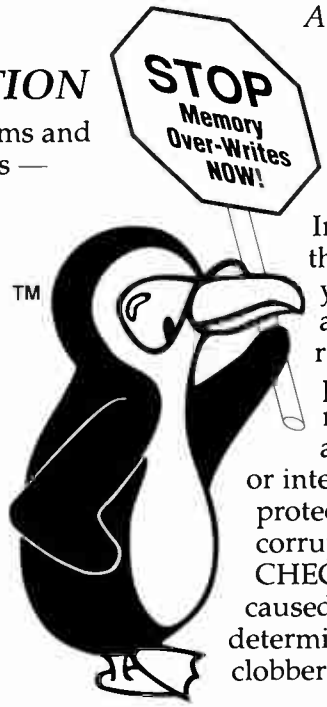
Gives you the protection of a protected operating system under MS-DOS.

Finds out-of-bounds memory accesses — AUTOMATICALLY.

AUTOMATIC PROTECTION

Flush out those Nasty pointer problems and other out-of-bounds memory accesses — AUTOMATICALLY.

Each time you make a change to a program, run BOUNDS-CHECKER while testing the new code. If you accidentally access out-of-bounds memory, BOUNDS- CHECKER will pop up displaying the offending SOURCE LINE. And your program runs at full speed.



Increase Productivity During Development, Improve Reliability During Q/A

You can run BOUNDS-CHECKER while testing your program. There are no additional steps to your testing cycle, but you can feel secure when the program has passed through BOUNDS-CHECKER with no reported problems.

Many over-write problems and other out-of-bounds memory accesses do NOT show up during normal testing. An out-of-bounds memory location may be modified, but that particular location doesn't happen to be important at the time. Once the program is in the field and a certain network is loaded or a certain T&SR or device driver is loaded, that memory location suddenly becomes very important... AND THE SYSTEM CRASHES.

You can prevent these problems by making BOUNDS-CHECKER a standard part of your testing procedure.

HOW IT WORKS

BOUNDS-CHECKER uses the 80386 virtual machine technology to provide real-time memory protection. In addition BOUNDS-CHECKER uses the symbolic information output by your compiler to differentiate CODE and DATA. When your program is running, BOUNDS-CHECKER protects the program's CODE and all memory outside your program. When an MS-DOS system call, BIOS call or interrupt occurs, BOUNDS-CHECKER protects the system software from corrupting your code. So, BOUNDS-CHECKER will not only detect problems caused by your program, it will also determine if a T&SR or other program is clobbering you.

Enormous Productivity Gain

Don't spend days or even weeks chasing down one of those subtle memory over-write problems. Use BOUNDS-CHECKER to pinpoint the problem in *seconds*.

Don't RISK a Recall

Don't take the unnecessary RISK that your program is unknowingly clobbering an out-of-bounds memory location. BOUNDS-CHECKER was developed to find these potential time bombs quickly, painlessly and AUTOMATICALLY!

$249.00

Requires 80386 PC.
MS-DOS is a trademark of Microsoft Corporation.

Nu-Mega TECHNOLOGIES

CALL TODAY (603) 888-2386 or FAX (603) 888-2465

P.O. BOX 7607 ■ NASHUA, NH ■ 03060-7607 ■ U.S.A.

Circle 189 on Reader Service Card

World Radio History

legislative district. Thus, the disk heads have to move around a lot to bring in or write a file, and that slows your file access time.

Disk optimizer programs like Vopt reorganize your hard disk, moving files around so that they're compact and contiguous, the way the Constitution specifies congressional districts should be. Alas, there isn't a Vopt that will run against Washington; but there's now a Vopt version that works fine with the Perstor controller. It really does speed things up, too; I ran it on Roberta's machine last night, and the time saved in reading in a large text file is noticeable.

Vopt comes with several other disk programs, including Vmarkbad, which will find and mark bad sectors. Unlike Gibson's SpinRite II, the Golden Bow programs do not rewrite the disk formatting information; but SpinRite won't work with the Perstor controller. For that matter, SpinRite doesn't work with my Priam hard disk drive in Big Cheetah, or any system like the Premier 386/33 that has on-board disk caching. Vopt and Vmarkbad do, which is why I'll continue to rely on them until the next generation of disk tools comes out.

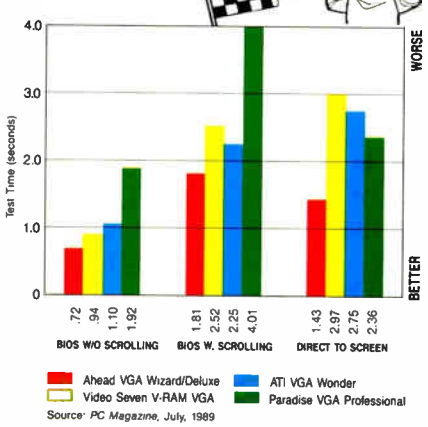
AND THE WINNER IS . . .

VGA WIZARD & WIZARD/DELUXE

INFOWORLD: #1 Rating

$199 List for VGA Wizard

"BEST" PC Magazine Benchmark:



Source: PC Magazine, July, 1989

- SUPER HIGH RESOLUTION: 1024 x 768
- FASTER THAN VIDEO 7's V-RAM
- TECHNOLOGY & RELIABILITY: AHEAD'S VLSI VGA CHIP
- 16-BIT FULLY IBM VGA COMPATIBLE

- Compatibility: IBM PC/XT/AT & 386 compatible.
- Reliability: simpler design and less components.
- Speed: faster than other VGA cards (see chart).
- Resolution: highest among VGA.
- Size: smallest 16-bit VGA card.
- Price: best price/performance.
- Technology: state-of-the-art minimal chip count.
- Capability for future upgrade.
- Easy to install, no need to read the manual.
- Excellent technical support and service.
- Free drivers included.
- One year warranty. *Made in U.S.A.*

Distributors/Dealers are welcome

Three different cards are available:
VGA Wizard/Deluxe: for power users.
VGA Wizard: for price/performance users.
VGA Wizard/3270: for terminal emulation users.

AHEAD systems, inc.

Phone (415) 623-0900 FAX (415) 623-0960
44244 Fremont Blvd., Fremont, CA 94538

Circle 13 on Reader Service Card (DEALERS: 14)

Liberty

Liberty is a program that gives me problems.

On the one hand, Liberty is a step in the right direction: a program built to illuminate and expound the U.S. Constitution, which in my judgment is one of the most beautiful works of human history. It gives you the text of the Constitution. They call it a hypertext version, but they mean only that you can hot-key in a table of contents and click on any article and section, and that portion will appear on-screen. There are no hypertext linkages within the document itself. In addition to the Constitution, there are related materials.

The whole thing is visually well done and will make use of whatever graphics capability you have, from monochrome to VGA. There's mouse support, and windowing, and menus, and text scrolling. There are materials on the Constitutional Convention and its delegates, some Constitutional law cases, and that sort of thing.

That's the good news.

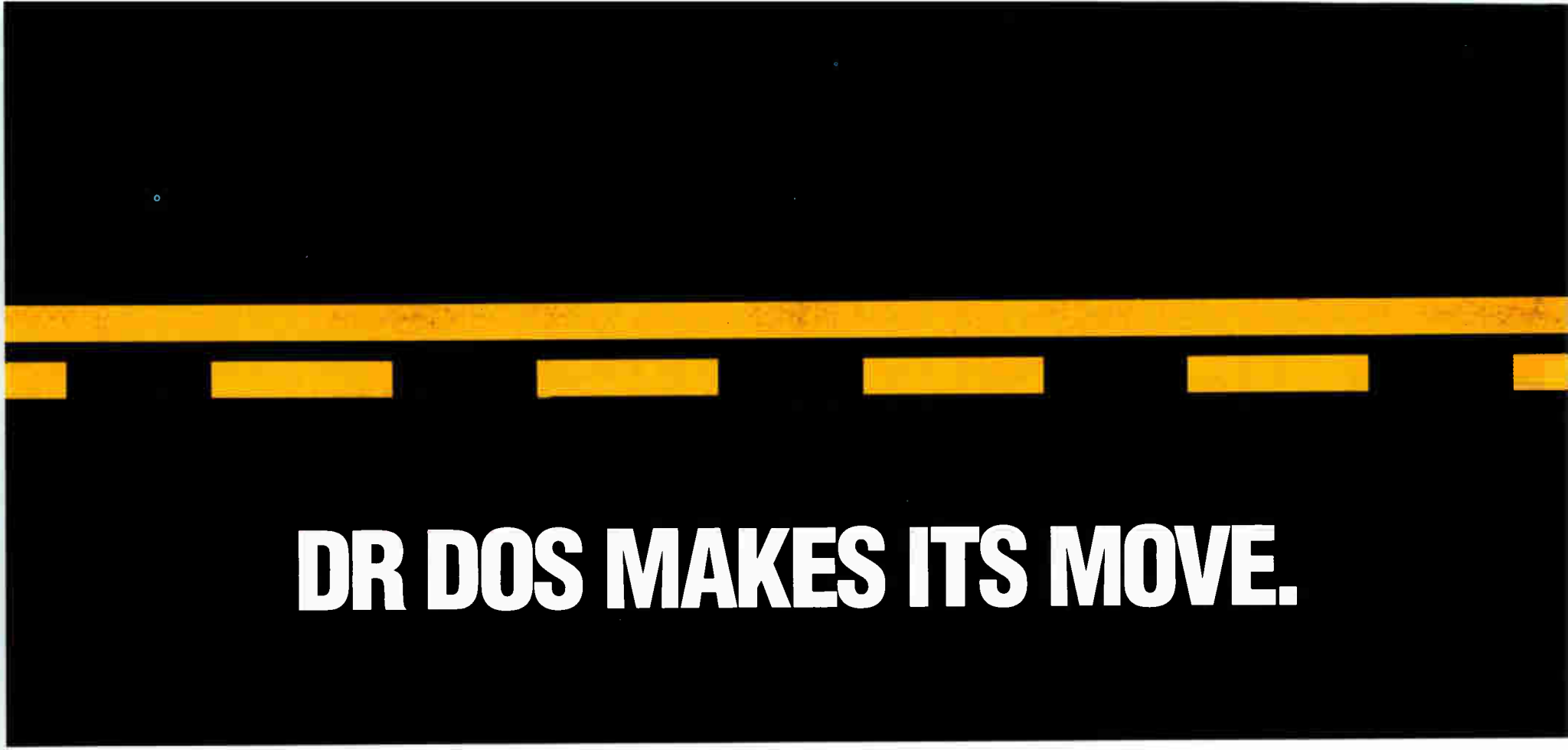
The bad news is that there isn't very much related material. The data about the delegates to the convention is one screen's worth, not enough to get you through a decent game of Trivial Pursuit. There's almost nothing on the history of the debates, or the Connecticut Compromise, or anything like that.

You can get a great deal more information on the Convention by reading a good book, such as Clinton Rossiter's *Seventeen Eighty-Seven: The Grand Convention*, which can be obtained for $9.70. Copies of the Constitution itself are, I presume, still available free to any civics class teacher who wants them. I know when I was a professor of political science at Pepperdine University, I was deluged with both commercial companies and private foundations who wanted to give my students copies of the Constitution and the Bill of Rights.

It's the same with the court cases. Liberty's citation of *Marbury* v. *Madison* isn't very accurate and conveys nothing of the political flavor of that decision, in which the Federalists stole a march on Jefferson in a way that left him without any remedy to the Supreme Court's assertion of the power to interpret the

continued

World Radio History



INTRODUCING DR DOS 5.0.

While others are making promises, we'll be making deliveries.

DR DOS 5.0 features MemoryMAX™, giving you over 620K for your applications. You can even run large applications like Ventura Publisher® on Novell NetWare® and other popular networks.

Our intuitive graphical user shell, ViewMAX™, makes it simple to access applications. And our built-in disk cache makes applications run even faster.

DR DOS 5.0 provides on-line help, and with the self-installing FileLINK™, it's easy to transfer files between two systems. Plus, DR DOS 5.0 is fully executable from either RAM or ROM, and it supports hard disk partitions up to 512 megabytes.

If you're looking for a laptop or notebook, ask your manufacturer about DR DOS BatteryMAX™ (patent pending), which can increase battery life two to three times.*

So why wait? Get the maximum from your system now.

DR DOS. It's the best move you'll ever make.

For more information, call (800) 848-1498. Dept. DR11

DR DOS™ 5.0

Digital Research®
WE MAKE COMPUTERS WORK

*BatteryMAX available through OEM implementation. Digital Research is a registered trademark, and the Digital Research logo, DR DOS, MemoryMAX, ViewMAX, BatteryMAX, and FileLINK are trademarks of Digital Research Inc. Other product names are registered trademarks of their respective owners. Copyright © 1990, Digital Research Inc.

Circle 81 on Reader Service Card

World Radio History

Constitution. (That power is *not* given explicitly in the document.)

Liberty, in other words, is a good start on what it ought to be. The programming is very good indeed. The linkages work. It's easy to find what information is in there. The problem is that there isn't enough to it. The summary data pages aren't bad, but they don't lead anywhere. It's as if someone set out to write a book but ran out of steam after doing a good chapter and an outline.

I sure would like to see the Liberty software used to do the job right. It wouldn't even be all that hard; the data is all in the public domain. As it is, I'd recommend that you buy Rossiter's book, and maybe one of Daniel Boorstin's books; you'll spend less money and learn a lot more.

Constitution Papers

Of course, the best way to make up a collection on the Constitution is to use a CD-ROM, and I recently got a new one from the Electronic Text Corp. The Constitution Papers has, in addition to the U.S. Constitution, the constitutions of all the 13 founding states, all the *Federalist* papers, and a fairly good selection of other early documents, such as Hamilton's "Plan of Union," Paine's "Common Sense," and suchlike. All in all, a useful CD-ROM indeed.

There's only one problem. The retrieval software is Word Cruncher View. This is a sort of general-purpose software that is best described as wretched. In theory, you can use the same software to look at more than one CD-ROM; in practice, changing from one CD-ROM to another is difficult without resetting the computer in between. But it's all right, because once you get into WCV, you aren't really tempted to browse through the documents on the disk anyway.

The colors chosen for presenting documents are green on black. It turns out there is a way to change colors, including the line number colors, and when the rather nonintuitive word search is properly used, it works. The formatting of the output is still ugly.

Electronic Text Corp. is working on updates; there's considerable potential improvement on the way.

The company also sent another CD-ROM called Word Cruncher, but my attempts to access it with the software loaded from the Constitution Papers CD-ROM got messages saying that software was restricted to that disk, and I should make contact with Electronic Text Corp. However, I found a subdirectory called BATCH on the WCV disk, and switching to that revealed an Install program.

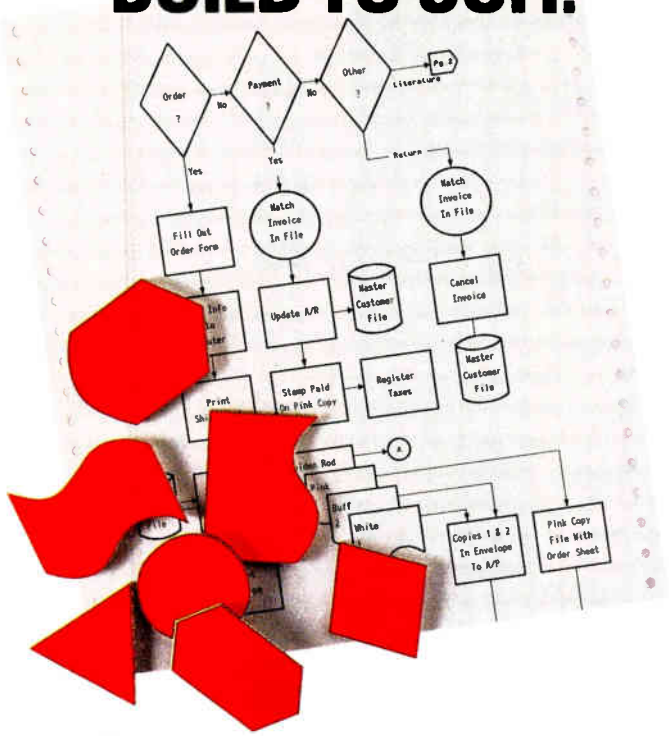
Running that got me a snide message about how I might be violating their license agreement. All right by me. By then I was ready to dwark their license in a vlendish manner. I ran the Install program and discovered that there are indeed a *lot* of documents on the Word Cruncher CD-ROM. One of them claims to be the complete works of Shakespeare. Good enough, let's look at that. I tried *Henry IV, Part I*, since that was the first work I studied in freshman literature at the University of Iowa.

I got it on the screen; it's single-spaced in wretched green on black, with no line spacing between the speeches, about as ugly a way to read Shakespeare as any I have ever seen.

Frankly, that was enough for me, even though the CD-ROM has a number of other documents that might be worth looking at. There are King James and

continued

BUILD TO SUIT.



Announcing Flow Charting™ 3

Now, you can create, update and print presentation-perfect flowcharts to your specifications—in no time!

Quick to master and a snap to use, Patton & Patton's flowcharting software is the standard of both large and small businesses around the world—and is available through all major software dealers.

See your dealer today! Or, for a "live," interactive demo disk, call:

800-525-0082, ext. BY27.

International: 408-778-6557, ext. BY27.

PATTON & PATTON

Software Corporation

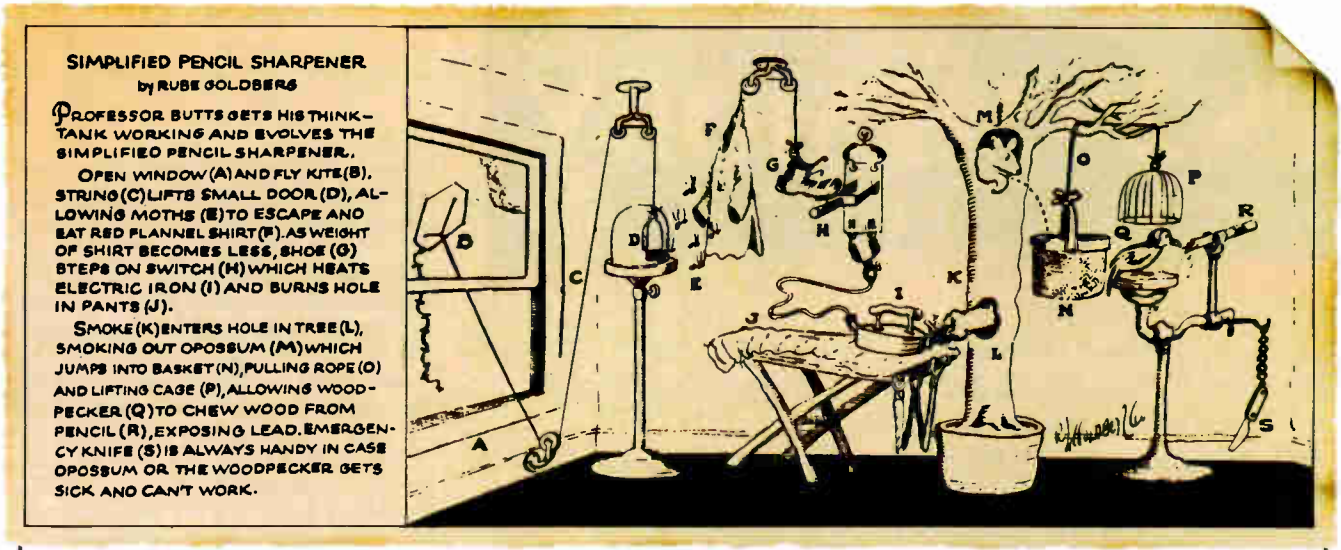
Excellence in charting the flow of ideas!

Works on IBM & 100% compatible PC's, supports CGA/EGA/VGA and over 150 dot matrix and laser printers, with multiple print densities and 10 font sizes. **Creates multi-page charts, portrait or landscape, on most standard paper sizes.** Mouse or keyboard controlled.

IBM is a registered trademark of International Business Machines Corporation.

Circle 198 on Reader Service Card

World Radio History

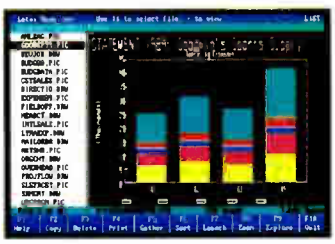


Considering the way most utilities function, you have to wonder where the designers got their inspiration.

They sure didn't get it from us.

The idea behind new Lotus® Magellan® 2.0 was simple. Namely, that people who need a utility shouldn't have to suffer for it.

So, instead of daunting interfaces and convoluted commands, Magellan supplies you with all the functions you use most. In a way that lets you use them faster and easier.



Magellan's viewing screen says a lot about Magellan: simple, uncluttered and easy to understand.

For example, to call up a file when you can't remember the name, just type in the word, phrase or concept you need to find. Magellan will come back with a list of relevant files in seconds, arranged according to how well they match the search criteria.

View each one as it actually appears in its application, even if it's a graphics file. Find the right file and launch the application with a single keystroke.

Magellan is the only utility that lets you view deleted files. To UnDelete, all you have to do is just type in the file name.

Magellan also has PKzip,® the file compressor that can condense data files by up to 50%. You can even view compressed files without expanding them. And when you do need to expand one, a single keystroke will do it.

We've reduced a number of other commands down to a single stroke, as well. So you can quickly Copy, Delete, Move, Sort or Rename files, groups of files, or even entire directory branches in the Tree mode. And Verify files for any changes due to corruption or contamination, just as easily.

All of which is why *PC Magazine* said, "Magellan could well be the finest utility ever written for the PC." And why every major computing magazine has given it practically every award they have.

If you own the original Magellan, you can upgrade to new Magellan 2.0 for only $39. Or upgrade from a competitive utility* for a bit more. Call **1-800-TRADEUP, ext. 569.** To get a better idea of how Magellan works, just call the same number and ask for a free auto demo disk.

What could be easier?

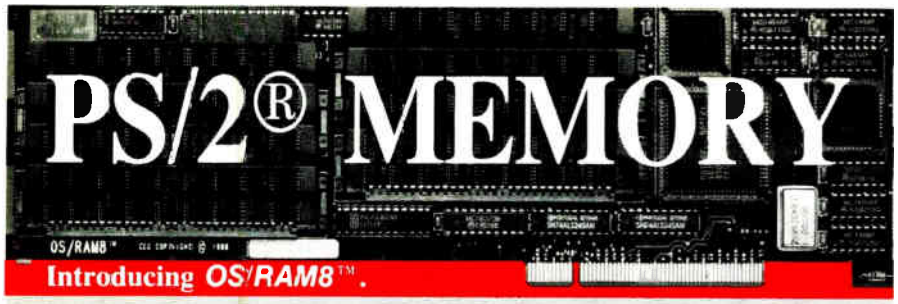
Introducing Lotus Magellan 2.0

*Competitive utilities eligible for upgrades are Norton Commander,® Norton Utilities,® PC Tools,™ Fastback,® XTree,® XTreePro™ and Mace Utilities.®

© 1990 Lotus Development Corporation. All rights reserved. Lotus and Magellan are registered trademarks of Lotus Development Corporation. PKZip is a registered trademark of PKWARE, Inc. Norton Commander and Norton Utilities are registered trademarks of Peter Norton Computing, Inc. PC Tools is a trademark of Central Point Software, Inc. Fastback is a registered trademark of Fifth Generation Systems. XTree is a registered trademark and XTreePro is a trademark of Executive Systems, Inc. Mace Utilities is a registered trademark of Paul Mace Software, Inc.

World Radio History

Circle 51 on Reader Service Card



- 8 Mbytes of memory + 2 serial ports.
- Extended and expanded memory. LIM 4.0.
- Works with all of your programs.
- Run DOS or OS/2 effortlessly.
- Fast and simple switchless installation.
- Auto-configuration for all operating systems.
- Works in all Micro Channel™ computers.
- Expanded memory 10 times faster than Intel.
- Risk free guarantee. Two year warranty.
- IBM approved ID. Best price. Fast delivery.

Call today 1-800-234-4232 or 617-273-1818

cec Capital Equipment Corp.
Burlington, MA. 01803

PS/2 and Micro Channel are trademarks of IBM

New International Bibles; WordPerfect manuals; a number of American literary works, including four by Mark Twain; a bunch of speeches, including some by Churchill; and a whole lot more. Alas, for all of those the format remains hideous, and the retrieval procedure awkward. You *can* use this disk, but you won't have much of an aesthetic experience.

The odd part is that back a few years ago, the WCV software was one of the more advanced text presentation systems available for CGA systems, which, I guess, tells you just how bad things were in those days, because I don't think WCV has got any *worse* since then. Alas, it's no better, either.

DiscPassage

The WCV software had one positive effect: it made me appreciate just how good the DiscPassage retrieval system is by comparison. DiscPassage is another of the "universal" retrieval systems; CMC Research hopes to license its use to many CD-ROM publishers.

Frankly, until I saw WCV in action, I wasn't all that fond of DiscPassage, but by comparison to most of what's available, it's wonderful.

CMC is the outfit that gave me my first Sherlock Holmes on Disc. They have "improved" their software since that time. One of the "improvements," alas, has been to present all text in stark white on black; the original Sherlock Holmes on Disc used softer colors and was much easier to read, with quite subtle colors for the line of command key interpretations across the bottom. Now that line is blue on white, and the line of white across the black background is a bit obtrusive—but I'll take it, I'll take it. Anything is better than hideous green on black.

The new CMC Sherlock Holmes CD-ROM has one thing going for it: it's now possible to display all the illustrations on Big Cheetah's Video Seven VGA card. The illustrations also work with the Tecmar board in the Z-386/25 and with a few other VGA boards I popped in. The illustrations are quite handsome, and there are also maps, and the "dancing men" of the story by that name. There's not as much on the Holmes disk as I'd have liked—all the stories are there, but they could have given a good map of Victorian London, and there are no end of public domain articles about Holmes. CMC says they're accumulating more material for a subsequent release.

I also have the CMC Shakespeare CD-ROM. That came with yet another update of their retrieval software—one so updated that it won't work with the Sherlock Holmes CD-ROM. Fortunately, the Holmes CD-ROM has retrieval software on the disk itself, and that does work; interestingly, the program on the Holmes disk is about twice as large (144K bytes) as the newest version. The new version installs easily and works reasonably well with the Shakespeare disk (for some reason, it has trouble locking in on the Video Seven board, but it eventually will). Naturally I have just called up Act One, Scene One, of *Henry IV, Part I*.

The contrast with the Word Cruncher presentation is quite dramatic. The CMC Shakespeare tells me the proper names of the characters, and these are set out in a nicely formatted header. The lines are indented properly and set in the middle of the screen. Character names are given in full, "Hotspur," "Falstaff," and "Prince Henry," not "Hot," "North," and "Fals," as in many cheap one-volume editions. Line numbers are given off to the right, every 10 lines, in an unobtrusive manner, not numbered like a BASIC program as with Word Cruncher. The search and retrieval software is a lot easier to use, too.

The Word Cruncher CD-ROM gives you many more documents on the disk, but to read them you have to endure their wretched software; CMC gives you less but lets you enjoy it more. I suppose you can't have everything.

BOOTCON

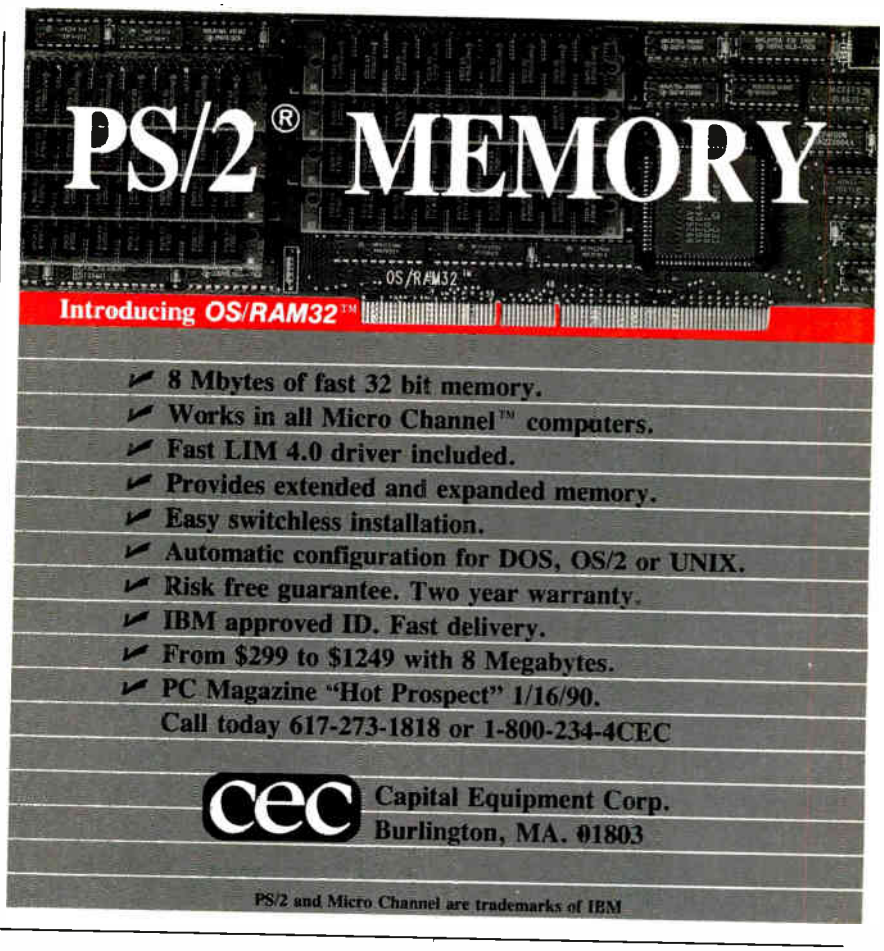
I have for some time lamented the problem of booting up a system with different CONFIG.SYS files: for example, if you want a choice between DESQview and Windows/386, or you sometimes want to bring up a very clean DOS with no TSR programs at all. Up to now, the only remedy has been a variation on the theme of batch files.

No longer. Now we have BOOTCON, and it solves the problem nicely. It sets your system up so that on boot-up, you are offered a choice of up to 26 different CONFIG.SYS and AUTOEXEC.BAT combinations; these can be utterly different from each other. If you do nothing, the system is booted with the default CONFIG.SYS and AUTOEXEC.BAT; you can tell it how long it will wait for you to intervene.

There isn't an awful lot to say about this program. It works, and as far as I can tell, it's bulletproof; it hasn't crashed anything I've tried it with, and I run a lot of goofy software. It works well with both DESQview and Windows. The interface is well thought out. The setup is simple, and it requires only a DOS editor, such as the one in Norton Commander (DOS's EDLIN would do in a

World Radio History

Circle 52 on Reader Service Card



pinch). You can, but don't have to, set up the system with a password that must be given before the machine will boot. The program uses only 200 bytes of system memory, it isn't copy-protected, and you get both 3½- and 5¼-inch disks.

This thing is great for hackers: no more booting up with a floppy disk because you installed some driver that locks up the system. Now you can just make the new stuff option C of BOOTCON, and if that locks up, reboot with option A or B; it really is that simple.

I've had this running for a couple of months and have yet to have the slightest problem with it.

Highly recommended. You need this program.

MicroClean

There are about a zillion outfits that make disk drive cleaning products, and I have no notion of how you'd go about choosing one over another. The MicroClean Professional Series PC Kit is certainly good enough, and it's better than many. It comes with the usual disk cleaning stuff, plus a bottle of high-pressure canned air. There are also some sealed packets of antistatic screen-cleaning towels that I've found work much better than Windex and paper towels.

It can be important to keep your system cleaned out. The other day, my high-density 1.2-MB floppy disk drive was having increasing problems in reading 360K-byte disks; eventually it became intolerable. I got a new drive from Barry Workman, but when I opened the machine, I found that the old floppy disk drive was clogged up with dust balls. I swapped for a new drive anyway, but once the dust was blown and vacuumed out and the MicroClean head cleaner was run, we couldn't find anything wrong with the old drive.

Do your machine a favor. Open it up, vacuum it, and use a good cleaning kit on it. It can't hurt. And if, like me, you have to put a lot of bad disks through your floppy disk drive—some companies ship their product on media so bad you can *see* the lumps of oxide on it—you really do need a good disk cleaning kit.

It's even more important to clean tape cartridge drives. MicroClean also makes kits for that. Of course, the brand isn't as important as getting in the habit of doing the job; but MicroClean is more than good enough.

Maps, Wise and Informative

For weeks, I've been getting materials and updates on two programs, Mapwise and Mapinfo. As the stuff came in, I cleverly put it into one box, thinking I would get around to reviewing this program one day.

Of course, there are two programs, not one. Moreover, they have nothing whatever to do with each other.

Mapinfo is a highly sophisticated program for taking data—sales, income distribution, epidemic information, whatever you like—and plotting it on predrawn maps. The maps can be of the U.S., or a state, or a city, or a county. Mapinfo has metropolitan maps, rural maps, highway maps, city maps, census tract maps, congressional district maps; you name it, they can probably furnish it. Mapinfo works across networks, and it can integrate data from a variety of sources. If there's another program like it, I haven't seen it (although of course I have not really been looking, either). Certainly Mapinfo is good enough for nearly any professional map database requirement. Recommended.

Mapwise, on the other hand, has almost nothing to do with maps. Mapwise is a statistical analysis program; the "maps" in the title pertain to *conceptual* maps.

The best way to learn about Mapwise is to get the Bricklin demonstration program. This goes through just what Mapwise can do, which is quite a lot. It can do multivariate analysis and pretty well explain what it has done. At least I think it can. I put it that way because I didn't have any trouble understanding what Mapwise was trying to do; but I once had heavy-duty training in statistics. On the other hand, I haven't done serious statistical work since I got mad at *Runner's World*'s evaluation of running shoes and did my own analysis of their data with Zeke I back in 1978. Alas, they didn't want to publish my critique; I wonder why, since it demonstrated that their analytical staff didn't know what they were doing. If they had had Mapwise, they wouldn't have made that mistake.

At this point, I could get technical about what's going on underneath the more or less user-friendly Mapwise surface, but what's the point? Mapwise is the kind of program you don't know you need until you try it; but if your work involves any kind of statistical inferences at all—and most businesses do—it will not harm you to get the Mapwise demonstration disk and see if the program can help you. You may be surprised.

A Minor Polemic

Our work would be a lot easier if the people who send stuff for review would follow some simple rules for dealing with columnists. I'm writing about my own situation, but the rules apply pretty well

continued

World Radio History

ITEMS DISCUSSED

Battle Chess $49.95
Interplay Productions
1575 Corporate Dr.
Costa Mesa, CA 92626
(714) 549-2411
Inquiry 992.

BOOTCON..... $59.95
Modular Software Systems
115 West California Blvd., Suite 113
Pasadena, CA 91105
(818) 794-7602
Inquiry 993.

Chessmaster 2000 ..... $49.95
The Software Toolworks
19808 Nordhoff Place
Chatsworth, CA 91311
(818) 885-9000
Inquiry 994.

Constitution Papers CD-ROM.... $59
Word Cruncher CD-ROM.....$249
Electronic Text Corp.
778 South 400 East
Orem, UT 84058
(800) 234-0546
(801) 226-0616
Inquiry 995.

Corporate Voice.....$119.95
Scandinavian PC Systems, Inc.
51 Monroe St., Suite 1101
Rockville, MD 20850
(800) 288-7226
(301) 294-7450
Inquiry 996.

DVA-4000..... $2495
VideoLogic, Inc.
245 First St.
Cambridge, MA 02142
(617) 494-0530
Inquiry 997.

Liberty..... $29.95
Zephyr Services
1900 Murray Ave.
Pittsburgh, PA 15217
(412) 422-6600
Inquiry 998.

Mapinfo $750
Mapping Information Systems Corp.
200 Broadway
Troy, NY 12180
(800) 327-8627
(518) 274-8673
Inquiry 999.

Mapwise
full version.....$495
student version.....$9.95
Business Technology Center
Bradley University
Peoria, IL 61625
(309) 677-3299
Inquiry 1000.

Panzer Battles..... $39.95
Strategic Studies Group, Inc.
1747 Orleans Court
Walnut Creek, CA 94598
(415) 932-3019
Inquiry 1001.

Personal Computer Music System $219.95
Synthesizer Card $179.95
Ad Lib, Inc.
50 Stanford St., Suite 800
Boston, MA 02114
(800) 463-2686
(418) 529-9676
Inquiry 1002.

Professional Series PC Kit $23.95
MicroClean
1290 C Reamwood Ave.
Sunnyvale, CA 94089
(408) 745-0611
Inquiry 1003.

PS180-16FN.....$345
Perstor Systems, Inc.
1335 South Park Lane
Tempe, AZ 85281
(602) 894-3494
Inquiry 1004.

ScanMan Plus
PC version.....$339
Micro Channel version $399
Logitech, Inc.
6505 Kaiser Dr.
Fremont, CA 94555
(415) 795-8500
Inquiry 1005.

Sherlock Holmes on Disc CD-ROM $99
Shakespeare CD-ROM $99
CMC Research, Inc.
7150 Southwest Hampton, Suite 120
Portland, OR 97223
(503) 639-3395
Inquiry 1006.

Sota 340i
512K bytes of video RAM.....$995
1 MB of video RAM..... $1195
Sota Technology, Inc.
559 Weddell Dr.
Sunnyvale, CA 94089
(408) 745-1111
Inquiry 1007.

Vopt..... $59.95
Golden Bow Systems
2665 Ariane Dr., Suite 207
San Diego, CA 92117
(800) 284-3269
(619) 483-0901
Inquiry 1008.

Xian $39.95
Leong Jacobs, Inc.
2729 Lury Lane
Annapolis, MD 21401
(301) 266-3660
Inquiry 1009.

to all the BYTE columnists. First, most of us don't work at the headquarters—I'm not in Peterborough—but that's still the best place to send most products.

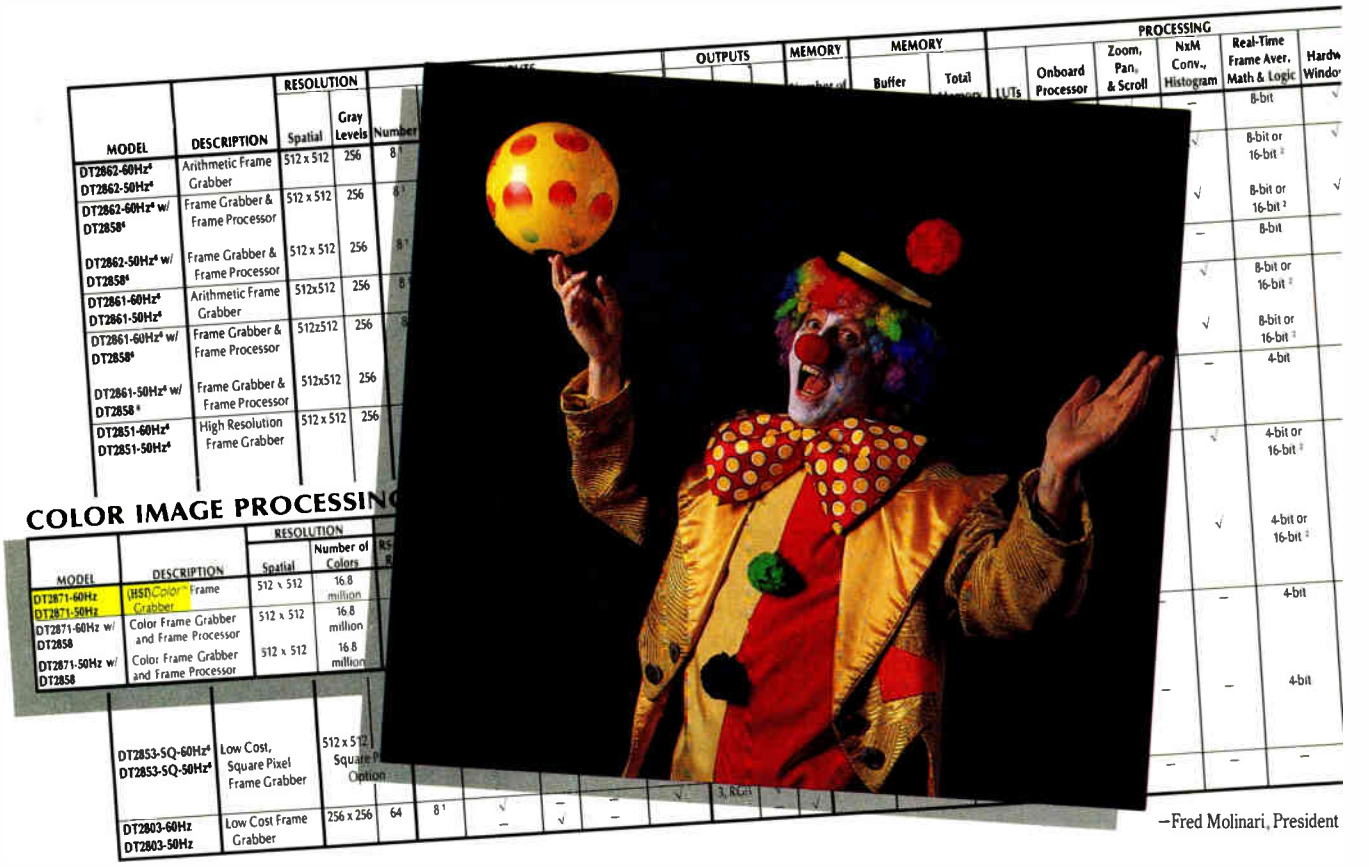
There are very efficient people in Peterborough who look after my interests, and once or twice a week they make up a large package that comes by Federal Express direct to Chaos Manor. Some companies manage to find my Hollywood address and send stuff here, which is fine if it's a very large box or I'm looking out for it; but, alas, all too often it gets mixed in with family mail, and from there it can be put almost anywhere.

The important thing about sending stuff to Peterborough is that it must have *my name on it*. If it doesn't and goes direct to BYTE, it falls into the hands of the BYTE review staff. Whatever happens after that is out of my hands, but it's very unlikely I'll ever see it. There's a corollary to that: if it's sent to *me*, the BYTE

continued

World Radio History

IBM PC Image Processing Highlights. No. 3 in a series.



MODEL	DESCRIPTION	RESOLUTION Spatial	Gray Levels	Number
DT2862-60Hz[4] DT2862-50Hz[4]	Arithmetic Frame Grabber	512 x 512	256	8[1]
DT2862-60Hz[4] w/ DT2858[4]	Frame Grabber & Frame Processor	512 x 512	256	8[1]
DT2862-50Hz[4] w/ DT2858[4]	Frame Grabber & Frame Processor	512 x 512	256	8[1]
DT2861-60Hz[4] DT2861-50Hz[4]	Arithmetic Frame Grabber	512x512	256	8
DT2861-60Hz[4] w/ DT2858[4]	Frame Grabber & Frame Processor	512z512	256	8
DT2861-50Hz[4] w/ DT2858[4]	Frame Grabber & Frame Processor	512x512	256	8
DT2851-60Hz[4] DT2851-50Hz[4]	High Resolution Frame Grabber	512 x 512	256	8

COLOR IMAGE PROCESSIN

MODEL	DESCRIPTION	RESOLUTION Spatial	Number of Colors
DT2871-60Hz DT2871-50Hz	(HSI)Color™ Frame Grabber	512 x 512	16.8 million
DT2871-60Hz w/ DT2858	Color Frame Grabber and Frame Processor	512 x 512	16.8 million
DT2871-50Hz w/ DT2858	Color Frame Grabber and Frame Processor	512 x 512	16.8 million

DT2853-SQ-60Hz[4] DT2853-SQ-50Hz[4]	Low Cost, Square Pixel Frame Grabber	512 x 512 Square P Option													
DT2803-60Hz DT2803-50Hz	Low Cost Frame Grabber	256 x 256	64	8[1]	√	–	–	√	–		3, RGB	–	√	–	–

OUTPUTS | MEMORY | MEMORY Buffer | Total | PROCESSING LUTs | Onboard Processor | Zoom, Pan, & Scroll | NxM Conv., Histogram | Real-Time Frame Aver., Math & Logic | Hardw Windo

				–			8-bit	√
				√			8-bit or 16-bit[2]	√
				√			8-bit or 16-bit[2]	√
				–			8-bit	
				√			8-bit or 16-bit[2]	
				√			8-bit or 16-bit[2]	
				–			4-bit	
				√			4-bit or 16-bit[2]	
				√			4-bit or 16-bit[2]	
				–			4-bit	
				–			4-bit	
				–	–	–	–	

—Fred Molinari, President

Why clown around in black and white when you can do it in color...just as easily.

The DT2871 Frame Grabber. The next logical step.

Now, moving from monochrome to color image processing is as easy as plugging our DT2871 (HSI) *Color*™ Frame Grabber into your IBM® PC AT®-compatible computer.

The DT2871 features real-time 24-bit color capture and display. It also performs real-time RGB/HSI and HSI/RGB color-space conversion for processing captured images in either the red-green-blue or hue-saturation intensity domain . . . intensity being the link to monochrome processing which performs gray scale operations.

The DT2871 connects directly to DT-*Connect*™ processor boards for faster compute-intensive color processing. And, is supported by our Aurora™ software for accelerated application development.

Now, color image processing can be much less complicated and quicker to execute.

So, add a little color to *your* act.

Call (508) 481-3700
In Canada, call (800) 268-0427

FREE 1990 Image Processing Handbook.

DATA TRANSLATION®

World Headquarters: Data Translation, Inc., 100 Locke Drive, Marlboro, MA 01752-1192 USA, (508) 481-3700 Tlx 951646
United Kingdom Headquarters: Data Translation Ltd., The Mulberry Business Park, Wokingham, Berkshire RG11 2QJ U.K. (0734) 793838 Tlx 94011914
West Germany Headquarters: Data Translation GmbH, Stuttgarter Strasse 66, 7120 Bietigheim-Bissingen, West Germany 07142-54025
International Sales Offices: Australia (2) 662-4255; Belgium (2) 466-8199; Canada (416) 625-1907; China (1) 868-721 x4017; Dermark (42) 274511; Finland (0) 372144; France (1) 690-77802; Greece (1) 361-4300; Hong Kong (5) 448963; India (22) 23-1040; Israel (52) 545685; Italy (2) 82470.1; Japan (3) 502-555D, (3) 348-83GL, (3) 555-1111; Korea (2) 756-9954; Netherlands (73) 99-6360; New Zealand (64) 9-545313; Norway (2) 53 12 50; Portugal (1) 545313; Singapore (65) 7797621; South Africa (12) 8037680/93; Spain (1) 455-8112; Sweden (8) 761-7820; Switzerland (1) 723-1410; Taiwan (2) 702-0405.

DT-Connect, (HSI) Color and Aurora are trademarks, and Data Translation is a registered trademark of Data Translation, Inc. All other trademarks and registered trademarks are the property of their respective holders.

Circle 75 on Reader Service Card

World Radio History

Circle 47 on Reader Service Card

CD-ROM

BUREAU OF ELECTRONIC PUBLISHING

NEW!

Guaranteed Lowest Prices!

Microsoft CD-ROM Special

CD-ROM drive kit with Bookshelf	$849
CD-ROM drive kit with Bookshelf and Programmers Library (LAN)	1169
Bookshelf essential writing reference	Call
Programmers Library on-line reference	Call
Stat Pack business research statistics	145
Small Business Consultant management tool	120

NEC CD-ROM Special

CDR-72 CD-ROM Drive ext., PC & Mac	$Call
CDR-82 CD-ROM Drive int., PC	Call
CDR-35 CD-ROM Drive ext., smallest, lightest	Call
Clip Art 3D 2,500 3-D images, PC & Mac	Call
Image Folio 4,000 photos, VGA format, PC	Call
Type Gallery Adobe or Laserjet typefaces	Call
Image Gallery Clip art library, PC & Mac	Call
Photo Gallery Tiff format photos, PC& Mac	Call

PC Sig Library

PC-SIG AUTHORIZED DEALER

The definitive shareware and public domain software collection. The newest version containing the equivalent of over 1400 floppy disks on one CD-ROM disc. including: •word processors, spreadsheets, databases •teaching and educational software •business and financial software •communications software•language and utilities programs •graphics and games •entertainment and home software •and more... $465

Knowledge Access

KAware

CD-ROM Development System KAware Disc Publisher full featured development system - prepare, index, access & distribute info on CD-ROM. For publishers & info managers with technical documentation, images, catalogs, lists, reference databases & more. Retrieval features: keyword/ hypertext/Boolean searching, menus, pull down windows, user added notes & export other programs.

KAware Disk Publisher/Full Text	$795
KAware Disk Publisher/Fielded	$795
KAware Disk Publisher/Image	$795

Bureau Best Sellers

Between Heaven & Hell	Oxford English Dictionary
CD Guide on CD-ROM	Oxford Textbook of Medicine
CIA World Fact Book	McGraw Hill Encyclopedia
Computer Library	Whole Earth Catalog
Grolier Encyclopedia	Guiness Disc of World Records
Movie Database	US Patent Database

NEW! **U.S. History on CD-ROM**

Essential reference over 30,000 pages covering the full spectrum of U.S. History from 1600 to 1990 $395

Pioneer 6 disc Minichanger

DRM-600 CD-ROM Drive gives you up to 6 CD-ROM discs on-line for over 3 Gigabytes $1395

MORE! Over 200 different titles and drives in-stock for the PC and Mac

Free subscription to CD-ROM End User with every order!

Money back guarantee Free tech support

Call - special drive/title combo's

Call - FREE on-line CD-ROM access!

VISA MasterCard AMERICAN EXPRESS FEDERAL EXPRESS Overnite Delivery

Bureau of Electronic Publishing, Inc.

Dept. Q, 141 New Road, Parsippany, NJ 07054

Fax # 201-808-2676

Call: 1-800-828-4766 orders only

(201) 808-2700 information

review people won't ever see it. In other words, if you want me to look at it, send it to me; if you want the BYTE staff to look at it, send it to them; and, not to put too fine a point on it, if you want both me and the BYTE staff to look at it, you'd better send it to both.

Secondly, those who are sending revisions of software should understand that columnists and reviewers get a *lot* of software. While BYTE in Peterborough may be a tad more efficient than I am, neither the Peterborough staff nor I really have either the room or the resources for truly efficient filing and retrieval of unsolicited review materials.

Case in point: today there arrived a CD-ROM from a company containing, according to their blurb, an enhanced world atlas. The cover page of the supplementary materials they sent shows a map of the U.S.S.R., which is appropriate just now. Alas, I can't tell you much about it: attempts to read the directory of the CD-ROM on either the Amdek drive on Big Cheetah or the Denon drives on the Z-386/25 report a general read failure. There was included with the CD-ROM an instruction card telling me how to install their reader software from a floppy disk. There was no floppy disk, since this was apparently an update of a product previously sent to me.

The problem is that I don't *have* their floppy disk, at least not ready to hand. Every CD-ROM publisher has its own proprietary retrieval software. Most put that software on the CD-ROM, which is where it belongs. This company has put it on a floppy disk. This is, I suppose, no problem for someone who habitually uses the company's CD-ROM, but since I don't, I have not the foggiest notion of where that floppy disk is. Now sure, I once installed the company's drivers; but even with a 330-MB hard disk drive, I haven't room for every CD-ROM driver in existence. Consequently, I can't tell you anything more about this new CD-ROM than that it exists.

The moral of the story should be clear: when sending review copies of software revisions, you'd be *much* better off to send the entire package, including a duplicate of the original program and manuals. If the overworked reviewer you're sending it to has kept the original, no harm done; if he or she hasn't, you're miles ahead in getting him or her to look at your product.

Winding Down

My oddest new acquisition is Corporate Voice from Scandinavian PC Systems. The company calls it the world's first

Corporate Voice analyzes writing styles so that you can juggle your own writing around to be more like some standard—or someone else's work.

"style replicator," and that's no bad description: what it does is analyze writing styles so that you can juggle your own writing around to be more like some standard—or someone else's work. What they've done is take Roland Larson's Readability program and modify the emphasis. The result, though, is worth a look. More on this another time.

The book of the month is *The Tempting of America: The Political Seduction of the Law* by Robert Bork (Free Press, 1989). Bork tells his side of the story and looks hard at what Constitutionalism is all about. In a less serious vein, I enjoyed a science fiction novel: Susan Schwartz's *Heritage of Flight* (Tor Books, 1989). The computer book of the month is Tom Rugg and Phil Feldman's *QuickBASIC Programmer's Toolkit* (Que Books, 1990).

The game of the month is Panzer Battles by the Strategic Studies Group. This is a well-designed and interesting simulation of WWII action on the Russian Front, with plenty of tools to let you modify their scenarios or create your own in handsome color and detail.

Next month I should have a report on what's happening in the U.S.S.R., assuming that my visa comes and I get my taxes done.... ■

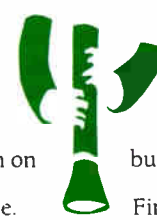
Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. Jerry welcomes readers' comments and opinions. Send a self-addressed, stamped envelope to Jerry Pournelle, c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on BIX as "jerryp."

World Radio History

Introducing AvCase™ 8051.

Three finely-tuned instruments for embedded-system development.

AvCase™ 8051 C Compiler, Assembler, and Simulator from Avocet. Play them solo, for peak performance. Or bring them together in perfect harmony as an integrated system. AvCase will manage all the steps—from editing source code, compiling, assembling, and linking, all the way to debugging. ▪ *High-level language in the key of C.* AvCase C Compiler is our biggest seller. It produces fast, tight, optimized code that helps speed development time. ▪ *Clear, concise scoring.* AvCase Assembler is the classic Avocet assembler tuned-up and ready for your most demanding applications. ▪ *Full dress rehearsal without leaving your desk.* AvCase Simulator lets you test code on your own PC. With the new source-level debugging feature you can work at both the C and assembly language level. ▪ *Let the music begin.* If you want to meet your project deadlines—come in on budget—and develop a high-quality, bug-free product—you simply can't do better than AvCase. Find out more about these finely-tuned instruments. Fax, write, or call toll-free *1-800-448-8500* for complete information, including a *free* AvCase Brochure and Avocet Catalog.



AVOCET
SYSTEMS, INC.

Avocet Systems, Inc., 120 Union St., P.O. Box 490, Rockport, Maine 04856. Telephone 1-800-448-8500/in Maine, or outside the U.S. call 207-236-9055/FAX 207-236-6713. TLX 467210 Avocet CI.

Circle 33 on Reader Service Card

World Radio History

TERMINAL EMULATION FROM TERM ISN'T THE NEXT BEST THING TO BEING THERE. IT IS BEING THERE.

With TERM, you can operate remote systems exactly as if you were there.

TERM *is considered the industry standard for exact terminal emulations, but emulation isn't the only issue – regardless how precise it is. The real objective is access, and accessibility requires that your machine act like their machine.*

Exact Emulation.

With SCO Color Console and TERM, anything that runs on Xenix can now be operated remotely from your PC, Macintosh or Unix box. TERM literally puts you in front of the remote system. You can now take advantage of the full range of keyboard functions and screen attributes including function key programmability and complete color support. In short, your terminal becomes their terminal. This is access.

In addition to SCO ANSI, TERM features very exact VT220, VT102, Wyse50 and nine other terminal emulations on any physical display device. Other emulation features include a fully remappable keyboard,132 columns, transparent print, graphics line draw and multinational character support.

Network & Asynchronous Access.

Exact emulations are merely one feature in a communications program which is considered the industry standard for asynchronous communications. And now Century Software introduces TermNET- all of the features of TERM in a network version.

TermNET operates identically to TERM and provides direct network connectivity featuring multisession TCP/IP, OSI and X.25 support. Both TERM and TermNET provide intelligent file transfer for fast data movement and a powerful, customizable script language that automates every aspect of communication sessions. They run identically on machines made by over 100 manufacturers, providing keystroke-for-keystroke compatibility across multiple operating systems including: MSDOS, UNIX, Xenix, Macintosh, VMS, BTOS, MS-Windows and X Windows.

Access & Connectivity Solutions.

Century Software is dedicated to meeting the challenges of systems interoperability. With the addition of TermACS (Asynchronous Communications Server) and TERM for X Windows to our family of software products, we are creating *The Access Standard* – a complete line of communications tools that provide state-of-the-art asynchronous and network connectivity. This means access to information from any system, any network.

CENTURY IS THE ACCESS STANDARD.

TERM AT A GLANCE

- Multi-session Network & Async Access.
- Direct TCP/IP, OSI & X.25 network support.
- Exact VT220, VT102, Wyse50 and SCO ANSI on all systems.
  - Fully remappable keyboard.
  - Full numeric keypad support.
  - Full color support.
  - Automatically restartable file transfers.
- State-of-the-art Lempel-Ziv-Welch data compression.
- 38.4K sliding window file transfers.
- KERMIT protocol for mainframes.
- XMODEM and YMODEM protocols for bulletin boards.
- Wildcard file send/receive capability.
- Auto-login, dial/redial modem control.
- Powerful script language for customized applications.
- Performs unattended polling/file transfers.
- Remote maintenance capability.
- Electronic mail/TELEX/FAX Easylink/MCI Gateway.
- Superior X Windows xterm Replacement.

CENTURY SOFTWARE

The Access Standard

5284 South 320 West,
Suite C134
Salt Lake City, Utah 84107
Phone: 801-268-3088
Facsimile: 801-268-2772

UNITED KINGDOM	FRANCE	FRANCE	BELGIUM	NETHERLANDS	ITALY	WEST GERMANY	AUSTRALIA
Systems Marketing	Tauris Data	Top-Log	Top-Log	T-Point Software	ESA Computers	Tauris Data	Qunix
Phone: 0488-681004	Phone: (1) 30-21-55-05	Phone: (1) 42-04-21-18	Phone: 02/872-22-40	Phone: 074-912470	Phone: 0541-741113	Phone: (6121) 509392	Phone: (07) 831-866

Circle 55 on Reader Service Card (DEALERS: 56)

World Radio History

GO AHEAD, MAKE MY DAY

Owning and installing free Unix software

In May's column, I mentioned a number of useful programs that are available free of charge. Some of these (e.g., `pathalias`, `uuhosts`, and `smail`) could be considered administration-level programs. Others (e.g., `elm` and `xcomm`) are utility programs meant to be used by ordinary users, although installing them generally takes some effort and access to system directories or devices.

What about more general programs that can be fairly easily compiled, run, and understood by users who aren't system administrators, gurus, or even programmers? Do such things exist?

A great deal of free Unix software fits the above criteria. The software development facilities available on most Unix systems let you just type `make`, in many cases, and wait until your new program is ready.

If your Unix system doesn't have a C compiler, you are just about out of luck unless you can find a friend on a compatible system who is willing to compile programs for you. There are some programs that are written in shell or `awk` language; they are accessible to anyone with a Unix system.

Getting and Keeping Software

Finding software distributed via Usenet is simple if you're on the network and subscribe to one of the `comp.sources` newsgroups. Otherwise, you can contact one of the public access or archive sites in the list I mentioned last month. Or you can retrieve the files through UUNET at (703) 876-5050 through their UUCP, Internet, or 900-number links.

But there are more ways to combine source files than simply sharing them. `Shar` earned its popularity because it facilitates mass distribution of ASCII-based program source files through E-mail or news. When you get programs from archive sites or on disk, they generally will be packed, compressed, or in some way reduced to save as much space as possible. Many systems have `pack`/`unpack` or `compress`/`uncompress`, and some have `arc` (see the table). These are all free, so getting the source code to these should be a top priority for any new Unix user. My personal preference is to use `compress` on single files. `Arc` is great for gathering all the files in a directory into a single, efficient larger file. `Arc` will automatically select the most efficient compression method.

You should also establish the name of a directory where all the "finished" (compiled and debugged) software should go. A poor choice would be `/bin` or `/usr/bin` or any directory that comes with your delivered system, because the next time you receive a system upgrade, all your software is likely to be wiped out. Regular users have no choice; since you can't modify system directories, the only reasonable place is a `/bin` directory under your home directory.

If you're running Unix on your own PC or have system administration access to your Unix machine, you can do anything you want. Make up a separate directory on the root file system, such as `/usr/lbin` or `/usr/local/bin`. This is more convenient and faster when searching but, again, can cause problems when you upgrade or restore your system. I recommend that you set up a systemwide directory for your own binaries (that's what `bin` stands for, by the way) on a separate file system and then include that directory in the system `$PATH` (see the November 1989 Unix /bin).

Another caution to system administrators: Never unpack or `unshar` programs while you're running as "su" or "root."

continued

ILLUSTRATION: JOHN BREAKEY © 1990

World Radio History

Circle 151 on Reader Service Card

See Your Data *

MapInfo software can find, display and analyze your data geographically. See your prospects, customers, facilities —anything in your database. Find addresses by street, ZIP code, city, etc. (We can even supply the maps.*)

Any point or region on the map can have a complete record of data behind it. See your *actual* dBASE data in a window to view, edit, and print. Draw your own boundaries. Add titles and legends for high quality presentations.

Perform analyses on your data to sum, average, or count your database records by location. Color sales territories by volume of orders, ZIP codes by numbers of leads, countries by your demographic data.

From street-level to worldwide, MapInfo can merge your databases with maps. Play visual "what if" with your data. See patterns, trends, and opportunities you never knew existed. If you need to map your data, MapInfo can do it.

*MapInfo now has "TIGER," the most up-to-date and comprehensive library of street maps available on the PC. Prices vary. MapInfo comes with a map of the world and the U.S. with all ZIP code locations. Runs on IBM PCs or compatibles with 640K RAM, a hard drive, and graphics.

MapInfo™ Corp.

Changing The Way The World Looks At Information™

200 Broadway, Troy NY 12180
To order, call 1-518-274-8673
or 1-800-FASTMAP Toll free.

MapInfo is a trademark of MapInfo Corp. dBASE is a trademark of Ashton-Tate.

FILE SUFFIXES

Free software is usually distributed in either compressed, archived, or packed form.

Suffix	Method	How to retrieve
.Z	Compressed	Uncompress filename
.z	Packed	Unpack filename
.arc	Archived	Arc -x filename

They could have unwelcome surprises that might affect everyone on the system. This is another reason to unshar files in their own directories.

A Beginner's Guide to Makefiles

The make program on Unix allows an entire executable binary program to be compiled, built, and installed by simply typing the command make in a directory where a Makefile can be found. The Makefile contains the instructions necessary to efficiently construct the entire program. For instance, a line in a Makefile such as

```
piece.o: piece.c mydefs.h
```

means that a compiled object module called piece.o is dependent on both the source file piece.c and the header file mydefs.h. If either of these text files is modified, typing make will recompile piece.c (automatically using cc with the -c flag) to create piece.o. Typing make again will do nothing, as the make program knows that the modification time of piece.o is later than that of piece.c and mydefs.h, so that recompilation is unnecessary. In fact, even listing piece.c in the dependency line above is unnecessary, since the make program understands that a C source file is needed to produce an object file: It's the header file that's not obvious to the make program.

An entire Makefile typically looks like this:

```
DEFS = -DSYSV
#
# use -DBSD or -DXENIX
# as appropriate

CFLAGS = -O $(DEFS)
LIBS = -lm
BIN_DIR = /usr/lbin
OBJS = piece.o section.o

program: $(OBJS)
  cc $(CFLAGS) $(OBJS)\
  -o $@ $(LIBS)

piece.o: mydefs.h
install: program
  strip program
  cp program $(BIN_DIR)
```

This is not half as complex as it looks at first glance. The uppercase definitions followed by equal signs are used to easily identify parameters that you are likely to change. For instance, even if you don't know anything about the internals of this program, the comment lines (starting with a # sign) imply that if you're working on a Xenix system, you can simply edit the DEFS entry to read -DXENIX to configure the program for your system.

Similarly, if you have problems getting the program running, you could change the CFLAGS entry to use the -g flag (useful for debugging) rather than the -O flag (which forces optimization). And the BIN_DIR line can be altered to fit the directory where you have chosen to put your binaries.

Luckily, most Makefile writers put these definitions at the top, where they are easy to see right away. Get into the habit of scanning the Makefile before you begin compiling any program, and you will save yourself a lot of work. Of course, it never hurts to read the instructions, and that's why I always try to go over the README (or equivalent) and *.1 or *.man files that are often included with a software distribution. There may be hidden "gotchas" listed here that might save you a lot of effort. Why spend 4 hours trying to get a graphics system compiled cleanly on your PC, just to find it runs only on Sun workstations?

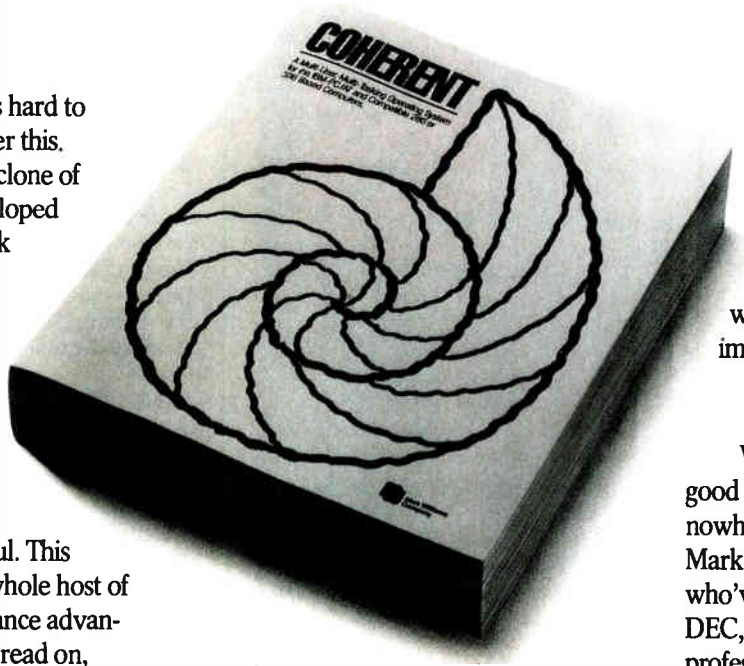
The $@ is simply shorthand for "the name of the target file" (in this case, program). This is useful in case you already have a program by that name: Just change it in one place in the Makefile, and you're done. Typing make alone is shorthand for typing "make program," or whatever is to the left of the colon on the first dependency line in the Makefile itself. The command make install would first run every command needed to compile program, and then strip and copy the resultant executable file. Typing make -n shows you what will be accomplished by a make, without actually running the commands.

Speaking of hidden gotchas, the most devastating to new Makefile users is this: Program instruction lines (such as those beginning with cc, strip, or cp above) *must* begin with a tab character,

continued

World Radio History

Everything You Ever Wanted In UNIX. And Less. $99.95.*



OK. We know it's hard to believe. So just consider this. Coherent™ is a virtual clone of UNIX. But it was developed independently by Mark Williams Company. Which means we don't pay hundreds of dollars per copy in licensing fees.

What's more, Coherent embodies the original tenet of UNIX: small is beautiful. This simple fact leads to a whole host of both cost and performance advantages for Coherent. So read on, because there's a lot more to Coherent than its price.

SMALLER, FASTER...BETTER.

Everybody appreciates a good deal. But what is it that makes small so great?

For one thing, Coherent gives you UNIX capabilities on a machine you can actually afford. Requiring only 10 megabytes of disk space, Coherent can reside with DOS. So you can keep all your DOS applications and move up to Coherent. You can also have it running faster, learn it faster and get faster overall performance. All because Coherent is small. Sounds beautiful, doesn't it?

But small wouldn't be so great if it didn't do the job it was meant to do.

EVERYTHING UNIX WAS MEANT TO DO.

Like the original UNIX, Coherent is a powerful multi-user, multi-tasking development system. With a complete UNIX-compatible kernel which makes a vast world of UNIX software available including over a gigabyte of public domain software.

Coherent also comes with Lex and Yacc, a complete C compiler and a full set of nearly 200 UNIX commands including text processing, program development, administrative and maintenance commands.

And with UUCP, the UNIX to UNIX Communication Program that connects you to a world-wide network of free software, news and millions of users. All for the cost of a phone call.

We could go on, but stop we must to get in a few more very important points.

EXPERIENCE, SUPPORT AND GUARANTEES.

Wondering how something as good as Coherent could come from nowhere? Well it didn't. It came from Mark Williams Company, people who've developed C compilers for DEC, Intel, Wang and thousands of professional programmers.

We make all this experience available to users through complete technical support via telephone. And from the original system developers, too!

Yes, we know $99.95 may still be hard to believe. But we've made it fool-proof to find out for yourself. With a 60-day money-back no-hassles guarantee.

You have to be more than just a little curious about Coherent by now. So why not just do it? Pick up that phone and order today.

You'll be on your way to having everything you ever wanted in UNIX. And for a lot less than you ever expected.

LESS IS MORE!	Coherent For the IBM-PC/AT and compatible 286 or 386 based machines.	Santa Cruz Operations XENIX 286, Version 2.3.2
No. of Manuals	1	8
No. of Disks	5	21
Kernel Size	64K	198K
Install Time	20-30 min.	3-4 hours
Suggested Disk Space	10 meg	30 meg
Recommended Memory	640K	1-2 meg
Performance*	38.7 sec	100.3 sec
Price	$99.95	$1495.00

*Byte Execl benchmark, 1000 iterations on 20 MHZ 386.

1-800-MARK WMS

(1-800-627-5967 or 1-708-689-2300)

60-DAY MONEY BACK GUARANTEE!

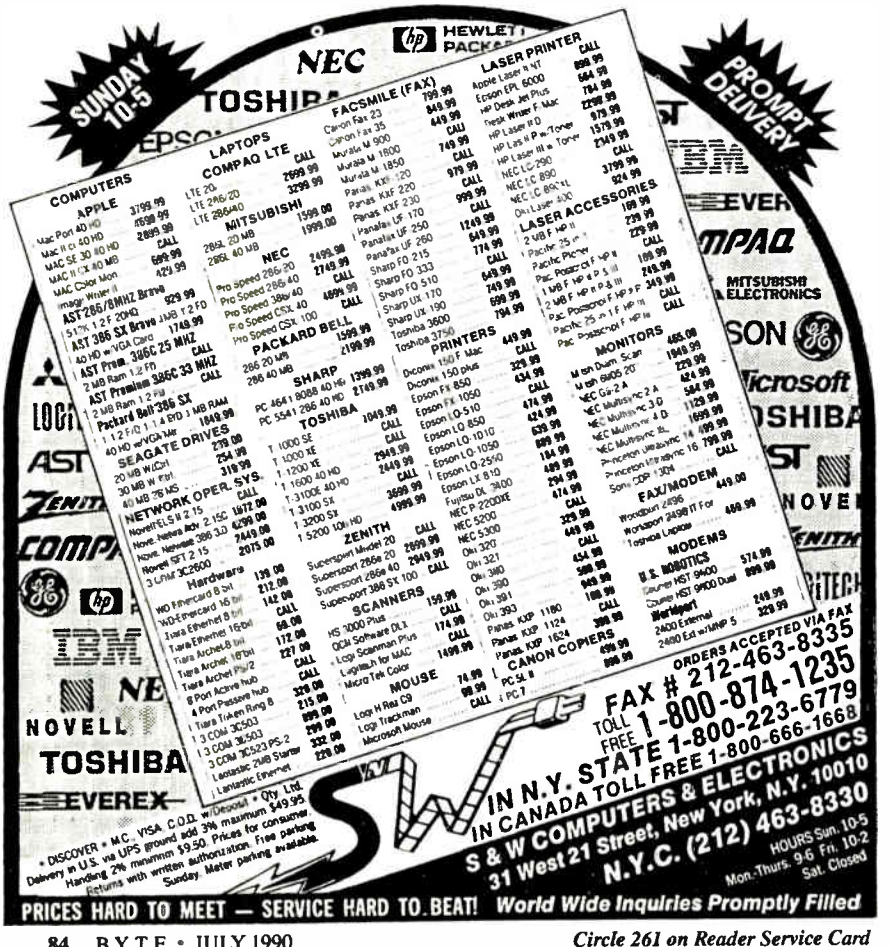
Mark Williams Company

601 N. Skokie Highway
Lake Bluff, IL 60044

*Special introductory price good through October 31, 1990. Coherent is a trademark of Mark Williams Company. UNIX is a trademark of AT&T. XENIX is a trademark of Microsoft.

World Radio History

Circle 260 on Reader Service Card



rather than spaces, to avoid errors like "must be a separator on rules line."

Head(er)aches

Sometimes you edit the `Makefile` and then are bombarded by dozens of C compiler errors. At times like this, I go straight for the `*.h` header files, as there is inevitably something buried there.

The most common is the `index()`/`strchr()` problem. Berkeley-based systems use a function called `index()` to deal with substrings of a string, while Unix System V variants call exactly the same function `strchr()` (plus, there are reverse functions!). So, if either of these shows up as undefined, simply put two lines in the source, or (better yet) one of the header files that defines each in terms of the other, such as the following:

```
#define index strchr
#define rindex strrchr
```

or the opposite:

```
#define strchr index
#define strrchr rindex
```

Load errors, on the other hand, can be equally mystifying. Suppose you compile all the source files and then get loader errors at the end because certain routines are still undefined. You can sometimes save the day by changing the LIBS parameter to include more libraries that can be found on your system, such as `-lx` or `-lm`. Use the command `ls /lib/lib*.a /usr/lib/lib*.a` to find them all—you can add a file such as `/usr/lib/libplot.a` to your `Makefile` simply by listing it as `-lplot`. This assumes that the program wasn't written for a Berkeley or Sun system—expecting certain libraries to be found there—while you're running Xenix or Unix System V.

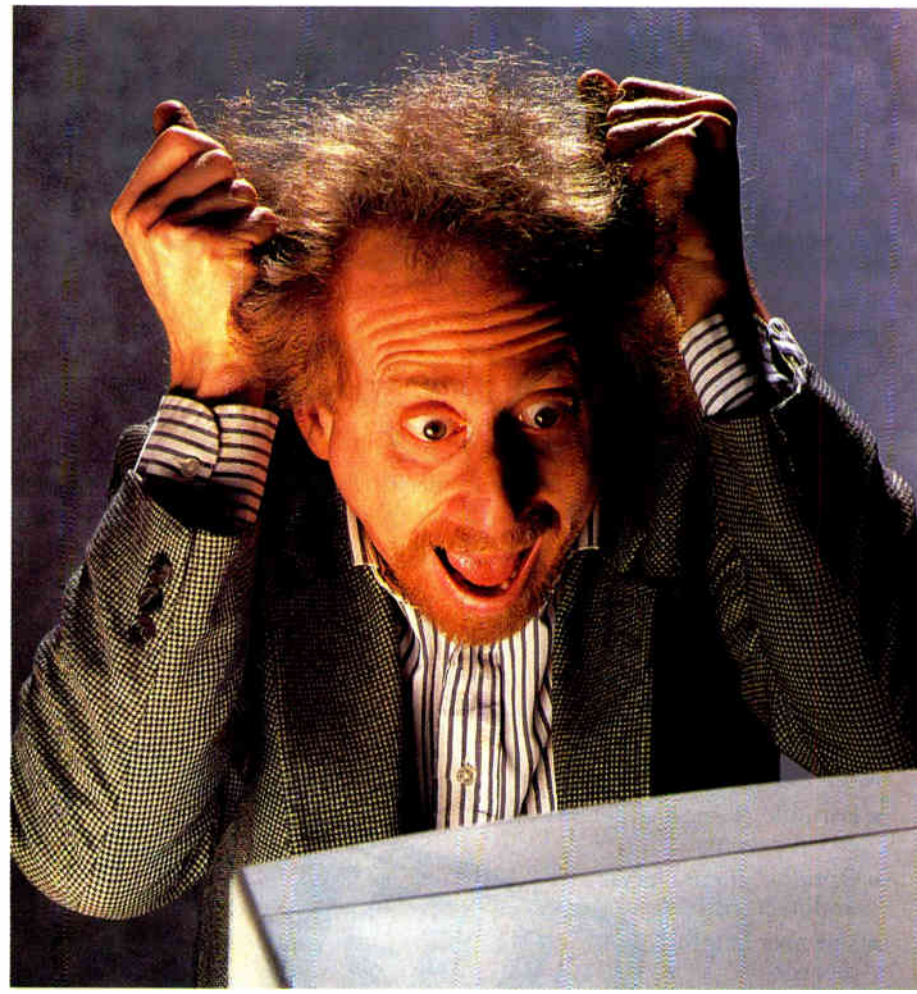
If you are really brave, you can try porting an otherwise incompatible program to your system—in which case, it would be nice if you posted the changes to the network so others could benefit from your work. If you don't have the time, just wait. In a few months or years, someone else will probably do it! ■

David Fiedler is executive producer of Unix Video Quarterly *and coauthor of the book* Unix System Administration. *He has helped start several Unix-related publications. You can reach him on BIX as "fiedler."*

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Circle 261 on Reader Service Card
World Radio History

Instead of taking your frustrations out on your hardware and pulling your hair out, you can take a better approach to your software.



Powerful UNIX tools for DOS and OS/2.

MKS Programming Platform is a comprehensive portfolio of tools and languages that free you from those agonizing details of programming and software development. By letting you focus on your end objective, you'll produce better code, easier and with less stress.

It gives you virtually unrestricted access to the power and flexibility of UNIX, and full DOS or OS/2 capabilities.

"MKS software is absolutely the best in its class. Don't mix environments without it."

Grover Righter, Director Hybrid Systems,
Novell Netware Product Division

MKS Programming Platform includes MKS Toolkit with over 150 UNIX compatible commands, and a combined command interpretor/programming language that allows you to create your own optimal environment. It also gives you MKS LEX & YACC, RCS (Revision Control System), and Make.

The Programming Platform runs on standard PC networks like Novell NetWare and PC NFS, allowing you to use a PC as a UNIX workstation and off-load your mini or mainframe.

MKS Programming Platform Prevents Hair Loss.

"With this package, you can become familiar with the UNIX environment on your microcomputer, with DOS only a keystroke away."

Byte Magazine, May 1989

What's more, it tracks the POSIX standard, so you can meet specifications required by the US Federal Government without investing in new hardware.

If you're a UNIX expert, you'll appreciate having a fully predictable environment on your PC. If you're new to UNIX or POSIX, the MKS Programming Platform eases the learning curve by allowing you to switch back to DOS or OS/2 at any time.

Organizations, including, AT&T, Hewlett Packard, ITT, NCR, and the National Institute of Standards and Technology, already benefit from MKS software. They use elements of the Platform to create a standard operating environment, or as a UNIX/POSIX training tool. Universities use the Platform to enrich personal research computing environments and double the bandwidth of their PC teaching labs.

Whatever your needs, you'll find MKS Programming Platform to be the most efficient, most productive, and friendliest way to cross the bridge between DOS or OS/2 and UNIX.

So be kind to yourself, your hardware (and your hair) with a better approach to software from MKS!

For more information, or to order, call:
1-800-265-2797 (continental U.S. only)
1-519-884-2251 (outside continental U.S.)
1-519-884-8861 (FAX)

Australia	03-419-0300	Netherlands	020 14 24 63
England	0364 53499 or 0763 73455	Sweden	0762 704 60
France	01 47 95 01 07	West Germany	0551-792488 or 0721 886 664

MKS

MKS, MKS Make, MKS Toolkit Korn Shell, MKS LEX & YACC and MKS RCS are trademarks of Mortice Kern Systems Inc. UNIX is a trademark of AT&T.

35 King Street North, Waterloo, Ontario N2J 2W9
Full 30 day money back guarantee.
Put The Power Of UNIX In Your PC.

Circle 167 on Reader Service Card

World Radio History

THE TOOLBOX

■ BY ■ FAIRCOM ■

NOW USE 4GL SPEED & C SOURCE CODE POWER WHEN DESIGNING YOUR DBMS

Whether you need the development speed and convenience of 4GL programming or the low-overhead power capabilities of C source code, The ToolBox by FairCom can meet the requirements of any professional developer!

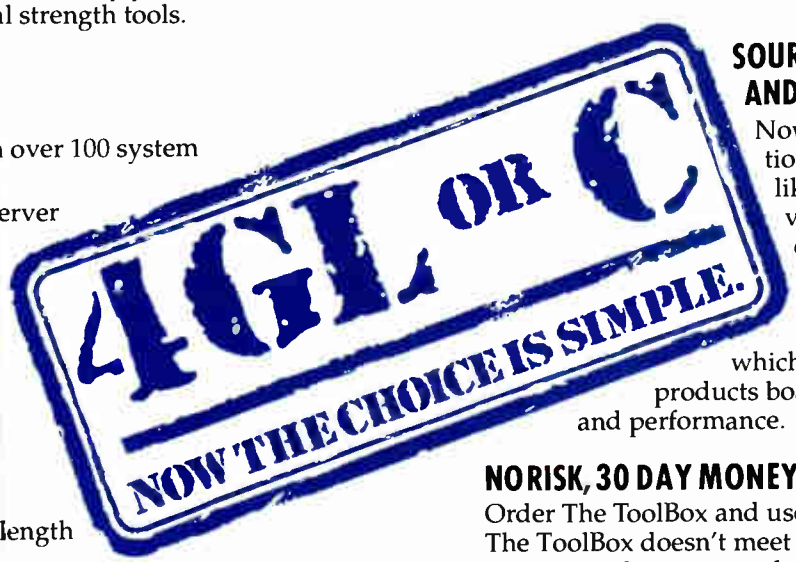
INDUSTRIAL STRENGTH TOOLS

Develop applications the way you want with The ToolBox's industrial strength tools.

c-tree®

DATA FILE MANAGEMENT

- Portable. Used in over 100 system environments
- Optional client/server architecture
- Variable length records
- Key compression
- Ascending/Descending key segments
- Dynamic space reclamation
- Fixed & variable length key fields
- Advanced, high-speed B+ trees



d-tree™

INTERFACE DEVELOPMENT

- Prototype generation is easy with the RUN utility
- C-tree interface streamlines data base operations
- Dynamic Development -- Interface/Resources mgmt.
- Complete screen handler creates entire windows
- HELP management assists with pop-up menus, etc.
- Menu management -- Pop-up, Pull down, Lotus, etc.

r-tree®

REPORT GENERATION

- Create or change reports without C programming
- Multi-file access with virtual fields & records
- Complete layout control with conditional page breaks, conditional output and headers/footers for each break
- Dynamic format specifications w/horizontal repeats
- Powerful set functions & automatic accumulators
- Arbitrarily complex selection criteria

SOURCE CODE POWER AND 4GL FLEXIBILITY

Now you can create applications using the methods you like – whether it's 4GL convenience (Special Edition) or the C source code power (Professional Edition) of The Toolbox Series from FairCom. No matter which one you choose, both products boast unparalleled portability and performance.

NO RISK, 30 DAY MONEY-BACK GUARANTEE

Order The ToolBox and use it for 30 days. No risk. If The ToolBox doesn't meet your development needs, just return the entire package for a full refund.

CALL (800) 234-8180 TO ORDER YOUR COPY OF THE TOOLBOX TODAY!

With over 10,000 current users, FairCom is a major supplier of C programmer tools. Call today to order your copy of The Toolbox, or for more information.

FAIRCOM CORPORATION
4006 West Broadway
Columbia, Missouri 65203
(314) 445-6833 ■ FAX (314) 445-9698

THE TOOLBOX PRICE LIST

The ToolBox, Professional Edition $1,095
DOS, Unix, Xenix, VMS, OS2 Full source, single and multi-user support.

The ToolBox, Special Edition $695
Microsoft, Borland, Xenix, OS2 Object Libraries, single user only.

Upgrade to Professional Edition $400
Includes overnight delivery.

Circle 99 on Reader Service Card

World Radio History

UP CLOSE AND PERSONAL

Personal organizers bring the office to you and ease your work wherever you are

It's really Fred Langa's fault. After I'd reviewed a couple of hand-held computers in the form of the Sharp Wizard and the Psion Organiser last year, and found them less than completely useful, Fred suggested that I didn't really appreciate them as they were meant to be used. In September, as Fred and I covered NetWorld, I had the opportunity to see a personal organizer in action. Fred was right.

As you may know from experience, a major trade show is hectic indeed. It's easy to get involved in a meeting and completely miss another appointment. In this environment, I noticed that as each appointment approached, the Sharp Wizard in Fred's pocket would chirp, he'd open it, read notes about the meeting, the people involved, and the location of the meeting, and we'd be on our way. This would all happen while I was still trying to find the right page in my Day-Timer.

I watched the performance repeated at Comdex in November and decided that the time had come to take another look at personal organizers, not as a review this time, but as a way to extend the reach of your computer as well as a way to organize your day.

Pocket Packets of Power

As interesting as pocket-size electronic gadgets are, not all of them are particularly relevant to computer users. One of the best potential uses for these devices is to have them somehow bring at least part of the power of the office computer to the field. To do so, they need a way to communicate with a personal computer.

If a pocket organizer can transfer meaningful programs or data, or if it can transfer data collected in the field to the PC back in the office, it can be useful indeed. Of course, it must have other aspects that make it useful as well, such as good displays, well-chosen software, and a transfer interface that works.

I looked at four such devices, three of which are marketed as personal organizers, the fourth as a calculator. Actually, they are all calculators, just as they are all organizers, data storage devices, and much more. However, each is aimed at a specific segment of the market.

The four machines I looked at are the Sharp Wizard OZ-7000, along with a couple of new IC cards; the Casio BOSS SF-8000, along with two programs for it; the Selectronics DataStor 8000, which comes with SideKick; and the Hewlett-Packard HP 48SX Scientific Calculator, which comes with several proprietary programs. With prices starting at $350 and under, each seems to be aimed at users on the move. Each has an electronic appointment calendar like the one Fred used to convince me to do this piece.

But How Useful Are They?

Of course, for one of these devices to be really useful, it needs to do more than just beep at a certain time and move data around. To be truly valuable as a piece of support equipment, it must be a tool. It is hard to be specific about criteria, though, because each user's needs can vary quite a bit, and because these machines are quite different despite their similarities. The best measure of usefulness is that these machines must be able to help their users perform tasks in and out of the office.

As it turns out, all these devices are useful, and all but one is extremely useful. That doesn't mean, however, that they are universally easy to learn or simple to use. They are a compromise, after

continued

ILLUSTRATION: JOHN LABBÉ © 1990

World Radio History

ITEMS DISCUSSED

BOSS SF-8000 ..... $260
Casio, Inc.
570 Mt. Pleasant Ave.
P.O. Box 7000
Dover, NJ 07801
(201) 361-5400
Inquiry 1101.

DataStor 8000 ..... $40
Microlytics, Inc.
2 Tobey Village Office Park
Pittsford, NY 14534
(716) 248-9150
Inquiry 1103.

HP 48SX Scientific Calculator ..$350
Hewlett-Packard, Inquiries
1000 Northeast Circle Blvd.
Corvallis, OR 97330
(503) 757-2000
Inquiry 1102.

Wizard OZ-7000 ..... $300
Sharp Electronics Corp.
Sharp Plaza
Mahwah, NJ 07430
(201) 529-8200
Inquiry 1104.

all—like every other product in this business. They must trade size for memory capacity and ergonomics. This means that storage space is limited, displays are small, and the keys are hard to type on. On the other hand, if they didn't make these trade-offs, they wouldn't be so portable.

One real measure of usefulness is the variety of the software that's available with or for these machines. A great deal of available standard software adds versatility to the machines and makes them productive instantly. You are much less likely to use a machine for which you must write software, simply because you are much less likely to write the software.

Software for Field Use

Along with the ability to set alarms and appointment information, each of these devices contains software aimed at making its user's life easier. They all succeed at this to some extent, although the DataStor's success is more limited. It has a sort of free-form database that allows full text searching. You can put anything into the machine and search for it later. It does not, however, include a collection of preprogrammed software that handles other functions.

It's important to note, though, that the DataStor costs less than $100, including a free copy of Borland's SideKick. You can transfer data into the machine from SideKick files or from dBASE files. Once the information is in the machine, you can search for it using the built-in software. Unfortunately, the screen is tiny, so you can't see a whole calendar at once, nor can you see a lengthy record in the database without scrolling.

If all you need is a place to stash information until you get back to the office, the DataStor is fine, and it's certainly inexpensive enough. In addition, it will work as a basic calculator, although it is not programmable at all. You do need to be careful of its battery life, though. I inadvertently left the alarm set so that it went off once each day, and then I went out of town. It beeped plaintively in my office once a day until the battery died.

The Casio BOSS and the Sharp Wizard are both aimed at the same general market, and they succeed from completely different directions. The Wizard is shaped like a pocket calendar and opens like a book. It has a keyboard on the right and an eight-line screen on the left. There's a slot for IC cards below the screen. The slot has a pressure-sensitive membrane covering it, so you can press your finger over icons on the IC card to choose actions.

The IC cards that fit into this slot contain various applications, including a trip planner and money planner that I tried out, as well as a dictionary, language translator, and others. The Wizard also has numerous built-in functions, including the appointment calendar, a calculator, a telephone directory, an electronic memo pad, and various clocks.

The BOSS has a similar selection of built-in functions. The screen is about twice as large, however, and will allow two monthly calendars to be displayed side by side. Meetings and appointments are shown as hourly bar charts—a nice idea. The biggest difference is that the BOSS has a tiny QWERTY keyboard, and you must download all your application software from a PC. The disk-based BOSS applications, though, which are similar to those available for the Wizard, are much less expensive than the Wizard's IC cards.

Pocket Cruncher

The real star of this class of device is the HP 48SX. Although billed as a calculator, there's really a lot more to it. Calling it just another calculator is like calling a Mercedes-Benz 560 just another car. Doing things like running an appointment calendar with it is like driving the Mercedes half a block to the store at 15 miles per hour. This is a machine that has its own programming language and will accept code that you create on your PC or Macintosh and use the resultant software to run models, collect data, display graphics, or solve large equations. Once you've accomplished all this, it will load the information back into your computer for further processing.

The HP 48SX looks like a calculator with a very large screen. Each key has as many as four functions, making it complex to use. But once you've learned how, it's very powerful. The version I looked at had an extra 128K bytes of memory as well as the equation-solver package. The HP 48SX does everything from graphics to calculus. I never did use all its functions, but I never got tired of trying.

Justifying a Purchase

There's no doubt that these little devices are fascinating. I never failed to draw a crowd when I used one in public. More important, they can significantly ease your work. The HP 48SX is clearly aimed at engineers and scientists who, besides using it for their work, also need to attend meetings. The Casio BOSS and the Sharp Wizard seem more useful to the traveling executive. The little DataStor is useful for less demanding tasks, but it can't keep up with the bigger machines.

There's no question that these machines do provide a limited, but very real, link with the computer while you're away from the office. All of them let you move information between your office computer and the one that resides in your pocket, and they'll support your day-to-day activities in the process. Fred was right. They may not replace a Day-Timer, but that's not their purpose. Instead, they bring a piece of the office to you. ■

Wayne Rash Jr. is a contributing editor for BYTE and technical director of the Network Integration Group of American Management Systems, Inc. (Arlington, VA). He consults with the federal government on microcomputers and communications. You can contact him on BIX as "waynerash," or in the to.wayne conference.

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

World Radio History

Memory beyond 640K DOS.
386|DOS-Extender™ takes you there.

It breaks the 640K barrier so you can build high-performance, multi-megabyte programs in Extended-DOS.

How? By turning DOS into a true 32-bit operating system. 386|DOS-Extender enables you to create protected mode applications that use all the memory in a 386 PC – up to 4 gigabytes. You work within a flat, 32-bit address space. No more suffering with overlays, bank-switched EMS, or segmentation.

With full 32-bit memory and power, you can finally build workstation-class applications for the PC. Your Extended-DOS programs will run considerably faster, have room for more features, and be more responsive than those in 16-bit DOS.

And if that's not enough, add Phar Lap's 386|VMM™ virtual memory manager. With true demand-paging, 386|VMM enables your application to grow bigger than available RAM. Both code and data are automatically swapped to disk as needed.

All this, without any new operating environment for your end-users to buy or learn. Your program looks exactly like any other DOS application. Because 386|DOS-Extender is embedded into your program, end-users never see it.

Welcome to the promised RAM.

Every 80386 PC that can run MS-DOS or PC-DOS can run 386|DOS-Extender. It is totally compatible with all DOS-based software, including TSRs and network managers.

386|DOS-Extender is backed by a full complement of 32-bit languages. Choose your favorite from among C, Fortran, Pascal, Ada, Assembler, and others. And with Phar Lap, you'll be using the finest, most widely-used 386 software development tools in the world.

For a glimpse of the promised RAM, take a look at AutoCAD 386, IBM Interleaf Publisher, and Mathematica.® They are just a few of the hundreds of Extended-DOS applications already being shipped with 386|DOS-Extender. Utilizing this exciting new technology, industry leaders are keeping their competitive edge by delivering the speed and power 386 users have been waiting for.

So if you're trying to create the best software possible, call Phar Lap today. And we'll take you to the promised RAM.

Phar Lap 386|DOS-Extender.
We open a world of memory.

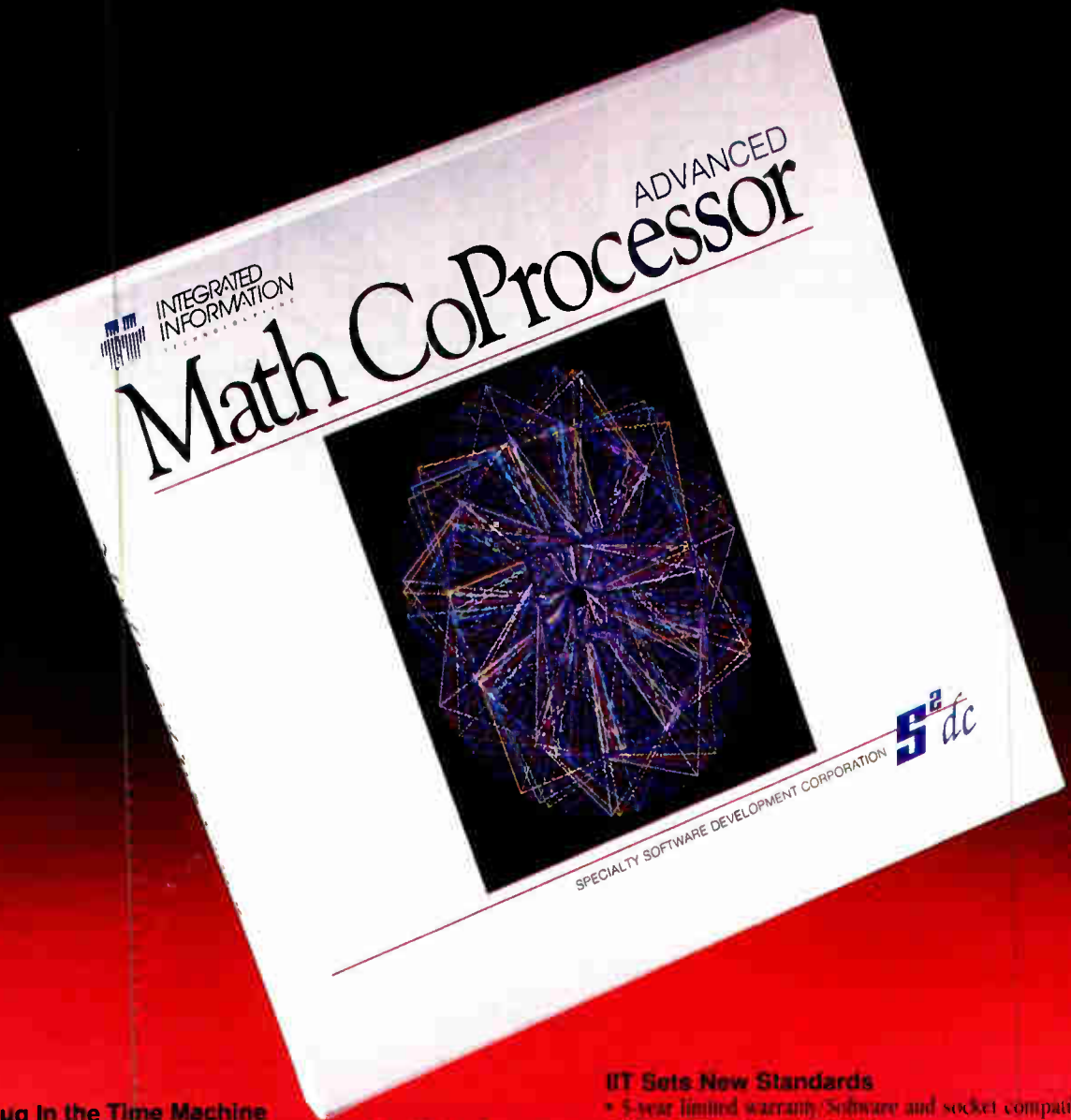
Phar Lap Software, Inc.
60 Aberdeen Avenue
Cambridge, MA 02138
617/661-1510
FAX 617/876-2972

Trademark holders: 386|DOS-Extender™ and 386|VMM™ – Phar Lap Software, Inc.; Interleaf Publisher™ – Interleaf, Inc. Registered trademark holders: Phar Lap® – Phar Lap Software, Inc.; Ada® – U.S. Dept. of Defense; MS-DOS® – Microsoft Corp.; AutoCAD® – Autodesk, Inc.; IBM® – IBM Corporation; Mathematica® – Wolfram Research, Inc. © 1989 Phar Lap Software, Inc.

Circle 205 on Reader Service Card

World Radio History

TIME MACHINE



Plug In the Time Machine
Plug the IIT Advanced Math CoProcessor into the dedicated socket in your computer and you'll radically reduce the time involved in numeric calculating processes. ***Just plug it in.***

Fastest Performance
- Fewer cycles to execute existing instructions
- Remarkably increased productivity

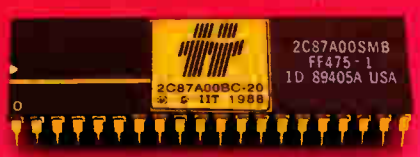
Guaranteed Accuracy
- Warranted to be in compliance with IEEE 754-1985 standard

Full Line of 2C87 and 3C87 Math Co-processors
- Completely compatible with existing 287 and 387 sockets

Runs Cool—Lowest Power Consumption
- Longer battery life for laptop systems
- Low heat output for desktop systems
- Advanced CMOS technology for higher reliability

IIT Sets New Standards
- 5-year limited warranty/Software and socket compatible
- Benchmark software included
- Made in USA

The Future Is Now
- Twenty-four additional 80-bit numeric registers
- 4 × 4 matrix instruction/A CAD industry standard
- Complete 387 instruction set in the 2C87
- Sleep mode for longer battery life



The IIT-2C87™

Go Ahead. It's Your Time.
Just plug it in. Call your local dealer today to order the IIT Advanced Math CoProcessor, or call Specialty Software Development Corp. at (512) 327-8608 for the name of the dealer nearest you.

Dealer inquiries welcome.

Circle 265 on Reader Service Card

it's about time!

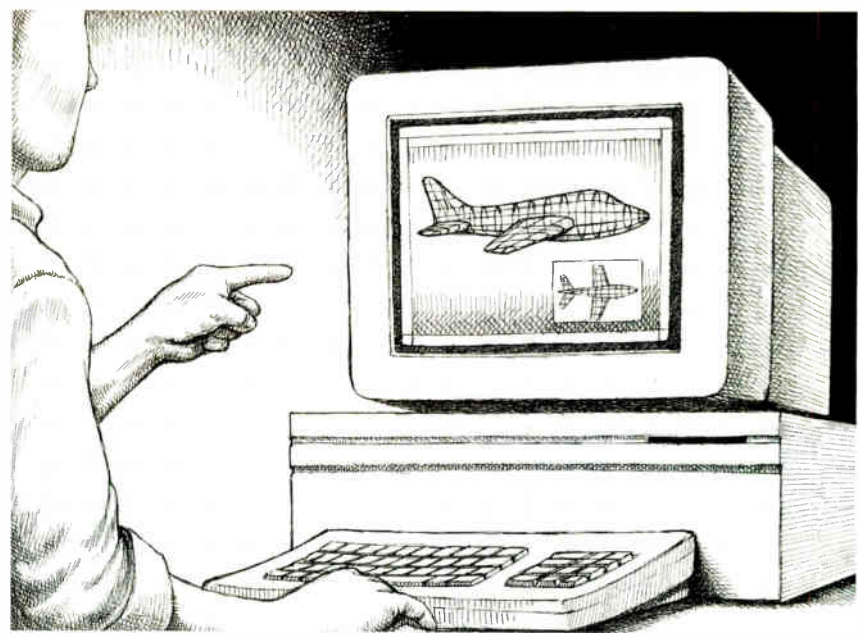
S²dc

MARKETED BY: SPECIALTY SOFTWARE DEVELOPMENT CORP.
110 Wild Basin Road, Suite 270
Austin, TX 78746 • 512/327-8608

IIT, IIT-2C87 and IIT-3C87 are trademarks of Integrated Information Technology, Inc. Intel is a registered trademark, and 286 and 387 are trademarks of Intel Corporation.
World Radio History

CAD: THE MAC CAN DO THAT?

Yes, it can—and other things as well



Several months back, I did a consulting gig for a large electronics company in the San Francisco Bay area. The company wanted recommendations for buying a new batch of computers. It sounds like a simple job, but it isn't. First, I will give you a little background: The company employs hundreds of engineers to design and fabricate specialized electronic components for the U.S. military, research firms, and universities. This means that the components are sold to a single customer in very small quantities. The end result is that the company does an awful lot of new design work, because the custom components are so different each time around.

Some time ago, the company settled on AutoCAD, with its many design libraries, as its basic design program. The first choice was (naturally) fast 386-based PCs, so it bought 25- and 33-MHz Everex 386 machines with VGA graphics. The company's only real concern was how fast its boxes could run AutoCAD, since screen editing and redrawing can take a long time with complicated drawings. Interface issues got short shrift, as did data interchange with other computers. Overlooked was the idea that the company might want to use the computers for anything other than AutoCAD work. The company was focusing so much on solving its immediate problems that it had forgotten to look ahead.

Well, I don't mind solving immediate problems; after all, that's one thing a consultant is supposed to do. I suggested that perhaps these 386 boxes weren't the best solutions for its long-term engineering needs. I mentioned the NeXT cube, the Sun SPARCStation, and the Macintosh as alternatives.

For many complex reasons, the company was not ready for Unix, so the NeXT and Sun systems were out. The reaction I got to my suggestion of the Macintosh was unexpected: It was amazingly hostile.

Most of the managers I talked with were significantly misinformed about the capabilities of the Mac and how it could fit their needs. They didn't know that the Mac had models with processing power comparable to that of their 386 machines. They also didn't know that the Mac supported gray-scale and color large-format (19- and 21-inch) monitors, or that you could run CAD applications (like AutoCAD). But overall, they were mostly amazed that a Mac could run CAD as fast as (or faster than) the 386 systems.

So I pulled together a demonstration using a Mac IIci and a Mac IIfx set up side-by-side with an Everex 386/33. Each Mac had 8 megabytes of RAM, and the IIci had a DayStar FastCache processor cache card (the IIfx has its own built-in cache). For displays, I used a 19-inch SuperMac color monitor with an accelerated 24-bit color card on the IIci, and an Apple 13-inch RGB monitor and the new Apple 24-bit AMD29000 accelerated QuickDraw card on the IIfx. Both Macs ran System 6.0.5 and AutoCAD. The Everex had 6 MB of RAM with EMS, VGA, and a custom graphics accelerator card running DOS 3.3.

I invited the biggest Mac skeptic in the group to sit down in front of the machines and try AutoCAD. Without telling him how to use AutoCAD on the Mac, save for a 5-minute demonstration of the Finder and using the mouse, he was off. His skepticism remained for about the first 5 minutes beyond that, but then you could almost see his scowl lift. The Macs were at least as fast as the Everex (and much faster on some AutoCAD operations).

continued

ILLUSTRATION: DAVID ROSE © 1990

World Radio History

All the computers used the same working AutoCAD drawings taken from the Everex machine. This was so that the managers would have familiar drawings to manipulate and to see just how easy it was to network the Macs with their Everexes. In addition, I had installed a bunch of Mac productivity applications. (The managers weren't very satisfied with their 386s' productivity programs.) I included MacWrite II and Nisus 2.02 for word processing, Think Pascal 3.0 for personal programming, WingZ and Excel for spreadsheets, FileMaker II for personal databases, and a number of attractive utilities, desk accessories, communications applications, and drawing aids.

When the demonstration was officially over, I couldn't get these managers to end the meeting. So we kept working on the Mac IIci and IIfx for several hours more, finding out just how much easier it was to work on the Mac—particularly, getting lots of allied work done (like all the paperwork that has to accompany each AutoCAD drawing), while not sacrificing a fast and familiar CAD application.

I find myself gravitating to the Mac IIfx, even though the Everex is an awfully fast machine.

A Truth Revealed

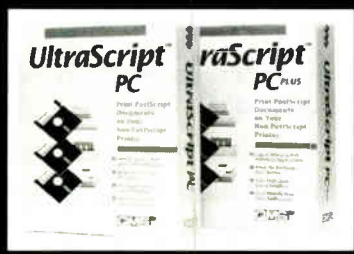
The one-day hands-on with the Mac IIci and Mac IIfx convinced the company that it had been shortsighted in dismissing the Mac out-of-hand. This is because the Mac mythology it had heard was wrong. The company won't be dumping its 386s—nor should it—but it will be bringing in Mac IIcis and IIfxs from now on instead of just more 386s. The company also tried to make its existing 386s a bit more palatable for non-AutoCAD work by adding Windows and DESQview to them.

This whole CAD episode reminded me of how easy it is to believe in the wrong things about the Mac and its supposed shortcomings for technical applications. While there are certainly some specialized scientific applications that only run on fast DOS machines (especially some instrument telemetry-gathering programs), the Mac has largely caught up with fast DOS machines as a strong platform for CAD, simulation systems, business and scientific statistics, and engineering programming support.

Since this consulting experience, I have been working with a Mac IIfx and an Everex 386/33 side-by-side to see if my gut feeling—that the Mac has really become a serious technical workstation competing with the best of them—is borne out for other applications. So far, I find myself gravitating to the Mac IIfx, even though the Everex is an awfully fast machine. I need to keep at this for a while, but the best advice I can give you now is that the high-end Macs really do not have any serious technological bottlenecks keeping them from stellar technical work.

continued

A New Era in PostScript® Printing...



UltraScript™ PC

Best of 1989 PC Magazine
January 16, 1990

- Break the PostScript Price Barrier
- Gain Access to a Wide Variety of Applications
- Print High Quality Text & Graphics
- Print Directly from Most Applications

UltraScript PC is a software program that allows you to print PostScript language documents on virtually any dot matrix, ink jet, or laser printer.

NOW SUPPORTS COLOR

UltraScript PC includes 25 typefaces for only $195. UltraScript PC Plus includes 47 typefaces for only $445.

To keep on breaking price barriers, purchase additional fonts from the UltraScript Type Collection. Get the same licensed typefaces as Adobe at almost half the price!

Available at your local dealer or call 800/635-3997 or 408/986-9400

QMS

The following are trademarks or registered trademarks of their respective companies: UltraScript, QMS and the QMS logo of QMS, Inc.; Adobe and PostScript of Adobe Systems, Inc.

Circle 226 on Reader Service Card (DEALERS: 227)

World Radio History

Computing Know How

With these two top-notch books from Abacus

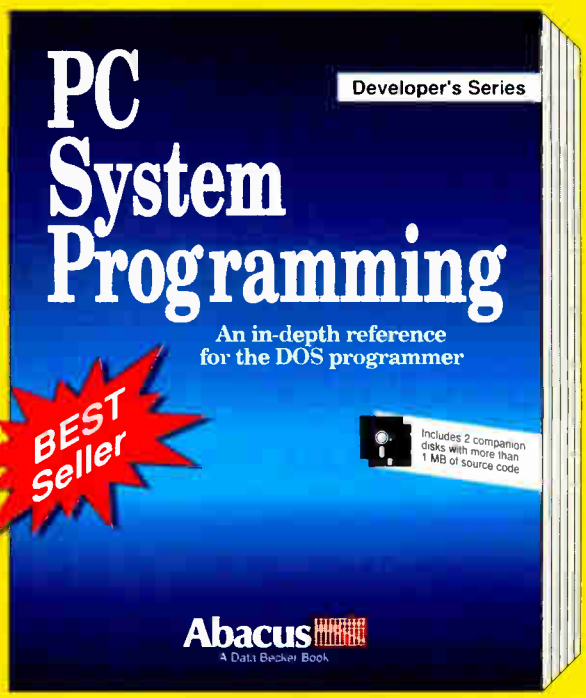
PC System Programming for Developers is a literal encyclopedia of PC know-how. This book features parallel working examples written in BASIC, Pascal, C and assembly language. Explains memory layout, DOS operations, writing device drivers, hard disks, PC ports, mouse drivers, fundamentals of BIOS, graphics and sound, TSR programs and more.

Some of the topics covered include:

- PC memory organization using extended. expanded memory
- Hardware and software interrupts
- COM and EXE programs
- Handling program interrupts in BASIC, Turbo Pascal, C and assembly language
- DOS structures and functions
- Programming graphics cards
- Writing device drivers

If you use the PC and want to know how, you'll find all you need in this book. Learn professional techniques from **PC System Programming.**

ISBN 1-55755-036-0. 920 page book and 2 companion disks with more than 1 MB of source code in compressed format. **$59.95**



What the readers are saying about **PC System Programming**

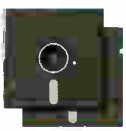
"This book is such a good reference and so complete and in-depth I keep it next to my system reference manuals and compiler manuals." J.K - *customer*

"The day I saw this book, I bought it." F.R. - *customer*

"Excellent work" G.O. - *customer*

"Best written book I've seen." A.V.R, Tulsa, OK - *customer*

Each book includes two companion disks with more than 800K of source code.



Turbo Pascal Internals gives you "know how" to program faster, easier, tighter and better. Use Turbo for system programming tasks-writing TSRs, performing multi-tasking. using SAA windowing, implementing expanded and extended memory. Learn how Turbo generates machine code, scans the keyboard, handles the mouse, uses UNITS and OOPS, performs fast screen display, more. A massive source of Turbo Pascal know-how.

ISBN 1-55755-080-8. 750 page book and 2 companion disks with more than 800K of source code. **$49.95**

Available at B Dalton Booksellers, Waldens, and Software Etc. nationwide.

In the UK contact
Computer Bookshops 021-706-1188.

In Canada contact
Addison Wesley 416-447-5101.

We accept Visa, Master Card or American Express.
Call or write for your free catalog of more PC books.

In US & Canada call TOLL FREE:

1-800-451-4319 Ext.27

Abacus

Dept. B7, 5370 52nd Street SE, Grand Rapids, MI 49512
Phone: (616) 698-0330 • Fax: (616) 698-0325

Circle 49 on Reader Service Card

☐ **Yes**, please send me ( ) PC System Programming @ $59.95 ea + S&H

☐ **Yes**, please send me ( ) Turbo Pascal Internals @ $49.95 ea + S&H

In US and Canada add $4.00 postage per order. MI residents add 4% sales tax. Foreign orders add $12.00 per book.

Amount Enclosed _____ Please bill my ☐ MC ☐ Visa ☐ AmEx

Card Number _____ Exp. _____

Signature _____

Name _____

Address _____

City _____ State ____ Zip _____

World Radio History

Tip of the Month—Take It to the Limit

One of the reasons that I have so many problems with hard disk drives is that I stress them to the limit. I'm writing this column, for instance, on a Mac IIci, saving it to a Jasmine DirectDrive 180. The drive has about 150 MB on it in about 9000 files. The trouble is, the Mac's Hierarchical File System was created long before 180-MB SCSI hard disk drives became available. As such, HFS really doesn't like all these files on my DirectDrive 180. It would just as soon forget about them and convince me to drop the number of files down to something under 5000.

I placate HFS a bit and help the Finder out as much as I can by rebuilding my desktop at least once a month. This cleans out dead file markers and leftover icons from deleted files. I nest folders like mad (so the Finder doesn't have to wade through so many folders lying about loose on the desktop) and partition the disk into manageable sizes.

In addition, I use SUM II to keep copies of my volume directories and back up these shadow directories to other disks. I also use it to perform regular incremental tape dumps. As nice as all that is, it still is not enough to insure the contents of my hard disk or speed up maddeningly slow Finder operations like file copying.

Until we can all benefit from the blandishments of System 7.0, which will improve the situation, I have found a temporary solution. Or rather, during my BYTE review of the Jasmine DirectServe file server ("AppleShare Without a Mac," March), I found an INIT I had never tried before: the Apple Desktop Manager INIT (DTM). This specialized INIT is sitting, big as life, in the System Folder on the AppleShare server installer disk.

This INIT replaces the Finder's standard methods of managing the desktop with a minidatabase that's optimized to work with large numbers of files and big disk volumes (which is why AppleShare uses it). Although DTM doesn't come on Apple's System upgrade disks yet (it doesn't have the Cupertino Seal of Approval for single-user applications), you can easily copy it from the AppleShare disk to any Mac's System Folder. System 6.0.4 and 6.0.5, in fact, were built to work with DTM from the start, and System 7.0 uses it with extensions like FileShare as the file-managing heart of System 7.0's improved Finder.

If you have big disks with lots of files (or maybe even if you don't), I advise you to get hold of a copy of the DTM INIT and install it. In case it doesn't work (which occasionally happens), back up your hard disk first. Then get into the habit of biweekly or monthly desktop rebuilding. Together, these will make the Finder work faster and reduce your ennui while waiting for your Mac to catch up with you. And they'll also help you to avoid some disk failures. Of course, if you're careful like me, you'll also already have lots of tape backups, just in case. ■

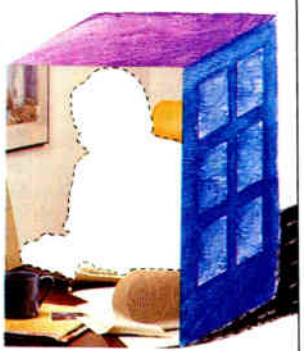
Don Crabb is the director of laboratories and a senior lecturer for the computer science department at the University of Chicago. He is also a contributing editor for BYTE. He can be reached on BIX as "decrabb."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Co/Session lets you use your office PC as though you were there...

Co/Session remote access communications software enables you to do everything you previously had to do at the PC in your office— *but* from the location of your choice and at your own convenience.

Via modem, you can access (even transfer) files, run programs, print reports, use on-line network resources, and more, just as though you were seated at the keyboard in your office...



even when you're not

Even when you're at home...before dinner...when you get back from the health club...after you read the kids a story. Even when you're on the road...in your hotel room...at a branch office...calling on a client. Co/Session can help you accomplish all you have to do while allowing you to enjoy the things you want to do. To find out more about how, call us toll-free, at 800- 322-9440.

PC EXPO See us at Booth #312

Co/session a product of Triton Technologies Inc.
200 Middlesex Turnpike, Iselin, New Jersey 08830
(201) 855-9440 • Fax (201) 855-9608
In Canada: GENTEK Marketing Inc. (416) 738-9300

Circle 295 on Reader Service Card (DEALERS: 296)

World Radio History

JMP™ to a Higher Level of Discovery

With JMP Software for Statistical Visualization

Make a quantum leap in data analysis with JMP software for your Apple Macintosh®. JMP combines traditional statistics with today's most innovative graphics.

Discover more.

▲ Fit regression and Analysis of Variance models, but see them in a new way with leverage plots, showing how each point contributes to each hypothesis test. ▲ Fit means, but see the significance of their differences visually with comparison circles. ▲ Analyze high-dimensional data and extract principal components, but see both the points and variables in the same graph with a biplot, one that spins in 3D. ▲ Examine a correlation matrix, but see more with a matrix of scatterplots with density ellipses. See high-dimensional outlyingness of points with Mahalanobis distance plots. ▲ See your data always displayed in a familiar spreadsheet grid.

Interact more.

▲ Point and Click to view, edit, or manipulate your data...to get an analysis...to identify points...to customize...to get context-sensitive help...to choose colors and marker symbols for your points in every graph. ▲ Point and Click on a calculator panel to make formulas for variables. ▲ Point and Click on your data in one graph, and the corresponding points will be highlighted in all the other graphs instantly. ▲ Click and Drag to change the intervals for histograms instantly...to spin your 3D graph smoothly in real time...to resize any graph. Cut and Paste your data within JMP or to other applications. ▲ Cut and Paste reports to other applications or journal them to a file.

Understand more.

▲ JMP is simple to use, so you can spend your time studying your data, not your software. ▲ JMP presents statistical results visually, so you are always looking at graphs as well as numbers, finding patterns, and noticing points that don't fit patterns. ▲ JMP organizes its statistical methods in a unified way. You approach your data more directly with fewer frustrations regarding the statistical recipes. You always have a method that takes into account the variable's measurement level: nominal, ordinal, or interval.

MacWEEK says "JMP is powerful and easy to use. The programmers' delight in writing JMP is evident throughout and makes the program intuitive and a pleasure to use."

A Free Video Preview

For a free video preview of JMP, call our JMP Sales Department at (919) 677-8000. In Canada, call (416) 443-9811. Or, write us at the address below.

JMP™ ***From SAS Institute Inc., the number one name in data analysis software.***

SAS Institute Inc. □ JMP Sales Dept.
Box 8000 □ SAS Circle □ Cary, NC 27512-8000
Phone (919) 677-8000 □ Fax (919) 677-8123

To use JMP, you need an Apple Macintosh with 1+ meg, 2 meg recommended.

JMP is a trademark of SAS Institute Inc., Cary, NC, USA.
Apple and Macintosh are registered trademarks of Apple Computer, Inc.
Copyright © 1990 by SAS Institute Inc. Printed in the USA.

Circle 250 on Reader Service Card

World Radio History

See the Future.

FLEXSCAN® Models 9400/9500 have been specifically designed for professional use in the CAD and Desktop Publishing fields. The Multi-Scan System is optimized at three usage ranges (f(H):30-38kHz VGA, 48-50kHz PC CAD/CAE range, and 64-78kHz Professional Graphics) to provide the display potential to take full advantage of today's and tomorrow's most powerful equipment.

Our Dynamic Focusing Circuit and the DBF System CRT deliver superior resolution and convergence over the entire 20" screen, with ultra-high resolution on PC's (1280×1024) and MAC II. Ergonomic design minimizes reflection and static, with maximum ease of operation.

FLEXSCAN®, already compatible with the next generation.

NANAO®

NANAO USA CORP.
23510 Telo Ave., Suite 5
Torrance, CA 90505 USA
Phone (213)325-5202
Fax (213)530-1679

Circle 175 on Reader Service Card

FLEXSCAN 9400/9500
20"(19V); 0.31mm dot pitch CRT
1280×1024 high resolution
Scan Frequency : Automatic Adjustment
H:30kHz-78kHz(9500),
30kHz-65kHz(9400)
V:55Hz-90Hz
Anti-reflection, CRT surface panel (9500)
Anti-reflection, anti-static CRT coating (9400)

Macintosh II is a registered trademark of Apple Computers Inc.
NANAO and FLEXSCAN are registered trademarks of NANAO USA Corp.

World Radio History

FREE AT LAST!

Farewell, 64K-byte segments; hello, wide-open memory spaces

Well, at least I *hope* so. Last month, I told you about one of the two big features of OS/2 2.0: multiple virtual DOS machines. The other big feature is access to the 386's memory management capabilities.

The Intel microprocessor line, from the 8086 through the 286, relies on a *segmented* architecture. That means that the chip can't just say, "Let me look at location 351,799 in the memory." Instead, it must divide the memory into segments, each no larger than 64K bytes. The minimum number of segments required to describe DOS's 640K-byte space is 10. The idea with segments is that they make it easier to keep the system neat and tidy. Each program or subroutine can go into a *code* segment, and the data or a given data structure can go into a *data* segment. Any given location within a segment is described by its *offset*.

There's nothing intrinsically wrong with a segmented architecture. It eases some system housekeeping tasks, like code relocation. Convincing a piece of 6502 machine code on an Apple to move from the address it was originally loaded into took patience and knowledge of 6502 assembly language; moving some 8088 code from one place to another takes only a "memory move" command and a reload of the pointers to the code and data. The problem is the 64K-byte limit.

Truthfully, most code segments are not affected by the 64K-byte barrier, although it does pose a minor hindrance. The way around this limit for code segments is to simply put different subroutines in different segments. Subroutines can then call one another by jumping from one code segment to an entirely different one. This is called a *far call*. On the other hand, putting multiple subroutines into the same code segment means that the programmer needn't jump from code segment to code segment, and this is called a *near call*. Far calls take a bit longer to process.

The larger annoyance comes from data areas. It's much easier to write code that keeps each data structure entirely in a single data segment. Data structures that require more than one 64K-byte segment require constant loading and reloading of the pointers to the data segments. As is the case with avoiding far calls, avoiding dealing with segments improves performance.

It's easy to see this. Just write a simple program that creates and fills an array smaller than 64K bytes. Compile it as a small memory model (all near references) and run it. Then recompile it as a large memory model (force all references to be far) and rerun it. You're not getting anything more accomplished, but the program will probably take about 20 percent longer to execute.

That's a lot of time to waste in system overhead. Imagine what a pain it must be to write a spreadsheet program for earlier versions of OS/2 if you want to let a spreadsheet grow to 16 megabytes: You would potentially have to manage 256 64K-byte segments! It's not only an annoyance to programmers, it's also depriving you and me—tons of good Unix and mainframe programs have never been ported to the IBM PC just because dealing with this 64K-byte segment nonsense seemed like too much trouble.

Enter the 386. It can address 4096 MB of memory, again using a segment:offset addressing scheme. But the segments

continued

ILLUSTRATION: CHRIS SCHMIDT © 1990

World Radio History

themselves can be as large as 4096 MB. Thus, a programmer can choose to make all the memory one big segment: OS/2 2.0 does that, and that's the "0:32 memory model" that you see references to in the press. Version 2.0 essentially discards the notion of segments.

Making all the memory a single segment means that all code and data references are near references. The payoff is immediate: I created a 1-MB data structure using 64K-byte segments and then rewrote the program for OS/2 2.0 without segments. Despite the fact that both programs ran on the same machine, both under version 2.0, the no-segment version was almost 20 percent faster.

"Wait a minute," you ask. "How can OS/2 make the memory one big pool, yet keep buggy applications from crashing the system and each other?" A good question—wasn't a protected-mode operating system one of OS/2's goals? Sure, and that hasn't changed.

"Compiler Ads Are Confusing."

They all claim that their products are the fastest and most powerful. Buzz words like optimized, integrated, and modular are everywhere—never meaning quite the same thing.

We'd like to be more direct. We'll tell you what you can do with our compiler—then you make the comparisons.

■ DUAL PERFORMANCE You have two compilers in one integrated package—Quick for speed applications development and optimizing for the best code generation—with a simple menu option to move between the two. ■ FLEXIBILITY You can interface directly with C or any other language. Write only one set of sources for DOS and OS/2, run the most complex applications with no change. ■ COMPATIBILITY You can generate code compatible with Microsoft Windows, using all window facilities. And develop Presentation Manager applications with no additional software. ■ OPTIMIZATION You get true global optimization, using data flow analysis and proprietary techniques, not just the standard peephole optimization and automatic assignment of variables to registers. ■ ENVIRONMENT You have many features you won't find in any other environment—like the ability to organize your code into separate libraries and set compiler options both globally and on a per-module basis. And a make facility that is so well integrated, you don't even know it's there. ■ TOOLS You get a debugger, profiler, object librarian and overlay linker with unique capabilities. And a runtime library with surprises like interrupt driven serial communications, true multitasking, graphics, and mouse interface modules.

Stony Brook Professional Modula-2 (both the Quick and optimizing compilers for DOS *and* OS/2) for $295. Stony Brook QuickMod (for DOS *or* OS/2) for $95.

Stony Brook—we eliminate the confusion.

■ The fine print version of this information with all the details, including our benchmark performances, will be mailed to you within 24 hours if you call our 800 number.

Stony Brook SOFTWARE

Your Partner in Software Development

800/624-7487 805/496-5837 California and International

805/496-7429 Fax

187 East Wilbur Road, Suite 9
Thousand Oaks, CA 91360

©1989 Gogesch Micro Systems, Inc.

Remember my discussion last month of paged memory? Each program gets a *memory page table*. The program then refers to this table of 4K-byte pages, not actual memory: It sees only the memory that it's supposed to see. The size of the table can be restricted by the operating system, and that's how the protection is accomplished. Although your 386 may have 8 MB of RAM, your application may know of only 2 MB.

Further, the virtual memory system still remains in place, although now it swaps to disk on the basis of pages rather than segments. That's more efficient (although I haven't tested it yet), because operating-system designers can plan on needing exactly 4K bytes of disk space for each memory page. Segments, on the other hand, could be smaller than 1K byte or as large as 64K bytes.

As the days go on and I find out where the minefields are, I use the machine running version 2.0 more and more. It's a real improvement.

Applications Keep Pouring In...

About a year and a half ago, I wrote part of a book on OS/2 (*Using OS/2* from Que) and needed very much to capture Presentation Manager screens. Microsoft included a screen grabber with its Software Development Kit, but it saved only to Windows Paint format. Better than nothing, but I still had to get proficient at taking photographs of computer screens. Many were the times I longed for a PM screen capture program.

Nowadays there are two: Charles Petzold has written one called PMCAP and put it in the public domain (you can find it in the ibm.os2 conference on BIX), and recently I've been using Hotshot Graphics from Symsoft. The latest version, 1.7, still runs only under DOS, but it includes a screen grabber that works under PM and produces great output on a laser printer. It also saves to .PCX format, so you can easily include screen shots in most desktop publishing systems. If you're documenting a PM application, I recommend Hotshot Graphics.

Last month, I mentioned an inexpensive text editor called Qedit, but I bemoaned the lack of block fills and command repeat prefixes. Both problems are now fixed in version 2.8. A mere $79 gets you this nifty OS/2 text editor from SemWare (4343 Shallowford Rd., Suite C-3, Marietta, GA 30062, (404) 641-9002). I've now converted to Qedit for all my daily work, under DOS and OS/2.

And if you're bored by the dull gray background of the PM desktop, get on

continued

Circle 268 on Reader Service Card (DEALERS: 269)

World Radio History

The New Hercules Graphics Station Card

Introducing the Hercules Graphics Station Card. With more features than any card in its class. And more power. The company that took the monotony out of monochrome now puts more zip into analog monitors.

Fast Graphics

Time is more precious then ever. But Windows 286 applications like PageMaker, Excel and Corel Draw can make you wait while they work. Not with the Hercules Graphics Station Card—it'll run Windows 286 programs up to five times faster than a regular VGA card and at higher resolutions too! And soon it will bring even more performance to Windows 3.0 applications.

The secret is the on-board Texas Instruments 34010 graphics processor. It frees the CPU from the drudgery of graphics functions and screen memory control so you won't have to wait for your screen to catch up with you.

From VGA on UP

A whole megabyte of video memory lets the Hercules Graphics Station Card offer a full range of modes—from VGA up to 1024 x 768 resolution with 256 colors, and plenty in between. So it will run all your software—from general business to complex design programs. And as your software needs become even more sophisticated, you won't need to shop for a new video card.

Life-like Images

Computer images can look realistic when software can access more colors. The 16- and 24- bit color modes on the Hercules Graphics Station Card allow any standard analog monitor to display up to 16.7 million colors for high quality photo-realistic images.

And best of all, you can have all these features for less than you'd think. Call us at **800 532-0600, ext. 245** (U.S.) or **800 323-0601, ext. 246** (Canada) for the quickest way to your Hercules dealer.

© Copyright, 1990 Hercules Computer Technology, Inc., 921 Parker Street, Berkeley, CA 94710. Hercules and Hercules Graphics Station Card are trademarks of Hercules Computer Technology, Inc. All other product names are trademarks of their respective owners.

Circle 323 on Reader Service Card

Hercules

Takes the wait out of Windows!

World Radio History

ITEMS DISCUSSED

Hotshot Graphics 1.7 .....$247
Symsoft Corp.
444 First St.
Los Altos, CA 94022
(415) 941-1552
Inquiry 991.

BIX (ibm.os2/listings) and get ahold of ANIMATE.EXE. It replaces the gray background with either a moving starfield, fireworks, walking lines, or kaleidoscopic wallpaper.

Two Short HPFS Tips

I was asked by two readers—Jim Gilliland and Christopher Boaro—to add to my discussion of a few months ago about High Performance File System speed. I found HPFS's speed improvements over file allocation table–based systems to be measurable but nonspectacular. I said then that I really don't care about the speed improvement, as I was happy enough about long names, extended attributes, and the rest.

Both readers ask me to point out that the big HPFS performance improvement comes with a big cache—not the 64K-byte cache that gets set up by default, but a 256K- or 512K-byte cache. (You just change the line in your CONFIG.SYS that says IFS=C:\OS2\HPFS.IFS-C:64 so the 64 is expanded to whatever size your memory can bear.) Then you can turn on "lazy writes" by adding RUN =C:\OS2\CACHE.EXE /LAZY:ON to CONFIG.SYS.

A final tip for the month: When doing a class for a client, I reformatted an entire 20-MB hard disk drive and installed HPFS. The next day, the client called me, as he was trying to reformat the drive back to DOS. He'd boot from a DOS floppy disk, try to format C, and get "format failure." It took me a minute to realize what was going on: HPFS uses a new "partition ID" code. It's different from DOS's partition ID code—hence the format failure. The fix is easy. Run DOS FDISK, delete the HPFS partition, and then create a new DOS partition. Then you can format without trouble. ■

Mark J. Minasi is a managing partner at Moulton, Minasi & Company, a Columbia, Maryland, firm specializing in technical seminars. He can be reached on BIX as "mjminasi."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Haven't you heard?

You should know about EasyFlow!

Chances are you've heard one of our 80,000 ecstatic customers talking about **EasyFlow**.
They're talking about how much time you can save on flowcharts and data flow diagrams and how **EasyFlow**, unlike most "screen draw" programs, is dedicated to fast composition and modification of flowcharts and data flow diagrams.
They're talking about the automatic line routing, automatic text centering, the slick cut & paste and how they can create charts and then cleanly move them into a desktop publishing program.
They're talking amongst themselves but they don't tell their bosses. Their bosses think they had to sweat bullets to come up with these amazing results. *You mean you still do?!*
They're saying **EasyFlow** works with most matrix printers, laser printers and plotters and comes with a 200 page manual.
They're saying they got all this plus 350 context sensitive help messages on screen for only $149.95
and that RUSH delivery is available.
If you haven't heard, call us and find out for yourself what everyone else is talking about!

EasyFlow

Flowcharting Made Easy!

HavenTree Software Limited
P.O. Box 1093 - A Thousand Island Park, NY 13692
Order Desk: 1-800-267-0668
Info: (613) 544-6035 ext.80 Fax: (613) 544-9632
From our fax to yours... Info Fax: (613) 544-2049

Circle 112 on Reader Service Card

World Radio History

NEW ADVANCED AT TECHNOLOGY

Stronger • Smaller • More Efficient

COMPUTER NOTIFICATION & UNATTENDED SHUTDOWN

...with Universal Cable Interface

NEW STANDBY UPS MODELS

- 250 VA To 2300 VA
- Sinewave Output 1 msec Transfer MAX
- More Features & Power at a Lower Price

CABLE INTERFACE STANDARD

Shutdown Interface To:

- Microsoft LAN Manager 2.0
- Novell
- Banyon
- 3Com
- System V Unix
- SCO Xenix
- Custom Configurations Any System

SHUTDOWN SOFTWARE FOR NOVELL & SCO XENIX

MINUTEMAN® A.T.

UNINTERRUPTIBLE POWER SUPPLIES

SLIMLINE AT650

UPRIGHT AT 800 →

NEW A.T. MODELS

Model	List Price
AT250	$ 339.00
AT450	$ 469.00
AT600	$ 689.00
AT650	$ 599.00
AT800	$ 879.00
AT1200	$1179.00
AT1600	$1479.00
AT2300	$1979.00

Ask About Our Novell Approved MONITOR BOARDS

ON-LINE UPS MODELS
1000VA To 5000VA
Sinewave Output

220 Volt Models for International use Available

PARA SYSTEMS, INC.

1455 LeMay Drive
Carrollton, TX 75007

Telephone:
(214) 446-7363

FAX: (214) 446-9011 TELEX: 140275 OMEGA

1-800-238-7272

Circle 197 on Reader Service Card

World Radio History

With Windows you can

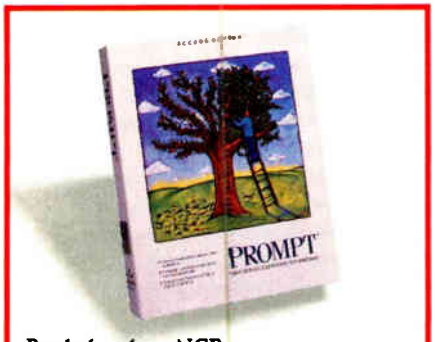
Intel ... 5 years
4275 *Connection CoProcessor*–Send and receive faxes from within many popular applications. 2400 bps modem option also available. Includes free copy of Fax-it software for Windows. . . . . $529.

☐ 3½" format available from us. Specify when ordering.
◙ package includes both 5¼" and 3½" disks.
▣ 3½" format available from manufacturer by request. Call us for details.
CP—copy-protected; **NCP**—not copy-protected.

The four-digit number next to each product is the product's ITEM NUMBER. Please refer to this number when ordering. Thank you.

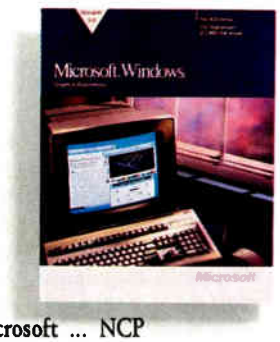
SOFTWARE

We only carry the latest versions of products. Version numbers in our ads are current at press time.



Broderbund ... NCP
7289 ◙ *Prompt 1.0*–Makes hard disk management under Windows quick and easy. Search, move, copy, rename, delete, compress, or encrypt files in one easy step. Even view contents of most files . . . . . $79.

Adobe Systems ... NCP
6591 ◙ Illustrator Windows 1.0. . . . . $279.
6590 ◙ Streamline Windows 1.0 . . . . . 229.
(Entire Adobe Type Library, from 1 to 133 are available. Call for more information.)
Aldus ... NCP
1332 ☐ PageMaker 3.01 . . . . . 499.
Alpha Software ... NCP
5104 ◙ Alpha Four 1.1 . . . . . 319.
4103 ◙ Alpha Works 2.0 . . . . . 89.
Application Techniques ... NCP
1214 ◙ Pizazz Plus 2.0. . . . . 69.
Ashton-Tate ... NCP
6922 ☐ MultiMate 3.31. . . . . 69.
4450 ☐ dBASE IV 1.0 . . . . . 499.
Autodesk ... NCP
4519 ☐ Autosketch 2.0. . . . . 95.
6119 ☐ Autosketch Animator 1.0 . . . . . 245.
Avery ... NCP
6006 ◙ Label Pro 1.0. . . . . 49.
Bitstream ... NCP
◙ Collections: Newsletters, Flyers, Books & Manuals, Reports and Proposals, Presentations or Spreadsheets *each* 159.
◙ Fontware . . . . . *each* 99.



Microsoft ... NCP
7010 ☐ *Windows 3.0*–It's what the GUI ("gooie") gurus have been waiting for. The latest in Graphical User Interface for MS-DOS machines. Lets each application access much more memory and do it faster . . $89.

Bloc Publishing ... NCP
1447 ☐ FormTool 2.01 . . . . . 55.
6245 ◙ PopDropPLUS 1.0. . . . . 59.
Borland International ... NCP
4330 ▣ Turbo C Professional Pack 1.0 . . . . 175.
4332 ▣ Turbo Pascal Professional Pack 1.0. 175.
6242 ◙ Quattro Pro 1.0 . . . . . 325.
1514 ◙ Paradox 3.0. . . . . 469.
Brightbill-Roberts ... NCP
5408 ☐ Hyperpad 1.0 . . . . . 85.
Broderbund ... CP
1434 ☐ New Print Shop *(NCP)* . . . . . 39.
1433 ◙ Memory Mate 3.01 *(NCP)* . . . . . 45.
7288 ◙ Prompt 1.0 for Windows . . . . . 79.
7289 ◙ Dragnet 1.0 for Windows . . . . . 89.
ButtonWare ... NCP
6419 ◙ PC-File 5.0. . . . . 75.
Caere ... NCP
6004 ◙ Omnipage 386 2.1 . . . . . 599.

Central Point ... NCP
5039 ◙ PC Tools Deluxe 6.0. . . . . $89.
5038 ☐ Copy II PC 5.0. . . . . 27.
Chronos Software ... NCP
4387 ◙ Who•What•When 2.0 . . . . . 179.
Concentric Data Systems ... NCP
6575 ◙ R & R Relational Report Writer 3B 109.
Corel Systems ... NCP
5506 ☐ CorelDRAW! 1.2 . . . . . 329.
Crosstalk Communications ... NCP
2908 ☐ Crosstalk XVI 3.7 . . . . . 119.
5611 ☐ Crosstalk for Windows 1.0 . . . . . 129.
Data Storm ... NCP
4798 ◙ PROCOMM PLUS 1.1 . . . . . 65.
Delrina Technology ... NCP
4325 ◙ PerFORM 2.1 *($30 rebate!)* . . . . 159.
Delta Technology ... NCP
5829 ◙ Direct Access 5.0. . . . . 52.
Digital Composition Systems ... NCP
5876 ◙ db Publisher Report Maker 2.0 . 185.
Dow Jones ... NCP
5494 ◙ News/Retrieval Membership Pkg. 24.
5th Generation ... NCP
2762 ☐ Mace Utilities 1990. . . . . 89.
3950 ◙ Fastback Plus 2.1 . . . . . 109.
FormWorx ... NCP
5810 ☐ FormWorx with Fill & File 2.5 . . . . 85.
Fox Software ... NCP
6188 ▣ FoxPro 1.0. . . . . 489.
2233 ▣ Foxbase Plus 2.1 . . . . . 199.
Franklin Software ... NCP
7071 ◙ Language Master 2.2 . . . . . 59.
Funk Software ... NCP
2228 ☐ Sideways 3.21 . . . . . 42.
4479 ☐ Allways 1.1. . . . . 115.
Generic Software ... NCP
2265 ▣ Generic CADD Level 3 1.1.3. . . 225.
Great American Software ... NCP
4880 ☐ One Write Plus Accounting Sys. 2.06 179.
5825 ◙ Money Matters 1.0. . . . . 55.
Harvard Associates ... NCP
2324 ▣ PC Logo 3.0 . . . . . 59.
Hilgraeve ... NCP
2323 ◙ HyperACCESS/5 1.1 *(DOS & OS/2)* 115.

Corel Systems ... NCP
5506 ☐ *CorelDRAW! 1.2*–The world's finest PC illustration software now comes with even more value: CorelTRACE, over 100 typefaces, over 300 clip-art images, a Pantone license–all bundled in for free . . . . . $329.

PC CONNECTION®

World Radio History

have the same interface

IBM ... NCP
6187 ▣Storyboard Plus 2.0 ..... $239.
6599 □Current 1.0 ..... 239.
Individual Software ... NCP
2408 □Professor DOS 4A ..... 27.
6222 ▣Resume Maker 1.0 ..... 29.
Intuit ... NCP
2426 ▣Quicken 3.0 ..... 39.
LaserTools ... NCP
6882 ▣PrintCache 2.2 ..... 99.
Lord Publishing ... NCP
5191 ▣Ronstadt's Financials 1.02 ..... 75.
Lotus ... NCP
5417 □1-2-3 3.0 ..... call
5653 □1-2-3 2.2 ..... call
5134 ▣Magellan 2.0 ..... 119.
2660 □Freelance Plus 3.01 ..... 345.
MECA ... NCP
2798 □Managing Your Money 6.0 ..... 119.
7002 ▣Home Lawyer 1.0 ..... 69.
Microcom ... NCP
6234 □CarbonCopy Plus 5.2 *(2 req.)* ... 115.
Micrografx ... NCP
6597 ▣Designer 3.0 ..... 489.
Micro Logic ... NCP
6787 ▣Info Select 1.1 ..... 55.
Microlytics ... NCP
2731 □GOfer 2.0 ..... 45.
MicroMaps ... NCP
6890 □AtlasPC 1.0 *(PCX version)* ..... 45.
6891 □AtlasPC 1.0 *(EPSF version)* ..... 105.
Microsoft ... NCP
2860 □Learning DOS 2.0 ..... 35.
7010 □Windows 3.0 ..... 89.
2904 □Works 2.0 ..... 99.
2901 □Word 5.0 ..... 209.
6195 ▣Word for Windows ..... 329.
2856 ▣Excel 2.1 *(req. 80286/80386)* ... call
6133 ▣Excel for OS/2 1.0 ..... 339.
5188 □QuickPascal 1.0 ..... 55.
2894 □QuickBASIC 4.5 ..... 69.
2895 □QuickC 2.0 ..... 69.
2853 ▣C Compiler 6.0 ..... 339.
2880 ▣Macro Assembler 5.1 ..... 99.

Franklin Software ... NCP
7071 ▣*Language Master 2.2*–Provides dictionary definitions for 80,000 words plus the largest thesaurus available. The writing tool that's just a hot key away. Supports all major word processors ..... $59.

Multisoft ... NCP
6805 □PC-Kwik Power Disk 1.0 ..... $49.
4925 □PC-Kwik Power Pak 1.5 ..... 79.
Nolo Press ... NCP
2982 □WillMaker 3.0 ..... 35.
Norton-Lambert ... NCP
4928 □Close-Up Customer 3.0 ..... 135.
4929 □Close-Up Support 3.0 ..... 165.
PC Globe ... NCP
5902 □PC Globe 3.0 ..... 39.
5900 □PC USA 1.0 ..... 39.
Personics ... NCP
3126 ▣SeeMORE 2.0 ..... 54.
4384 ▣Ultravision 2.0 ..... 79.
Peter Norton ... NCP
3152 ▣Norton Commander 3.0 ..... 99.
3146 ▣Advanced Utilities 4.5 ..... 99.
6397 ▣The Norton Backup 1.0 ..... 99.
Precision Software ... NCP
6600 ▣Superbase 4 for Windows ..... 429.
Quarterdeck ... NCP
6422 □QRAM 1.0 ..... 49.
3221 □Expanded Memory Mgr. 386 5.0 . 59.
3220 □DESQView 2.26 ..... 79.
4586 □DESQView 386 1.1 ..... 129.
6400 □Manifest 1.0 ..... 39.

Broderbund ... NCP
7228 ▣*Dragnet 1.0*–Lightning fast text retrieval for Windows. Searches through any file format. Cut & paste into Windows programs or launch the application and data file in one easy step ..... $89.

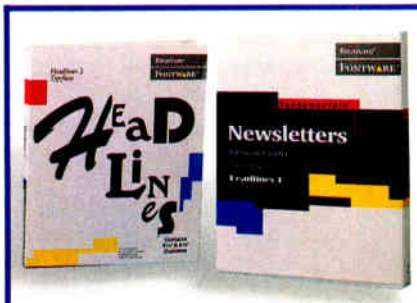
Reality Technologies ... NCP
6572 ▣WealthBuilder 1.01 ..... 145.
Reference Software ... NCP
4396 ▣Grammatik IV 1.0 ..... 52.
Revolution Software ... NCP
4480 ▣VGA Dimmer 2.01 *(screen saver)* . 19.
RightSoft ... NCP
4155 ▣RightWriter 3.1 ..... 54.
Samna ... NCP
5799 ▣Ami Professional 1.0 ..... 309.

1-800/776-7777

MMC
PC Connection
6 Mill Street
Marlow, NH 03456
SALES 603/446-7721 **FAX** 603/446-7791
740B

Symantec ... 1 year
3425 □*Q&A 3.0*–The top-rated, best-selling integrated database and word processor offers simple mail merge, detailed reporting, versatile word processing, advanced network, support, and more ..... $229.

Softlogic Solutions ... NCP
3546 □Disk Optimizer 4.05 ..... 45.
3542 □Software Carousel 4.0 ..... 55.
Software Publishing ... NCP
3499 □PFS:First Publisher 3.0 ..... 99.
3478 □PFS:First Choice 3.02 ..... 105.
3496 □Professional Write 2.2 ..... 165.
3493 □Professional File 2.01 ..... 199.
3482 □Harvard Graphics 2.13 ..... 339.
6289 ▣Draw Partner 1.0 *(for Harvard Graph.)* 59.
Symantec ... NCP
3412 ▣Grandview 1.0 ..... 199.
3425 □Q&A 3.0 ..... 229.
3431 □Timeline 4.0 ..... 469.
Systems Compatibility ... NCP
6564 □Software Bridge 4.1 ..... 79.
TIMESLIPS ... NCP
2987 □Timeslips III 3.4 ..... 169.
6994 □PercentEdge 1.0 ..... 69.
Timeworks ... NCP
6253 ▣Publish-It! 1.1 ..... 115.



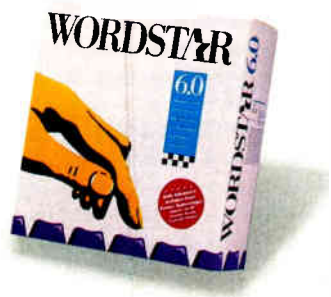
Bitstream ... NCP
▣*Fontware*–52 different typeface packages in point sizes from 2 to 144 ..... **each $99.**
▣*Collections*–Typeface packages designed to produce Books & Manuals, Reports & Proposals, Newsletters & more . **each $159.**

PC CONNECTION®

ALL ITEMS SUBJECT TO AVAILABILITY. PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

World Radio History

For your writing and



WordStar International ... NCP

6791 ☐ *WordStar Prof. 6.0*–Offers support for advanced scalable-font laser printers (including the new Hewlett-Packard LaserJet III), Advanced Page Preview, plus the word processing features you need ..... $279.

TOPS ... NCP

6675 ☐TOPS Network Bundle 3.0 ..... 159.
3720 *Flashcard 2.1 (AppleTalk network card; 1 year warranty)* ..... 155.

Traveling Software ... NCP

4190 Battery Watch 2.0 *(3½" only)* ..... 35.
5179 ◙LapLink III 3.0 ..... 95.

True BASIC ... NCP

3561 ◙True BASIC 2.1 ..... 52.

Vericomp ... NCP

3765 ◙SoftBytes 2.0 ..... 35.
6771 ◙Memory Master 1.0 ..... 45.

WordPerfect Corp. ... NCP

3804 ☐WordPerfect 5.1 ..... 265.
6685 ◙DrawPerfect 1.0 ..... 279.

WordStar International ... NCP

6791 ☐WordStar Prof. 6.0 ..... 279.

Xerox ... NCP

3812 ☐Ventura Publisher 2.0 ..... 529.

XTREE ... NCP

6161 ◙XTreePro Gold 1.3 ..... 75.

Software Publishing ... NCP

NEW! Business Gallery and Recreation Gallery with hundreds of images for the new First Publisher 3.0.

7296 ◙*Business Gallery* ..... $54.
7297 ◙*Recreation Gallery* ..... 54.

RECREATIONAL/EDUCATIONAL

Broderbund ... CP

5701 ☐Where/Time Carmen Sandiego? .. $32.
6295 ◙The Playroom ..... 32.
5851 ◙SimCity ..... 33.

Electronic Arts ... NCP

6436 ◙Hunt for Red October ..... 20.
4659 ◙Chessmaster 2100 *(CP)* ..... 35.
5804 ◙Deluxe Paint II *(Enhanced)* ..... 89.

Microsoft ... NCP

2858 ☐Flight Simulator 4.0 ..... 39.

Parlor Software ... CP

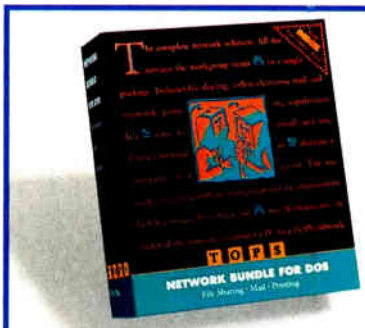
3159 ☐Bridge Parlor 2.3 ..... 49.

Penton Overseas ... NCP

◙VocabuLearn/ce Levels I & II (French, Italian, German, Spanish, Russian, and Hebrew) ..... *each* 39.

Sierra On-Line ... CP

6023 ◙Leisure Suit Larry III ..... 39.
6796 ◙Codename: Iceman ..... 39.
6972 ◙Conquests of Camelot ..... 39.



TOPS ... NCP

6675 ☐*Network Bundle for DOS 3.0*–Allows you to quickly and easily share files, electronic mail, and printers between your Apple Macintosh, IBM PC and/or Sun Workstation. Now includes Inbox EMail software . $159.

Spectrum Holobyte ... NCP

5993 ◙Welltris ..... 22.

Stone & Assoc. ... NCP

3438 ◙Young Math *(ages 5 to 8)* ..... 22.
3439 ☐2nd Math *(ages 7 to 16)* ..... 27.

True BASIC, Inc. ... NCP

◙Kemeny/Kurtz Math Series: 10 titles ..... *each* 45.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

American Power ... 2 years

6812 200DL *(stand-by power source)* .. 155.
6811 360SX *(stand-by power source)* ... 255.
7107 450AT *(stand-by power source)* ... 339.
7106 520ES *(stand-by power source)* ... 399.
7105 600LS *(stand-by power source)* ... 469.

MECA ... NCP

7002 ◙*Home Lawyer 1.0*–Let Hyatt Legal Services help you through the legalese by using plain English. Contains 16 commonly used documents and guides you step-by-step through each one ..... $69.

AST Research ... 2 years

1299 SixPakPlus 384k C/S/P ..... 187.
6795 SixPak 286 512k ..... 209.
4107 RAMpage Plus 286 512k ..... 419.
6980 VGA Plus *(w/512K) (800 x 600 res)* 159.

Boca Research ... 5 years

7001 BOCARAM/AT PLUS *(0-8 Meg ext.)* 125.
7000 TophAT *(16-bit backfill 512K to 640K, with 0K)* ..... 79.
6998 I/O Board for AT ..... 59.
6999 I/O Board for Microchannel S/S/P . 109.

Brother International ... 1 year

5787 HL-8e Laser Printer ..... 1799.
5788 HL-8Ps PostScript Laser Printer . 2949.

Compucable ... 2 years

1604 2-Position switch box ..... 25.

Cuesta ... 1 year

1608 Datasaver 400 Watt *(power backup)* 429.

Curtis ... lifetime

1694 Emerald SP-2 ..... 36.
1707 Ruby SPF-2 *(6 outlets)* ..... 55.
1708 Ruby-Plus SPF-2 Plus ..... 65.

Datadesk ... 3 years

6901 Switchboard ..... 175.

Diconix ... 1 year

5655 150 Plus Printer *(Parallel)* ..... 359.

Epson ... 1 year

We are an authorized Epson Service Center.

1906 FX-850 *(80 col., 264 cps, 9 pin)* ... call
1904 FX-1050 *(136 col., 264 cps, 9 pin)* .. call
5183 LQ-510 *(80 col., 180 cps, 24 pin)* ... call
1930 LQ-850 *(80 col., 264 cps, 24 pin)* .. call
6765 LQ-1010 *(136 col., 180 cps, 24 pin)* call
1917 LQ-1050 *(136 col., 264 cps, 24 pin)* call
4116 LQ-2550 *(136 col., 333 cps, 24 pin)* call
5184 LX-810 *(80 col., 180 cps, 9 pin)* .... call
1052 Printer-to-IBM cable *(6 feet)* ..... 15.

5th Generation ... 1 year

7157 Logical Connection Plus 512k .... 599.

Hayes ... 2 years

2307 Smartmodem 2400 ..... 349.
2308 Smartmodem 2400B *(w/Smartcom II)* 279.

Hercules ... 2 years

2318 Graphics Card Plus ..... 189.

PC CONNECTION®

World Radio History

The Three Biggest Lies:

1. **The check is in the mail.**
2. **My diet starts tomorrow.**
3. **Performance doesn't matter in 3270 communications.**

The truth is, for most 3270 PC-to-mainframe applications, performance DOES matter.

When you're linking multiple PCs — a few, a dozen, or hundreds — to your IBM mainframe, it just makes sense to do it with the highest speed and efficiency available. Often, a simple plug-and-play product isn't enough.

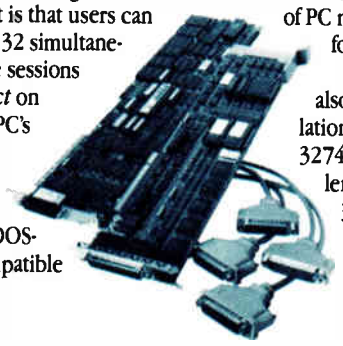
32 sessions with no impact on your gateway PC.

Consider DataTalker 3270. It's designed *specifically* for high-performance, multiple-user applications.

We deliver DataTalker 3270 on a powerful co-processor board with on-board memory. This allows you to offload all communications processing from your gateway PC, freeing it for applications processing.

The result is that users can perform up to 32 simultaneous mainframe sessions with *no impact* on your gateway PC's performance.

We offer DataTalker 3270 in both DOS- and UNIX-compatible versions. Each provides full IBM 3278/79 terminal emulation, 32 LUs, file transfer (IND$FILE), BSC or SNA support, NetView support, and Application Program Interface (our own plus IBM's HLLAPI 3.0). Only 1K of PC memory is required for API applications.



DataTalker 3270 also provides full emulation of IBM 3174, 3274, and 3276 controllers, as well as IBM 3287 printers.

Only 1K of memory required for API applications.

To learn the truth — and nothing but the truth — about our high-performance DataTalker 3270, call us today at **1-800-233-2536.** Or write to us at 3796 Plaza Drive, Ann Arbor, Michigan 48108. FAX: 313/662-1965.

CLEO

CLEO Communications
A Division of Interface Systems, Inc.

World Radio History

numbers and database.

Epson ... 1 year
5183 *LQ-510 Printer*–Makes high quality 24 pin printing affordable. Includes push tractor and Epson's exclusive SmartPark paper handling features standard. 180 cps draft, 60 cps LQ (12 cpi mode)..... **call**

Hewlett-Packard ... 1 year
3754 LaserJet III *(w/toner)* ..... 1699.
3582 LaserJet IIP *(w/toner)* ..... 1069.

Intel ... 5 years
3421 2400B MNP Internal Modem .... 199.
352 2400B Internal Modem 2 *(for PS/2)* 249.
119 2400 Baud External Modem ..... 179.
420 2400EX MNP Modem..... 229.
346 Inboard 386/PC w/1 Meg *(w/free Ami)* 519.
4266 Above Board Plus 512k..... 419.
4267 Above Board Plus I/O 512k..... 449.
5336 Above Board Plus 8 2 Meg..... 599.
5342 Above Board Plus 8 I/O 2 Meg ... 629.
4272 Above Board 2 Plus 512k ..... 169.
5396 Above Board MC 32 0k ..... 359.
4275 Connection CoProcessor *(w/Fax-it)*. 529.
MATH COPROCESSORS
2370 80287-8 *(for 8 MHz 80286 CPU's)* . 199.
2369 80287-10 *(for PS/2 Models 50 & 60)* 229.
4750 80387SX *(for 80386SX CPU's)*.... 309.
2371 80387 *(for 16 MHz 80386 CPU's)*.. 349.
2372 80387-20 *(for 20 MHz 80386 CPU's)*399.

Kensington Microware ... 1 year
2582 Master Piece Plus ..... 109.
5697 Expert Mouse *(Trackball for PS/2)* . 115.

Key tronic ... 3 years
4518 101 Plus Keyboard ..... 99.

Kraft ... 5 years
5801 New Game Adapter *(2 game ports)*. 27.
5800 3 button Thunder Joystick..... 29.
5802 Trackball..... 69.

Logitech ... limited lifetime
5464 C9 Mouse for PS/2's..... 69.
5151 HiREZ Mouse *(C9)* ..... 85.
6029 Trackman *(Trackball) serial* 85. *bus* 89.
4297 ScanMan Plus *(hand scanner)* ... 185.
6786 ScanMan w/Catchword 1.0..... 315.

Micron Technology ... 2 years
6669 Intensify 2 Meg Expansion for HP LaserJet II *(upgradeable to 4 Meg)*. 329.
6013 Beyond Mem. Brd. for Model 50 *(512k)* 359.

Microsoft ... lifetime
2897 Mouse with Paintbrush ..... 109.
2898 Mouse with Windows 3.0 ..... 149.

MicroSpeed ... 1 year
6007 PC-TRAC Trackball *serial* $75. *bus* $85.
6010 FastTRAP 3D Trackball *serial* 99. *bus* 109.

Mouse Systems ... lifetime
5997 Trackball *(1 yr. wrnty.) serial* 75. *bus* 85.
4306 PC Mouse II w/PC Paint+ ..... 89.

NEC ... 2 years
4799 Multisync 2A *(VGA Monitor)* ..... 499.
5085 Multisync 3D Monitor ..... 689.
6208 Multisync 4D Monitor..... 1199.

Orchid Technologies ... 4 years
4690 ProDesigner VGA *(800 x 600)* .... 249.

PC Power & Cooling ... 1 year
REPLACEMENT POWER SUPPLIES
3202 Turbo Cool 150 *(25° - 40° cooler)* 129.
3200 Silencer 150 *(84% noise reduction)* 115.

Pacific Data Products ... 1 year
6779 25 Cartridges in One! *(for LJ II, IIP, IID)* .275.
7072 25 Cartridges in One! *(for LJ III)*. .....349.
7054 Memory upgrade for LaserJet IIP/III
1 Meg ..... 179. *2 Meg* ..... 249.
6839 Memory upgrade for LaserJet II
1 Meg ..... 179. *2 Meg* ..... 249.
6833 Pacific Page *(PostScript Cartridge for LaserJet IIP/III)* ..... 379.
6834 Pacific Page *(for LaserJet II)* ..... 499.

Intel ... 5 years
2346 *Inboard 386/PC with Free Samna Ami*–Gives you 80386 processing power, 1 Mb RAM, and Samna's powerful windows-based word processor (regularly at $129). 30 Day Money Back Guarantee..... **$519.**

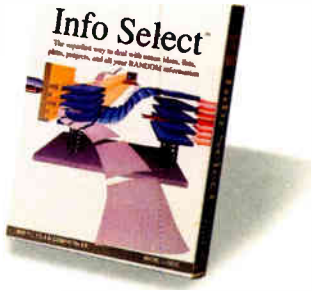
Practical Peripherals ... 5 years
3101 1200 Baud Internal Modem ..... 65.
3100 1200 Baud External Modem *(mini)* . 77.
3103 2400 Baud Internal Modem ..... 135.
3102 2400 Baud External Modem..... 179.
5286 2400 Baud Int. MNP Modem *(Lev. 5)* 175.
5285 2400 Baud Ext. MNP Modem *(Lev. 5)* 209.
4542 2400 Baud Internal Modem for PS/2 . 229.

Reflection Technology .. 1 year
7127 Private Eye *(visual display)* ..... 499.

1-800/776-7777

MMC

PC Connection 740B
6 Mill Street
Marlow, NH 03456
SALES 603/446-7721 **FAX** 603/446-7791



Micro Logic ... NCP
6787 ◙*Info Select 1.1*–The fastest most exciting new way to deal with notes, ideas, plans, contacts, and all your RANDOM information. Easy yet powerful. Endless uses . **$55.**

SAFE Power Systems ... 2 years
4562 Safe 425W *(standby power bkup)* 329.
6747 Safe 400S..... 409.

SOTA Technology ... 2 years
5111 SOTA 286i-12 *(12 MHz accelerator)* 269.
5402 SOTA 386i-16 *(16 MHz accelerator)* 389.

Targus ... lifetime
7028 Foliopac 1..... 79.
4899 Nylon Laptop carrying case ..... 55.
6037 Premier leather carrying case .... 199.

TheComplete PC ... 2 years
5598 TheComplete Half Pg. Scanner 400 189.
5140 TheComplete Page Scanner..... 549.
5828 TheComplete Communicator ..... 559.

Tripp Lite ... 2 years
6199 Isobar 4-6 *(4 outlets, 6 ft. cord)* .... 49.
6200 Isobar 6-6 *(6 outlets, 6 ft. cord)* .... 59.
6019 LS 600 Line Stabilizer ..... 85.

Video 7 ... 7 years
5883 1024i VGA *(includes 512k)* ..... 289.
4931 VRAM VGA 512k ..... 399.

Intel ... 5 years
Features data compression for faster throughput and error-correction for more reliable transmissions.
6421 *2400B MNP Internal Modem*..... **$199.**
6420 *2400EX MNP Modem* ..... 229.

PC CONNECTION®

*DEFECTIVE SOFTWARE REPLACED IMMEDIATELY. DEFECTIVE HARDWARE REPLACED OR REPAIRED AT OUR DISCRETION.

World Radio History

Learn one. Learn all.

DRIVES

IOMEGA ... 1 year

116 Bernoulli II Single 44 Meg Internal $995.
117 Bernoulli II Dual 44 Meg External 1969.
113 44 Meg Cartridge Tripak *(5¼")* . . . 249.
Controller Cards (required)
499 PC2 Card . . . . . 169.
500 PC2B Card *(bootable card)*. . . . . 229.

Mountain Computer ... 1 year

917 40-60 Meg Internal Tape Drive. . . . 379.
502 83-152M Ext. Tape Drive. . . . . 799.
500 83-152M Int. Tape Drive . . . . . 629.
190 DC2000 Pre-formatted Cartridges ea. 35.

Pacific Rim ... 1 year

010 1.2 Meg External *(for PS/2's)* . . . . . 215.
602 1.44 External *(for PC/XT/AT)* . . . . . 239.

Plus Development ... 2 years

425 Hardcard II 40 Meg *(19 ms)* . . . . . 599.
424 Hardcard II 80 Meg *(19 ms)* . . . . . 699.

Seagate ... 1 year

FREE PCTV® Hard Drive Installation Tape with purchase of 20, 30 or 40 Meg Seagate drive for the IBM PC (not for AT). Beta or VHS.
285 20 Meg Int. Hard Drive ST225 *(w/controller and cables, 65 ms)* . . 275.

Targus ... lifetime

New luxurious leather cases designed for all popular models of "Notebook" style laptops.
7028 *Foliopac 1* . . . . . $79.
7029 *Foliopac 2*
(with optional A.C. adaptor pocket) . . . . . 85.

3½" 20 Meg Int. Hard Drive ST125-1 (28 ms) *(w/controller, cables, mounting equip. for PS/2 Model 25 or 30 or PC/XT - specify computer)* . . . . . 339.
286 30 Meg Int. Hard Drive ST238 *(w/controller and cables, 65 ms)* . . 289.
554 40 Meg Int. HD ST251-1 (28 ms) . . 359.

TEAC ... 1 year

951 720k Drive *(specify XT or AT, 3½")* . 79.
670 1.44 Meg Drive for XT *(3½")*. . . . . 99.
326 1.44 Meg Drive for AT *(includes Bastech software utilities, 3½" copy prot.)* . 119.

MISCELLANEOUS

Checkfree

360 CheckFree . . . . . 25.

CompuServe

1676 CompuServe Information Service . $24.

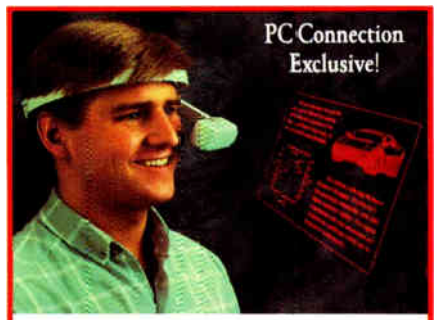
Cables ... lifetime

1019 Smartmodem-to-AT cable *(10 feet)* . 15.
5511 Right Angle Printer cable *(6 feet)* . . . 15.
1050 Parallel Printer cable *(15 feet)* . . . . . 19.

DISKS

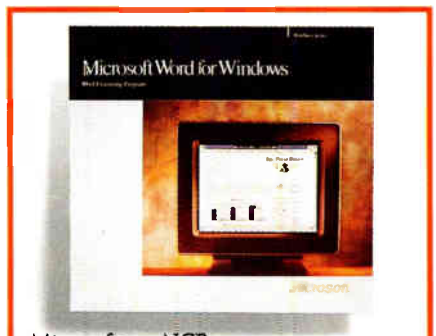
Maxell ... lifetime

2789 5¼" MD2-D 360k Disks *(Qty. 10)* . . . . 12.
2790 5¼" MD2-HD 1.2Mb Disks *(Qty. 10)* . . 19.



Reflection Technology ... 1 year

7127 *Private Eye*–A large screen in a small box. A tiny virtual display which offers a full-size, 12" IBM CGA auxiliary screen to PCs & laptops. View privately in planes or meetings. Brighter than LCDs. Great for games! $499.



Microsoft ... NCP

6195 ◉ *Word for Windows*–Combines the power of Word for the PC with ease of use and WYSIWYG accuracy of Microsoft Windows. Supports cut & paste from other Windows programs. . . . . $329.

2792 3½" DS/DD 720k Diskettes *(Qty. 10)* . . 14.
2793 3½" DS/HD 1.44Mb Diskettes *(Qty. 10)* 27.

Sony ... lifetime

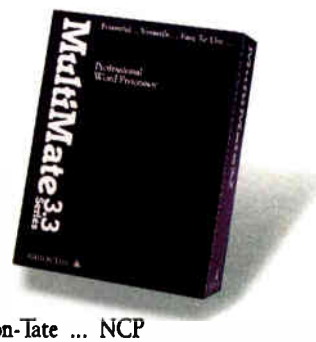
3291 5¼" DS/DD 360k Disks *(Qty. 10)* . . . . 10.
3292 5¼" DS/HD 1.2Mb Disks *(Qty. 10)* . . . 19.
3297 3½" DS/DD 720k Diskettes *(Qty. 10)* . . 13.
3298 3½" DS/HD 1.44Mb Diskettes *(Qty. 10)* 22.
6659 QD 2000 Tape Cartridge . . . . . 19.

MEMORY

6556 256k DRAMs *(100 nanosecond)* . . . call
3248 256k DRAMs *(120 nanosecond)* . . . call
4366 1 Meg x 9 SIMMs *(100 nanosecond)* call
5510 1 Meg x 9 SIMMs *(80 nanosecond)* call
5746 1 Meg Chips *(80 nanosecond)* . . . . call

OUR POLICY

- We accept VISA and MASTERCARD only.
- No surcharge added for credit card orders.
- Your card is not charged until we ship.
- If we must ship a partial order, we never charge freight on the shipment(s) that complete the order (in the U.S.).
- No sales tax.
- All U.S. shipments insured; no additional charge.
- APO/FPO orders shipped 1st Class Mail.
- International orders U.S. $250 minimum.
- Upon receipt and approval, personal and company checks clear the same day for immediate shipment of your order.
- COD max. $1000. Cash, cashier's check, or money order.
- 120 day limited warranty on all products.*
- To order, call us Monday through Friday 9:00 AM to 1:00 AM, or Saturday 9:00 AM to 5:30 PM. You can call our business offices at 603/446-3383 Monday through Friday 9:00 AM to 5:30 PM.



Ashton-Tate ... NCP

6922 ☐ *MultiMate 3.31*–Upgrade to MultiMate 4.0 through Ashton-Tate for $79.50. Total cost $151.50 including shipping. Save over $400 on list price of $565. Call for details . . . . . $69.

SHIPPING

Note: Accounts on net terms pay actual shipping.

Continental US:

- For heavy hardware items such as printers, monitors, Bernoulli Boxes, etc. pay actual charges. Call for UPS 2nd-Day & Next-Day-Air.
- For all other items, add $3 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd-Day-Air at no extra charge if you are more than 2 days from us by UPS ground.

Hawaii:

- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add $3 per order.

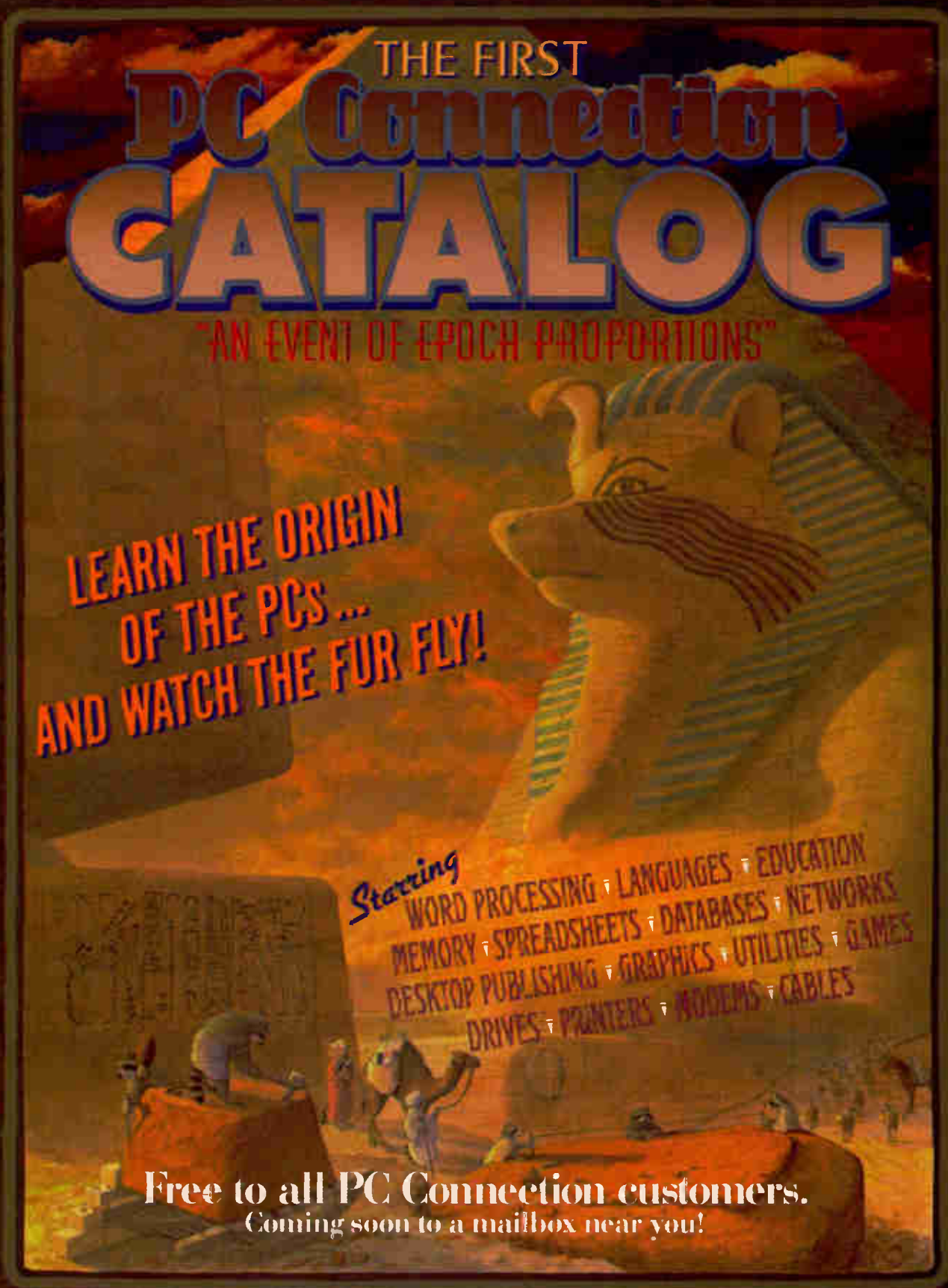
Alaska and outside Continental US:

- Call 603/446-7721 for information.

PC CONNECTION®

©COPYRIGHT PC CONNECTION, INC., 1990. PC CONNECTION IS A REGISTERED TRADEMARK OF PC CONNECTION, INC., MARLOW, NH. THE RACCOON CHARACTER(S) ARE TRADEMARKS OF PC CONNECTION, INC.

World Radio History



World Radio History

NETWORKS SHOULDN'T BE THIS HARD

Getting ready to work on a LAN involves a lot of hassle. Why?

Anyone who's ever had to get a bunch of PC compatibles ready to go on a LAN will tell you that setting them up is too darn hard. First, you have to install the network adapter of your choice—Ethernet, Token Ring, ARCnet, or whatever. That job wouldn't be that bad if all you had to do was open your system, insert the board, and connect the network cable, but that's only the beginning. You have to make the network board work, which means fiddling with such PC goodies as interrupts (IRQs), DMA addresses, I/O ports, and memory addresses. Nothing is worse than having a LAN board that gives you only three interrupt choices, all of which you're already using with other boards in your machine.

The source of all this confusion, of course, is the PC architecture, which doesn't automatically recognize add-in boards (or much of anything else attached to the system, for that matter). The Micro Channel and Extended Industry Standard architectures promise some help in this area, but most people are still using PCs with the classic AT-bus architecture. The problem of managing add-in boards of any type is bad enough that a whole subindustry of products, such as Quarterdeck Office Systems' Manifest, exists to help you figure out what's going on in your PC.

Once you have installed the network adapter, you have to load the drivers for that board and your network operating system. With NetWare, that process involves generating the client software, or shell, by running a special program, SHGEN. Worse, you need a different combination of drivers and client software for every board configuration and LAN operating-system combination. The final step is to enter the right commands in the right sequence, and then you're ready to log onto the server of your choice—whose name you must already know.

None of this, by the way, even touches on the problems of network administration—we'll talk about them in future columns. This month, we'll focus strictly on the hassles that you must endure just to use the network.

The Mac Alternative

If you're used to PC networks, this setup process might not seem too bad. It might even seem reasonable—but that only means that you can learn to live with anything. To see just how much easier it can be, consider the Mac.

To connect a Mac to a LocalTalk network, you plug the LocalTalk cable into the printer port that's standard on every Macintosh. Then you turn on the Mac and bring up the Chooser desk accessory (also standard on every Mac). Click on the AppleTalk icon and activate AppleTalk, and the Chooser presents you with a list of available servers. Pick the one you want, and you're in business; the server's disk icon will appear on your screen. The Chooser will even ask if you'd like to connect to this server automatically each time you turn on your Mac, so you don't have to go through this minor hassle again.

You couldn't ask for much more, although we would like to see the Mac automatically give you the option of connecting to any new servers when it boots up. The first time you turned on your Mac, it would ask if you'd like to connect to each of the available servers; thereafter, it wouldn't bother you unless a new server came on-line.

To be fair, even a Mac forces you to do more work if you want to use an Ethernet

continued

ILLUSTRATION: KENT CHRISTIANSON © 1990

World Radio History

or Token Ring adapter: then you have to open the case, stick in the board, and drag some drivers from the disk that came with the board into your system folder. Mac boards configure themselves automatically, however, so there's no messing with interrupts or DMA addresses or any other such rot.

Why the Difference?

This comparison between Macs and PCs may seem grossly unfair, but it's not. Why, after all, should millions of PC users have to work so much harder than Mac users to use a LAN?

The problem is that the PC world has become a multiparty system, while the Mac world is still a benevolent dictatorship. Apple, love it or hate it, set the Mac LAN standards, and now everybody's following them. True, TOPS and 3Com offer Mac LAN operating-system alternatives, but even those vendors are making their products compatible with Apple's AppleTalk File Protocol (AFP), the file access protocol at the heart of Mac LANs.

PC users, on the other hand, live in a world of relatively open standards, where they're free to choose from NetWare, LAN Manager (in all its many flavors), LANtastic, or any of several dozen other LAN operating systems. Each of those products uses different client software and works with a different subset of the many available LAN adapters.

So, what's a poor buyer to do? Don't get us wrong—we're not arguing for any kind of PC LAN dictator, benevolent or otherwise. The disadvantage to Apple's domination is obvious: Note, for example, how slow Apple was in bringing Ethernet and Token Ring to the Mac, and how high Mac prices are relative to the costs of PCs of equal power.

What we are suggesting is that LAN users and buyers everywhere start demanding better treatment.

Look at today's system vendors. You can call the PC vendor of your choice and order a PC with a monitor, a hard disk drive, and 2 megabytes of memory—or whatever other configuration you want—and it will arrive sometime later, ready to go—or darn close. OK, you might have to install DOS yourself, but many vendors of PC compatibles even do that for you. (Every vendor should follow their lead and install the operating system that you buy.) You should only have to hook up your monitor and plug in the system and monitor to get to work.

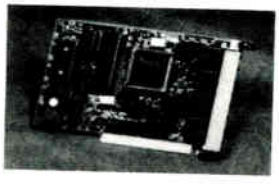
So why not add network adapters to the list? Why can't your vendor let you call up and say something like, "I need 10 PCs with [your configuration] and Ethernet for NetWare 286" and then deliver exactly that? When you get your system, you connect the keyboard and monitor and plug the network cable into the connector waiting on the back of your system. Let the vendor deal with the hassle of making the network adapter work with the rest of the system; after all, who knows the system better?

It's also time for vendors to start seriously considering adding network support to their motherboards; Ethernet and Token Ring chip sets are now available, and they're shrinking rapidly in size and cost.

That's not the end of it. The system vendor should set up each machine's AUTOEXEC.BAT (and, if necessary, CONFIG.SYS) file, so that you can connect to the network immediately, or the

continued

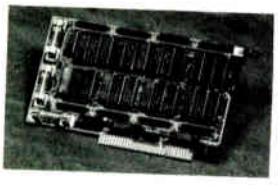
MODEL PCSS-8I
Serial I/O Board



The **PCSS-8I** is GTEK's most popular intelligent eight channel serial I/O card. The **PCSS-8I** supplies a 15 MHz coprocessor to reduce the serial communication load on your computer. The **PCSS-8I** comes with 32K bytes of DYNAMEMORY™. DYNAMEMORY™ allocates and deallocates memory to transmit and receive queues as needed, which perform as if it has 512K bytes of buffer memory. BIOS interface software included. SCO™ XENIX® driver available.

FULL
1 YEAR WARRANTY!

ORDER TOLL FREE 1-800-282-GTEK (4835)



MODEL PC-64
Serial I/O Board

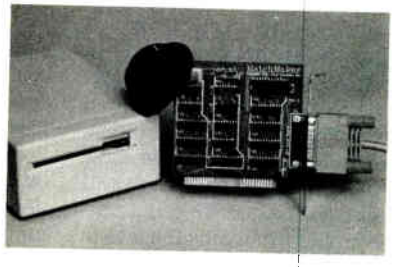
The **Model PC-64** from GTEK is a high speed parallel I/O board. It allows you bit-wise manipulation of eight bit ports. The board has 8 ports for a total of 64 bits. Each port contains fused 5, 12 and -12 volts from the computer.

GTEK® INC
DEVELOPMENT HARDWARE & SOFTWARE
P.O. Box 2310
Bay St. Louis, MS 39521-2310
Fax: 1-601-467-0935 • MS & Technical Support 1-601-467-8048

GTEK is a registered trademark of GTEK, Inc. Dynamemory is a trademark of GTEK, Inc.
SCO is a trademark of Santa Cruz Operation. XENIX is a registered trademark of Microsoft Corp.

Read Mac Disks in a PC
MatchMaker

– the best way to share data between a PC and a Mac. The **Match**Maker card lets you plug a Macintosh floppy drive into a PC.



- Easy-to-install half-size card.
- Use any external Macintosh drive.
- DOS-like command software included.
- 1 year warranty, Made in USA.
- Also available; **MatchPoint-PC** to read/write Apple II disks.

"...by far the most cost effective solution..." PC WEEK

MicroSolutions
Computer Products
132 W. Lincoln Hwy.
DeKalb, IL 60115
(815) 756-3411

Circle 110 on Reader Service Card (DEALERS: 111)

Circle 160 on Reader Service Card

World Radio History

Our Printer Sharing Unit Does Networking!

An Integrated Solution

Take our **Master Switch**™, a sophisticated sharing device, combine it with **MasterNet**™ networking software for PCs, and you've got an integrated solution for printer and plotter sharing, file transfer, electronic mail, and a lot more. Of course you can also share modems, minis, and mainframes or access the network remotely. Installation and operation is very simple.

Versatile

Or you can use the Master Switch to link any computer or peripheral with a serial or parallel interface. The switch accepts over 20 commands for controlling the flow of data. It may be operated automatically, by command, or with interactive menus. Its buffer is expandable to one megabyte and holds up to 64 simultaneous jobs. The **MasterLink**™ utility diskette for PCs comes with every unit and unleashes the power of the switch with its memory-resident access to the commands and menus.

Other Products

We have a full line of connectivity solutions. If you just want printer sharing, we've got it. We also have automatic switches, code-activated switches, buffers, converters, cables, protocol converters, multiplexers, line drivers, and other products.

Commitment to Excellence

At Rose Electronics, we're not satisfied until you're satisfied. That's why we have thousands of customers around the world including large, medium, and small businesses, factories, stores, educational institutions, and Federal, state, and local governments. We back our products with full technical support, a one-year warranty, and a thirty-day money-back guarantee.

ROSE ELECTRONICS

Call now for literature or more information.
(800) 333-9343

Give a Rose to your computer

P.O. Box 742571 • Houston, Texas 77274 • **Tel** (713) 933-7673 • **FAX** (713) 933-0044 • **Telex** 4948886

Circle 244 on Reader Service Card

World Radio History

vendor should at least provide a batch file that does the job. (You still have to know the name of the server that you want, but that's a completely separate problem that the LAN operating-system vendors should solve.)

Let's also make LAN operating-system vendors do their part. They could cut down the configuration process and load the network adapter device driver at run time; who wants a generation process, anyway? Vendors should also standardize the client software, at least among different versions of the same network operating system. NetWare is already close, and the many versions of LAN Manager are heading in that direction, but users should demand that vendors get there more quickly.

Is It Feasible?

Can this grand scheme really work? Yes—for the most part. So many different LAN operating-system and network adapter combinations exist that no system vendor can reasonably cover them all. Fortunately, they don't need to help everybody—just most of us. If every system vendor offered this setup for just NetWare and LAN Manager with only Ethernet, Token Ring, and maybe ARCnet, that would cover over 90 percent of the LAN marketplace. And that's good enough for us.

We're not alone in endorsing this idea. At least one vendor, Gateway 2000, already installs DOS and most add-in boards for its buyers and plans to extend that support to network boards—and the necessary drivers for, at the least, NetWare—in the near future.

You can do your part, too: Urge your system vendors to follow this path; if they won't, take your dollars elsewhere. Everybody's in this game for a profit, so enough lost customers will drive the message home to even the biggest vendors.

In the meantime, we'll keep griping at the vendors who force us to fiddle with IRQs and DMAs and network adapter drivers, and we'll praise the few who don't. Using a PC LAN just doesn't have to be this hard. ■

Mark L. Van Name and Bill Catchings are BYTE contributing editors. Both are also independent computer consultants and freelance writers based in Raleigh, North Carolina. You can reach them on BIX as "mvanname" and "wbc3," respectively.

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Circle 137 on Reader Service Card

People are talking about us.

F77L-EM/32

Port 4GB mainframe programs to 80386s with this 32-bit DOS-Extender compiler. The Winner of *PC Magazine's* 1988 Technical Excellence Award just got better. New Version 3.0 and OS include: Editor, Make Utility, Virtual Memory Support, DESQview Support, New Documentation and Free Unlimited Runtime Licenses. F77L-EM/32 $895 OS/386 $395

F77L

The compiler of choice among reviewers and professionals. Includes a Debugger, Editor, Profiler, Linker, Make Utility, Weitek and 386 Real-Mode Support, Graphics. $595

Lahey Personal Fortran 77

New Version 3.0: Full ANSI 77, Debugger, Editor, Linker, Library Manager, Microsoft and Borland C interfaces, 400 page Manual, Unbeatable Price. $99

Contact us to discuss our products and your needs. (800) 548-4778
Lahey Computer Systems, Inc. P.O. Box 6091, Incline Village, NV 89450
Tel: (702) 831-2500 FAX: (702) 831-8123 Tlx: 9102401256
FORTRAN IS OUR FORTE

NOW!—Non-DOS Formats for 3½ and 5¼ inch disks

COPIES MOST FORMATS FLAWLESSLY.

NEW: The V3000 now supports non-dos formats, i.e., Unix, Xenix, NCR, etc., in addition to all IBM formats.

Attach a Victory V3000 Autoloader to your IBM/PC or Macintosh, enter one or more jobs, and walk away! The system automatically copies 5¼ or 3½ inch disks—up to 180 per hour. Switching the copy drive takes less than a minute. Auto-Dup tests the quality of each copy, sorting the disks into one of two output bins.

Do-It-Yourself Servicing. The Autoloader's simple component design and diagnostics for checking drive alignment and speed allow you to maintain the system without outside service.

Call (800) 421-0103. And ask about Victory's family of affordable Autoloaders that support Serialization and Custom Label Printing.

VICTORY ENTERPRISES
Technology, Inc.

Victory Plaza
1011 E. 53½ Street
Austin, TX 78751-1728
(512) 450-0801

Internationally call BFI: Frankfurt (49-6074) 40980, London (44-622) 882467, Milan (39-2) 33100535, or LOADPLAN: London (44-1) 2007733 or Melbourne (61-3) 5254088.

Circle 301 on Reader Service Card

World Radio History

Laugh, sob, growl, warble, wail (or just talk) across your LANtastic PC Network.

The newest version of our LANtastic PC network has really got people talking.

You see, LANtastic is the first PC network to support Voice. So you can actually send voice messages from one PC to another across the LAN.

It's easy. Just pick up the telephone handset provided with the LANtastic Voice Adapter (sold separately at $149* per adapter), bring up a handy menu, and talk. Use Voice Chat to carry on a realtime conversation or save the voice message in a digital format for playback later in your own voice—just like regular E-mail.

Only LANtastic has Voice. And Voice is just one of the reasons people are talking about LANtastic version 3.0.

Another is our new easy installation program that'll have you up and running in minutes.

And disk caching to boost network speed.

Plus enhanced printing, E-mail, security and more.

All of which led PC Magazine to conclude: "LANtastic blows away the DOS-based competition in terms of performance."

—May 29, 1990

And don't worry. Even with all these new features, LANtastic still has the smallest RAM overhead of any network.

LANtastic version 3.0. Call 602-293-6363.

Developers. Artisoft offers a Voice Programmer's Interface so you can create your own "talking" software using the LANtastic Voice Adapter. Order it directly from Artisoft.

ARTISOFT
Revolutionizing Connectivity

*Manufacturer's suggested retail price. Before voice messages can be sent from one PC to another, optional LANtastic Voice Adapters must be installed on both PCs.
**Manufacturer's suggested retail price is $249 for LANtastic 2Mbps adapters and $349 for LANtastic Ethernet Adapters. © 1990 ARTISOFT. LANtastic is a trademark of ARTISOFT.

Circle 28 on Reader Service Card

World Radio History

SHORT TAKES

BYTE editors' hands-on views of new and developing products

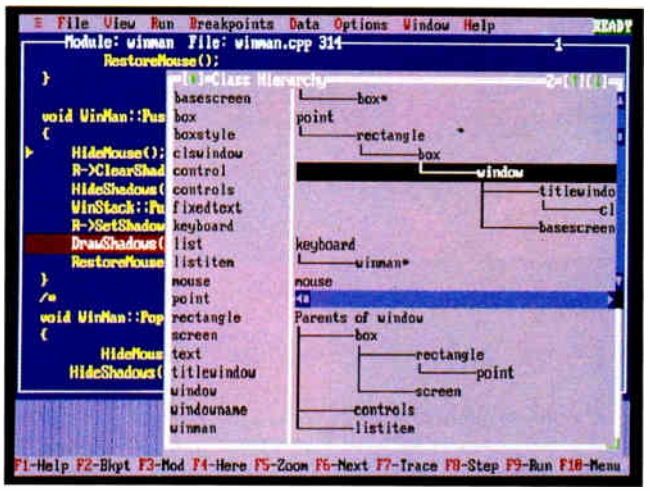
Turbo C++

HyperCard 2.0

Plus for OS/2

DaynaFile

FrameMaker 2.0/Mac



Bringing C++ to the Mainstream

Borland's **Turbo** C++ introduces a wholly redesigned multiwindow development environment and a full implementation of AT&T's version 2.0 of the object-oriented C++ language.

The new Borland IDE (Integrated Development Environment) employs multiple overlapping and resizable windows, but it still runs in text mode rather than graphics mode. Windows have scroll bars, close boxes, and zoom boxes, and you can move, scroll, and resize them using the mouse with pull-down menus or by keyboard shortcuts; I found a mixture of the mouse and shortcuts very convenient.

Borland has incorporated its new VROOMM (Virtual Run-Time Object-Oriented Memory Manager) technology, so you can open as many windows as you like. When the main memory runs out, Turbo C++ starts swapping chunks to the hard disk, to extended or expanded memory, or to the RAM disk (command-line switches decide which). I was impressed to find 328K bytes of memory free when I shelled out to DOS with five windows open and SideKick Plus loaded!

You can point and shoot your way through the IDE with Macintosh-style buttons and check boxes for setting options. All dialog boxes that require you to enter text (e.g., filenames) keep a scrolling history list, so you can reuse previous entries. This is a generalization of the old Pick feature. The directory browser displays an Xtree-like picture of your subdirectory structure. Error messages are piled up in a scrolling window. You select one and press Return to edit the source file that has a cursor over the offending statement. You can also preserve messages from previous compiles.

The editor now has cut-and-paste commands and a viewable clipboard window, although the old WordStar commands are still supported. The new macro language proved disappointing; it allows only sequences of the existing commands, with no loops or conditionals. The powerful new Transfer option allows you to bind your own programs and utilities into the IDE, call them from a menu, and have them output messages via an IDE window. The Turbo Assembler (TASM) and Debugger come preinstalled as Transfer options. In a few minutes, I installed the Turbo Pascal command-line compiler and was able to compile Pascal programs from an IDE window. If Turbo Pascal produced object files rather than Turbo Pascal files, I could have linked mixed-language programs directly.

Turbo C's projects, a visual form of the Make utility for large programs, are much enhanced in Turbo C++. The Project Manager now lets you browse each project's source modules in a window and edit them by pressing Return; ditto for their header files. Project Manager checks dependencies and recompiles only the minimum number of modules. You can specify what translator to use for each module (e.g., C++, TASM, custom preprocessors, or Turbo Pascal) and what nonstandard libraries to link it with.

To create overlays (which now employ VROOMM) you just tick a single check box for each chosen module; no more worrying about memory sizes or loading order. A minor irritation: Creating a project is the only way you can link your own libraries within the IDE. However, Borland still supplies TCC, the command-line version of the compiler.

Turbo C++ contains both C and C++ compilers, but the integration cannot be seamless. By default, it compiles files with the extension .CPP using the C++ compiler and those with .C extensions using the C compiler. Running the C++ compiler on old C programs usually ends in error, thanks to the stricter type checking in C++. Turbo C++ implements in full the new version 2.0 iostream class library, but it also offers the stream library from version 1.x to compile older C++ programs.

Borland has upgraded the C compiler in Turbo C++ to full ANSI conformance; it passed 72 of the 79 tests in the Plum Hall validation sampler, the remainder failing through known bugs in my beta-test copy. I tested

THE FACTS

Turbo C++
$199.95; Professional version, $299.95

Requirements:
IBM PC, 640K bytes of RAM, and DOS 2.0 or higher.

Borland International, Inc.
1800 Green Hills Rd.
P.O. Box 660001
Scotts Valley, CA 95066
(408) 438-8400
Inquiry 1010.

World Radio History

Turbo C++ on a 16-MHz 386SX machine without an FPU. Having no C++-specific benchmarks at hand, I ran the Sieve of Eratosthenes in 0.61 second for 10 iterations (twice as fast as Turbo Pascal 5.5). In the Plum Hall Simple Benchmarks, Turbo C++'s performance ranked close to Sun C's on a Sun-3/75 workstation.

In short, I think Turbo C++ is another landmark product from the folks at Borland.

—Dick Pountain

Apple Deals a New HyperCard

Apple's HyperCard program has been the major catalyst of the Macintosh's success in the multimedia and interactive training markets. The often-imitated program lets users manipulate data using the metaphor of a stack of index cards. In a smart marketing move, Apple bundled HyperCard with every new Mac, and HyperCard enthusiasts and commercial programmers responded by developing HyperCard stacks for applications ranging from teaching golf techniques to toolkits for composing music.

But, in spite of its popularity, HyperCard has been in need of some improvements, particularly when it is used for serious software development. The current version, 1.2, lets you work with only a single stack on the screen at one time. Also, the individual cards must be the size of the small Mac screen (512 by 342 pixels), and there is no support for color. In addition, HyperCard 1.2 had limited tools for designing the visual appearance of each card.

Apple's new version of **HyperCard, version 2.0**, changes all that. The new version supports multiple HyperCard windows on the screen simultaneously. The size of HyperCard windows can now range from 64 by 64 pixels up to 1280 by 1280 pixels. There are also some new external commands (XCMDs) that allow you to display color PICT and gray-scale images.

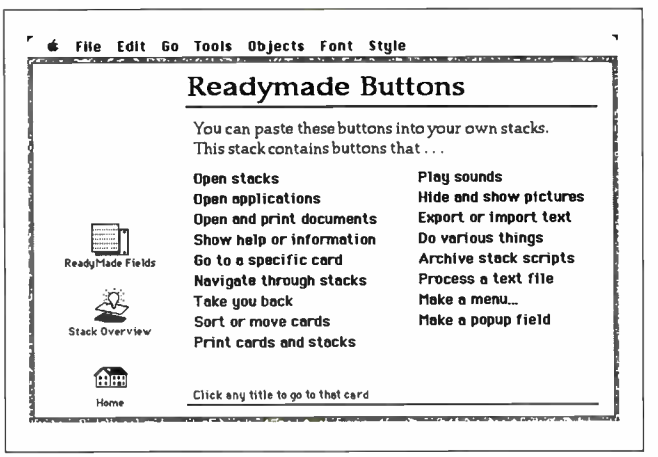
Version 2.0 also includes new tools for creating graphical designs and visual effects on cards. There is a custom palette builder for designing control panels and other navigational tools. The new version also allows more flexible combinations of text fonts and sizes.

Probably the biggest improvements have been made to the HyperCard development environment. Version 2.0 includes a new script editor that can operate in a separate window while HyperCard stacks are also on the screen (the old editor took over the whole screen). There is also a debugger that can trace variables and perform step-by-step execution.

For increased performance, HyperCard 2.0 includes a quasi compiler, which compiles script commands at run time. However, although Apple calls it a compiler, the new system does not allow compiled binary data to be saved to disk. In other words, HyperCard compiles the script the first time it is initiated during a HyperCard session. Nevertheless, the technique does provide improved performance.

While Apple is often criticized for high prices, HyperCard is one of the best bargains available.

—Nick Baran



THE FACTS

HyperCard 2.0
$49.95 upgrade for existing Macintosh owners; free for new Macintosh purchasers.

Requirements:
Apple Macintosh with System 6.0.5

Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Inquiry 1011.

Plus Gets Hyper Across Platforms

Unless you're a Macintosh user, *hyper* is just an other obtuse industry buzzword. Still, as Apple has proved with HyperCard, the concept of interrelated stacks of cards is an eminently useful way of organizing and retrieving information.

With **Plus**, Spinnaker Software has brought the power of HyperCard (and much more) to the IBM PC platform. Plus is available for the Mac and for the PC, with versions for both Windows 3.0 and OS/2. I tested a prerelease copy of the OS/2 version.

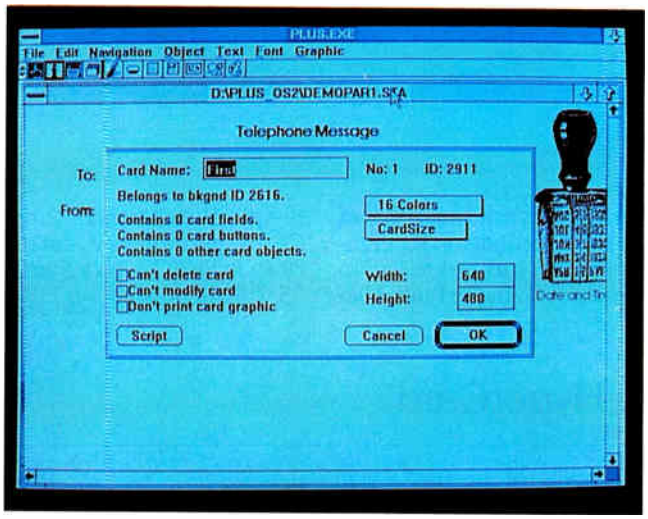
continued

World Radio History

At its heart, Plus is an applications development environment that uses an object-oriented paradigm to create stacks (applications) that can relate textual and graphics data on cards in just about any way you can imagine. The beauty of Plus is that it's one of the few applications currently available that offers true multiplatform compatibility. Because it uses an identical file format, an application that I created under OS/2 could be run on a Mac or under Windows 3.0.

Plus essentially has three levels of use, from very simple to extremely complex. At its simplest and most immediately utilitarian level, Plus can directly read a Mac HyperCard stack. Using BYTE's in-house network, I transferred a name and address stack from our resident Mac server and immediately had it available on my PC.

While the ability to use a Mac stack as is, is handy indeed, it's only a small part of Plus's utility. Because its programming abilities extend far beyond those in HyperCard 1.2.2, you can modify and expand an existing stack. I added color and addressable graphics objects to the basic stack and resized the cards in the stack to fit more cards on the larger PC screen.



THE FACTS

Plus for OS/2
$495.95

Requirements:
IBM AT, PS/2, or compatible running OS/2 1.1 or 1.2 Standard or Extended Edition with a hard disk drive with at least 2 MB of free space.

Spinnaker Software
One Kendall Sq.
Cambridge, MA 02139
(617) 494-1200
Inquiry 1012.

Creating an application from scratch in Plus obviously requires more effort. Since Plus's programming environment is graphics-oriented, I found that using it required a real (and slightly painful) shift in thinking away from the standard linear way of creating an application using a more conventional programming language.

I also had to continually think "objects." I created a simple time-planning stack by placing the objects on cards, which themselves are objects. Because it's highly interactive, Plus gave me plenty of help, with fill-in-the-blank menus popping up when I needed to define relationship scripts between objects.

Plus's third level is the most complex, and the most powerful. Included in Plus is PPL (Plus Programming Language). It's a complex English-like language that's essentially a highly extended version of HyperCard. And while basic non-PPL stack creation is powerful in itself, you really need to learn PPL to get full utility from Plus. For example, you need to write a PPL program to integrate graphics into a stack or to do something like exporting stack data into an external database.

Plus is a prime example of the power and the paradox of the new generation of applications development environments based on graphical user interfaces. While Plus is complex, has a long learning curve, and requires quite a commitment, it will create an unlimited variety of applications. Because of that, in-house developers who have the resources (and extensive programming experience) to commit to it will find Plus an invaluable tool for creating common cross-platform applications.

— Stan Miastkowski

DaynaFile for NeXT Lets the Cube Use Floppy Disks

Steve Jobs proclaimed NeXT's 250-megabyte erasable optical disk cartridge the "floppy disk of the nineties," but it costs a bundle more than ordinary floppy disks. Not surprisingly, several vendors have come forth with 3½- and 5¼-inch floppy disk drives that plug into the SCSI port of the NeXT Computer. The first one I've had a chance to work with is the **DaynaFile** external floppy disk drive from Dayna Communications, a company that has specialized in devising DOS-compatible drives and file-exchange utilities for the Macintosh.

The DaynaFile system reads and writes DOS disks and also formats floppy disks using the NeXT file system, so that NeXT files can be stored on standard floppy disks. The only limitation with using NeXT formatted disks is that other NeXT machines must also have the DaynaFile drive in order to use the disks. You have to convert Mac disks to DOS format using Apple File Exchange and the Mac SuperDrive or the Dayna DOS Mounter utility that comes with DaynaFile for the Mac.

The DaynaFile system is available with a choice of 3½- or 5¼-inch floppy disk drives or in a dual-drive unit with both drive types. I tested the dual-drive setup. To install the drive, you plug in the SCSI cable, flip a switch, and install the software. Once installed, you have two new files, DaynaUnix and DaynaDOS, in your NeXT's LocalApps directory.

Once these files are installed, you have a completely transparent floppy disk system attached to the NeXT Computer. DaynaDOS and DaynaUnix provide a simple window and dialog box for copying files and formatting disks. The DOS system includes a text-translation utility that preserves the linefeeds and carriage returns in documents created in DOS. However, there are no file-conversion utilities for handling database, spreadsheet, or word processing formats.

You first have to convert these file types to ASCII text. You can directly transfer

continued

World Radio History

Embedded systems designers have already used **CrossCode C** *in over 577 different applications.*

CrossCode C has twelve important features to help you program your 68000-based ROMable applications

It's the one 68000 C compiler that's tailor-made for embedded systems development

CrossCode C is designed specifically to help you write ROMable code for all members of the Motorola 68000 family. It comes with these twelve special features to help you get your code into ROM:

1. A 100% ROMable Compiler: **CrossCode C** splits its output into five memory sections for easy placement into ROM or RAM at link time.

2. Integrated C and Assembler: You can write your code in any combination of C and assembly language.

3. Readable Assembly Language Output: The compiler generates assembly language code *with your C language source code embedded as comments*, so you can see each statement's compiled output.

4. Optimized Code: **CrossCode C** uses minimum required precision when evaluating expressions. It also "folds" constants at compilation time, converts multiplications to shifts when possible, and eliminates superfluous branches.

5. Custom Optimization: You can optimize compiler output for your application because *you* control the sizes of C types, including pointers, *floats*, and all integral types.

6. Register Optimization: Ten registers are reserved for your register variables, and there's an option to automatically declare all stack variables as *register*, so you can instantly optimize programs that were written without registers in mind.

7. C Library Source: An extensive C library containing over 70 C functions is provided in source form.

8. No Limitations: No matter how large your program is, **CrossCode C** will compile it. There are no limits on the number of symbols in your program, the size of your input file, or the size of a C function.

9. 68030 Support: If you're using the 68030, **CrossCode C** will use its extra instructions and addressing modes.

10. Floating Point Support: If you're using the 68881, the compiler performs floating point operations through the coprocessor, and floating point register variables are stored in 68881 registers.

11. Position Independence: Both position independent code and data can be generated if needed.

12. ANSI Standards: **CrossCode C** tracks the ANSI C standard, so *your* code will always be standard, too.

There's More

CrossCode C comes with an assembler, a linker, and a tool to help you prepare your object code for transmission to PROM programmers and emulators. And there's another special tool that gives you symbolic debugging support by helping you to prepare symbol tables for virtually all types of emulators.

CrossCode C is available under MS-DOS for just $1995, and it runs on all IBM PCs and compatibles (640K memory and hard disk are required). Also available under UNIX, XENIX, and VMS.

CALL TODAY for more information:

1-800-448-7733
(ask for extension **2003**)

Outside the United States, please dial

PHONE: **1-708-971-8170**
FAX: **1-708-971-8513**

SOFTWARE DEVELOPMENT SYSTEMS, INC.
DEPARTMENT 23
4248 BELLE AIRE LANE
DOWNERS GROVE, ILLINOIS 60515 USA

CrossCode™ is a trademark of SOFTWARE DEVELOPMENT SYSTEMS, INC. MS-DOS® is a registered trademark of Microsoft. UNIX® is a registered trademark of AT&T. XENIX® is a registered trademark of Microsoft.

World Radio History

THE FACTS

DaynaFile
$1105 for dual drives;
$850 for a 3½-inch
1.44-MB drive; $750
for a 5¼-inch
1.2-MB drive

Dayna Communications
50 South Main St.
Salt Lake City, UT
84144
(801) 531-0600
Inquiry 1013.

TIFF and Encapsulated PostScript files, as well as WriteNow files. You can format DOS disks using the DaynaDOS utility as well as create new directories and work with hidden files. The DOS system worked flawlessly.

DaynaUnix lets you work with NeXT files stored on floppy disks. DaynaUnix "mounts" the floppy disk just like the NeXT system mounts optical disk drives. The floppy disk appears as another directory on the NeXT file system.

The only catch is that you have to remember to "unmount" the disk after using it, or else you'll get a system error. Otherwise, DaynaUnix works smoothly. Again, the only limitation is that other NeXT machines would also require the DaynaFile system to make this utility really useful.

One drawback is that the DaynaFile system is not cheap. NeXT vendors are faced with the problem of a small potential customer base until the NeXT Computer becomes more established in the market. Therefore, they charge higher prices than we're accustomed to paying for products in the Mac and DOS world.

—Nick Baran

A Frame of Reference

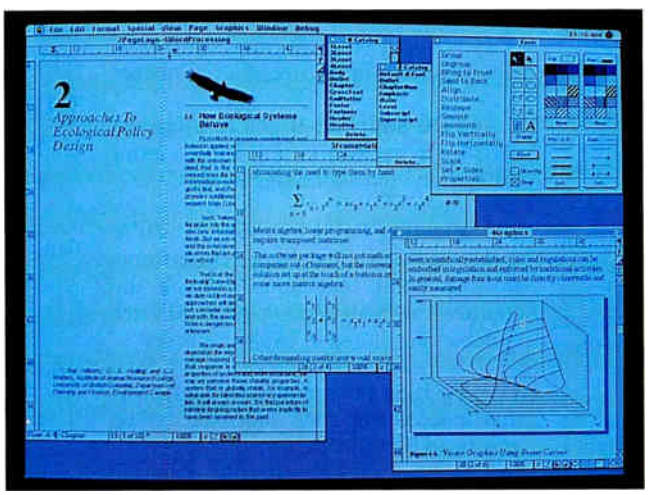
It seems that you can't turn around anymore without bumping into a new WYSIWYG this or DTP that. As much as these terms have been stretched of late, it's refreshing to see them applied to a product that lives up to its acronyms.

Technical publishing is the intended forte of Frame Technology's **FrameMaker 2.0/Mac**, and it is uniquely equipped for the task. This software, once available exclusively on Unix workstations, has migrated to the Macintosh.

FrameMaker is named for its central design element, the frame. These are rubberbanded into position on a blank page and are subsequently filled with headlines, body text, bit-mapped graphics, or drawings. It's possible, however, that you may never stretch your own frame; FrameMaker includes a host of predefined styles, covering everything from simple memos to books.

The FrameMaker 2.0 screen is a study in excellent user interface design. FrameMaker uses pull-downs, but it places most of the repetitive operations a simple mouse-click away. Icons for zooming, next/previous page, font and paragraph style, and other common functions surround the document window. Several of these, like the style icons, pop up dialog boxes or selection lists that can remain on-screen for subsequent use.

Technical documents are unique in their complexity. A single work may include headlines, numbered sections, outlines, text boxes, drawings, tables, bit-mapped images, and equations in addition to the body text. FrameMaker not only handles these (and considerably more), but does them with style. Clicking an icon brings up a selection list of paragraph styles. Each one has a name, or tag, associated with it. Clicking, say, "subsection" will automatically increment the subsection number, display it in a user-definable format, and let you type that subsection's title. Each style sheet has its own set of paragraph tags, and adding new ones is child's play.



ASCII text can be imported, along with Microsoft Word and MacWrite documents, but you can dump your word processor once FrameMaker hits the scene. Not only does it provide advanced hyphenation, spelling checking, and kerning, but it justifies, paginates, and flows text around graphics objects as you type.

FrameMaker 2.0's availability on the Apple Macintosh could convince non-believers that the Mac actually is capable of being a serious workstation after all. FrameMaker is publishing for people who make their living at it. ■

—Tom Yager

THE FACTS

FrameMaker 2.0/Mac
$995

Frame Technology Corp.
1010 Rincon Cir.
San Jose, CA 95131
(408) 433-3311
Inquiry 1014.

World Radio History

Here's How We Protect Your Software And Profits Better.

We'll Never Tell...

. . . the world how we protect your hard work. But then, why should we? It's not that we're hard to get along with. On the contrary. We'll show you how our unwordy approach to software protection can actually work better for you. We'll deliver the best balance of guaranteed copy control and cost-effective installation.

Unlike other manufacturers, our hardware is *uniquely custom-wired for each developer* and supplied with a specific *encrypted interrogation routine* for maximum security.

The precise routines assume responsibility for all hardware, software and timing issues so your time and money isn't wasted engineering protection schemes.

The Products That Protect **Your** Revenues

- **PROTECH KEY**
  Identically reproduced packages.
- **MEMORY KEY**
  MACINTOSH MEMORY KEY
  NEC MEMORY KEY
  Active protection, modular packages, customized packages, serialization, demo control, access control.
- **MEMORY-ONE KEY**
  Customized packages, modular packages
- **MICROPROCESSOR KEY**
  Non-operating system specific protection based on RS232C communications for minicomputers, workstations, etc.

MICROPHAR

In EUROPE:
MICROPHAR, 122 Ave. Ch. De Gaulle 92200,
Neuilly Sur-Seine **FRANCE** Tel: 33-1-47-38-21-21 Fax: 33-1-46-24-76-91

For distributors in:
- **BELGIUM/NETHERLANDS,** E2S (091 21 11 17) • **GERMANY,** Delta Xmit (0621 41 08 178)
- **IRELAND,** TMC (021 87 37 11) • **ITALY,** Siosistemi (030 24 21 074)
- **PORTUGAL,** HCR (1 56 18 65) • **SPAIN,** Hal 2000 (023 37 31 05)
- **SWITZERLAND,** SAFE (024 21 53 86) • **UNITED KINGDOM,** Market.I (1 446 84 31)

PROTECH
MARKETING, INC.
1-800-843-0413

In the U.S., the AMERICAS & the PACIFIC:
PROTECH, 9600-J Southern Pine Blvd.,
Charlotte, NC 28217 ***Se Habla Español***
Tel: 704-523-9500 Fax: 704-523-7651
Hours: Mon-Thurs: 8:30-7:00 ET, Fri: 8:30-5:30 ET

FOR A DEMONSTRATION PACKAGE OR ADDITIONAL INFORMATION, PLEASE WRITE OR CALL.

For Europe Circle 221 on Reader Service Card

For Americas & Pacific Circle 222 on Reader Service Card

*Macintosh is a registered trademark of Apple Computer, Inc
*NEC is a registered trademark of NEC Information Systems, Inc

World Radio History

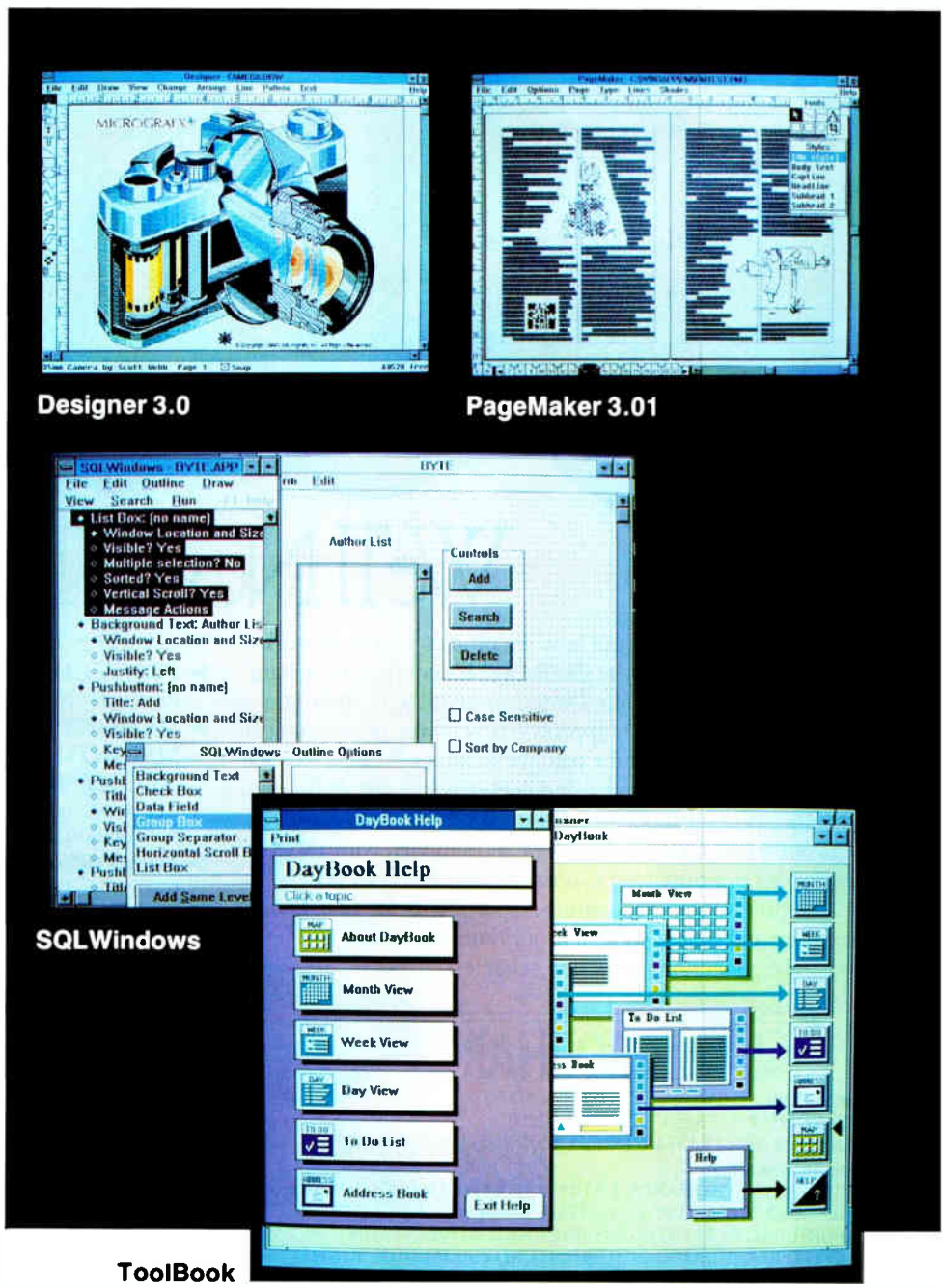
WINDOWS SHOPPING:

Now that we've had a chance to work with the first crop of Windows 3.0–compatible applications, we are convinced that Windows has finally come of age. Programs look, feel, and perform better than ever before. Don't underestimate the importance of Windows' stylish new appearance. Nowadays, operating systems have to dress for success. The graphical-user-interface fashion industry has become a big business; even Unix is making itself over for the 1990s. People respond powerfully to Windows 3.0's carefully designed look, and that will fuel the demand for 3.0-compatible software.

The changes are not just skin-deep, though. Newly incarnated as a protected-mode operating system, Windows compares favorably with OS/2 in certain respects—notably, memory management.

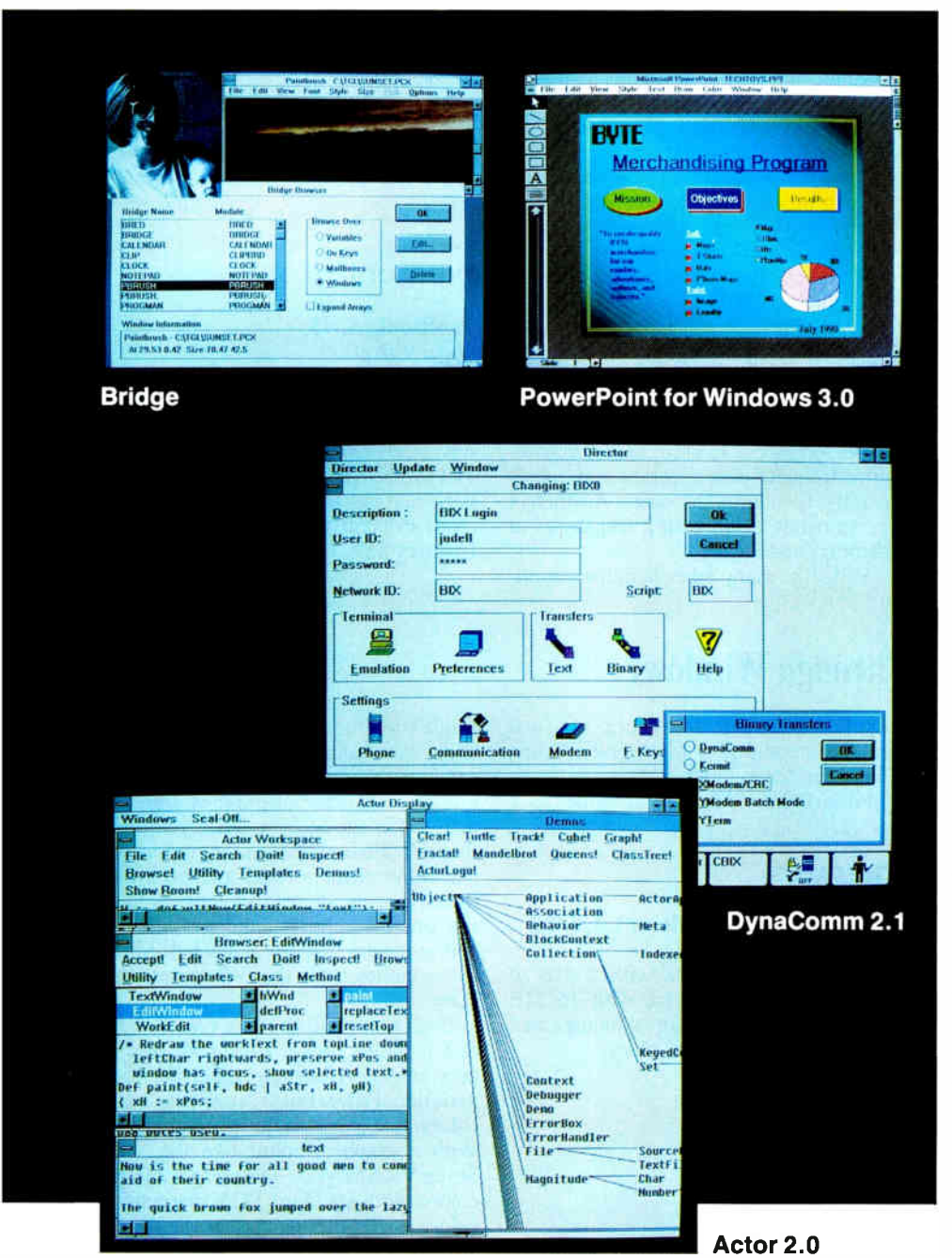
Considered singly, not all applications get a huge performance boost from 3.0's new memory manager. Many Windows programs got by fairly well under Windows 2.11 with the help of expanded memory. For example, the BYTE PageMaker benchmark runs only slightly faster under 3.0 (using 2 megabytes of extended memory) than under 2.11 (using 2 MB of expanded memory). But what happens when you run, say, Micrografx's Designer at the same time?

Under Windows 2.11, some programs, like PageMaker, relied on Windows' use of expanded memory (to swap code segments); others, like Designer, used the memory themselves to store data. Unfortunately, the two strategies conflicted. To give Designer access to expanded memory, you had to disable Windows' use



World Radio History

3.0 Applications Take Shape



of it—and that crippled PageMaker's performance.

Windows 3.0 unifies memory management; developers and users can now awaken from the long nightmare that was EMS. No more compromises and configuration trade-offs—if your machine has extended memory, Windows (and its applications) will just use it. As a result, 3.0 makes multitasking serious applications practical. The effect on productivity can be dramatic.

The programs that we review this month demonstrate the breadth of uses to which Windows can be put: desktop publishing, object-oriented programming, hypermedia, telecommunications, presentation graphics, and networked database management. Of the applications we considered, some are entirely new, some have been ported to Windows, and most are 3.0-compatible versions of existing programs.

Conversion to protected mode does not appear to be a major obstacle; as a result, 3.0 seems likely to inherit the existing body of Windows software in short order. Perhaps more important, a rich collection of software development tools—tailored to different levels of interest and expertise—supports Windows 3.0. That has been one of the keys to the long-standing popularity of DOS, and it certainly bodes well for mass acceptance of Windows.

This month and next, we'll explore the strengths (and weaknesses) of Windows 3.0 in a series of short product reviews. We can't cover all the applications, and that is a telling sign. Windows has achieved critical mass; it's here to stay.

—Jon Udell

continued

PHOTOGRAPHY: PAUL AVIS © 1990

World Radio History

ToolBook: An Application Construction Set for Windows

If, as many people suggest, Windows makes the IBM AT look like the Apple Macintosh, then where is the Windows version of the Mac's popular HyperCard software? A number of companies have recognized the opportunity and have labored to bring a hypertext-style program to the Windows 3.0 environment. Asymetrix is one company with a Windows 3.0 version of a HyperCard-like product. I looked at an early version of its **ToolBook** and found it similar to HyperCard, but different—and, in some ways, better.

ToolBook functions more or less as a software construction set for fairly sophisticated graphics applications—what Asymetrix calls *books*. Most users will probably use ToolBook to create prototype applications or to generate training materials. ToolBook makes it easy to create a multipage electronic training book, where readers can quickly skip around from page to page by clicking on a button or "hot word."

One of the product's best features is its animation capability, which, although somewhat crude, allows you to generate training books that could never be represented on paper through traditional printing. For example, the animation could show trainees exactly how a tricky toner cartridge lifts out of a laser printer. ToolBook also has some database support, including the ability to create a simple flat-file database and to access dBASE files.

Building applications with ToolBook takes some getting used to, but it does let you create a fairly sophisticated book without ever writing a line of code. Yet you can write code when you need to, by accessing ToolBook's own OpenScript programming language, which has many object-oriented features. For example, you can have an information box suddenly appear every time the cursor goes over a certain object on the screen. You can also access other Windows applications through the DDE (dynamic data exchange) channels, or make use of the Windows DLLs (dynamic link libraries).

ToolBook has a bevy of interesting features and capabilities. But this large number of features may have an impact on performance. Certain books may require frequent disk accesses and consequently be somewhat slow. Asymetrix recommends a 386 with 2 megabytes of memory, and I agree.

Still, like many other Windows applications, ToolBook can be addictive. After using it awhile, several possible unusual applications occurred to me. One would be a police artist application, where witnesses to crimes could create a sketch of a criminal by simply pushing buttons to select various noses, eyes, lips, and so on.

As I mentioned before, comparisons with HyperCard come to mind. But HyperCard is free with the purchase of a Mac; ToolBook costs $395. Fortunately, Asymetrix says it will not charge a royalty for a run-time version of the package, so you can distribute your books for free to anyone who has Windows 3.0. If you need to create some eye-catching hypermedia and simple database applications, ToolBook seems to be worth the price.

—Rich Malloy

THE FACTS

ToolBook, $395
Requirements:
IBM AT or compatible with at least 1 MB of memory and Windows 3.0.

Asymetrix Corp.
110 110th Ave. NE, Suite 717
Bellevue, WA 98004
(206) 462-0501
Inquiry 857.

Making Points Powerfully Through Windows

PowerPoint for the Mac helped define the product category known as desktop presentation software. Products of this type let you develop slide shows, often by pulling together text, data, or charts from other applications, and then output them to the screen, to a printer or plotter, or to a slide service.

The new **PowerPoint for Windows 3.0** may set another standard. It offers an expanded set of features over its Mac ancestor, proving that a PC equipped with Windows 3.0 and the right add-ins can stand up to the Macintosh in the color presentation arena. Because of its intuitive graphical user interface and its WYSIWYG fonts and colors, PowerPoint could challenge character-based Lotus Freelance Plus and Software Publishing's Harvard Graphics. In addition, the supplied Bitstream fonts, clip art, and templates could give Micrografx Graph Plus a run for its money.

PowerPoint treats a set of slides as a single file. First you design the "master" slide, which sits behind all the others and can include a frame, a background color, a logo, and other original or imported text and image objects. Then you create the individual slides (in any order—you can move them around and even copy them from one show to another) by layering on text, charts, and graphics. If you're unsure how to get started, Microsoft supplies more than 40 sample templates.

Each presentation has a color scheme that includes background, text, and accent colors. After you select the background, PowerPoint suggests other colors that work well in combination. With a graphics board like the Video Seven VRAM VGA, you can get 256 real colors; with standard VGA there are 16 colors, and dithering creates the illusion

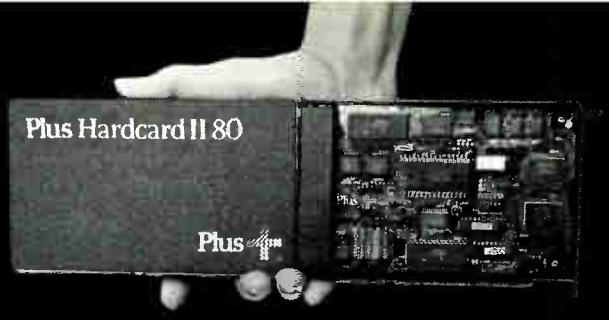
continued

THE FACTS

PowerPoint for Windows 3.0, $495
Requirements:
IBM AT or compatible with 2 MB of RAM; a hard disk drive with 16 MB available; Windows 3.0; a mouse; and EGA, VGA, or better graphics.

Microsoft Corp.
1 Microsoft Way
Redmond, WA 98052
(800) 426-9400
(206) 882-8080
Inquiry 858.

World Radio History



The fastest way to add disk space for Windows 3.0

It's from Plus. The same company who brought you the original Hardcard®. Which means you can expect its performance to be as remarkable as its ease of installation.

Like a 19 ms effective access time. And a 1:1 interleave. For the speed demanded by your disk-intensive applications. And reliability. Like a 60,000 hour MTBF. Our unprecedented two-year warranty. And technical support.

All on a 80MB or 40MB card that installs in about thirty minutes. And works with DOS, OS/2 and of course, leading network operating systems. In the U.S. or Canada call 1-800-624-5545. We'll fill you up with all the details.

Plus®

© 1990 Plus Development Corp. Hardcard and the Plus logo are registered trademarks and Hardcard II is a trademark of Plus Development Corp.

Circle 206 on Reader Service Card

Oops. Out of storage. So just drop the new Hardcard II™ into your 286/386 PC. How convenient. 80MB. Tank full.

E F

World Radio History

of more. The advantage of color schemes is that if you change them, all objects keyed to the scheme will be updated. By contrast, you have to change spot colors manually.

The PowerPoint icon bar is remarkably simple. There are tools to draw shapes (ovals, rectangles, and lines, but no polygons), a labeling tool, and a word processing tool. The word processor includes a spelling checker, and it can import outlines from Microsoft Word for Windows.

One feature new to the Windows version of PowerPoint is the Chart tool. This miniature version of Excel allows you to create a spreadsheet (original, or imported from Excel or Lotus 1-2-3) and a hot-linked chart with all the graph types available in Excel. The finished chart is then copied directly into a PowerPoint slide. This is one example of PowerPoint's excellent use of DDE (dynamic data exchange). The program can also link to other Windows applications through the clipboard.

Microsoft ships 400 vectored clip-art images with PowerPoint. For output, you can print to a black-and-white or color plotter or printer, including PostScript devices, or you can ship files to Genigraphics for 35mm slides. Besides the slides themselves, PowerPoint also produces notes for the presenter and handouts for the audience that include miniature representations of the slides.

Creating a slide show with PowerPoint is easy, fast, and fun. I found the program to be slow on a 286 system, so for best results I would recommend a 386 machine with a fair amount of memory. PowerPoint is strong in charting, word processing, file exchange, color support, and presentation, but it's a little weak in drawing tools and effects. Most likely, in an attempt to avoid the kitchen sink phenomenon, Microsoft is counting on an exchange of images between Windows applications to fill in where PowerPoint lacks power.

—Andy Reinhardt

Building Stand-Alone SLQBase Applications

SQLWindows works hand-in-hand with Gupta Technologies' SQLBase, which is the first Structured Query Language server for the PC and still one of the leading contenders in its field. SQLBase runs on a dedicated DOS or OS/2 server and communicates over NetBIOS with DOS clients. You can develop character-mode client applications with Gupta's C application programming interface, or much more sophisticated graphical applications using SQLWindows. This slick 4GL (fourth-generation language) runs under Windows 3.0 and provides all the tools you need to build stand-alone Windows 3.0 applications that access SQLBase.

Two views share the screen when you are developing an application with SQLWindows. In the form window you draw, resize, and align user interface elements: menus, list boxes, data fields, scroll bars, and—particularly handy in the SQL environment—table windows. In the outline window, which automatically receives a structured-text representation of what you design in the form window, you build a protocol that mediates between users and the SQL engine.

It took me a couple of hours to do a simple program from scratch. I began with WINTALK, the Windows version of Gupta's interactive SQL command interpreter. Running WINTALK on the client, I imported a .DBF file into a server-resident SQL table. (Incidentally, the lengthy demonstration script that comes with WINTALK provides an excellent introduction to SQL.) Then I fired up SQLWindows, added a list box to the form window, and linked it to a column of my database. To forge that link I trapped and handled two messages. The first, sent to the program at start-up, triggered a connection to the server. The second, sent to the list box in response to a menu pick, activated a function (which I wrote in the SQLWindows application language) that issued a SQL query and then looped through the result set adding values to the list box.

SQLWindows neatly encapsulates Windows' message-oriented architecture, which greatly simplifies the task of building an interface. Still, negotiating a clean exchange between Windows display objects and SQL result sets takes a lot of work, particularly for multiuser applications. Gupta documents how to maximize both concurrency and consistency; basically, you monitor a hidden row ID and lock a row only when its ID becomes invalid. That's easier said than done; Gupta plans to endow table windows with more intelligence in a release due out later this year.

Under DOS, a SQLBase application requires considerable RAM-resident support. On top of NetBIOS you have to run Gupta's router, which eats up an additional 165K bytes of RAM. (An alternate, high-loading router uses only 56K bytes.) Under Windows, the router runs as a DLL (dynamic link library).

With Windows 2.x, that configuration didn't leave very much room for your SQLWindows application, let alone other concurrent Windows tasks. But the Windows 3.0 version of SQLWindows really shines. Now, neither DOS nor Windows suffers. DOS only needs to provide basic network services. (For NetWare users, a forthcoming native IPX router will eliminate the need to load Novell's add-on NetBIOS.) Given some extended memory to work with, Windows provides SQL services effortlessly.

Gupta plans to offer SQLBase on the Sun SPARCStation later this year, and to adapt SQLWindows for use with other servers: OS/2 Extended Edition Data Manager, SQL Server, and Oracle. There's work to be done, but SQLWindows should go a long way toward making the Windows 3.0 client workstation a reality.

—Jon Udell

continued

THE FACTS

SQLWindows, $1295
SQLBase for DOS, $1995
SQLBase for OS/2, $2495
Requirements:
Client: IBM AT or compatible with 1 MB of RAM and a hard disk drive
DOS server: 1 MB of RAM
OS/2 server: 4 MB of RAM

Gupta Technologies
1020 Marsh Rd., Suite 210
Menlo Park, CA 94025
(415) 322-4100
Inquiry 859.

World Radio History

Windows 3.0 Compatible

THE BEST GETS BETTER

CORELDRAW! 1.2

The World's Finest PC Illustration Software

New!

CorelTRACE! Autotrace Program

- Fast, precise, versatile and easy to use
- Automatic centerline or outline tracing (or you can combine the two methods)
- Batch processing of multiple files with complete control over the conversion process
- Accepts TIFF and PCX input files and produces EPS files

New!

Typeface Conversion Export

- Now exports typefaces to Z-soft Type Foundry
- Also imports over 5,000 typefaces from Adobe, Bitstream, Compugraphic and others

New!

Connectivity and Compatibility

- New import filters:DXF(CAD), GEM, HPGL, EPS, PICT(Mac)
- Also imports Lotus PIC, PCX, TIFF, Illustrator, GDF, CGM
- New export filters:DXF(CAD), GEM, HPGL, PICT(Mac), AI (mac), WPG(WordPerfect), and Videoshow. Also exports displayable EPS, Windows Metafile, SCODL
- Fully compatible with all Windows software and Ventura, WordPerfect, Lotus 123, Freelance, Harvard Graphics etc.

Easy, Powerful Drawing

- Streamlined user interface and lightning speed
- Powerful Bezier curve editing
- Calligraphic pen shapes

Over 100 Precision Fonts in any Size

- COREL's top quality typefaces (including 35 that match those in PostScript printers) are included for both screen and printer
- You see EXACTLY what you get, and you can view font shapes before you select them
- You can skew, rotate, magnify or fit text to a curve and interactively kern or edit lettershapes

Dazzling, Low Cost Color Output

- Supports all popular color printers and slidemakers. Full PANTONE* and CYMK Color support for color separations

Add Flair!

It's easy with CorelDRAW!

PANTONE® license included free

Call customer service: (613) 728-8200 for information and a free demo disk

*Pantone, Inc.'s check standard trademark for color reproduction and color reproduction materials.
Requires MS-WINDOWS® 2.03 or later.

COREL

Tel: (613) 728-8200
Fax: (613) 728-9790

Circle 319 on Reader Service Card

PageMaker Revs Up under Windows 3.0

PageMaker is a healthy-size package; the executable file alone is over three quarters of a megabyte. Add your document file and a number of graphics files, and you're asking your PC to manipulate megabytes of data for every document. But PageMaker has always run in 640K bytes of conventional memory under Windows. True, it used more than that, but only by swapping code segments to and from expanded memory and the hard disk drive.

Windows 3.0 has done great things for **PageMaker 3.01**. Aldus's newest release takes good advantage of the Windows look and feel, as well as using the improved memory and task management to greatly improve performance. PageMaker still runs as one single task; it's just that the task is no longer hampered by the environment.

I ran PageMaker 3.01 under both Windows 3.0 and Windows/286 version 2.11 on a 33-MHz 386 with 4 MB of memory. Under Windows 3.0, flowing a 90K-byte document into 35 pages took about 35 seconds. The standard Windows/286 installation provides no expanded memory, using only extended memory as a SmartDrive cache. PageMaker and Windows were trying to juggle about 10 MB of data, and only pulled it off with constant disk swapping. Windows/286 took over 1½ minutes for the same job.

The next thing I tried was using Quarterdeck's QEMM to simulate 2 MB of expanded memory and letting Windows/286 use that for segment swapping. That cut the time down to within 2 seconds of the Windows 3.0 test. The moral of the story: With enough memory tricks, you can really open up Windows/286. With Windows 3.0, you don't need any tricks.

Don't forget about the OS/2 version of PageMaker. Under OS/2, PageMaker gets some added goodies. OS/2's multiple application threads give you more control over PageMaker's operation. Under any version of Windows, some operations, such as autoflow, cannot be interrupted except at specific times. But OS/2 PageMaker puts these operations into a separate execution thread and allows the user input thread to run concurrently. The result is a snappier feel and better ability to manage long operations.

Windows/286 made using long documents with PageMaker 3.0 a chore; with the 3.01 update, PageMaker under Windows 3.0 is a joy. Before PageMaker 3.01, getting that kind of performance boost would require switching over to OS/2—a pretty big step. PageMaker 3.01 and Windows 3.0 give you that boost and more, without sacrificing compatibility with your DOS and other Windows applications. And just wait—PageMaker 4.0 promises to be even better.

—Howard Eglowstein

THE FACTS

PageMaker 3.01, $795
Requirements:
IBM PC with 2 MB of RAM.

Aldus Corp.
411 First Ave. S, Suite 200
Seattle, WA 98104
(206) 622-5500
Inquiry 860.

Actor Sets a New Stage for OOP

Actor does for Windows what Digitalk's Smalltalk/V does for the Mac and for Presentation Manager: It brings the graphical-user-interface revolution full-circle. Object-oriented programming concepts underlie today's GUIs, but OOP tools haven't dominated the field of GUI programming. That irony may not persist much longer. Actor's interpreted methods execute briskly under Windows 3.0; access to extended memory will allow more ambitious Actor applications.

If you've used Smalltalk, you'll feel right at home in Actor's Browser, Inspector, and Debugger. I miss some of the conveniences of Smalltalk/V PM: Actor's class-hierarchy list doesn't expand and collapse, and methods and instance variables aren't as easy to cross-reference. But I prefer Actor's C-like syntax and its smooth integration with underlying application programming interfaces. Actor methods can call DOS, the Windows kernel, or Windows DLLs (dynamic link libraries) with practically no fuss at all.

Unlike Smalltalk/V, Actor couples closely with its native GUI. That cuts two ways: You lose portability, but you gain the chance to learn a lot about the innards of Windows. I've never got very far with the Windows Software Development Kit/Microsoft C combination, but with Actor, formerly daunting topics like logical fonts and text metrics are far more accessible. Of course, as with Smalltalk, you have to learn a lot about Actor's classes and methods to get anything done. OOP technology makes a powerful lever; the trick is in finding the fulcrum.

Actor doesn't gain as much from Windows 3.0 as you might think. The Windows/286 version of Actor 2.0, released earlier this year, added the ability to swap Actor's static memory (code) and dynamic memory (data) to disk. Although Windows 3.0's enhanced mode provides virtual memory, Actor continues to roll its own. There's really no choice: Virtual memory is only an option in Windows 3.0, not a standard feature as in Unix and OS/2. Of course, Actor now has more global heap to play with. And Windows 3.0's ability to run more Windows and DOS programs in a given amount of RAM makes Actor applications (like all 3.0-compatible Windows programs) more attractive.

Actor has always played to several audiences. Some developers use it to create prototype applications that ultimately get built using a compiled language; because it's much more powerful than simple menu-and-screen interface builders, you

continued

THE FACTS

Actor 2.0, $695
Requirements:
IBM AT or compatible with a hard disk drive, 1 MB of RAM, and Windows 3.0.

The Whitewater Group
Technology Innovation Center
906 University Place
Evanston, IL 60201
(312) 491-2370
Inquiry 861.

World Radio History

Develop It Once And For All

Professional ORACLE Allows PC Developers To Build Applications For All Their Computers. Without Re-coding.

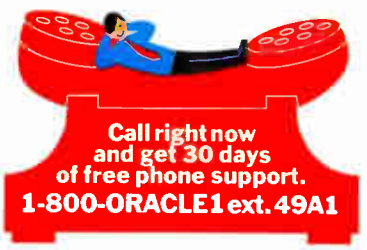
Software developers can now use their PCs to create even the most sophisticated database applications and then run them unchanged on virtually any major computer system.

Everything from a standalone PC to a client-server configuration on a LAN, from a minicomputer to the largest IBM mainframe.

In fact, applications developed with ORACLE* tools and database run unchanged on over 80 different computers.

ORACLE tools give PC programmers an integrated set of application development tools including a powerful 4GL, a screen generator, a reportwriter and a menu generator.

ORACLE tools can access data distributed over multiple ORACLE databases as well as data stored in other vendors' software such as IBM's DB2 and SQL/DS and DEC's RMS.

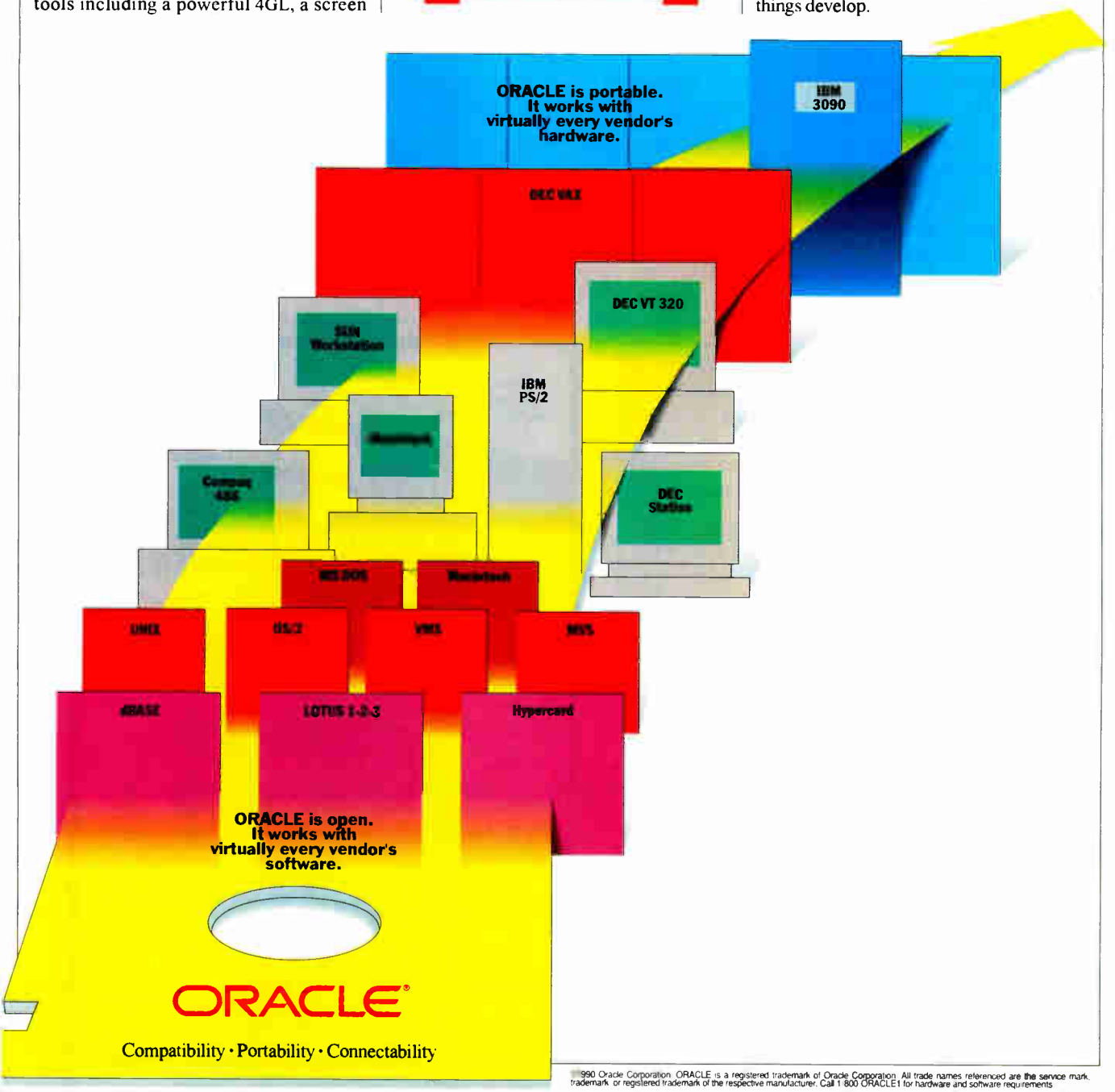


Oracle backs all of its products with the largest service, support and consulting group in the world.

And if you order now, Oracle will provide 30 days of free installation support plus a 30-day money-back guarantee.

Buy the Professional ORACLE tools and database for $1299, or you can buy just the tools for $799.

Call 1-800-ORACLE1, ext. 49A1 right away and see just how quickly and easily things develop.



©1990 Oracle Corporation. ORACLE is a registered trademark of Oracle Corporation. All trade names referenced are the service mark, trademark or registered trademark of the respective manufacturer. Call 1-800-ORACLE1 for hardware and software requirements.

World Radio History

can create highly functional prototypes. Others use it as an OOP laboratory for growing class libraries that they later transplant to C++. Still others deliver finished applications in Actor—typically of the client/server variety, in vertical markets. The large memory and protection that Windows 3.0 gives Actor applications will likely shift the balance in favor of Actor itself as a delivery system.

What does Actor still lack? Encapsulation of the communications and database services that mainstream Windows 3.0 client applications will require. As network and Structured Query Language (or object-oriented) database technologies mature, The Whitewater Group should evolve its class library to accommodate them. A well-connected Windows 3.0 workstation will not need a powerful file system or a sophisticated database: Unix, OS/2, or hosts can provide these amenities. But the Windows workstation will need graphical interfaces to such hosts, and Actor figures to be a key provider of these. —*Jon Udell*

Windows 3.0 Paints a Rosier Picture for Designer

Products like **Designer 3.0**, the latest version of Micrografx's leading drawing program, prove that PCs will play an increasingly important role in professional graphics. Windows 3.0 isn't a cure-all for Designer, but it's a powerful tonic. Under Windows 2.11 you had to reserve expanded memory for Designer's exclusive use in order to manipulate complex images, and even then there were problems. For example, although Designer's import function could move graphics from a disk file straight into expanded memory, interapplication cut-and-paste operations were bound by the conventional memory available to the Windows clipboard. Windows 3.0's direct use of extended memory makes the promise of Macintosh-style interoperability finally real for applications like Designer.

Still, life isn't perfect. Although Designer 3.0 runs more briskly on my 20-MHz 286 machine under Windows 3.0 than under Windows 2.0, there's no getting around the fact that it takes quite a long time to render layered, vector-rich images to the screen. A math coprocessor would liven things up; so would a graphics coprocessor. Over the next year or so, two trends—the falling price of 34010-based display boards, and rising demand for serious PC-based imaging software—will inevitably intersect.

For hardware vendors, Windows 3.0 drivers are a high priority. At the moment, it's unclear how Windows' raster-oriented Graphics Device Interface can best utilize vector-oriented coprocessors. Designer 3.0's new outline fonts underscore the need for vector support: Screen redraws crawl when you add lots of outline text to a drawing. The need will grow much more pressing when Microsoft incorporates TrueType into Windows. Windows' fate as a production

continued

Drover's ToolBox for Windows

Attention: Windows developers programming in C.

Drover's ToolBox for Windows packs powerful features into your Microsoft Windows™ applications, saving you months of coding time.

- Features seven new classes for use in dialogs. (Integer, date, time, float, etc. with automatic screen validation)
- Windows 2.x and 3.x compatible
- Increases functionality of Windows Software Developers ToolKit™
- Includes over 200 useful functions in a single DLL (Dynamic Link Library)
- Converts most C runtime library functions to far pointers, including sprintf and sscanf
- Start programming windows applications immediately with standard C conventions
- Comes with extensive documentation including many examples and shell applications using the ToolBox
- Extends flexibility of SQLWindows™ and Actor™ development environments
- An indispensable library for developers

At $295 it's the best productivity booster yet. Just call or fax us with your order (VISA and MasterCard accepted).

Drover Technologies, Inc.
660 White Plains Road, Tarrytown, NY 10591-5134
Phone (914) 631-4942 • Fax (914) 631-7013

Industrial Control Systems
LAN Terminals
Diskless Systems

ROMDISK™

For the IBM PC, XT, AT PC DOS* or MS DOS*

SOLID STATE DISKETTE AND DRIVE EMULATORS
LAN PERFORMANCE IMPROVEMENT

- Make PC/XT/AT and compatibles diskless terminals with local DOS and program storage.
- Single or dual disk emulation of 5¼" or 3½" diskettes up to 1.2MB, read/write up to 770K.
- In-board and interchangeable Cassette models using EPROM, Flash EEPROM and SRAM technology.
- On-board EPROM programmer—simply copy a diskette to program the EPROMs or Flash EEPROMs. Flash EEPROMs remotely programmable on LANs.
- Two Autoboot modes, a File (read) and a Programming mode—automatic disk drive designation set-up during booting.
- Flash EEPROM models are electrically erasable. SRAM models are battery backed. EPROM models are ultraviolet erasable.
- Programming utilities included with programmable models; LAN utilities for remote programming of Flash. EEPROMs available for Flash models on request.
- List prices with memory ICs from $295. OEM prices and models available OEM with or without memory ICs.

VISA MasterCard

CURTIS, INC.
2837 North Fairview Ave. • St. Paul, MN 55113
612/631-9512 Fax 612/631-9508

*IBM PC, XT, AT, PS/2 and PC DOS are trademarks of IBM; MS DOS is a trademark of Microsoft

Circle 90 on Reader Service Card

Circle 73 on Reader Service Card

World Radio History

Word's out.

If you think the best word processor for Microsoft® Windows comes from Microsoft, there are two things you should consider.

And neither of them come from Microsoft.

There's Amí,® the ground-breaking program that brought the graphical interface of Windows to word processing in the first place.

And Amí Professional, the muscular new high-end complement to the critically-acclaimed original.

Whether you're an executive type who

They may look like desktop publishers, but Amí and Amí Professional are what word processing should have been all along. Amí is yours for just $199. Amí Professional for $495.

types only occasionally, or a heavy user who needs lots of specialized features, one of these programs is definitely your type.

Or both, if you happen to be a corporation.

Because, in addition to using the same interface and file format, they're both designed to save you the type of thing you care about most.

Time.

About three quarters of the time you're used to spending on everything from simple letters and memos to presentations and newsletters.

"A stunning achievement, one that no other PC word processing product—even Microsoft's estimable Word for Windows—can claim to have reached."

—PC/Computing

"The features in Amí Professional are both intuitive and fast... a spectacular achievement by any standard... Word for Windows suddenly faces a formidable challenge."

—PC Magazine

"Amí Professional outperforms the competition and has laid the path for word processing in the 1990's. Its superior layout and graphics-related capabilities in addition to standard features put it a step above the rest."

—InfoWorld

"Samna achieved a remarkable coup surpassing Microsoft and WordPerfect with Amí Professional."

—Software Digest

How?

By letting you create your words and your page layouts *simultaneously*—as one intuitive train of thought.

By providing you with professionally designed style sheets that make it simple to generate the most sophisticated-looking documents.

Software Digest

Rating	Overall Evaluation	Overall Power	Program Name
★★★	7.9	6.9	Amí Professional
★★★	7.7	7.7	Microsoft Word
★★★	7.6	8.1	Word Perfect
★★★	7.2	6.7	Microsoft Word for Windows

Software Digest gives Amí Professional its highest overall rating.

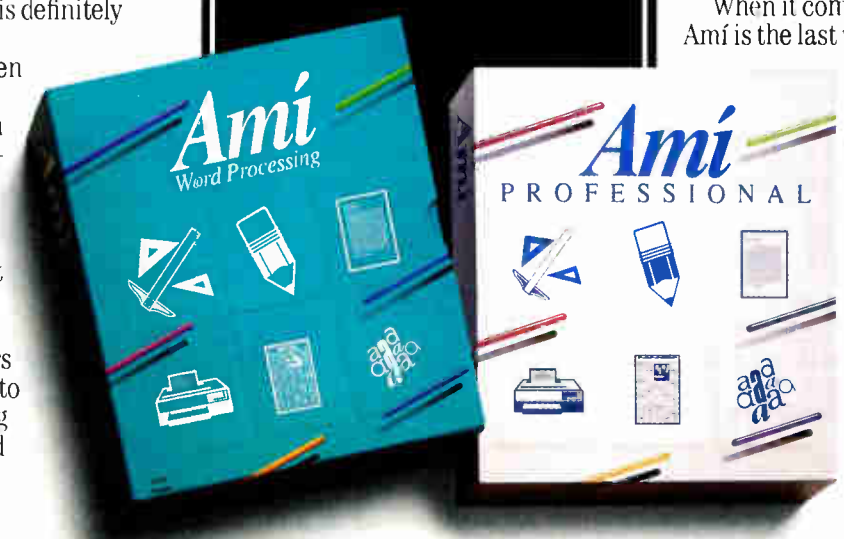
And by making it easy to exploit even the most sophisticated word processing features.

As well as those features you'll find in Amí Professional that you won't find even in the most sophisticated of traditional word processors.

Including tables that let you perform basic math. Charts and graphs. A drawing program. And Dynamic Data Exchange with other Microsoft Windows applications.

Now that a certain long-awaited Windows application has finally arrived, we think you'll agree with the experts.

When it comes to word processing, Amí is the last word.



samna
WORD PROCESSING

Call 1-800-831-9679 for a free self-running demo and information on our Windows 3.0 version.

Requires IBM® AT, PS/2 or compatible (80286 or 386 CPU); CGA, EGA, VGA or Hercules compatible displays; MS/DOS 3.0 or higher. Amí is a registered trademark of Samna Corporation. All other trademarks and copyrights are acknowledged. A free runtime version of Microsoft Windows is included with each copy of Amí and Amí Professional. Amí Professional is also compatible with Hewlett Packard's New Wave.

Circle 246 on Reader Service Card

World Radio History

graphics platform—and by extension, the fate of applications like Designer—will depend on the effective utilization of advanced display hardware.

Designer 3.0 comes with two new accessories. Electronic SlideShow does on-screen presentations; it features PCX and TIFF color bit-map support, transition effects, and prerendering. The program's TeleGrafx Imaging Center Driver transmits via modem and phone lines to either of two service bureaus (more are to be added later) for conversion into 35mm slides, 4-inch by 5-inch transparencies, overhead foils, and full-color presentation prints.

Another bonus is a free clip-art library with more than 1700 professional-quality images. Other new features include the ability to trace color PCX and TIFF images and convert them to editable color vector images; clip-art preview (so you can see what a piece of clip art looks like before importing it); a Bézier curve drawing tool that allows setting and editing Bézier control points while drawing; enhanced color-separation controls; improved PostScript and Matrix (SCODL) film recorder drivers; and the ability to import the embedded TIFF portion of an Encapsulated PostScript file.

Micrografx advertises Designer as the "cure for Mac envy." Windows 3.0 adds considerable credence to that claim.

—George Bond

THE FACTS

Designer 3.0, $695
Requirements:
IBM AT or compatible with 1 MB of RAM, a hard disk drive, an EGA or VGA graphics card, a graphics monitor, and a mouse or compatible pointing device.

Micrografx, Inc.
1303 Arapaho
Richardson, TX 75081
(800) 272-3729
Inquiry 862.

Bridge over Troubled Waters

You've heard the refrain: "The graphical interface makes everything easy; all you do is point and click." And point, and click, and drag, and point, and click . . . after a while, ease-of-use starts to feel like tyranny. Enter **Bridge**, a graphical command language for Windows. Bridge batch files can launch Windows (or DOS) applications; select, resize, and move windows; control menus and dialog boxes; feed keystrokes to running programs; conduct DDE (dynamic data exchange) conversations with DDE-aware Windows applications; and manage message-oriented interprocess communication (IPC).

Here is a trivial but handy use of Bridge. When my PC boots and loads Windows, a Bridge batch file activates

continued

Complete 386/33 MHz Cache System for Under $2,000.

HARD DRIVE 43MB INCLUDED

MIS 386-33MHz STANDARD

- 1MB 80NS RAM
- 32K 25NS SRAM CACHE
- REAL TIME CLOCK CALENDAR
- INTEL/WEITEK MATH CO-PROCESSOR SOCKET
- TEAC 5.25" 1.2MB FLOPPY DRIVE
- 43MB 28MS Hard Disk Drive
- 2 SERIAL, 1 PARALLEL AND 1 GAME PORTS
- MGP ADAPTER
- SAMSUNG 12" AMBER MONITOR
- NMB HI-TEK 101-KEY ENHANCED KEYBOARD
- DESKTOP CASE WITH FIVE DRIVE BAYS
- 220W POWER SUPPLY
- ONE YEAR PARTS AND LABOR WARRANTY

$1,995

VGA (640x480) upgrade	Add	$ 450
S-VGA (800x600) upgrade	Add	$ 499
P-VGA (1024x768) upgrade	Add	$ 699
80MB/212MB Hard Drive upgrade	Add	$250/750
3.5" 1.44MB Floppy Drive	Add	$ 85
4MB RAM Upgrade	Add	$ 350
64K Cache Upgrade (386-25/33 MHz)	Add	$ 120
Vertical Case	Add	$ 150
Mini Vertical Case	Add	$ 75
CALL FOR ADDITIONAL CONFIGURATIONS		

386-25MHz STANDARD System	$1,895
386-20MHz STANDARD System (Non-Cache)	$1,495
386SX-16MHz STANDARD System	$1,045
286-12MHz STANDARD System	$ 895
486-25MHz STANDARD System (64K Ext. Cache)	$3,795

MIS Computer Systems
P.O. Box 70897 Sunnyvale, CA 94086-0897

30-DAY MONEY BACK GUARANTEE!

Order Now
1-800-733-9188 VISA MasterCard

Prices and terms are subject to change without notice. 30 days money back does not include monitor and shipping charge. CA residents add appropriate sales tax. No surcharge on credit card purchases. Personal and company checks require 2 wks clearance. All names mentioned are registered trademarks of their respective companies.

Circle 159 on Reader Service Card

World Radio History

The Old Standard For Debugging Just Retired

"I find not only (MultiScope™'s) capabilities, but also the level of technical support provided, to be utterly fantastic. My productivity in these few months has literally doubled. There is no doubt in my mind that several features in the Solver Utility that will be bundled with the upcoming Lotus 1-2-3/G product owe their existence solely to my use of your wonderful debugger." *Letter sent to MultiScope, Inc. 12/89*

The award winning MultiScope Debuggers for **DOS, OS/2** and **Windows 3.0** are the most sophisticated debugging tools available today. The selection of unique features includes: • Run-time debugging to monitor program execution • Post-Mortem debugging to analyze program state after a crash • 100% CodeView™ compatible • Direct support for C*, Pascal, Modula-2, FORTRAN, and BASIC • 14 views of the program: Source, Local/Global Data, Graphical Data, Assembly, Breakpoint, Watchpoint, Register, Thread, Module, Procedure, Call Chain, Memory, Output, and Log • 386/486 ICE and virtual DOS debugging • Conditional breakpoints • Dual monitor, Serial and LAN remote debugging • VCR-like remote control from application screen.

MultiScope Debuggers have easy to use Windows, PM and character mode user interfaces.

The new standard for debugging has arrived. For more information and a free trial version, please call (800) 999-8846, (415) 323-4286, or FAX (415) 323-4186. For European pricing please call ++46-13-63189.

* C 5.1 and C 6.0 support
All trademarks are property of their respective owners

PC Magazine Technical Excellence Award, InfoWorld Product of the Year, BYTE Award of Distinction.

MULTISCOPE

Circle 173 on Reader Service Card (DEALERS: 174)

World Radio History

the clock (which my WIN.INI loads as an icon), resizes it, and moves it to the lower right-hand corner of my screen. Silly as it sounds, there's no straightforward way to do this on a Mac or in any of the Unix graphical user interfaces. Windows 3.0's own Macro Recorder, which can remember and play back sequences of mouse and keyboard events, isn't a real solution, either. What you really need is programmatic access to a GUI's message stream—the modern equivalent of standard input. Then you can begin to treat GUI-based applications as Unix-style software building blocks that fit together in complementary ways.

Advanced Bridge applications can combine off-the-shelf DOS and Windows software to create customized, job-specific workstations. For example, a financial system might feed numbers from a proprietary DOS-based analytical program directly into Excel. Two Bridge components facilitate such interactions: A TSR DOS supervisor monitors DOS sessions, enabling Bridge to send and react to keystrokes and capture screen data, and the Bridge message controller supports more-complex interactions.

Under Bridge control, DOS and Windows programs can converse locally or over a NetBIOS-compatible LAN, using mailboxes to coordinate activities. Of course, shrink-wrapped programs are basically black boxes. Bridge can supply them with inputs and take action based on their outputs, but they remain passive components. But an optional toolkit lets developers create Bridge-aware DOS and Windows programs that actively exploit Bridge's message-oriented IPC.

Softbridge has packed the Bridge batch language chock-full of the goodies that DOS's sorely lacks: arrays, parameterized subroutines, local variables, file I/O, modern control structures, and a rich set of supporting functions. You can parse a filename, query and set file attributes, read or write an array, insert an element into an array, look up an element in an array, and search, concatenate, or alter strings. With the Bridge browser you can monitor windows, variables, mailboxes, and hot keys.

As users exploit Windows 3.0 to run more concurrent applications, Bridge should come into its own. Ultimately, of course, applications ought to integrate tightly with operating-system-level IPC mechanisms; Unix and OS/2 will likely serve that goal better than the DOS/Windows hybrid. But for now, if you want programmatic control of character-based and graphical applications under Windows 3.0, you'll find Bridge as handy as a Swiss Army knife. —*Jon Udell*

THE FACTS

Bridge
developer's toolkit, $695
run-time version, $125
Requirements:
IBM AT or compatible with a hard disk drive, 640K bytes of RAM, and Windows 3.0.

Softbridge Microsystems
125 Cambridge Park Dr.
Cambridge, MA 02140
(617) 576-2257
Inquiry 863.

Telecommunications Under Windows 3.0

DynaComm 2.1 is a telecommunications program that runs with Windows 3.0. It contains an extensive script language that provides a platform for building complex applications as well as simple log-in scripts. Its binary file transfer support is good, although ZMODEM is conspicuous by its absence. And it runs nicely in the background.

Windows 3.0 memory management works well with this program. When DynaComm 2.1 is loaded into a 286 machine with 640K bytes of main memory, 384K bytes of extended memory, and 1 megabyte of EMS 4.0, Windows 3.0 still has 532K bytes left for programs. DynaComm 2.0, on the same machine and using Windows/286, leaves only 271K bytes of memory for programs and 240K bytes of EMS. Windows 3.0 alone leaves 650K bytes of main memory for programs. With only Windows/286 loaded, 342K bytes of main memory and 320K bytes of EMS are left.

The ability to do file transfers in the background is a great asset. It lets you receive and send E-mail and conferencing system messages, or transfer program code or graphics, while doing other work; your computer is not out of general service during the transfer. DynaComm 2.1, running in the background, received a 20K-byte ASCII file in just over 5 minutes at 2400 bps over a packet-switching network. The same file transfer required almost 6½ minutes using Windows/286. Thus, a 200K-byte transfer would take about 15 minutes less with Windows 3.0.

The script language has the usual high-end telecommunications-program script language capabilities—conditional execution, parameter passing, local variables, subroutine execution, and so on. Its more advanced features include support for DDE (dynamic data exchange), dynamic reconfiguration of the graphical user interface, and event handling using WAIT and WHEN commands. These should make it easy to develop specialized interfaces for even very sophisticated and complex applications.

First-time programmers may find the language daunting; the price of its power is complexity. But users with general programming experience, even in other script languages or databases, should have few problems finding their way around this language. And over two dozen sample scripts are included.

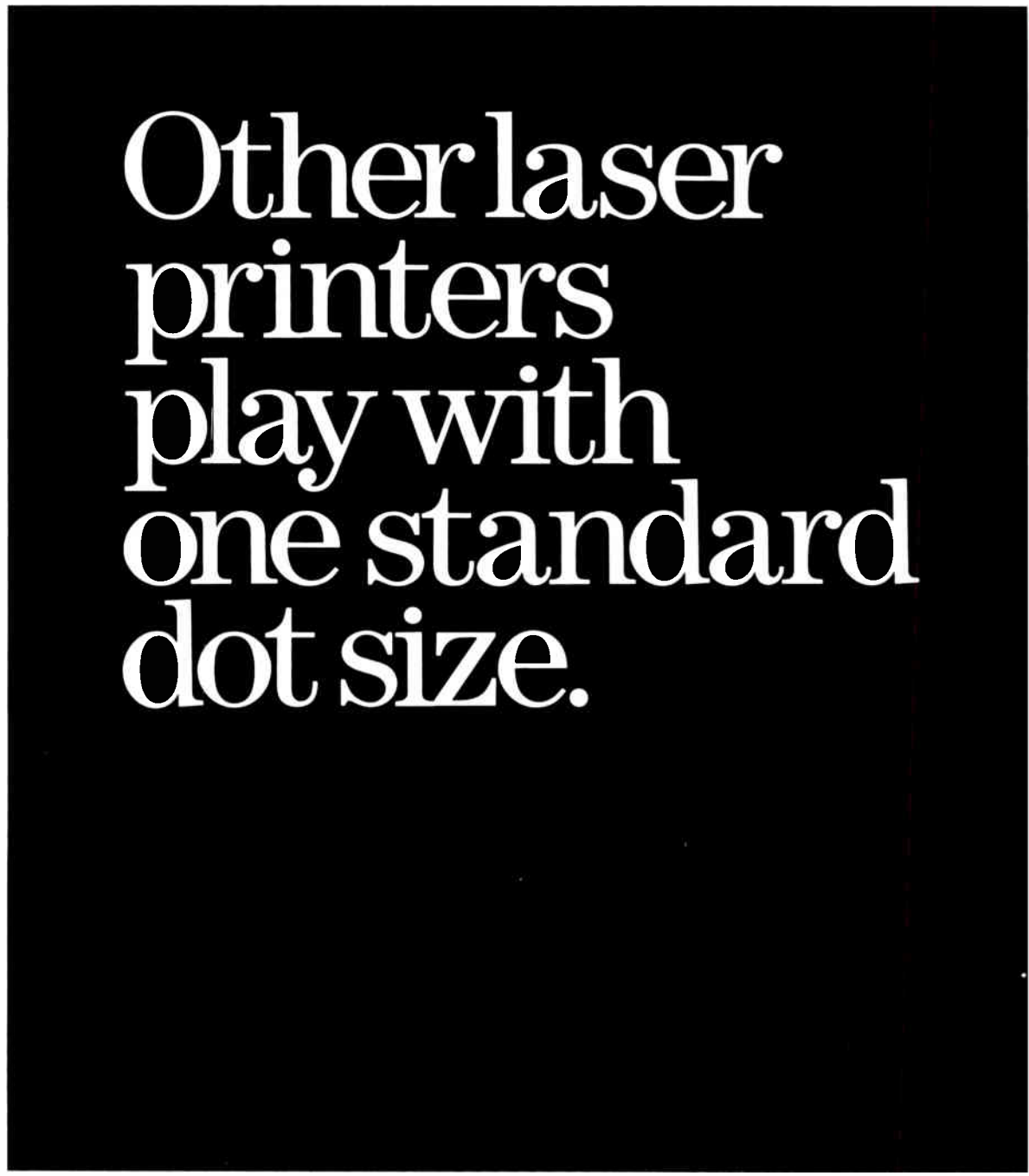
The program can emulate eight terminals: ADDS VP/60; CompuServe Vidtext; DEC VT52, VT100, and VT220; HP 700/94; IBM 3101; and TeleVideo 925/950. It supports NetBIOS, including AT&T ISN and UB NIU extensions, ComBIOS via interrupt 14H, and UB-NetCI. It can also be used on LANs. ■
—*George Bond*

THE FACTS

DynaComm 2.1, $295
Requirements:
IBM AT or compatible with a hard disk drive (400K bytes of free disk space is needed to install the application, 1 MB to install the entire DynaComm environment), 512K bytes of RAM (640K bytes recommended), and Windows 3.0.

Future Soft Engineering, Inc.
1001 South Dairy Ashford, Suite 203
Houston, TX 77077
(713) 496-9400
Inquiry 864.

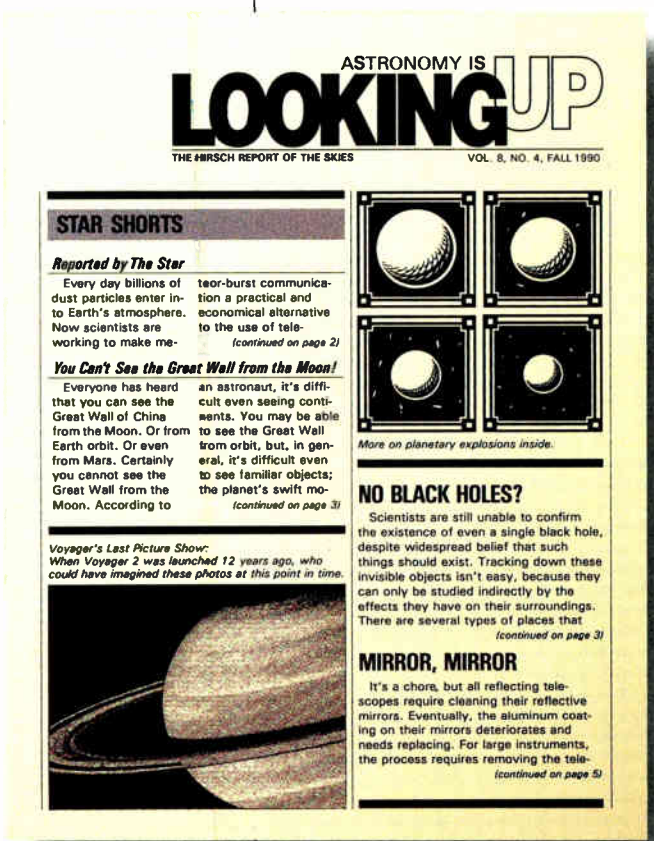
World Radio History



Circle 113 on Reader Service Card

World Radio History

HP makes it a



ASTRONOMY IS
LOOKING UP
THE HIRSCH REPORT OF THE SKIES
VOL. 8, NO. 4, FALL 1990

STAR SHORTS

Reported by The Star

Every day billions of dust particles enter into Earth's atmosphere. Now scientists are working to make meteor-burst communication a practical and economical alternative to the use of tele-

(continued on page 2)

You Can't See the Great Wall from the Moon!

Everyone has heard that you can see the Great Wall of China from the Moon. Or from Earth orbit. Or even from Mars. Certainly you cannot see the Great Wall from the Moon. According to an astronaut, it's difficult even seeing continents. You may be able to see the Great Wall from orbit, but, in general, it's difficult even to see familiar objects; the planet's swift mo-

(continued on page 3)

Voyager's Last Picture Show:
When Voyager 2 was launched 12 years ago, who could have imagined these photos at this point in time.

More on planetary explosions inside.

NO BLACK HOLES?

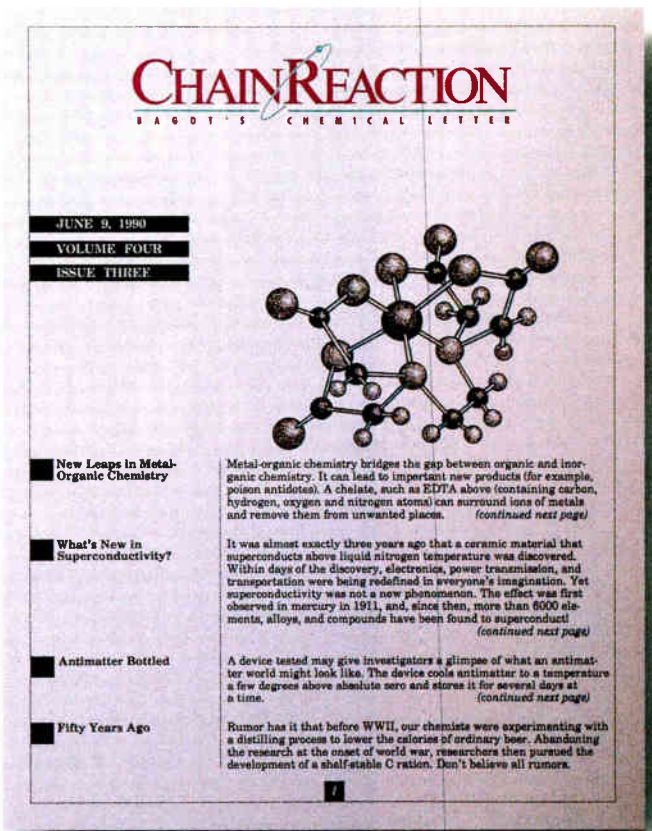
Scientists are still unable to confirm the existence of even a single black hole, despite widespread belief that such things should exist. Tracking down these invisible objects isn't easy, because they can only be studied indirectly by the effects they have on their surroundings. There are several types of places that

(continued on page 3)

MIRROR, MIRROR

It's a chore, but all reflecting telescopes require cleaning their reflective mirrors. Eventually, the aluminum coating on their mirrors deteriorates and needs replacing. For large instruments, the process requires removing the tele-

(continued on page 5)



CHAIN REACTION
BAGDY'S CHEMICAL LETTER

JUNE 9, 1990
VOLUME FOUR
ISSUE THREE

New Leaps in Metal-Organic Chemistry

Metal-organic chemistry bridges the gap between organic and inorganic chemistry. It can lead to important new products (for example, poison antidotes). A chelate, such as EDTA above (containing carbon, hydrogen, oxygen and nitrogen atoms) can surround ions of metals and remove them from unwanted places. *(continued next page)*

What's New in Superconductivity?

It was almost exactly three years ago that a ceramic material that superconducts above liquid nitrogen temperature was discovered. Within days of the discovery, electronics, power transmission, and transportation were being redefined in everyone's imagination. Yet superconductivity was not a new phenomenon. The effect was first observed in mercury in 1911, and, since then, more than 6000 elements, alloys, and compounds have been found to superconduct!

(continued next page)

Antimatter Bottled

A device tested may give investigators a glimpse of what an antimatter world might look like. The device cools antimatter to a temperature a few degrees above absolute zero and stores it for several days at a time. *(continued next page)*

Fifty Years Ago

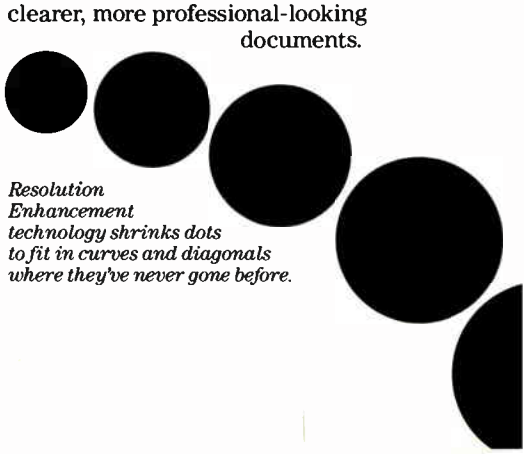
Rumor has it that before WWII, our chemists were experimenting with a distilling process to lower the calories of ordinary beer. Abandoning the research at the onset of world war, researchers then pursued the development of a shelf-stable C ration. Don't believe all rumors.

1

Introducing the new HP LaserJet III printer with Resolution Enhancement technology.

The rules have changed. Now the name of the game is Resolution Enhancement technology. You'll call it the best thing to happen to laser printing since the very first HP LaserJet printer. It gives you clearer resolution. Curves that really curve. And edges that are never jagged.

Instead of a "one-size-fits-all" dot, HP's built-in intelligence varies dot sizes. So they can fill areas where they could never go before. For clearer, more professional-looking documents.

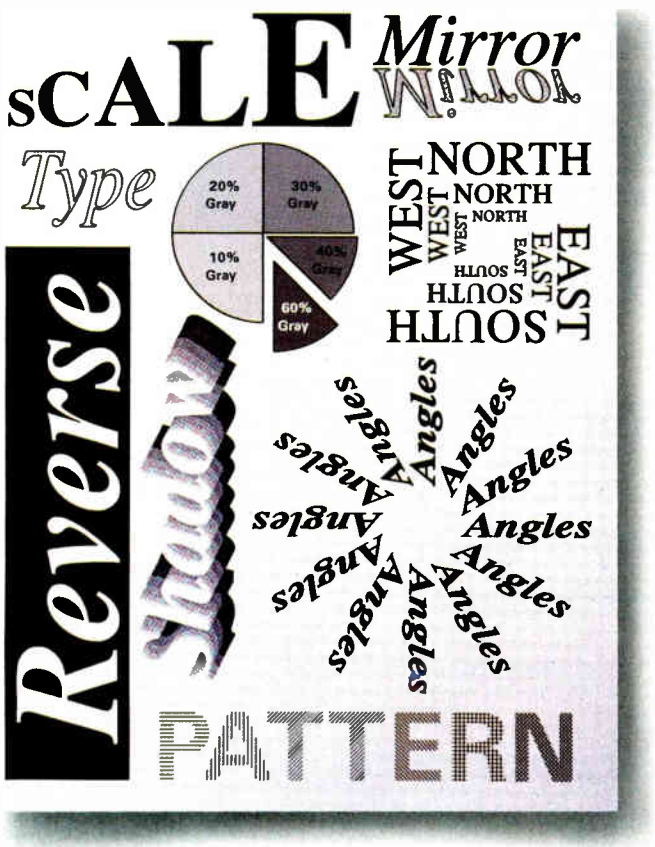


Resolution Enhancement technology shrinks dots to fit in curves and diagonals where they've never gone before.

©1990 Hewlett-Packard Company PE12003

World Radio History

whole new ball game.



But there's more than better print quality. 14 bit-mapped fonts and 8 internal scalable typefaces provide thousands of options. And enhancements to our PCL5 printer language, including our HP-GL/2 graphics language, let you print portrait and landscape on the same page. Reverse and angled type. Spirals. Even shaded text. You can also plug in Adobe PostScript® software.

For all its new features, the $2,395* list price of the HP LaserJet III is a good deal less than the HP LaserJet

Series II printer it replaces. With the same hardware compatibility, wide range of applications, 8 ppm print speed, and software compatibility, including WordPerfect 5.1 and WordStar® 6.0. And the same reliability as the rest of the HP printer family.

So call **1-800-752-0900, Ext. 1007.** Ask for our booklet on Resolution Enhancement technology and where to find your nearest authorized HP dealer. We'll put you in a whole new league.

There is a better way.

HEWLETT PACKARD

*Suggested U.S. list price. WordStar is a U.S. registered trademark of WordStar International Incorporated. Adobe and PostScript are registered trademarks of Adobe Systems, Inc.

Circle 114 on Reader Service Card

World Radio History

THE LASER PRINTER FOR TIGHT BUDGETS, TIGHT DEADLINES AND TIGHT SPACES.

THE NEW SHARP JX-9500.

Sharp's new laser printer saves you three things everyone seems to be short of—money, time and space. It takes up no more room than two sheets of paper, yet it prints 6 pages per minute of crisp text and graphics, and holds 250 sheets in its internal paper tray. As small and inexpensive as it is, the JX-9500 is a real office workhorse.

It's also ready to grow. Add a second paper tray for a full 500 sheet capacity. Or an automatic envelope feeder that handles 40 envelopes without forcing you to take the paper out. There are *two* font card slots. And memory is expandable to 4.5MB with easy-to-install RAM cards.

Room to grow. *The JX-9500 with automatic envelope feeder and second paper tray.*

We could go on and on about our remarkable new laser printer. But we suggest you call 1-800-BE-SHARP, because, as you can see, space is tight.

SHARP

FROM SHARP MINDS COME SHARP PRODUCTS™

©1990 Sharp Electronics Corp.

Circle 318 on Reader Service Card

World Radio History

Notebook Newcomer

■ Michael Nadeau

Airis hopes to challenge established small-PC makers with an innovative new machine

Designing a state-of-the-art notebook computer is risky. To begin with, the competition is playing a constant game of leapfrog. A leading-edge product today could be obsolete next week. On top of that, cheap knock-off products from the Pacific Rim and a cutthroat sales climate make entry into this market tough.

In fact, unless you are a Compaq or a Toshiba, you'd have to be a little crazy to jump in. Yet, that is what a start-up venture, Airis Computer, has done. Its notebook PC is so loaded with features that it could maintain the leading edge for a significant period of time—at a price half that of the competition.

Features, Features, Features

For $1895, the Airis VH-286 comes with most standard notebook PC features and several new ones. The standard configuration has a 12.5-MHz 286 CPU with a socket for an 80287 FPU. A 2½-inch 20-megabyte 23-millisecond hard disk drive from Conner Peripherals or PrairieTek is the sole mass storage device.

The VGA LCD video is an 11-inch, supertwist, backlit, black-on-white, 640- by 480-pixel screen with 16 levels of gray shading. A 2400-bps modem is built into the motherboard. Standard memory is 2 MB, upgradable to 4 MB using two 1-MB single in-line memory modules. A low-profile external floppy disk drive, powered from the computer, is a $150 option if you buy it with the system, $249 sold separately. Traveling Software's LapLink, standard on the hard disk drive, provides file transfer capability between the VH-286 and desktop PCs. MS-DOS 4.01 is the standard operating system.

The case measures about 10 inches long by 12 inches wide. The wedge shape is 2 inches thick at the back and about 1½ inches at the front. It is roughly the same size as a loose-leaf notebook. It weighs about 6½ pounds with batteries; the AC power pack weighs just under a pound and is smaller than most.

Standard ports include one RS-232C serial port, one parallel port, one RJ-11 connector for the built-in modem, an AC power connector, a floppy disk drive connector, and a PS/2 mouse port (which also supports an external keyboard). All are located at the rear. It does not have an external monitor port.

You have a choice of battery power—rechargeable nickel-cadmium batteries or 10 C-cell alkaline batteries. Airis had not yet determined battery life, but it estimates that the unit will run about 6 hours on nickel-cadmium batteries and perhaps as much as 12 hours on alkaline batteries. These impressive numbers are believable if you consider the extraordinary battery-saving features built into the VH-286.

Airis started with the battery-saving features found in most other notebook PCs—low-power components like the small hard disk drive, power-management utilities, and the strategic omission of a floppy disk drive. All major components automatically shut down when not in use, a feature found on systems like the Compaq LTE and Toshiba T1600. What's different is Airis's use of excess video RAM as an on-board disk cache

continued

Photo 1: *The Airis VH-286 sports a streamlined design free of harsh angles or protrusions.*

PHOTOGRAPHY: PAUL AVIS © 1990

World Radio History

and an efficient power-converter design.

To reduce the video RAM chip count from eight to four, the VH-286 designers opted for low-power pseudostatic RAM. But the configuration of these chips provided 512K bytes of video RAM; only 256K bytes were needed for video. The rest became the disk cache. Airis estimates that this cache (not yet implemented on the prototype I saw) achieves a 65 percent to 70 percent hit rate; thus, the system accesses the hard disk drive that much less, saving battery life.

A configuration utility allows you to set time-outs for component shutdowns. All system configurations can be set via the keyboard. A battery-watch utility monitors battery power. An auto-resume feature lets you return to an application at the point you turned off the computer. The feature maintains power to system RAM after you shut off the computer, so it "remembers" where it was.

One last unique feature is Airis's use of Intel's Flash EPROM technology in storing the BIOS. The Flash EPROM chip is soldered onto the motherboard, and it can be updated remotely by simply downloading new code over a phone line. Airis calls this feature TeleROM. Not only does this provide a convenient and inexpensive means for users to get BIOS updates, it reduces manufacturing and design costs by permitting on-the-fly changes to the BIOS code.

Good-Looking, Too

The hardware is interesting, but perhaps the most striking feature of the VH-286 is its appearance. Its streamlined shape is free of sharp angles or protrusions. All the ports and external connections are covered by a contoured, hinged panel that, when opened all the way, raises the rear of the system for a steeper typing angle. The Joss Design Group, a well-known design house from Chicago, is the architect of the system's housing.

The unit has no front latch to release the clamshell-style display. Instead, a cam mechanism in the screen's hinge locks it shut. To open the display, you press a button on the side of the hinge. This button is flush with the case. The screen folds back a full 180 degrees and is held in place by friction.

Eliminating the front latches has two advantages. It gets rid of any external release mechanism and protruding latches, and it allows for a slightly smaller footprint by requiring less material around the keyboard.

The design has another, hidden advantage. All the components snap together, except for the keyboard assembly, which has two screws. This translates into significant cost savings in manufacturing.

Airis says it was aiming for a professional-looking design that business users would be comfortable with. Compared to some of the competition—the Zenith MinisPort comes to mind—it has met that goal.

For Keyboard Fanatics

Airis is especially proud of its keyboard. The unit I saw, however, had only a prototype keyboard. The basic layout and feel, according to Airis, is similar to the final version, which is being developed by EECO/Maxi-Switch.

It is basically a standard, full-size, 82-key keyboard with some exceptions commonly found on small PCs. It has no separate numeric keypad, relying on an embedded one, and the function and some of the other nonalphanumeric keys are considerably smaller. Separate PageUp, PageDown, Home, and End keys are

Circle 140 on Reader Service Card (DEALERS: 141)
World Radio History

full size. No compromise was made on key travel or distance between key caps. The cursor control keys are full size and in the familiar inverted-T configuration, and the Enter key uses the larger backward-L shape. The Control, Shift, and Alt keys are where you'd expect them to be. Anyone moving from a standard desktop PC keyboard should have little trouble adjusting to the VH-286 keyboard.

The keyboard will have a couple of other uncommon features, as well, although they were not on the unit I saw. One is a keyboard remapping utility that lets you rearrange the key layout to your liking. The other is a "sticky key" feature that allows you to perform multiple-key sequences one-handed.

Performance

Functionality is more important than raw power on a notebook PC, but the Airis holds its own in the power department, too (see the table). Preliminary BYTE benchmark scores give it an excellent 2.35 CPU index, higher than the Compaq SLT's 1.59 and those of most 80386SX systems we've tested. Airis claims zero-wait-state operation for the VH-286, and the CPU index shows it.

The disk I/O index is an adequate 1.38, but this should improve when the disk cache is fully implemented. The video index of 1.48 is a little above average for LCD-based laptops.

Not Available in Stores

By pricing the VH-286 at under $2000, Airis has left little margin for profit. Therefore, it will sell the VH-286 only through direct sales; for most people, that means mail order. Assuming that Airis will provide good after-sale support à la Dell and other successful mail-order houses, this should not be a problem.

The VH-286 comes with a two-year parts-and-labor warranty—longer than many of its competitors. Since the system board uses mostly surface-mount technology, most repair service will be a simple matter of replacing entire components. Airis expects to have a one-week turnaround on repairs. Since each unit has a modem built in, the company can do remote diagnostics to try to resolve the problem over the phone.

COMPANY INFORMATION

Airis Computer Corp.
1824 North Besly Court
Chicago, IL 60622
(312) 384-5608
Inquiry 990.

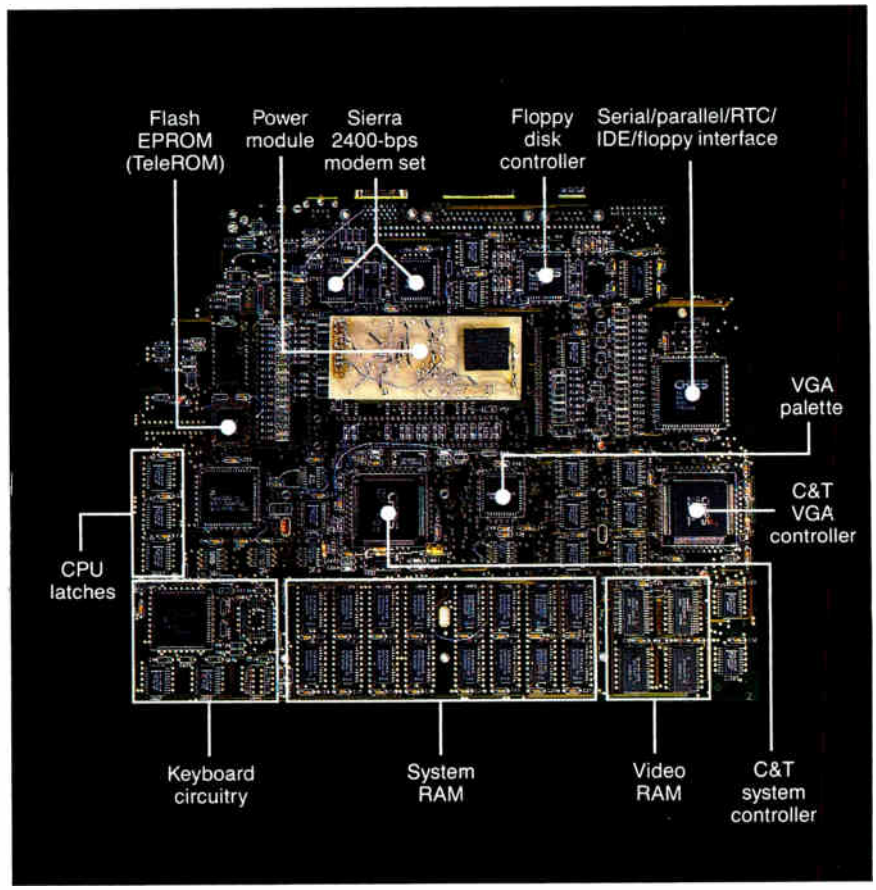


Photo 2: *The VH-286 motherboard makes extensive use of surface-mount technology. It has a number of wire jumpers, which should not appear on the final production units.*

BYTE BENCHMARK RESULTS

The 2.35 CPU index is very fast for a 286-based laptop and is owing to the VH-286's zero-wait-state operation (N/A = not applicable).

	CPU	FPU	Disk I/O	Video
Airis VH-286	2.35	N/A	1.38	1.48
Compaq SLT/286	1.59	N/A	1.77	1.43

Indexes show relative performance; for all indexes, an 8-MHz IBM PC AT = 1.
For a full description of all the benchmarks, see "Introducing the New BYTE Benchmarks," June 1988 BYTE.

Is It a Winner?

It's too early to predict the success of the Airis. If Airis can overcome the combined problems of a new company with a new product and deliver what it's promising, then both the company and the VH-286 will be worth keeping an eye on. I liked what I saw, and I don't see another vendor introducing a notebook PC with comparable features any time soon—certainly not for under $2000.

Airis hopes to tap into what it sees as an unfulfilled demand for a powerful, low-cost notebook PC. That demand exists; the question remains whether Airis has pushed the right buttons.

Some people will fault Airis for not including a floppy disk drive as standard. Many notebook PC users rely on floppies, but others, like me, prefer working from a hard disk drive whenever possible. Some users will feel uncomfortable buying direct.

Still, there's something very attractive about the Airis VH-286. Since the unit I saw was hardly finished, I'll wait until the final production units are available (sometime in early August) to make my final judgment. But the compromises Airis made in the design are quite reasonable. Most potential notebook PC buyers will be able to live comfortably with the trade-offs made in the VH-286. Good looks never hurt, either. ■

Michael Nadeau is BYTE's managing editor of the BYTE Lab. You can reach him on BIX as "miken."

World Radio History

POWER MONGER AND HIS GANG OF ONE.

Charles Mitchell,
Dell Senior Staff
Project Planner and the
new Dell System 425E

The Dell System 425E is a Class A device sold for use in commercial environments only. *Performance Enhancements: Within the first megabyte of memory, 384 KB is reserved for use by the system to enhance performance. The Dell 425E is photographed with optional extras. All prices and specifications are subject to change without notice. Dell cannot be responsible for errors in typography or photography. **Payment based on 36-month open-end lease. Leasing arranged by Leasing Group, Inc. In Canada, configurations and prices may vary. DELL SYSTEM is a registered trademark and Dell and 425E are trademarks of Dell Computer Corporation. Intel is a registered trademark and i486, 486 and 386 are trademarks of Intel Corporation. †Based on Compaq's published price list dated March 5, 1990, for Compaq DeskPro 386/33 Model 84 with 80387 coprocessor, 84 MB hard drive and video graphics monochrome monitor, and DeskPro 486/25 Model 120. 120 MB hard drive and video graphics monochrome monitor. UNIX is a registered trademark of AT&T in the United States and other countries. Other trademarks and trademarked names are used in this advertisement to identify the entities claiming the marks and names or their products. Dell Computer Corporation disclaims any proprietary interest in trademarks and trade names other than its own. ††On-site service may not be available in certain locations. For information on and a copy of Dell's 30-Day Total Satisfaction Guarantee, limited warranty, and Xerox's service contract, please write to Dell Computer Corporation, 9505 Arboretum Boulevard, Austin TX 78759-7299, Attn: Warranty. ©1990 Dell Computer Corporation. All rights reserved.

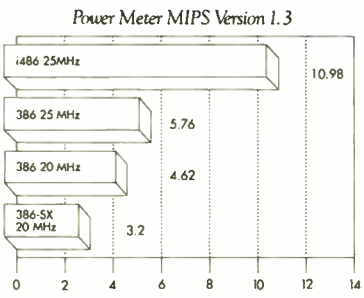
AD CODE 11E22

World Radio History

IN HIS WORDS.

In my opinion, the new Dell™ 425E™ sets the standard for i486™ 32-bit EISA I/O bus systems.

The Dell 425E delivers almost twice the MIPS of the Dell System® 325. Which gives me accelerated throughput for my power applications, especially when running 32-bit software. At the heart of the Dell 425E is Intel's® 32-bit i486 microprocessor, today's new definition of PC performance.



The i486 increases performance by its burst transfer capabilities and by reducing the complexity of some of the more commonly used 386™ instructions. Therefore, the instructions execute in fewer clock cycles.

But, those aren't the only performance improvements.

The processor's 8 KB internal cache gives you zero-wait-states for most memory accesses. And, the integral math coprocessor gives you all the capabilities of the 80387, with up to five times the performance on floating point instructions.

The Dell System 425E also has a high performance 32-bit EISA bus architecture that not only lets me expand my system with peripherals that have double the data path and up to eight times the data transfer rate of an ISA (PC/AT bus) system.

I can also use my 8-bit and 16-bit ISA cards without any problem. And I can select from the new high performance 32-bit cards, including EISA bus masters. With this kind of flexibility I'll never have to deal with an ISA only 486.

In conclusion, I believe it's the most sophisticated and powerful system for the money in the business.

It's really that simple.

THE NEW DELL SYSTEM 425E 25MHz i486 EISA.

- i486 microprocessor, running at 25 MHz.
- EISA architecture (downward compatible with ISA).
- Standard 4 MB of RAM,* expandable to 16 MB on system board, using optional 1 MB and 2 MB SIMMs.
- VGA systems include a high performance 16-bit video adapter.
- Socket for 25 MHz WEITEK 4167 math coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- 5 half-height drive bays.
- Dual diskette and hard drive controller.
- Six 32-bit EISA (ISA compatible), plus two 16-bit ISA expansion slots.
- High performance, IDE (80 MB, 100 MB, 190 MB), and ESDI (330 MB, 650 MB) hard disk drives.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- 231-watt power supply.
- 12-month On-Site Service Contract provided by Xerox.△

***Commercial Lease Plan. Lease for as low as $286/month.*

△*Xerox Extended Service Plan pricing starts at $672.*

80 MB VGA Monochrome System	$7,899
190 MB VGA Color Plus System	$8,699
330 MB Super VGA Color System (800 x 600)	$9,599
650 MB Super VGA Color System (800 x 600)	$10,799

Prices listed include 4 MB of RAM. 100 MB hard drive configurations also available.

ANNOUNCING NEW LOWER PRICES ON ALL DELL SYSTEMS.

IN ENGLISH.

Okay, it's time to come back to earth. You want a computer that's fast. Powerful. And affordable.

The new Dell System 425E is it.

It's perfect for running sophisticated applications, and easy enough to use even if you don't have a degree in Boolean Logic.

It's also only $7,899.

Which makes it $4,454 less than Compaq's 33 MHz 386 and $6,355 less than Compaq's 25 MHz 486.†

Best of all, all this advanced technology comes with the down-to-earth support and service from Dell.

One phone call and you get the works.

A one-year limited warranty, next-day deskside service by the Xerox Corporation.△ Fast delivery. And a thirty-day money back guarantee.

TO ORDER, CALL NOW.
800-444-1470
IN CANADA, CALL 800-387-5752

FOR NETWORKING/UNIX INFO
800-678-UNIX

HOURS: 7 AM-7 PM CST M-F 9 AM-2 PM CST ON SAT.

In conclusion, we believe it's the most sophisticated and powerful system for the money in the business.

It's really that simple.

ABOVE AND BEYOND THE CALL.

DELL COMPUTER CORPORATION

Circle 77 on Reader Service Card

World Radio History

Laser Printers Get Personal

The latest wave of Series II–compatible printers offers one feature that PostScript printers can't match: a price tag you can live with

Stanford Diehl and Stan Wszola

The wait is over. The era of the personal laser printer is upon us. Only a few years ago, when laser printers came on the scene, they carried eye-popping price tags that sent shivers up many a consumer's spine. How times change.

Hewlett-Packard introduced the first LaserJet printer in May 1984, and it set the standard for performance. The introductions of the HP LaserJet Series II printer in March 1987, and the LaserJet Series III earlier this year, have further pushed the boundaries of price/performance.

All the Series II–compatible laser printers in this roundup have list prices of less than $3000; some sell for under $2000 (take a look at some street prices, and you'll be hooked). Yet they provide more sophisticated text and graphics processing than ever before. This range of performance has never been available at such a low cost.

In the BYTE Lab, we've cut through a forest of features to give you an objective analysis of each printer. Our laser benchmarks put each printer through a rigorous suite of performance and compatibility tests. Because each test is geared to a particular mix of applications, you can pick the right printer for your needs (see the text box "How to Use Our Laser Printer Test Results" on page 151).

The Heart of the Beast

A curious form of schizophrenia exists among laser printers. Manufacturers tout feaures that are unique to their models, but when it comes to the printer engine itself, there's a marked similarity among the different brands. We examined 18 laser printers (see table 1), but they represent only six different printer engines: Canon, IBM, Kyocera Unison, Ricoh, Sharp, and TEC (Tokyo Electronics Corp.). Seven of the printers use the TEC engine, five use the Canon engine, three use the Sharp engine, and the others use different engines.

As expected, printers that use the same power plant have much in common. Each engine type boasts specific design and performance advantages—enough so that you should select an engine before picking a particular model.

One major difference among the different brands is whether the engine uses separate optical photo coupler and toner cartridges, as do the TEC, Sharp, Kyocera Unison, and Ricoh engines, or an integrated unit combining the OPC and toner in one, as do the Canon and IBM engines. (See the text box "Painting with Light" on page 142.)

Separate cartridges require maintenance more often. For example, the Epson EPL-6000 uses the TEC engine and requires a new toner cartridge every 1500 pages and a new OPC every 10,000 pages. A new toner cartridge is relatively inexpensive (a TEC toner cartridge lists for $29), but be prepared for a potential mess. You should quickly vacuum up any spilled toner, or it could migrate through the printer engine, ruining the printing and possibly damaging the engine. Another potential problem is that the OPC might be exposed to light during servicing; such exposure will reduce its ability to attract toner and degrade the quality of your printout.

Integrated cartridges, such as those for the Canon engine—which is used in the Brother, HP LaserJet, NEC, and Star Micronics printers—give you convenience at a price. With these cartridges, you can print 3500 to 4000 pages before the machine runs out of toner. It's a simple matter to open the printer, pull out the old cartridge, and insert a new one. But when you throw away the old cartridge, there may be plenty of life left in the OPC. (See the text box "To Refill or Not to Refill" on page 142.)

Paper Handling

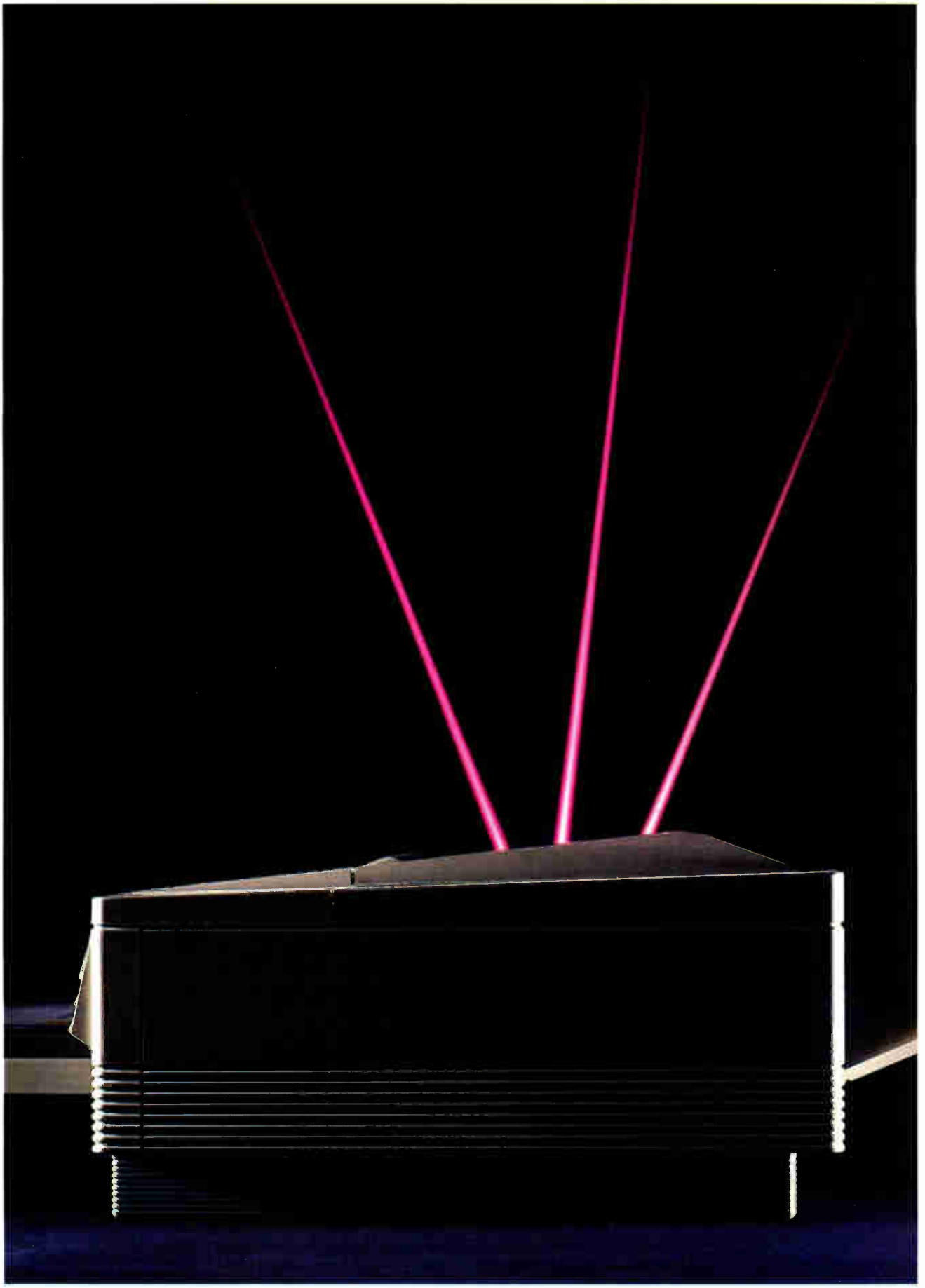
Laser printers can be very fussy about the type of paper they receive. Printer manufacturers recommend 16- to 34-pound paper with a smooth surface. Paper specifically made for use with laser printers or photocopiers is excellent. We used photocopier paper for our benchmark tests. Laser printer printouts cost between 2 and 3.4 cents per page. Typical dot-matrix printouts cost 1 cent per page or less. (See the text box "Your Mileage May Vary" on page 154.)

Be careful with preprinted forms or letterhead. When a page passes through the laser printer's fuser assembly, the paper is heated to 392 °F (200 °C) for a tenth of a second to fuse toner to paper. Some of the inks used in raised letterhead can melt and gum up the fuser rollers. Some colored papers scorch or discolor.

Feeding envelopes to a laser printer has always been a problem. You can manually feed the envelopes into any of these laser printers or use an optional envelope tray. Unfortunately, the trays are limited to 30 or 40 envelopes. Jams are a fact of life when you're doing envelopes, because they are thick and resist bending around the rollers and the OPCs inside the laser printers. Make sure that the adhesive used on the envelope flap and any

continued

World Radio History



PHOTOGRAPHY: PAUL AVIS © 1990

World Radio History

LASER PRINTERS

Table 1: *As the following comparisons show, many laser printers selling for less than $3000 don't force you to sacrifice speed or versatility. Most offer upgrade paths to at least 4.5 MB of memory and PostScript compatibility (●=yes; ○=no).*

Model	Brother HL-8e	Dataproducts LZR 650	Desktop Systems EXO-2507	Epson EPL-6000	Facit P6060	HP LaserJet IIP	HP LaserJet III	IBM Laser-Printer 4019
Standard features								
List price	$2895	$1695	$1995	$1899	$1595	$1495	$2395	$2395
Engine manufacturer	Canon	Sharp	TEC	TEC	TEC	Canon	Canon	IBM
Integrated or separate OPC/toner	Integrated	Separate	Separate	Separate	Separate	Integrated	Integrated	Integrated
Rated speed (pages per minute)	8	6	6	6	6	4	8	10
Operating noise level (dBa)	50	50	52	52	52	47	42.9	50
Engine life (pages)	180,000	200,000	300,000	300,000	300,000	Indefinite	Indefinite	Indefinite
Monthly duty cycle (pages)	3000	3000	3000	3000	4000	2500	16,000	20,000
Standard memory	1 MB	512K bytes	512K bytes	512K bytes	512K bytes	512K bytes	1 MB	512K bytes
Maximum memory	3 MB	4.5 MB	4.5 MB	4.5 MB	4.5 MB	4 MB	5 MB	4 MB
Interface (P=Centronics parallel)	P, RS-232C	P, RS-232C	P, RS-232C, RS-422	P, RS-232C	P, RS-232C	P, RS-232C, RS-422	P, RS-232C, RS-422	P, RS-232C
Dimensions (D,W,H) (in inches)	19 × 17.9 × 9.1	14.2 × 13.4 × 10.9	15.4 × 16.1 × 8.3	15.4 × 16.1 × 8.3	15.4 × 16.1 × 8.25	24.9 × 13.8 × 8	19 × 18 × 8.5	20.5 × 14.2 × 10.2
Weight (lbs.)	44	33.5	35.3	36	35.3	22	50	33.6
Power consumption (watts)	900	700	600	600	600	550	870	690
Warranty	1 year	1 year	1 year	1 year	1 year	1 year	1 year	1 year
Paper handling features								
Standard capacity tray	200	250	150	150	150	50	200	200
Maximum capacity (with optional tray)	200	500	150	150	440	300	200	700
Paper size handled	Letter, legal	Letter, legal, A4, B5	Letter, legal, A4, B5	Letter, legal, A4, exec.	Letter, A4, B5	Letter, legal, A4, exec.	Letter, legal, A4, exec.	Letter, legal, A4, B5
Prints envelopes	●	●	●	●	●	●	Optional	●
Prints labels	●	●	●	●	●	●	●	●
Prints transparencies	●	●	●	●	●	●	●	●
Output orientation	Face down	Face up or down	Face down	Face up or down	Face up or down	Face up or down	Face up or down	Face down
Optional equipment	Paper trays	Paper, env. trays	Paper trays	Epson emul.	Paper, env. trays, font cart.	Paper trays, font cart.	Paper trays	Paper tray, font cart.
Typographic features								
Resident typefaces	5	4	6	3	3	2	4	5
Font cartridge slots	2	2	2	2	2	1	2	2
Accepts HP font cartridges	●	○	●	●	●	●	●	○
Emulation								
Epson FX	●	●	Optional	Optional	○	Optional	Optional	○
IBM Proprinter	●	●	Optional	○	Optional	Optional	Optional	●
Diablo 630	●	●	Optional	○	○	○	○	○
HP 7475 plotter	●	○	Software	○	○	○	●	●
PostScript	○	○	Optional	Optional	○	Optional	Optional	○

preprinted return address will not melt when passing through the fuser.

Printing transparencies and labels requires materials that are specifically designed for laser printers. Do not attempt to make substitutions. Both types of materials must be able to withstand the heat from the fuser.

A Sure Cure for the Jaggies

One of the problems with trying to produce good-looking text and graphics on a laser printer are "jaggies," the stair-step effect on some curves and lines. Jaggies result from breaking up an image into a fine grid (i.e., 300 dots per inch). All the printers we examined function at 300 dpi. To get better quality and resolution, manufacturers could go to 600 dpi, but the cost for a more precise print engine and RAM for graphics would be prohibitive for most users.

Hewlett-Packard found a way around this dilemma. The LaserJet Series III uses the company's Resolution Enhance-

World Radio History

LASER PRINTERS

Kyocera F-1000A	Mannesman Tally MT 906	NCR 6435	NEC Silentwriter 2	Packard Bell PB9500	PCPI Laser-Image 1030	Sharp JX-9500	Star Micronics LaserPrinter 8	TI microLaser	Toshiba PageLaser6
$2895	$2195	$2395	$2695	$2195	$2295	$1795	$2799	$1799	$1549
Kyocera Unison	TEC	TEC	Canon	TEC	Ricoh	Sharp	Canon	Sharp	TEC
Separate	Separate	Separate	Integrated	Separate	Separate	Separate	Integrated	Separate	Separate
10	6	6	8	6	6	6	8	6	6
55	52	52	50	52	52	50	53	50	52
Indefinite	300,000	300,000	300,000	300,000	180,000	300,000	300,000	180,000	300,000
10,000	4000	5000	5000	4000	3000	3000	3000	3000	4000
512K bytes	512K bytes	512K bytes	1 MB	1.5 MB	512K bytes	512K bytes	1 MB	512K bytes	512K bytes
1.5 MB	4.5 MB	4.5 MB	5 MB	4.5 MB	5 MB	4.5 MB	5 MB	4.5 MB	4.5 MB
P, RS-232C	P, RS-232C	P, RS-232C, RS-422	P, RS-232C, AIM	P, RS-232C, RS-422	P, RS-232C	P, RS-232C	P, RS-232C	AppleTalk, P, RS-232C, RS-422	P, RS-232C
17.7 × 16.9 × 12.6	15.4 × 16.1 × 8.3	15.4 × 35.4 × 8.3	17.3 × 24.5 × 11.4	15.4 × 16.1 × 8.3	16.4 × 15.9 × 8.2	14.2 × 13.4 × 10.5	19.4 × 17.9 × 8.6	14.2 × 13.4 × 10.9	15.4 × 16.1 × 8.3
57.3	35	36	49	35.3	36	33.5	45	33.5	35
950	600	1000	870	600	1000	700	600	700	600
90 days	1 year	90 days	1 year or 60,000 pages	1 year	90 days	1 year	1 year	1 year	1 year
250	150	150	200	150	150	250	200	250	150
250	400	150	200	150	400	500	200	500	150
Letter	Letter, legal, A4, B5	Letter, legal, A4, A5, B4	Letter, legal	Letter, legal, A4, B5	Letter, legal, A4, A5	Letter, legal, A4, B5	Letter, legal, A4, B5	Letter, legal, A4, B5	Letter, legal, A4, B5
●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●
Face down	Face up or down	Face up or down	Face up or down	Face up or down	Face up or down	Face up or down	Face up or down	Face up ord down	Face down
Paper trays	Paper trays, printer emul.	Font cart., printer emul.	Paper trays, font cart.	Font cart., printer emul.	Paper trays, font cart.	Paper trays, font cart.	Paper trays, font cart.	Paper and env. trays, font cart., printer emul., serial board	Paper trays
6	3	3	3	3	4	3	4	4	4
2	2	2	2	2	1	2	2	2	2
○	○	●	○	●	○	○	○	○	●
●	Optional	Opt. cart.	○	Optional	●	●	●	Optional	○
○	Optional	Opt. cart.	○	Optional	●	●	●	○	●
●	○	●	○	Optional	●	●	●	Optional	○
○	○	Opt. cart.	○	○	●	○	○	○	○
PreScribe language	Optional	○	○	○	Optional	○	Opt. board	Optional	○

ment (RE) technology to improve the visual quality of its output. RE smoothes edges and produces sharper points and line intersections (see figure 1). It does this by adjusting the size and position of the individual dots in relation to each other. The print engine is still limited to 300 dpi, but text and graphics look slightly sharper.

Hewlett-Packard incorporated the RE circuitry into an application-specific IC in the controller electronics. The circuitry intercepts and stores a 6-dot-high by 2560-dot-wide section of the page. It examines the relative position of each dot to its 49 neighbors. The circuitry uses pattern recognition to identify any problem areas, and then it uses pulse-width modulation to control the laser beam. RE adjusts dot positions in a horizontal line by controlling the on/off timing of the laser beam; the technology adjusts the dot size by controlling the beam's intensity.

continued

World Radio History

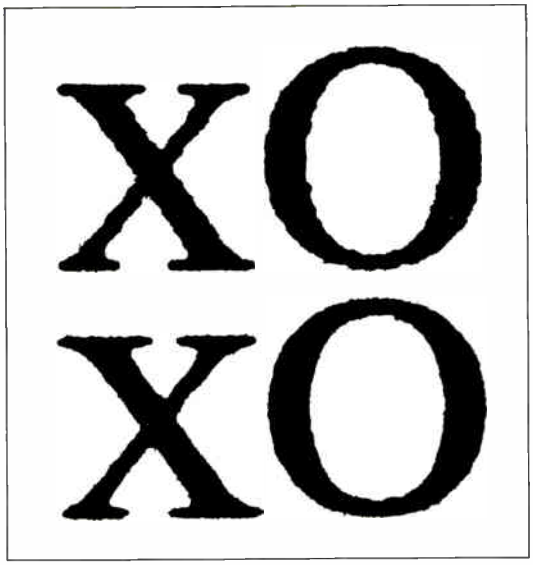


Figure 1: *Hewlett-Packard's Resolution Enhancement (RE) technology smooths out jagged curves. The sample output at top was printed on a LaserJet Series III with RE disabled. The bottom output is from the same printer with RE turned on. Both samples are enlarged 800 percent.*

Painting with Light

A laser printer engine emulates photocopier technology. But where a copier uses a bright light, laser printers use a low-power, solid-state laser.

A multisided, rotating mirror reflects the laser beam to project an image onto an electrically charged, photosensitive drum (also called an optical photo coupler, or OPC). As it sweeps across the rotating drum, the laser beam rapidly flickers on and off to paint the individual dots of the 300-dot-per-inch image. The charged drum attracts the toner to the areas that have been painted by the laser beam.

As a page of paper passes through the printer, it also receives an electrical charge. When the paper rolls against the drum, the toner image is transferred to the paper. The paper then passes through the fuser assembly, and it's there that heat and pressure melt the toner to make a permanent image on the paper. The paper then passes through the output rollers and lands in the output tray.

To Refill or Not to Refill

An entire industry has sprung up to refill used Canon toner cartridges. Refilled cartridges, on average, cost half the price of new cartridges. The drawback is that you may not know how many times a cartridge has been refilled. It could be recycled until the optical photo coupler (OPC) develops defects that begin to show in the printout.

Refillable, integrated cartridges are now available. For example, Pelikan sells integrated cartridges with four toner refills, good for 12,000 pages. They can be substituted for some of the older Canon cartridges. (Pelikan is based in Derry, PA, at (800) 288-6637.)

But most laser printer manufacturers discourage the use of refilled cartridges. Manufacturers claim that their cartridges are not built for reuse; seals on a reused cartridge could fail from heat stress and spread toner throughout the printer engine. Also, the OPC has only a limited life if you want the maximum quality in your printout. Reusing a cartridge could void your warranty.

We concur with these warnings. But if you must refill your cartridges, follow these precautions. Deal with a reputable company, mark your cartridges, and insist that you receive only your cartridges back. That's the only way to assure that your cartridge hasn't been refilled more than four times.

The RE circuitry's print quality improvement is subtle. With normal-size text in business correspondence, you wouldn't see an obvious difference between the older Series II and the new Series III. Only when we viewed the output with an eight-power loupe did we detect any differences (see figure 2 for a comparison of representative output from each of the engines we tested).

Port of Call

Because laser printers are relatively expensive compared to other forms of printer technology, many buyers use them on LANs or with printer-sharing devices. Most laser printers offer the option of different types of serial and parallel port connections.

Standard Centronics parallel ports let you position your printer up to 15 feet away from your computer. This distance also applies to any manual or electronic switching boxes, or other printer-sharing devices. An RS-232C serial connection allows for longer cable runs, up to 50 feet long. Another serial connector option is the RS-422A; this allows a higher data throughput and cable runs of up to 4000 feet. If you are using a Mac, several laser printers offer optional AppleTalk connectors with a maximum cable run of 1000 to 3000 feet, depending on your Mac's AppleTalk configuration.

We don't recommend manual switch boxes for laser printers. To switch to another host computer safely, you must switch all the lines simultaneously. Manual switches, depending on their design, make connections sequentially. This means that some data and ground lines may be left unconnected for a fraction of a second, which can damage the interfacing chips in the laser printer's controller electronics.

The NEC Silentwriter 2 offers the unusual feature of permitting two host computers to share the printer by connecting one host to the parallel port and the other host to the serial port. The printer can automatically handle data from both ports.

Fun with Fonts

A laser printer accepts three kinds of fonts: resident, or internal fonts; cartridge fonts; and downloadable, or "soft" fonts. Internal fonts come packaged with the printer; they are permanently stored in the printer's ROM. Cartridge fonts are ROM fonts that you buy separately. The cartridge, or "font card," plugs into a port on your printer. Soft fonts reside on a hard disk and are

continued

World Radio History

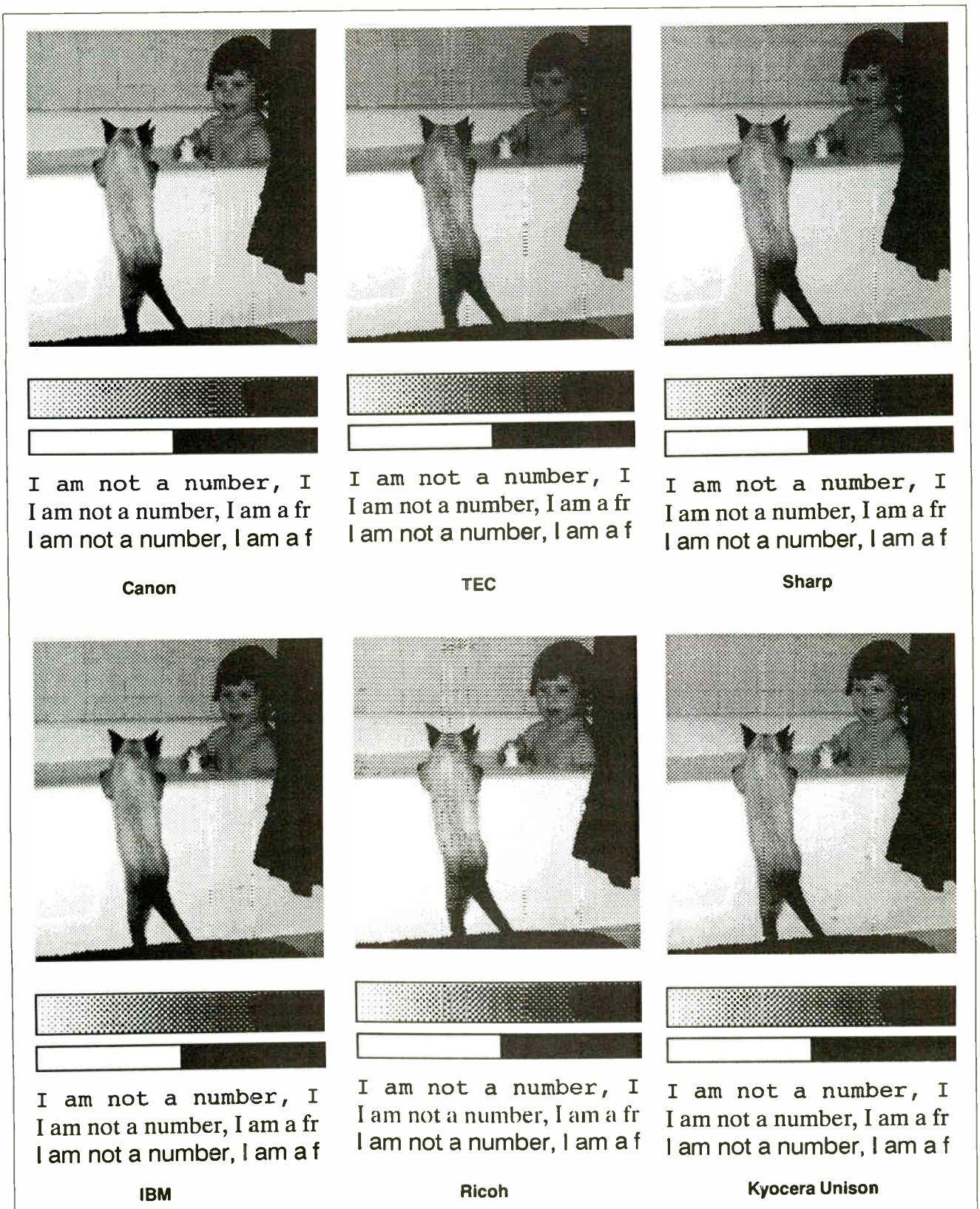


Figure 2: *A sample printout from each printer engine covered in this product focus. The engines varied little in print quality, although the Ricoh engine's output lacked the sharpness of the other five samples.*

World Radio History

To improve your document's appearance. To create your letterhead. To persuade others of your ideas. To add impact to your proposals.

That's what an **Intercon** font cartridge can do for you. Simply. Affordably. Without adding memory to your printer. Without waiting for downloading. Without taking any disk space.

Vary type size small to LARGE. Symbols for commercial, legal, mathematical, and linguistic documents.

YOU NEED ONE OF THESE.

■ **IBM® LaserPrinter Cards. Intercon** has font cards for the ***NEW*** IBM 4019 LaserPrinters with your specified fonts, logos and signatures.

■ **Intercon's** standard cartridges support WordPerfect® 5.0/5.1; MS-Word® 5.0; Word for Windows®; AMI®, MultiMate® Adv. 4.0; and other popular packages.

■ ***"PERFECT":*** The cartridge for WordPerfect® 5.0/5.1. Century (like Schoolbook) and Swiss (like Helvetica) 6 to 30 point. For all HP. $349.

■ ***PRO-IIP:*** Mix of fixed pitch and proportional. Century, Swiss, Letter Gothic, Presentation and Prestige. Six to 30 point. Ideal for HP IIP, IID and III. $249.

■ ***PHONT+:*** Designed for Epson, Toshiba, Brother and AT&T. Swiss, Dutch (like Times Roman), Letter Gothic, Presentation and Prestige. Six to 20 point. $349.

■ **Need custom tailoring?** Add your logo or signatures to a standard cartridge. Think about your cost savings in letterhead! Need specific fonts or point sizes? **Intercon** can design a cartridge to meet your exact specifications.

Intercon's font cartridges operate in the HP® Plus, 500, II, IIP, IID, and III; Canon LBP 8II; Epson® EPL 6000, Toshiba® PageLaser 6, Brother® HL8e; and AT&T® 593 laser printers.

See us at PC EXPO Booth #1179.

INTERCON®

WANNA FONT?

1870 Winton Road South, Rochester, New York 14618
For immediate service: 1-800-422-3880
Fax: (716) 473-4387. ■ ***Before you make ANY font decision, call us TOLLFREE. NO High pressure–just answers.***
Authorized **Intercon** dealers: ■ The ASCII Group Network ■ Concept Automation–DC area ■ Laser Save–Freehold, N.J. ■ Boston Tech.–Australia/N.Z.
DEALER INQUIRIES INVITED.
Other product names herein are for identification purposes only and are trademarks of their respective companies.

downloaded to the printer's RAM when needed.

For most needs, the internal fonts are barely sufficient. Most users will also want the fonts available in their word processor program, and they will invest in software fonts or font cartridges. If you're doing desktop publishing, trying to match previously used fonts, or trying to achieve a specific "look," then a good selection of optional fonts becomes important.

Many manufacturers inflate the number of fonts available in their laser printers by counting every font and then multiplying by portrait- and landscape-mode options, the different sizes for each font, and font sets for every printer emulation. For example, by counting portrait and landscape modes and other variables, Kyocera Unison claims 79 fonts for its F-1000A laser printer, although only six different typefaces are represented. For a fair comparison, you should count only the specific type styles available internally in each laser printer.

Some printers do not accept HP font cartridges, opting for their own font cartridges or cards. Such a policy can lock you into a vendor's product line. If you get the fonts you need up front, you'll be all right.

Soft fonts are readily available from commercial sources and from BBSes. All 18 printers that we reviewed will accept HP soft fonts, since they are all HP Printer Control Language (PCL) compatible. Soft fonts may seem like a dream until you start using them. You will soon notice them stealing precious RAM from your printer as well as consuming gobs of space on your hard disk drive.

Buyer Beware

While all these printers tout software compatibility with the original Series II, that doesn't make them clones. Considerable hardware differences exist even when printers have the same engine. Keep that in mind when you buy, especially if you use mail-order sources. Make sure your source also sells toner and other supplies. Consider what upgrades you expect to make. Some vendors, for instance, are shipping PostScript boards now, while others may never give you PostScript compatibility.

Even if vendors can meet your future needs, you will pay a premium if you are isolated from other sources. You can't count on a flurry of third-party development for printers out of the mainstream. The HP printers attract many third-party hardware and software developers, and

continued

Circle 123 on Reader Service Card
World Radio History

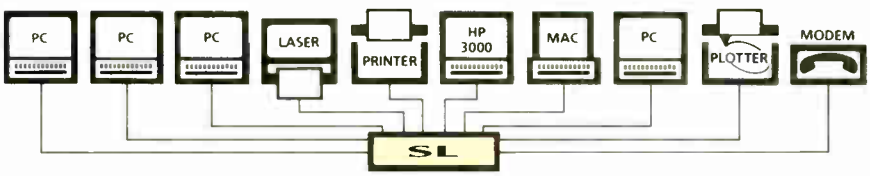
Ten Ports to Automatically
Share Printers, etc.
...Fast, Easy, and Inexpensive

SL **$495** with 256KB
$675 with 1MB
Also works great with LANs!

PC Magazine [July 1989, Page 263]:
"The Buffalo SL peripheral sharing device is simple enough to use immediately yet sufficiently flexible to form the center of a fairly complex network. It's a good choice..."

- **Ten Channels:** four parallel and six serial, all can be software configured as either input or output; automatic conversion from parallel to serial, serial to parallel, or serial to serial parameters; automatic switching and queuing of jobs
- **115,200 bps:** our software allows virtually all PC applications to send data serially to the SL twelve times faster than normal 9,600 bps serial
- **PC to PC Serial File Transfer Utility:** available free
- **Pop-up Menu via Hotkeys:** keyboard selection of printers, macros and many other control functions
- **Simple Installation:** just plug in the cables and run the menu-driven installation software for the Pop-up Menu
- **User Upgradable Memory:** from 0 to 4MB buffer

The SL Saves Money By Sharing Resources
Using the SL™ is the inexpensive way to let everyone share lasers, printers, plotters and modems. Greater access by more users reduces unproductive idle time and the need to purchase more of these expensive peripherals. An SL with memory improves PC productivity by allowing all users to simultaneously send their print jobs and quickly release their PCs to continue working. The SL is an alternative to a LAN at a fraction of the cost.



Smaller Switches

All Parallel Ports

AS-41 4 inputs to 1 output automatic switch without any buffer for only $200.

XE 2 automatic inputs to 2 electronic switch-selectable outputs from 256KB up to 2MB buffer, from $250 to $450.

45 Day Money Back Guarantee
CALL TOLL FREE TODAY
(800) 345-2356

Buffalo Products, Inc.
2805 19th St. SE
Salem, OR 97302
(503) 585-3414
FAX (503) 585-4505

Circle 46 on Reader Service Card

World Radio History

Circle 308 on Reader Service Card

Gradual Improvements.

Take a minute to think about improving your present system instead of buying a new one. W&T interface products let you share one printer by up to four computers. They let you keep on working while you are printing and they help secure multiuser systems from breaking down by lightning strokes.

Call or Fax us for a free W&T catalog. Then you can decide whether to order through your dealer (if you like to get everything from the same source), or to order directly from W&T Products. Our products are so easy to use that, if you need any technical support, we can give it to you over the phone.

Check us out:
You can test any product for 14 days, return it for any reason and pay only a $6 restocking fee per item.

20mA
C64/128
Centr.
IBMPC
IBM488
RS232
RS422
RS423
RS485

W&T
o.k.

System installation
RS232 lines can go up to about 50feet, Centronics lines up to about 15feet. For further distances you need line drivers. Be sure to use isolated ones to avoid problems with voltage drops and distant lightning. We manufacture drivers and isolators with up to 50.000 volts isolation. No one else does.

#20001, Centronics line driver	1kV 4KByte	$189
#80001, RS232 line driver	1kV	$229
#80050, RS232 line driver	50kV	$319
#88001, RS232 isolator	1kV	$129
#88050, RS232 isolator	50kV	$149

Portable Data Buffers with battery
Instrument readings, drilling templates, programs - you can transport all kinds of data in a small box.

# 22031, Centronics	32K	$149
# 22127, Centronics	128K	$319
# 88031, RS232	32K	$229
# 88127, RS232	128K	$319

Computers can run up to 95% faster
Your computer is forced to run with the brakes on because standard printer and plotter buffers are far too small. If you print alot a printer buffer can accelerate your system by up to 95% and anyone can plug it in within a few seconds.

# 22064, Centronics	64K	$149
# 22256, Centronics	256K	$229
# 22102, Centronics	1024K	$589
# 88128, RS232	128K	$229
# 88512, RS232	512K	$319

The ideal T-switch is the one you don't notice at all
Now there is a fully electronic automatic T-Switch that lets you share one printer between two or four computers. It does not need any operation and not even a power supply.

# 25210, Centronics, 2 PCs share 1 printer	$ 99
# 25410, Centronics, 4 PCs share 1 printer	$189

Lifestyle. Workstyle?
Remember when you could walk into a place of business and immediately recognize what was being done there? People loved their job and surrounded themselves with professionally-related artistic works. Thanks to W&T, this is again possible. We have commissioned West German artists to design artwork based on the PC-Codetable (order #17750), and part of the MS-DOS command set (order #17760). Computer professionals will find these prints to be both practical, and beautiful to display. Either print (approx. 20" by 28" in size) can be hanging in your office for $29.00. If you with to surround yourself, both prints can be purchased together for as little as $50.00.

To order by mail add $6 shipping and handling. FL residents add 6% sales tax. MSDOS is a trademark of Microsoft Corp., IBM is a trademark of IBM Corp.

We accept MasterCard and Visa.

A: Basic Merton (0222) 9736360 B: Brother Int. (02) 4674211 CDN: see USA CH: Weber (01) 9302003 D: Wiesemann & Theis (0202) 505077 DK: Jatec (86) 479139 F: Neol 88.62.37.52 IS: Thor (01) 681500 MEX: Telsa 5184500 N: RamTec (09) 224620 NL: Cat & Kursh (010) 4507696 P: Electronix 1-900848 SF: Moretec (9)1626812 SGP: Overseas Trade 2726077 USA: W&T Products 1-800-628-2086

W&T Products Corp.
P.O.Box 39559
Ft.Lauderdale, FL 33339
Phone: 1-800-628-2086
Fax : 1-305-491-5923

W&T PRODUCTS

the IBM LaserPrinter, if it catches on, will also spawn third-party support.

For many of these printers, you will have to rely on the vendor for hardware upgrades, font cards, and even printer expendables like toner. So make sure that your future needs are available now or, at the very least, in the works.

That Physical Presence

The dimensions that we list in table 1 describe the printers as they come out of the shipping box. In full regalia, with paper trays extended and any optional paper cartridges installed, these printers can have a very large footprint. Before you select a spot on your desk for that printer, make sure you know how much room is required. And remember that laser printers are air-cooled machines that require some breathing room to function properly. Do not position them flush against a wall.

All 18 laser printers produced approximately 42 to 55 adjusted decibels of noise while operating. Their sounds range from a low-pitched hum to a whine, both of which we found acceptable; this is, of course, a matter of personal preference. The average 24-pin printer, by comparison, produces from 63 to 75 dBa of noise with a higher pitch.

A Lapse in Memory

Finally, don't short-sell memory—the more, the better. Four of these printers double the usual installed memory to 1 megabyte. The Packard Bell PB9500 includes 1.5 MB standard. In these graphical days, 512K bytes of memory probably won't suffice. Since a laser printer must process a full page before printing it, there aren't many ways around a memory shortage. If you want to print a full-page, 300-dpi graphic, and your printer stocks only 512K bytes of RAM, you'll have to generate a smaller graphic or settle for 150 dpi. Also, be wary of maximum memory limitations. As your print jobs become more complex, your memory requirements will increase. The Brother HL-8e can take only 3 MB of memory, while the Kyocera Unison F-1000A is restricted to 1.5 MB. Your print jobs may fit within 512K bytes for now, but if you ever require more than 1.5 MB, you'll have no upgrade path.

Once you start using software fonts, your memory requirements skyrocket. To keep downloaded fonts in the printer memory, you'll need a minimum of 2 MB. If you are planning on doing desktop publishing, you should stock a healthy supply of RAM right from the beginning.

HP LaserJet III

Canon Cadre

The original HP LaserJet Series II contained the venerable Canon engine. It was a good choice. The printers with Canon engines—the HP LaserJet Series III, the Brother HL-8e, the NEC Silentwriter 2, and the Star Micronics LaserPrinter 8—closely resemble the LaserJet Series II. They are big and heavy, and rugged and dependable. These five printers will take up a lot of desk space. They are not as lean and streamlined as some of the other models, but they are built to last. Even their paper trays have a more rugged feel about them, sliding snugly into the front of the printer. These printers will probably hold up better than most in a multiuser environment.

The printers with Canon engines also offer greater convenience to the user. We found them much easier to install and maintain than the other printers. You simply slip the cartridge under the hood, and you're ready to print. As usual, greater convenience translates into greater cost. Generally, the Canon printers cost a bit more. On top of that, you'll pay more for the expendable cartridges. When the toner is spent, you can either throw out the entire cartridge, drum, and toner or take your chances refilling it, a practice that both we and HP discourage.

All the Canon models performed within a predicted range, with the Brother HL-8e posting the best overall numbers (see table 2). However, the Canon models did not significantly outperform our baseline machine, the HP LaserJet Series II. We also found little difference in the quality of the printouts. Even the LaserJet Series III, with its RE technology, did not stand out from the crowd.

Given the uncanny similarity of the Canon-engine printers, the HP models remain obvious choices. They're cheap, compatible by definition, and sure to be

continued

World Radio History

We put 25 font cartridges in one because the perfect printer is just a dream.

Let's face it. There hasn't been a printer built that has all the fonts you need. Which is why we created 25 Cartridges in One!

It has fonts from 25 Hewlett-Packard cartridges, saving you hundreds of dollars. You get 172 fonts and symbol sets such as Prestige Elite, Tms Rmn style and Helv style types. And our 3.6 pt AFS typeface so you can print full Lotus and Excel worksheets. Plus 69 international fonts.

Just plug 25 Cartridges in One! into your LaserJet*. It's compatible with virtually all major word processing software. And even works with our Headlines in a Cartridge product offering 14-48 pt fonts.

25 Cartridges in One! can help make your dream of the perfect printer a reality. To learn more, call or write: Pacific Data Products, 9125 Rehco Rd., San Diego, CA 92121, **(619) 552-0880.** Fax (619) 552-0889.

PACIFIC
DATA PRODUCTS

*Versions of 25 Cartridges in One! are compatible with HP LaserJet Series II, IIP, IID and III.

© Copyright 1990 Pacific Data Products, Inc. LaserJet Series II, IIP, IID and Series III are registered trademarks of Hewlett-Packard. AFS, 25 Cartridges in One! and Headlines in a Cartridge are trademarks of Pacific Data Products, Inc. All other company and product names are trademarks of the company or manufacturer respectively.

Circle 193 on Reader Service Card (DEALERS: 194)

World Radio History

supported. In fact, if you like the convenience and ruggedness of the Canon engine, you might even keep a keen eye open for a good used Series II. A proven workhorse, the HP LaserJet Series II has stood up well over time. (For a review of the HP LaserJet IIP, a $1495 laser printer built on a similar Canon engine, see "The LaserJet IIP: Inexpensive, Not Cheap," February BYTE.)

Mannesman Tally MT 906

All in One Basket

TEC manufactures the most common engine in this printer roundup. The TEC engine has one big advantage over the Canon engine: separate toner. When a TEC printer runs out, you replace only the toner cartridge—a significant savings over the long haul. Also, we found that the printers with TEC engines—the Desktop Printer EXO-2507, the Epson EPL-6000, the Facit P6060, the Mannesman Tally MT 906, the NCR 6435, the Packard Bell PB9500, and the Toshiba PageLaser6—were generally cheaper than models with the Canon engine or those with proprietary engines.

The TEC models print at a rated speed of 6 pages per minute, slower than the average Canon printer at 8 ppm. Because the TEC engine comes in a wider variety of models, components are not always interchangeable. We could easily transfer a Canon cartridge from one Canon engine to the next. This was less true with the TEC engines.

Canon cartridges are readily available from many sources. If you choose a model that accepts the same cartridge as that of the Series II, you will never have to worry about finding the right replacement. But you'd better make sure that the expendable supplies will be available for your particular TEC engine through mail order and other avenues.

We found that the TEC models did not handle paper as well as those that used the Canon engine. The paper trays were more fragile and did not slide into the printer as smoothly. The trays have tabs protruding from each side. These tabs fit into slots on the side of the printer and snap into place. We could not easily detect a good solid click when the tray was properly seated. In addition, the trays extend out from the side of the printer, adding to its footprint. We also noted more paper jams using these trays.

One pleasant surprise among the printers packing TEC engines was the Mannesman Tally MT 906. It proves that a printer need not be saddled with the performance limitations of its engine. While the first-page-output test times were consistent for all the TEC printers, the MT 906 performed the short memo test a good half-minute faster than any of the other TEC models. On the text-and-graphics test, the MT 906 showed just how significant powerful processing can be. It ran the test a full *13 minutes* faster than the nearest TEC competitor. The other TEC models posted an average graphics throughput of 3800 bytes per second or so. The MT 906, meanwhile, screeched by them all at a dizzying rate of 15,594 bytes per second. If you like the TEC engine, you'll look long and hard to beat the MT 906.

TI microLaser

A Fitting Footprint

The laser printers designed around the Sharp print engine are wonderfully compact, with footprints any desk jockey would love. We tested three of them: the Dataproducts LZR 650, the Sharp JX-9500, and the Texas Instruments microLaser. They all have paper trays conveniently tucked into a shelf at the bottom of the printer. The trays slide all the way into the printer, so you need not consider a protruding paper tray when clearing desk space for your printer. Again, parts are not interchangeable from one Sharp engine to another. We tried to place the

continued

BY THE NUMBERS

Table 2: *Benchmark test results in seconds except graphics throughput, which is in bytes per second for the laser printers to generate text, combined text and graphics, and HPGL files (N/A = not applicable).*

Printer	First page	Short memo	Text-and-graphics	Graphics throughput	Long document	HPGL
Brother HL-8e	19	290	575	9962	1152	705
Dataproducts LZR 650	19	395	1555	3065	1238	N/A
Desktop Printer EXO-2507	24	421	1298	3856	1371	800
Epson EPL-6000	26	425	1310	3736	1492	N/A
Facit P6060	24	423	1298	3815	1467	N/A
HP LaserJet Series II	20	316	724	8341	1034	N/A
HP LaserJet Series III	19	307	619	9693	1017	459
IBM LaserPrinter 4019	21	313	829	11,208	844	669
Kyocera Unison F-1000A	17	290	807	5517	1300	N/A
Mannesman Tally MT 906	25	382	473	15,594	1298	N/A
NCR 6435	24	432	1369	3482	1749	N/A
NEC Silentwriter 2	21	339	721	12,809	968	N/A
Packard Bell PB9500	25	425	1298	3815	1467	N/A
PCPI LaserImage 1030	24	410	1035	2134	1498	291
Sharp JX-9500	18	336	1138	4269	1252	N/A
Star Micronics LaserPrinter 8	20	315	641	8539	1022	N/A
TI microLaser	17	293	981	10,549	1195	N/A
Toshiba PageLaser6	24	423	1276	3815	1498	N/A

World Radio History

Experts Recommend A Super IQ.

"I especially recommend the all-inclusive font cartridge from IQ Engineering that has a ton of fonts all on the same cartridge."
John Dvorak

"...IQ's cartridges surpass everything else on the market."
PC MAGAZINE EDITORS' CHOICE
Super Cartridge 2
June 13, 1989

PC MAGAZINE
BEST OF 1989
Edward Mendelson
Printer Fonts: Super Cartridge 2
January 16, 1990

"...a half-dozen competitors, including Hewlett-Packard, have tried to catch up. None has even come close."

"...the best thing to happen to LaserJet owners since they bought their printer."
PC MAGAZINE
BEST OF 1988
Gus Venditto
Printer Fonts: Super Cartridge 1
January 17, 1989

"The Super Cartridge 2 may well be the last cartridge you will ever buy."
Andrew Seybold's Outlook

Your Laser Printer Needs A Super IQ. The IQ Engineering Super Cartridge 2 adds value to the HP LaserJet IIP, quality to the HP LaserJet Series II and speed to HP LaserJet III printers.

Your Best Deal On A IIP. You know that for less than a thousand dollars, you can have your own laser printer. But it has only three fonts, Courier, Courier, and something like Courier. Add a Super Cartridge 2 and get 17 typefaces in every size your software allows—from 4 to 30 points! Smart money says there's no better buy.

Quality Fonts For The Series II. Your series II printer is not obsolete, if you recycle with a Super Cartridge 2. You'll get every size of Tms Rmn and Helv in common use. Each font is designed for optimum resolution without need for enhancement algorithms. Chances are, a smart upgrade is all you need.

Speed For The LaserJet III. Why give up speed to get all the fonts you need? The Super Cartridge 2 snaps into the HP LaserJet III printer to deliver every ordinary font at full hardware speed and highest resolution. Try a test—you'll see the difference. Nobody's slow with a Super IQ.

Our 17-page guide reveals everything you need to know about font accessories. There's a Super Cartridge for every HP LaserJet printer and many compatibles, priced from $399 to $799. And compatibility with all the software programs you'd expect (including WordPerfect and many others).

Ask Us Today. We'll explain how we got the experts to agree. (Even the infamous John Dvorak). And we'll help you find a dealer with a Super IQ. So every printer will be as smart as it should be. Before you buy a font cartridge, listen to what the critics say about IQ Engineering.

Call For A Free Guide
1-800-765 FONT
(1-800-765-3668)
Canada: 1-800-663-6157

IQ ENGINEERING

W. Germany: 02161/65980 or 06172/459094 • France: (1) 40.26.22.32 • The Netherlands: 070-907051 • United Kingdom: (0) 665 5650 • Switzerland: 042-362040
Hong Kong: 5-8400336 • Malaysia: 3-2482900 • Australia: (02) 819-6811 • New Zealand: 4-4990967 • U.S.A.: (408) 733-1161

Super Cartridge 2, Super Cartridge WP, Super Cartridge, IQE and IQ Engineering are trademarks of IQ Engineering. Other products are trademarks of their respective holders.

Circle 125 on Reader Service Card (DEALERS: 126)

World Radio History

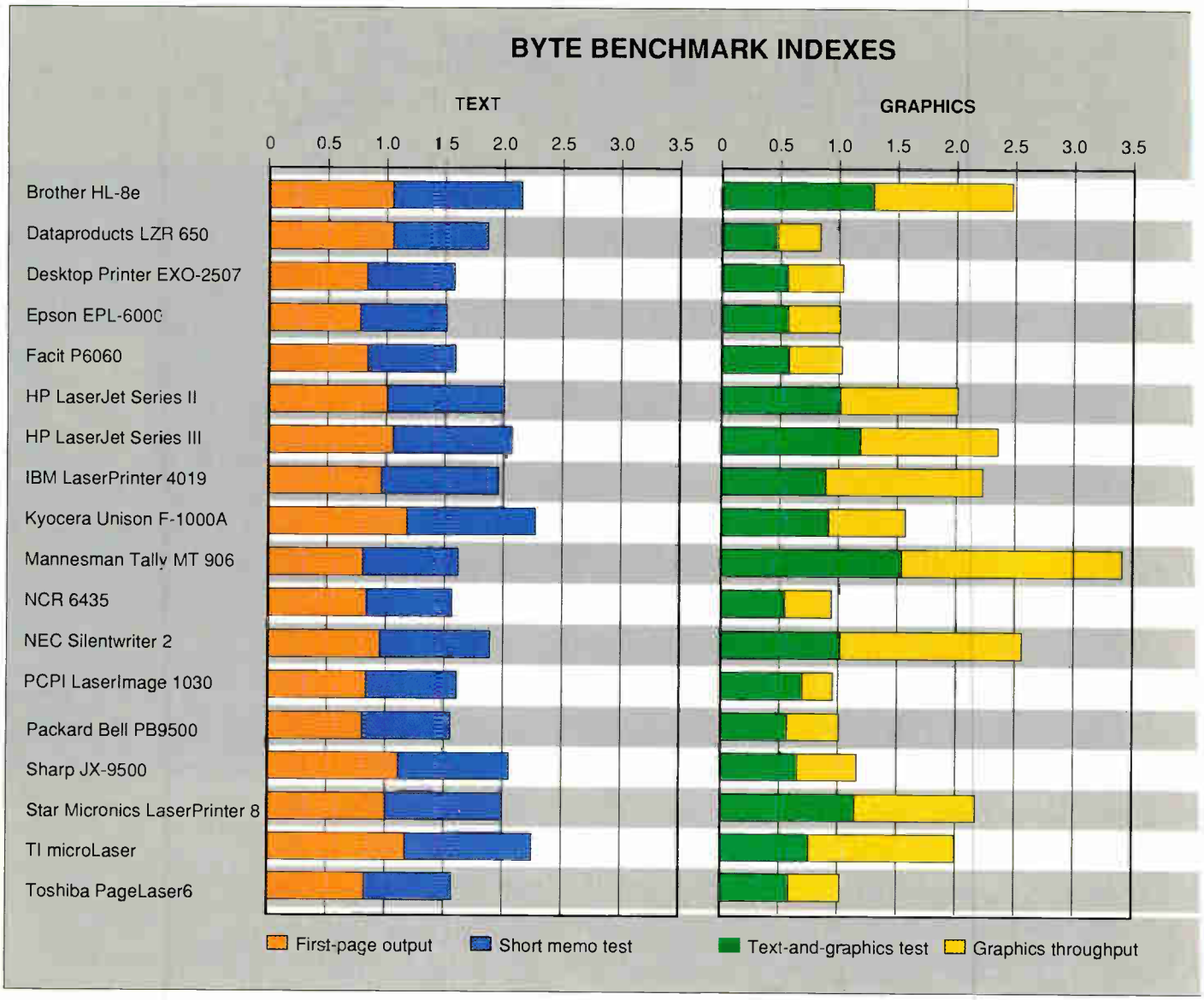


Figure 3: *The Text Index combines two tests, the first-page output test and the short memo test. Use this index if your applications tend to be small, textual print jobs (e.g., memos, letters, and simple spreadsheets). The Graphics Index combines the text-and-graphics test and the graphics throughput test. Use this index if your applications include heavy-duty graphical elements—newsletters, flyers, complex spreadsheets, and scanned images. Use the Long Document Index if your print jobs tend to be many pages of pure text. In all cases, long bars indicate superior performance.*

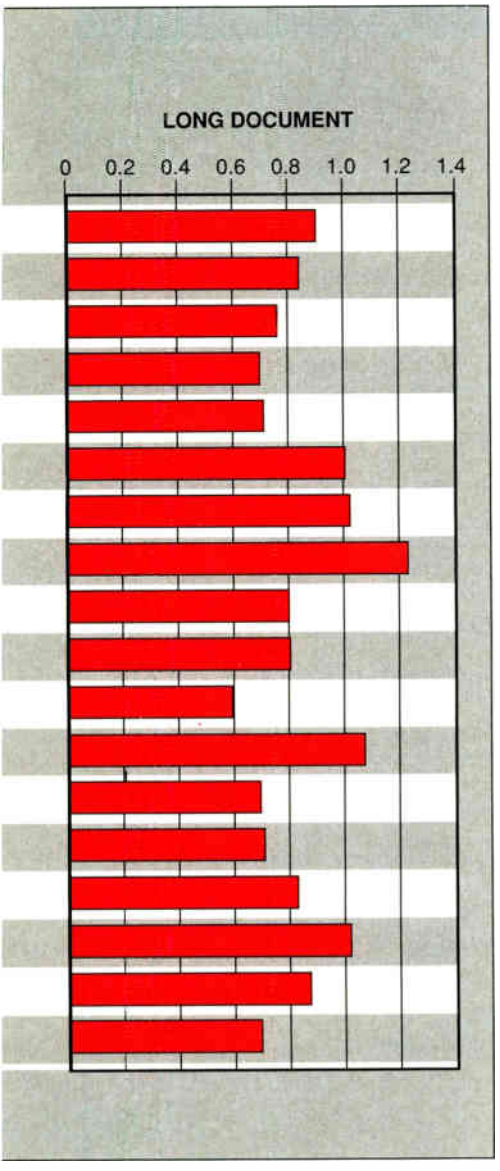
TI drum and toner into the JX-9500, but the printer would not accept them.

The Sharp models are inexpensive, and they perform a bit faster than the average TEC engine, despite sharing the same 6-ppm rating. The TI microLaser was the top performer of the printers with Sharp engines. Unfortunately, the microLaser did not pass our HP-PCL compatibility test. An escape sequence within our PCL file included a space. Hewlett-Packard considers this a bad programming practice, but all the other printers, including the Series II, ignored the space. The microLaser choked on the extra space and would not properly respond to the command. An engineer from TI acknowledged the problem and said a new set of ROMs will fix it.

Ironically, the microLaser suffers from being too compatible. It adheres to the PCL standard more closely than the LaserJet Series II does. The microLaser printed all our other documents without a hitch. It's a fine printer. Don't be dissuaded by the compatibility quirk; it will probably be fixed by the time you read this.

IBM LaserPrinter 4019

World Radio History



How to Use Our Laser Printer Test Results

The commandment we preach for every purchasing decision—Know Thy Application—is especially valid when evaluating laser printers. Once you decide how you're going to use your printer, check our benchmark tests to determine the right model for you.

You can't simply pick a printer with the highest page-per-minute rating and expect the fastest output. That may be true for pure text, but once you include graphics, the engine speed becomes less consequential. The fastest graphics printer usually boasts the richest processing power. The bulk of time passes when the printer processes and downloads the graphic, while a page of text prints as fast as the engine allows. A mixture of print jobs might favor a third printer with an optimal complement of features and speed.

All our tests were designed for a Hewlett-Packard LaserJet Series II–compatible printer with 512K bytes of RAM. We ran a total of seven tests on 17 printers plus the original Series II, our baseline machine. We printed each test document from the DOS command line using the `copy /b filename lpt1:` syntax. The graphs are indexed to a LaserJet Series II, so the longest bars reveal superior performance.

In the Text Index (see figure 3), we combined the first-page output test and the short memo test. If your shop runs a lot of small documents, pay particular attention to the Text Index. We also included some minor graphics (e.g., scanned letterhead). The first-page output test times how long it takes to generate a single page from command-line input to page ejection. The short memo test includes a single-page textual spreadsheet, a two-page memo, two letters with scanned letterhead, and 10 one-page memos. We timed each document separately. After one document was processed and ejected, we suspended timing until the printer's motor wound down. Then we sent the next document.

If you do heavy-duty graphics—newsletters, flyers, page layout—then you should focus on the text-and-graphics test and the graphics throughput (figure 3) results. The text-and-graphics test printed a complex PageMaker letterhead, a Quattro Pro spreadsheet with embedded graphics, an Ami Professional report with numerous fonts and embedded .PCX files, a flyer with a scanned photograph, and an eight-page BYTEWEEK. The graphics throughput test tracked a byte-per-second rate for producing a three-quarter-page, 300-dot-per-inch graphic.

The long-document test (figure 3) generated 125 pages of text. The text includes a variety of fonts that were downloaded before the test began, to simulate a shop that will download a group of soft fonts at the start of the day.

The HPGL test (figure 4) includes plot files from both AutoCAD and Vellum CAD. The test exercises a wide range of HPGL (Hewlett-Packard Graphics Language) commands. The HP Printer Control Language test samples a typical range of PCL commands. All the printers except the Texas Instruments microLaser (which had a minor problem; see the text) passed the compatibility tests without a hitch.

An Engine Like No Other

Two of the printers employ proprietary engines. IBM, as usual, went its own way with the LaserPrinter 4019, which uses an engine that boasts a full 10-ppm rating. The faster engine boosted the 4019's performance on the long-document test above all the others. There's a catch, though. Our model kept jamming paper. Obviously, this will slow down your print jobs considerably. At one point, the 4019 absolutely mutilated a piece of paper, leaving shreds of it in the paper path. It took us some time to pick the pieces of paper out from under the fuser.

Like the printers with Sharp engines, the 4019 carries its paper tray in a shelf at the bottom of the unit. It protrudes only slightly, adding little to the printer's footprint. Like the units with Canon engines, the 4019 has an integrated cartridge, so you throw the drum out with the toner. We didn't like the way the IBM's cartridge fits into the printer. It hangs loose instead of fitting snugly into its slot. As you close the printer, the cartridge absorbs the impact first—before the printer's lid snaps shut. And don't forget: When it comes to buying new cartridges, you'll be at the mercy of IBM.

A proprietary engine also drives the Kyocera Unison F-1000A. The printer has a hopper on top for the toner. Though convenient, this setup can be messy. Unlike all the other printers, the F-1000A requires that you pour the toner into the hopper, remove the toner container, and close the lid. This exposes you directly to black dust. You must also consider the pitfalls of going with a unique engine. When we were benchmarking the F-1000A, the

continued

World Radio History

COMPANY INFORMATION

Brother International Corp.
(Brother HL-8e)
200 Cottontail Lane
Somerset, NJ 08875
(201) 981-0300
Inquiry 1071.

Dataproducts Corp.
(Dataproducts LZR 650)
6200 Canoga Ave.
Woodland Hills, CA 91367
(818) 887-8000
Inquiry 1072.

Desktop Systems, Inc.
(Desktop Printer EXO-2507)
48431 Milmont Dr.
Fremont, CA 94538
(415) 683-4725
Inquiry 1073.

Epson America, Inc.
(Epson EPL-6000)
2780 Lomita Ave.
Torrance, CA 90505
(800) 922-8911
(213) 539-9140
Inquiry 1074.

Facit, Inc.
(Facit P6060)
400 Commercial St.
Manchester, NH 03108
(800) 733-2248
(603) 647-2700
Inquiry 1075.

Hewlett-Packard
Peripherals Group
(HP LaserJet Series II, Series III)
19310 Pruneridge Ave.
Cupertino, CA 95014
(800) 752-0900
Inquiry 1076.

IBM Corp.
(IBM LaserPrinter 4019)
101 Paragon Dr.
Montvale, NJ 07645
(800) 426-2468
Inquiry 1077.

Kyocera Unison, Inc.
(Kyocera Unison F-1000A)
1321 Harbor Bay Pkwy.
Alameda, CA 94501
(415) 748-6680
Inquiry 1078.

Mannesman Tally Corp.
(Mannesman Tally MT 906)
8301 South 180th St.
Kent, WA 98032
(800) 843-1347
(206) 251-5524
Inquiry 1079.

NCR Corp.
Peripheral Products
Division–Wichita
(NCR 6435)
3718 North Rock Rd.
Wichita, KS 67226
(316) 636-8570
Inquiry 1080.

NEC Technologies, Inc.
(NEC Silentwriter 2)
1414 Massachusetts Ave.
Boxborough, MA 01719
(508) 264-8000
Inquiry 1081.

Packard Bell
(Packard Bell PB9500)
9425 Canoga Ave.
Chatsworth, CA 91311
(818) 773-4400
Inquiry 1082.

Personal Computer Products
(PCPI LaserImage 1030)
11590 West Bernardo Court,
Suite 100
San Diego, CA 92127
(619) 485-8411
Inquiry 1083.

Sharp Electronics Corp.
Systems Division
(Sharp JX-9500)
Sharp Plaza
Mahwah, NJ 07430
(201) 529-9500
Inquiry 1084.

Star Micronics America, Inc.
(Star Micronics LaserPrinter 8)
420 Lexington Ave., Suite 2702
New York, NY 10170
(800) 447-4700
Inquiry 1085.

Texas Instruments, Inc.
(TI microLaser)
P.O. Box 202230
Austin, TX 78720
(800) 527-3500
Inquiry 1086.

Toshiba America Information
Systems, Inc.
Computer Systems Division
(Toshiba PageLaser6)
9740 Irvine Blvd.
Irvine, CA 92718
(800) 334-3445
Inquiry 1087.

printouts emerged faded and washed-out. We immediately suspected bad toner. Unfortunately, none of the other printers could loan its toner to the F-1000A. We had to go back to the vendor directly to obtain new toner, which fixed the problem.

The F-1000A matches the IBM LaserPrinter 4019's 10-ppm rating, but its results on the long-document test (see figure 3) did not corroborate a superior engine speed. The engine did seem extremely well built, however, and the paper tray was the best of the bunch.

Only one printer carried a Ricoh engine: the PCPI LaserImage 1030. The Ricoh design includes separate toner, a 6-ppm rating, and an awkward paper tray. Also, the output quality was inferior to that of the other printers, although the printer shined when producing plots.

The Laser Equation

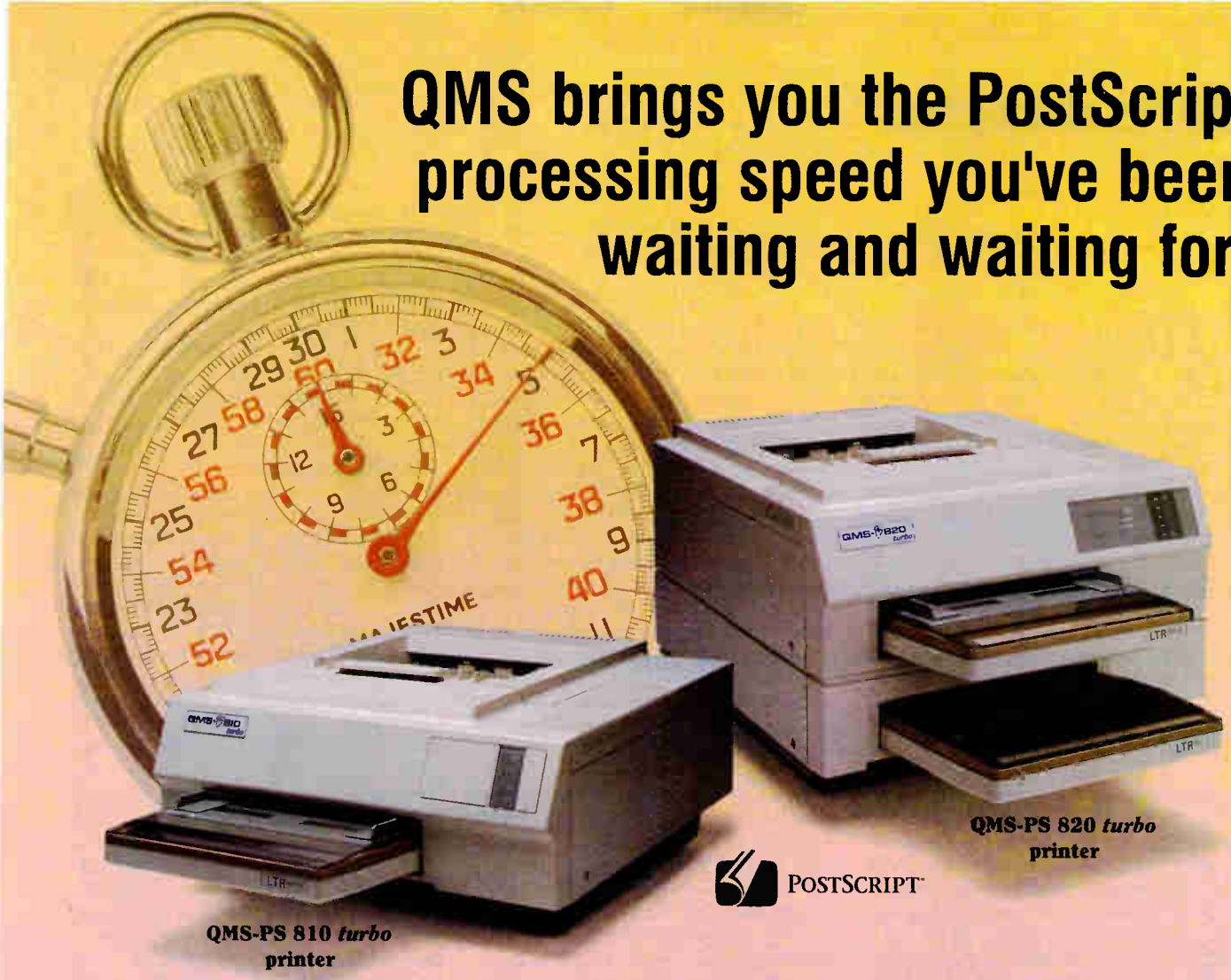
The Text Index (see figure 3) tests raw engine speed as well as the time that it takes to dump the page to the output tray. There were some telling results. The Kyocera Unison F-1000A ranked at the top of the Text Index, which is not surprising, given its 10-ppm engine rating. But that same engine did not perform as well as expected on other tests. The other 10-ppm engine, the one in the IBM LaserPrinter 4019, excelled, too. The printers with Canon engines—particularly the Brother HL-8e, the HP LaserJet Series II and III, the NEC Silentwriter 2, and the Star Micronics LaserPrinter 8—also showed off their high 8-ppm rating.

Surprisingly, the printers with Sharp engines—the Sharp JX-9500, the Dataproducts LZR 650, and the TI microLaser—consistently outperformed those with TEC engines, even though both engine types have a 6-ppm speed rating. Our tests tag the Sharp engine as a superior performer. The three Sharp engines even give the higher-rated engines a run for their money. The microLaser led the charge of the Sharp engines, with

continued

World Radio History

QMS brings you the PostScript processing speed you've been waiting and waiting for.



The Perfect PostScript Wait Loss Program.

QMS is first again. This time with two Adobe® PostScript® printers designed to cut the fat out of desktop publishing. Propelled by a supercharged 20 MHz 68020 processor, the QMS-PS® 810 *turbo* and QMS-PS 820 *turbo* printers help your productivity by reducing your page processing time by as much as 65 percent. And in today's "everything-right-now" world, who has time to wait 65 percent longer when there's an alternative?

Compatible and quickly expandable

Whether your computer is a Mac® or PC, you'll find a fast friend in the QMS® *turbo* printers. AppleTalk®, RS-232 serial and Centronics® parallel interfaces provide easy connections in practically any environment.

These 300 dpi printers have HPPCL® and HP-GL® emulations, plus 39 resident Adobe typefaces.

The memory is easily expandable from the standard 2 MB RAM to 3, 4 or 8 MB. And a SCSI interface supports up to seven hard disks of unlimited size.

Double your output

For twice the paper handling and twice the prints per month, choose the QMS-PS 820 *turbo* printer. A 10,000 page-per-month duty cycle, a highly rated engine life and dual 200-sheet paper cassettes make the QMS-PS 820 *turbo* printer a true workhorse. But the real networking advantage of this printer is speed.

Your wait for faster PostScript laser printers is over. For more information or the dealer nearest you, just call **1-800-523-2696**.
In Europe (31)-30/420129.

QMS™

©1990 QMS, Inc. The following are trademarks or registered trademarks of their respective companies: QMS, the QMS logo, QMS-PS of QMS, Inc.; Adobe, PostScript and the PostScript logo of Adobe Systems, Incorporated; AppleTalk and Mac of Apple Computer, Inc.; Centronics of Centronics Data Computer, Corporation; HP-GL and HPPCL of Hewlett-Packard Company.

Circle 224 on Reader Service Card (DEALERS: 225)

World Radio History

Your Mileage May Vary

How long can you expect your new laser printer to last? Like any complicated machine, a laser printer has a limited duty cycle. You can run these printers only so hard for so long before they overheat and break down. Engine designers assume that you won't use the printer continuously; there will be time for the printer to cool down. Most manufacturers rate their printers for a duty cycle of 3000 pages per month. That may seem small, but it is reasonable if you do some math.

Assuming that the laser printer is used in an office whose employees work an 8-hour day and approximately 20 working days per month, you would have to print 18¾ pages every hour to achieve the duty cycle.

Many manufacturers also rate their printers with a life span in total number of pages printed. The typical life span runs 300,000 pages, although IBM and Hewlett-Packard claim an indefinite period, assuming proper maintenance.

If you divide the 300,000-page life span by the 3000-page duty cycle, you get 100 months, or eight years and four months. Some manufacturers conservatively give their printers a five-year life span. Theoretically, with the current speed of development in laser printer technology, that old laser printer would be relegated to mundane printing tasks or the obsolete equipment room before it would wear out.

a result rivaling the 10-ppm F-1000A's.

In the Graphics Index tests (see figure 3), processing power prevailed over raw engine speed. The Mannesman Tally MT 906 leaves the other printers in the dust. This is especially noteworthy given the lackluster performance of the other TEC engines. For heavy-duty graphics and professional layout applications, the MT 906 is a clear winner.

The Brother HL-8e, LaserJet Series III, IBM LaserPrinter, NEC Silentwriter 2, Star Micronics LaserPrinter 8, and TI microLaser also performed well on the graphics tests. As we negotiated the full suite of tests, the Brother HL-8e emerged as a solid performer across the board. Apart from the MT 906, the printers with the TEC engine posted remarkably similar scores. Evidently, only Mannesman Tally has enhanced the processing power of the standard TEC model.

If you have a lot of long text documents to generate, the top performers on the Long Document Index (see figure 3) should appeal to you. We suspended timing on paper changes and jams, which will slow you down more than a sluggish engine. Our top performer, the 10-ppm IBM LaserPrinter 4019, did suffer from occasional paper jams, somewhat tainting its impressive time. The Kyocera Unison F-1000A, while performing sufficiently, did not do justice to its 10-ppm rating. The leaders in the other tests rose to the top here as well: the Brother HL-8e, the LaserJet Series II and III, the NEC Silentwriter 2, the Star Micronics LaserPrinter 8, and the TI microLaser.

The HPGL Subplot

Five of these printers can produce plots from an HPGL (Hewlett-Packard Graphics Language) file. Three of them offer ROM-based HPGL emulation, while a fourth packages a software HPGL emulator. The HP LaserJet Series III, driven by Hewlett-Packard's PCL 5, incorporates HPGL commands into its command set. The Series III output, though fast and legible, resembles a drawing more than a plot. The Desktop Printer EXO-2507 emulated HPGL with included software. As expected, the output was slow. And remember: Any of these printers could do the same trick with the right software package.

The IBM LaserPrinter 4019 and the Brother HL-8e produced fine HPGL plots, but both were almost as slow as the software emulator. If you need a laser printer to do a lot of draft plotting, consider the PCPI LaserImage 1030. In the lab, the PCPI's plot samples were consistently chosen as having the best output. Also, it absolutely blazed through the HPGL benchmark (see figure 4), easily beating all the other HPGL printers.

continued

Simple - Easy - Instant - Comprehensive

In solving complex system problems for integrators and end users, one of the most exclusive system consulting design firms uses AXSYS. Clients of Musgrave & Associates rely on them for solutions and product purchases.

M&A relys on AXSYS to find the best suited product, compare specifications and pricing, check availability, locate dealers, services and product profiles. AXSYS gives them all the information they need - the information you need!

AXSYS is an online data base which manufacturers, integrators, dealers and vars use to give buyers instant access to all their products and services. Buyers use AXSYS to find the right products for their needs - instantly and without any bias.

AXSYS is the professional's procurement analysis system!

Annual fee and connect time charges apply.

North Tower 1625
Denver Place
Denver, CO 80202

Dealers circle 30,
End Users circle 31,
OEMs circle 32 on Reader Service Card

Messages Only: (303)293-2201
Facsimile: (303)293-8407
or: (303)830-2115

World Radio History

Engineered for the office. Designed for people.

Due to space limitations, we can't show you all the awards our 1124 and 1180 printers have won.

What can we say? Of course, we're proud. But we've always been proud of our 1124 and 1180 Dot Matrix Printers — even before they started winning all these awards. Who wouldn't? They just make so much sense. Each one, for example, has multiple paper paths. Load it from the bottom or rear. And put it wherever you want. Each one has an EZ Set™ Panel. As well as a staggering 3400 print combinations possible from a wide variety of fonts, sizes and enhancements. And each one comes with a 2-year limited warranty on parts and labor. (See your dealer for details.)

Panasonic® 1124 and 1180 Dot Matrix Printers. They're everyone else's choice. Shouldn't they be yours, too?

Printers, Peripherals, Computers, Copiers, Typewriters and Facsimiles

Panasonic
Office Automation OA

Circle 195 on Reader Service Card

World Radio History

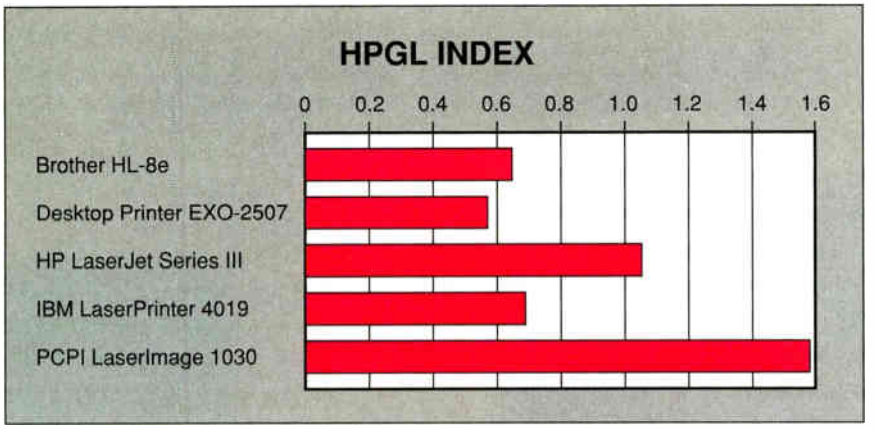


Figure 4: *The HPGL Index. Three of the printers support the Hewlett-Packard Graphics Language internally. A fourth, the Desktop Printer EXO-2507, packages software emulation. The LaserJet Series III, driven by HP's latest incarnation of its Printer Control Language (PCL 5), incorporates HPGL commands into its command set. The index is based on the Series III results. Long bars indicate superior performance. The PCPI LaserImage 1030 produced the sharpest plots in record time.*

The Best of the Laser Line

In the end, it's awfully hard not to pick an HP printer. Even the old Series II performed admirably on our tests. All the LaserJets are rugged, dependable, and supported like no other printer in the world—and they have a proven track record. The Series III includes 1 MB of RAM, an extended command set (PCL 5), and enhanced resolution—for a surprisingly low list price of $2395. The HP choice may not be too daring, but it's money in the bank.

Mannesman Tally packed some impressive processing power inside the MT 906. If your jobs demand a lot of graphics processing, a fast engine will only be wasted. You'll do better to find a fast processor, and you can't do much better than the MT 906. It also proved rugged for daily print jobs in the lab.

If you're looking for a truly personal laser printer, consider those printers that are based on the Sharp engine. They have an attractive price (all three are under $2000), an exquisitely small footprint, and a compact design destined for a cramped desktop. Of these, we liked the TI microLaser the best.

Most of us thought it would be a long time before laser printer prices dropped. But the wait is already over. Keep an eye out for low street prices. Sooner or later, you'll find a deal you can't refuse. ■

Stanford Diehl and Stan Wszola are testing editors/engineers for the BYTE Lab. They can be contacted on BIX as "sdiehl" and "stan," respectively.

GRAPHIC TOOLS LIBRARY

PC_VDI: Virtual Device Interface. Display and Printed graphics. Draw and print at 60 to 600 dpi. Outline fillable font factory. Text at any angle. Figure drawing. Very fast. User coordinates. All GKS draw. Graphic object manipulations. Resolution Enhancement Technology. Super VGA 256 color modes. Draw in memory or on screen.
NO ROYALTIES. $395. *Testprint demo program.*

PHONTM: THE FONTMAKER. Interactively create scaleable, expandable and fillable outline, stroke and bitmap fonts, figures and logo's. Scale to various size fonts. Laser loader. Use same font for display and print. Use fonts with PC_VDI, IBM 8514/A & others. $395.

SCANLIB: Image tools library. Image capture. Scale image up or down or auto scale to fit in a window. Animation in all graphic modes. Image rotate, skew, mirror, tile fill and window scroll. Virtual bitmaps and graphic pop-ups. Includes Text & Mouse functions. Drag image. Scaled print/plot. 149 functions. Draw text and line drawings in bitmaps. PCX, KPS formats. Color Mapping. Faster and better package for PCX file handling. $195.

MEGAVDI: Large image tools library. Draw and manipulate large drawings and scanned images. Image Database. Pan, scroll, rotate, hspeed-scale. Import PCX images in one large image file. Color print/plots with Pre-View. HP-GL and PaintJet. 1024X768X16. $895.

All products: Graphic modes from Herc. to Super VGA. Most 'C', Pascal, Fortran, MS QuickBasic 4.0 to 7.0

NOVA INC.
2500 W. Higgins Road, #1144
Hoffman Estates, IL 60195
708-882-4111 FAX: 708-882-4173

Customer Inquiries Handled Instantly!

FaxFacts

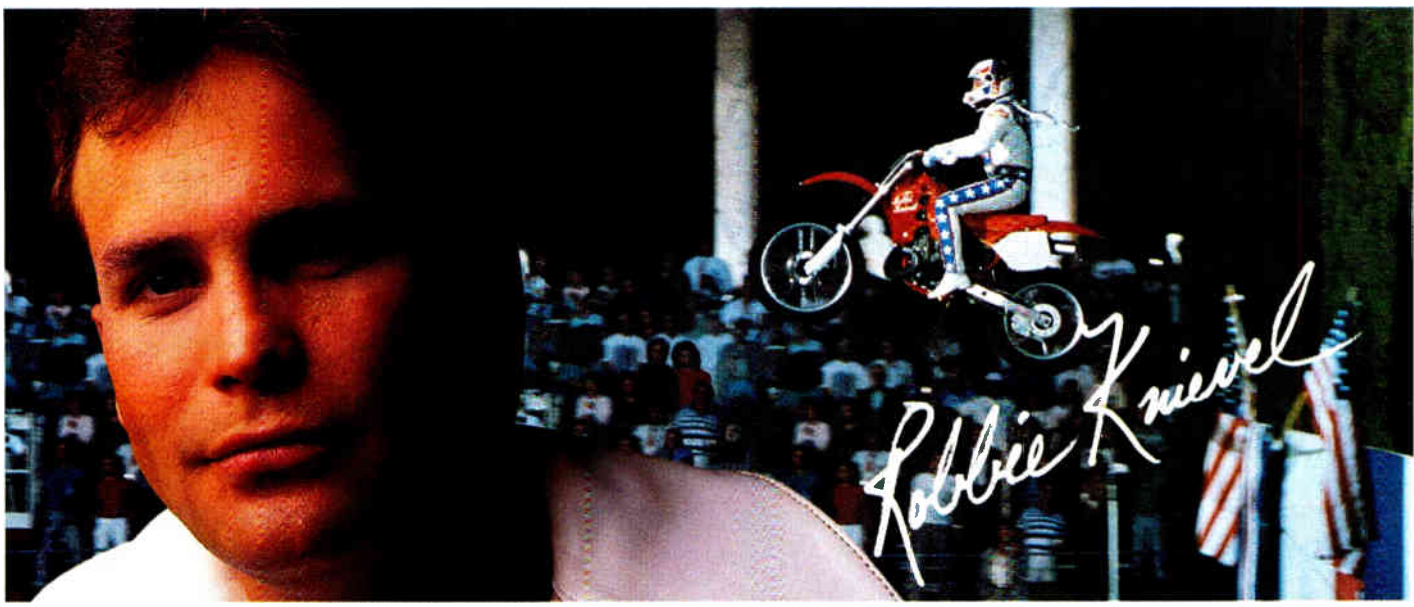
Copia International Ltd.
1964 Richton Drive, Wheaton, IL 60187
(708) 682-8898 Fax: (708) 665-9841

The time that it takes to send an interested customer more information, may just be enough time to have cost you the sale.
Let FaxFacts provide information to your customers while the impulse is strong! FaxFacts delivers customer information while he/she is on a Fax phone.
Call for the complete story or for a demonstration.

DEMO NUMBER: (617) 740-0025 PRESS: 1625000#
Also marketed under the names BENEFAX and FastFaxts.

World Radio History

"So, this punk comes up to me and says, 'Is there anything you won't do for a buck?' And I say, 'Sure. I won't plug in my PC without a Proxima product to protect it.'"



"I may be crazy, but I'm not stupid."

"When people tell me I take foolish risks, I say to them: 'At least I assess the risks, and I always take steps to protect myself. Do you?'

"Take many microcomputer users. They're cool and calm, just cruising along until – *wham!* – they've crashed. Lost all their data, maybe even burned out a motherboard. Yet they sit there, stunned. They had no idea they were at risk.

"Or maybe they just thought it would never happen to them. Yet studies indicate that every AC outlet in America has a 97% probability of incurring at least one system-damaging event each year.

"Whether it's a Proxima® ProLine™ Surge Suppressor that clamps down on incoming surges and spikes – or a Power Director® that protects against power problems and acts as a power control center – your micro needs ultra-reliable protection against the 101 power problems that threaten it.

"So check out the entire range of innovative Proxima Power Protection Products. And ask about the Proxima **Lifetime Equipment Protection Policy**. With the purchase of a ProLine 20 or 30, or a Power Director, it guarantees the survival of your hardware from a power problem – for life."

Whether you're operating a home computer or a technical workstation, there's a state-of-the-art Proxima ProLine to match your needs.

Want to hear more about how to save the life of your computer? Just write, and I'll send you, free, "Five Ways to Stop Being a Computer Daredevil." Or call 800/582-2580 (800/582-0852 in CA).

Name_____

Address_____

City_____

State_____ Zip_____

Return to: Computer Accessories Corp., 6610 Nancy Ridge Dr., San Diego, CA 92121 619/457-5500.

PROXIMA

by Computer Accessories Corporation

Circle 320 on Reader Service Card (DEALERS: 321)

Power Director and Proxima are registered trademarks, and ProLine is a trademark, of Computer Accessories Corp.

World Radio History

PostScript® laser printers used to be expensive, large and shared by the entire office.

Until now.

World Radio History

microLaser™ from Texas Instruments: the affordable PostScript printer you can call your own.

Finally, for less than $3,000, you can have a PostScript laser printer right at your desk. TI introduces its new microLaser, with the features you want – now and in the future.

Small size. Lots of value.

At only 13.4 inches wide and 14.2 inches deep, microLaser may be the small kid on the block, but it packs plenty of punch. This printer takes full advantage of the advanced software that runs on your PC. That's because it uses the Adobe® PostScript printer language and is compatible with the HP LaserJet® Series II – allowing you to switch between them easily. With that kind of flexibility, the six-page-per-minute microLaser is ideal for word processing, spreadsheet and desktop publishing applications.

Because microLaser features the PostScript language, you can print fonts in a variety of typestyles and sizes. Plus, you can print them tall-ways, long-ways, all kinds of ways. You can even print complex pages of integrated text and graphics.

Capabilities that grow as your needs grow.

One of the best things about microLaser is that you only buy what you need. So if you're not ready for PostScript language, you can buy the standard microLaser for less than $2,000 and add PostScript software and other powerful features later.

You can upgrade microLaser without tools or technicians by simply adding upgrade boards. These boards include up to four 1Mb increments of memory, serial and AppleTalk® interfaces and a PostScript interpreter. All you have to do to get additional fonts or emulations is plug optional microCartridges into two credit card-size slots.

Superior paper handling.

Part of what makes microLaser a truly personal desktop laser printer that takes up so little room is its paper drawer, which slides *inside*. Because microLaser holds *250 sheets* standard (it holds 500 when you add an optional paper drawer), you spend less time refilling paper and more time creating superb-looking documents.

New! PostScript printing just got *more* affordable – now only $2,499*

How do you enter the world of PostScript with its high-quality scalable fonts, integrated text and graphics, and broad software support? Buy TI's new microLaser PS17 – the laser printer that offers you more scalable fonts and other features, proving that great things come in small packages.

At just half the footprint of the HP LaserJet III, microLaser PS17 not only offers 17 scalable fonts (LaserJet III offers eight), they're *PostScript* fonts – the industry's standard for high quality. That means more than 4,000 software programs take advantage of microLaser's PostScript font capabilities.

Plus, microLaser PS17 offers the same superior paper handling as other microLaser models, is easily upgradeable and comes at a desktop price.

Why would you consider anything else?

Call TI at 1-800-527-3500 to find out more!

The printer also handles a variety of paper sizes and types – from letter, legal and executive to transparencies, labels and envelopes. For those times when you're facing a large mail merge task, just plug in an optional envelope feeder to easily alternate between letters and envelopes.

Your own PostScript printer is a call away.

To find out more about how you can have affordable PostScript printing right at your own desk, call TI today.

1-800-527-3500.

TEXAS INSTRUMENTS

© 1990 TI 66055

Standard microLaser is HP LaserJet II-compatible, prints six pages per minute and comes with .5 Mb of RAM. microLaser PS17 and PS35 have the same features as the standard microLaser, plus an Adobe PostScript interpreter with 17 or 35 typefaces and an extra 1 Mb of RAM. microLaser is a trademark of Texas Instruments Incorporated. Adobe and PostScript are registered trademarks of Adobe Systems, Inc. LaserJet is a registered trademark of Hewlett-Packard, Inc. AppleTalk and Macintosh are registered trademarks of Apple Computer, Inc. *TI suggested list price for microLaser model PS17.

Circle 282 on Reader Service Card

World Radio History

SYSTEM

Corey Sandler

REVIEW

The New 486s: Are Faster FPUs Enough?

The Spear Super 486/25U (left) and the Dyna Micro AIR486-C shine in floating-point-intensive applications.

For several years I commuted into Boston in a beat-up econocar with the pickup of a septuagenarian sloth. When I treated myself to a high-powered, state-of-the-art sports car, my driving time in Boston's infamous traffic did not change. But the new car sure looked good sitting there in its parking space, and every once in a while, I found a place to put the pedal to the metal....

That is also the story with the first round of 25-MHz i486-based computers, including the Spear Super 486/25U and the Dyna Micro AIR486-C. These machines are real screamers compared to a run-of-the-mill 286 system, but in much of today's traffic they are generally just equal to—or worse than—top-end 386s. Most of the potential horsepower of the i486 processor is held hostage by the speed of the CPU clock, the speed of the buses, and the capabilities of today's software.

But these two i486-based systems really shine in performing floating-point-intensive applications, turning in BYTE FPU benchmark indexes that are nearly double the 15.66 index of the ALR FlexCache 33/386 that was used for comparison. These scores are attributable to the integration of a math coprocessor within the i486 chip.

In raw throughput, the 25-MHz i486 performs about 11 million instructions per second, versus about 8 MIPS for a 33-MHz 386 machine. You'll best realize this power in applications such as file server, specialized CAD/CAM, and engineering. In most stand-alone tasks, you'll have a harder time seeing the differences between 25-MHz 486s and 33-MHz 386s. But success in the marketplace for the i486 should bring true 32-bit applications and utilities that will move systems along briskly (see the text box "The i486 at a Glance" on page 163).

Spear: A Thicket of Cables

The Spear Super 486/25U is an Extended Industry Standard Architecture-bus computer built around a Mylex MBE486 motherboard with a Phoenix BIOS. The test unit did not take advantage of the EISA bus, using AT-compatible cards and disk drives.

Enclosed in a sturdy tower case, the computer includes three disk drive bays accessible from the front and a tight-fitting internal cage that could accommodate two slim hard disk drives. It includes eight available slots, capable of automatically sensing 32-bit EISA peripherals and 16- or 8-bit ISA devices. Memory chips reside on the motherboard; our test unit came with 8 megabytes of 80-nanosecond DRAM.

World Radio History

Spear Super 486/25U

Company
Spear Technology Holding Co.
968 Hanson Court
Milpitas, CA 95035
(408) 946-6498

Components
Processor: 25-MHz Intel i486
Memory: 8 MB of 80-ns DRAM; 128K bytes of BIOS ROM
Mass storage: 5¼-inch 1.2-MB Teac floppy disk drive; 3½-inch 1.44-MB Toshiba floppy disk drive; 85-MB 18-ms Imprimis ESDI hard disk drive
Display: Eversync MON-300 14-inch multisync monitor; MaxLogic MX-677 VGA card (800- by 600-pixel resolution)
I/O interfaces: Two serial ports; one parallel port; eight EISA slots, capable of accepting 8-, 16- or 32-bit peripherals

Price
System as reviewed: $7960

Inquiry 852.

Dyna Micro AIR486-C

Company
Dyna Micro, Inc.
30 West Montague Expy.
San Jose, CA 95134
(408) 943-0100

Components
Processor: 25-MHz Intel i486; socket for 25-MHz Weitek WTL4167 math coprocessor
Memory: 4 MB of 70-ns DRAM (expandable to a maximum of 16 MB); 128K bytes of BIOS ROM
Mass storage: 5¼-inch 1.2-MB Teac floppy disk drive; 3½-inch 1.44-MB Teac floppy disk drive; 170-MB 17-ms MiniScribe ESDI hard disk drive; Western Digital 1007 ESDI disk drive controller
Display: Mitsubishi Diamond Scan AUM-1381A 14-inch multisync monitor; MaxLogic MX-677 VGA card; Orchid Technology ProDesigner VGA card
I/O interfaces: One parallel port; 9-pin and 25-pin serial ports; game port; one dedicated 32-bit memory card slot; seven 8-/16-bit peripheral slots; DTK 286 Courier I/O II Card

Price
System as reviewed: $6995

Inquiry 853.

I found the innards of the Spear Super 486/25U rather sloppily assembled. When the computer arrived, it would not recognize the presence of a hard disk drive. I eventually discovered that the cable to the supplied hard disk drive controller had worked its way out of its connector during shipping—a common enough problem and not necessarily the manufacturer's fault. However, a veritable thicket of unmarked cables and power wires wander back and forth under the covers. I had to reach inside and sort them out for myself.

When I called Spear for some advice on the disk drive problem, I learned that the single technician was unavailable at that moment. When I called back, I received courteous—but incorrect—advice to perform a low-level format on the hard disk drive. I found the problem myself by counting and tracing the confusing jumble of cables.

I also had a surprise the first time I pressed the reset button on the front bezel of the machine. The button popped right through the opening and ended up dangling inside the computer. The connector to the LED that indicates disk drive activity was also very loosely attached, and the bolts holding the swing-out support legs on the bottom of the tower were loose. All of these are minor, fixable faults for the experienced computer user. For the less adventurous owner, however, each of the problems could have required a call to technical support or a visit from a repairman.

I tested the Super 486/25U with a range of standard applications software and found no compatibility problems. The machine performed like an ordinary 386. My test suite included WordPerfect 5.1, Lotus 1-2-3 release 3.0, and DOS 3.3. BYTE benchmarks also test compatibility and scores with programs including XyWrite III Plus, Microsoft Word 4.0, Aldus PageMaker, Lotus 1-2-3 release 2.01, Microsoft Excel 2.0, dBASE III Plus, and several CAD programs. The BYTE Lab didn't note any problems.

Video Vagaries

I did run across an unusual problem, apparently not limited to the Spear machine; it involves the i486 processor, the EISA bus, and certain 16-bit peripherals. I tested a prerelease version of a CompuAdd high-resolution 16-bit VGA card based on Tseng Laboratories chips. The display adapter produced Super VGA images and provided downward compatibility with other graphics modes. Unfortunately, video benchmark scores were disappointingly slow. With the help of CompuAdd and Tseng engineers, I discovered that I had run into an obscure bug apparently related to the design of BIOS or programmable array logic chips on the Mylex motherboard in the Super 486/25U. It treats some—but not all—16-bit peripherals like lowly 8-bit devices. Thus, the speedy Super 486/25U acted like a lunky turbo XT with this particular video card. In the Dyna Micro AIR486-C, the card performed at its top speed and without any problem.

Spear uses a DTC 6280 ESDI controller, manufactured by Data Technology, a division of Qume. The board can control one or two ESDI hard disk drives and one or two floppy disk drives. You can disable the floppy disk drive control section of the card with a jumper if necessary. Spear included in the test machine an 85-MB 18-millisecond Imprimis ESDI hard disk drive, which performed as expected. The standard keyboard is a 101-key soft-touch Key Tronic. The Enter key is a smallish rectangle.

Spear provides a thrown-together collection of manuals, including a Phoenix 386 and 386SX BIOS User Guide, which was adequate, if not exactly appropriate, for the i486 BIOS under the covers.

The tower case was of sturdy construction and included a set of braces at the bottom to prevent its tipping over. I found it difficult, though, to access the internal disk drive bays. Also, the general quality of the plastics and metal was a bit on the crude side. Spear provides a one-year repair-at-manufacturer warranty.

The basic desktop system, including 1 MB of memory, one floppy disk drive, an ESDI or SCSI controller, one parallel and two serial ports, and a 101-key keyboard, sells for $4999. The system as tested, including the 85-MB hard disk

continued

World Radio History

Spear Super 486/25U, Dyna Micro AIR486-C

BYTE LAB

APPLICATION-LEVEL PERFORMANCE

WORD PROCESSING	Spear	Dyna
XyWrite III+ 3.52	**Med./Large**	**Med./Large**
Load (large)	:11	:11
Word count	:01/:06	:01/:06
Search/replace	:03/:12	:03/:12
End of document	:01/:07	:01/:07
Block move	:07/:07	:07/:07
Spelling check	:03/:08	:03/:18
Microsoft Word 4.0		
Forward delete	:10	:11
Aldus PageMaker 1.0a		
Load document	:06	:05
Change/bold	:13	:14
Align right	:10	:09
Cut 10 pages	:09	:09
Place graphic	:02	:02
Print to file	:42	1:02
Index:	**5.22**	**5.14**

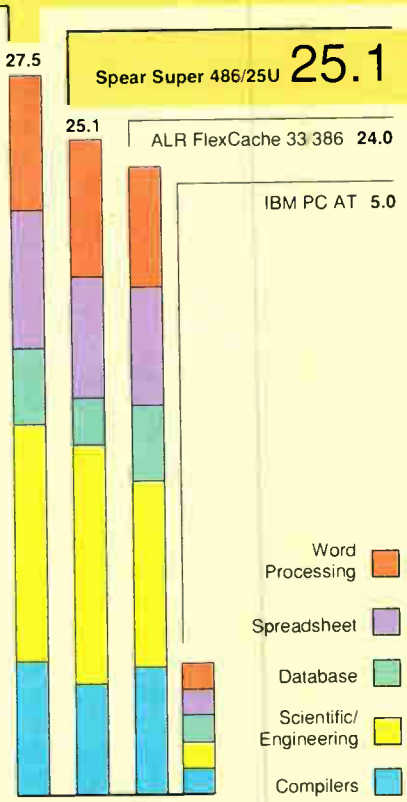
SPREADSHEET	Spear	Dyna
Lotus 1-2-3 2.01		
Block copy	:01	:01
Recalc	:01	:01
Load Monte Carlo	:08	:05
Recalc Monte Carlo	:02	:02
Load rlarge3	:03	:01
Recalc rlarge3	:01	:01
Recalc Goal-seek	:01	:01
Microsoft Excel 2.0		
Fill right	:03	:03
Undo fill	:54	:54
Recalc	:01	:01
Load rlarge3	:13	:11
Recalc rlarge3	:01	:01
Index:	**4.67**	**5.30**

DATABASE	Spear	Dyna
dBASE III+ 1.1		
Copy	:51	:36
Index	:19	:05
List	1:04	:44
Append	1:27	1:28
Delete	:02	:02
Pack	1:08	1:07
Count	:16	:03
Sort	1:10	:48
Index:	**1.75**	**2.92**

SCIENTIFIC/ ENGINEERING	Spear	Dyna
AutoCAD 2.52		
Load SoftWest	:20	:21
Regen SoftWest	:13	:15
Load StPauls	:05	:05
Regen StPauls	:03	:02
Hide/redraw	3:45	3:42
STATA 1.5		
Graphics	:10	:14
ANOVA	:06	:05
MathCAD 2.0		
IFS 800 pts.	:05	:06
FFT/IFFT 1024 pts.	:05	:05
Index:	**9.18**	**9.07**

COMPILERS	Spear	Dyna
Microsoft C 5.0		
XLisp compile	1:59	2:03
Turbo Pascal 4.0		
Pascal S compile	:03	:02
Index:	**4.25**	**5.11**

All times are in minutes seconds. Indexes show relative performance; for all indexes, an 8-MHz IBM PC AT = 1



*Cumulative applications index. Graphs are based on indexes at left and show relative performance

LOW-LEVEL PERFORMANCE[1]

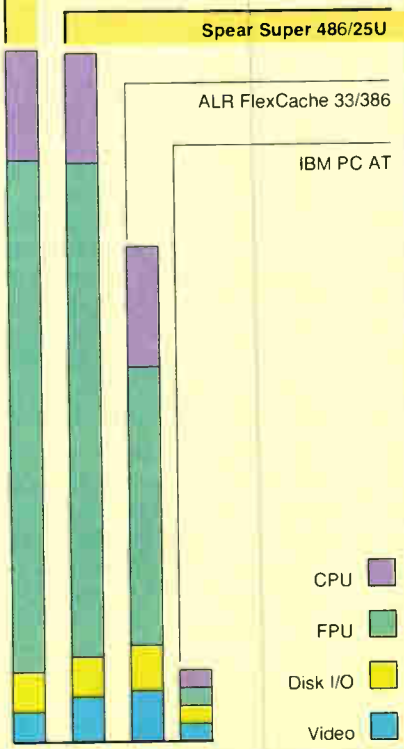
CPU	Spear	Dyna
Matrix	1.76	1.73
String Move		
Byte-wide	22.41	20.78
Word-wide:		
Odd-bnd.	16.53	17.06
Even-bnd.	11.61	12.28
Doubleword-wide:		
Odd-bnd.	12.85	13.52
Even-bnd.	6.26	8.05
Sieve	7.63	7.62
Sort	5.77	5.77
Index:	**6.20**	**6.21**

FLOATING POINT[2]	Spear	Dyna
Math	1.69	1.64
Error		
Sine(*x*)	0.66	0.63
Error		
e^x	0.67	0.65
Error		
Index:	**27.78**	**28.79**

DISK I/O	Spear	Dyna
Hard Seek[3]		
Outer track	3.31	3.32
Inner track	3.33	3.35
Half platter	6.63	5.00
Full platter	8.35	9.94
Average	5.41	5.40
DOS Seek		
1-sector	7.57	8.67
32-sector	18.41	17.93
File I/O[4]		
Seek	0.09	0.18
Read	0.87	0.52
Write	0.75	0.91
1-megabyte		
Write	2.97	3.04
Read	4.39	2.89
Index:	**2.21**	**2.19**

VIDEO Text	Spear	Dyna
Mode 0	3.73	5.55
Mode 1	3.72	5.55
Mode 2	3.66	5.42
Mode 3	3.66	5.40
Mode 7	N/A	N/A
Graphics		
CGA:		
Mode 4	1.45	2.42
Mode 5	1.45	2.40
Mode 6	1.54	2.49
EGA:		
Mode 13	3.17	4.27
Mode 14	3.41	4.56
Mode 15	N/A	N/A
Mode 16	3.38	4.54
VGA:		
Mode 18	3.54	4.78
Mode 19	1.58	2.58
Hercules	N/A	N/A
Index:	**2.56**	**1.75**

CONVENTIONAL BENCHMARKS	Spear	Dyna
LINPACK	64.04	64.37
Livermore Loops[5] (MFLOPS)	0.68	0.68
Dhrystone (MS C 5.0) (Dhry./sec.)	13192	13192



N/A = Not applicable

[1] All times are in seconds. Figures were generated using the 8088/8086 and 386 versions (1.1) of Small-C.

[2] The errors for Floating Point indicate the difference between expected and actual values, correct to 10 digits or rounded to 2 digits.

[3] Times reported by the Hard Seek and DOS Seek are for multiple seek operations (number of seeks performed currently set to 100).

[4] Read and write times for File I/O are in seconds per 64K bytes.

[5] For the Livermore Loops and Dhrystone tests only, higher numbers mean faster performance.

For a full description of all the benchmarks, see "Introducing the New BYTE Benchmarks," June 1988 BYTE.

World Radio History

The i486 at a Glance

Intel's i486 processor consists of one chip with three previously discrete components: a main processor, a math coprocessor, and a cache controller with 8K bytes of data cache. The company based the main processor on the 386's architecture, and the math coprocessor is compatible with the 80387DX chip.

Intel borrowed from RISC design to streamline the 386's instruction set for the i486, which maintains downward compatibility with earlier 80xx6 software. The chip contains 1.2 million transistors, more than four times as many as the 386. The purpose of the RAM cache is to reduce the number of idle (wait) states the processor must expend when engaged in repetitive data retrievals. When the CPU requests data, it looks first in the i486's 8K bytes of internal RAM. Static cache RAM can respond in as little as 25 nanoseconds, compared to a 70- to 100-ns response for DRAM. The i486 can also transfer 32 bits of data in one clock cycle, called burst mode—twice the speed of the 386.

According to Intel, the integrated FPU should yield better performance than a 386 chip mated with a separate 80387 coprocessor because of an improved interface and the shorter distance between the elements of the processor.

drive, a VGA controller, and a monitor, sells for $7960 in a tower configuration.

Dyna Micro: More Polish

The Dyna Micro AIR486-C is a considerably more finished product. Inside the standard desktop case was a model of neatness and organization. Connecting cables were nicely dressed and placed, boards were tightly tied down, and the general level of fit and finish was high.

The AT-bus AIR486-C reigned as the speed champion of the two systems tested, turning in a nearly identical score for CPU performance as the Super 486/25U but gaining a few points in the floating-point and application indexes.

The AIR486-C uses a standard 386-like architecture in a motherboard from AIR. One of the eight slots on the trim (9- by 13-inch) motherboard is given over to the exclusive use of a 32-bit memory board; the card in the test machine had four single in-line memory modules of 1 MB each installed, with room for a total of 16 MB. The remaining seven slots can hold 16- or 8-bit ISA cards.

For some users, one winning point for the AIR board is its socket for the Weitek WTL4167 math coprocessor, a supplement to the FPU on the i486 chip. The WTL4167 is a memory-mapped peripheral. To the i486 and its applications software, it appears to be a segment of memory. (The Spear Super 486/25U does not offer a Weitek socket.) According to Weitek, the chip could boost the floating-point performance by three to five times. But this chip, like the WTL3167 for 386s, is not compatible with instructions written for the Intel coprocessor. Applications must be written specifically to take advantage of the WTL4167's presence. According to Dyna Micro's technical support, several CAD programs and Novell NetWare 386 already support the Weitek extensions to the i486 FPU.

If you absolutely want or need (not the same thing) the latest and greatest technology, these computers are worth considering.

The standard keyboard is a 101-key layout from Maxi-Switch. The soft-touch board includes a large reverse-lily-pad Enter key.

The AIR486-C passed all the tests I threw at it, including the CompuAdd VGA card and other peripheral devices. My software suite and the BYTE Lab tests turned up no anomalies. A test call to technical support produced a quick and accurate response.

The unit as tested, including a hard disk drive and VGA monitor, lists for a competitive $6995. A base unit without the drive or monitor lists for $4995. Dyna Micro, which sells its machines primarily through resellers, also offers the 486 as a tower unit for an additional $150. The company provides a one-year warranty on parts and labor, with service performed at the factory. On-site service contracts from Intel are available as an option. Also, Dyna Micro offers a money-back refund within 30 days of purchase, and an 85 percent credit or refund within 30 to 60 days of purchase, except for special-order items.

Back to the Benchmarks

The CPU index of the BYTE benchmarks shows that both the Dyna Micro and Spear machines ran an impressive 6.2 times faster than BYTE's baseline 8-MHz AT. But neither machine could beat the 6.74 CPU index of the speedy 33-MHz ALR FlexCache 33/386.

The speed advantage of the i486's integral math coprocessor is obvious. On the floating-point tests, the 486s turned in scores nearly twice as fast as the FlexCache's and an amazing 28 times faster than the AT score.

Most significant for single users are the application results. Again, the FlexCache is the fastest of the lot in traditional tasks, although all the tested machines turned in very speedy results.

The bottom line is this: Both the Spear Super 486/25U and the Dyna Micro AIR486-C work well and prove that the era of the i486 is upon us. If you absolutely want or need (not the same thing) the latest and greatest technology, these computers are worth considering. My preference is the Dyna Micro AIR486-C.

If you are buying a machine for use as a server or for intensive CAD/CAM or engineering work, an i486 should be at the top of your shopping list. However, for many single users, the 25-MHz version of that chip doesn't offer significant improvement over a 33-MHz 386 costing several thousand dollars less. ■

Corey Sandler is president of Word Association, Inc., a consortium of high-tech authors based in Holliston, Massachusetts. He has written more than 20 books and is the former editor of several national computer magazines and newspapers. He can be reached on BIX c/o "editors."

World Radio History

Cure For The Common Clone

IMAGINE. 386sx power, 200 MB-HD, 8 MB RAM, 1024 x 768 VGA with an internal modem...and it fits in a briefcase!

Introducing the Brick.™ A 386sx with enough power, storage and graphics capability to run the most demanding applications. And it's the first desktop PC that's quiet enough, small enough and elegant enough not to be banished instantly to the floor. This remarkable computer measures 3"x 8"x 11" and weighs only 8.3 lbs.

More Practical Than A Portable

The Brick offers an alternative to the usual trade-offs associated with laptops. Simply keep a full sized monitor and keyboard at your home and office, and carry just the Brick in between. You save half the cost, half the weight, and all the hassle of coordinating files between multiple machines. *You can have **one** machine with all your files wherever you need it.*

A Powerful And Quiet Desktop

Bricks are available with a 16 or 20 MHz 386sx; a 387sx coprocessor; 1 to 8 MB RAM; and your choice of a 40 (25ms), 100 (25ms), or 200 MB (16ms) hard disk. Bricks also deliver superb VGA graphics with 1MB video RAM supporting 800 x 600 and 1024 x 768 resolution for CAD, DTP or Windows. As an added benefit, the Brick is very quiet. Its rugged aluminum case serves as a heat sink so the whisper fan rarely runs.

832k for DOS

The Brick provides another welcome bonus: an extra 192k of memory above the DOS 640k limit. This unique feature allows you to load resident programs, such as a network or TSRs, into a contiguous 192k block of

The Brick fits in half a briefcase, leaving room for everything else you have to carry.

World Radio History

The Brick
3"x 8"x 11"
Only 8.3 lbs.

high memory, and still leave the lower 640k free. The regular Brick shown above also accepts an internal ISA 16-bit half length card, while the "Stretch Brick," shown at right, accepts one full and one half length card.

Great Value

Complete Brick systems start at just $2,495. For your convenience, we also offer pre-installed software packages – including the DESQview™ or the new Windows® 3.0 environments – and top-rated applications. For example, the system (shown above) including all standard Brick features with optional color VGA monitor; 4 MB RAM; and a 100 MB hard disk pre-programmed with DESQview 386, Quattro®, Sprint®, askSam™, DOS™ and Tree86™ is only $3,995! With this package, we also include our exclusive interactive "Talking Tutorial" that quickly teaches you how to use each program. *Yes, the Brick actually talks.*

Optional paper white VGA LCD display with back-lit super twist technology.

Guaranteed Satisfaction

Because we are a direct selling manufacturer, we have a direct interest in the complete satisfaction of each and every customer. To ensure that satisfaction, **Ergo** offers: a 30-day money back guarantee, a One Year Warranty, unlimited 800-line support and our exclusive Advanced Diagnostics via modem.

Free Catalog

You'll find complete information on all Brick systems, plus a full complement of enhancements including FAX and networking cards, tape backup unit, cases, monitors and more in our 32-page catalog. Why not call for it today?

Ergo also offers a line of traditional 386 computers, from 16 to 33 MHz, starting at just $1,895. Call us at **1-800-633-1925** and we'll help you select the system that best meets *your* needs.

$2,495

System Includes

- Stretch Brick
- 16 MHz Intel 386sx
- 1 MB RAM, Exp. to 8 MB
- 40 MB hard disk with password protection
- Mono VGA monitor
- 16-bit full and 8-bit half card expansion slots

Standard Features

- 1024 x 768 VGA controller with 1MB video RAM and EGA, CGA, MDA support
- 101 keyboard
- 2,400 bps modem
- 3.5" 1.44 MB floppy
- 2 serial & 1 parallel port
- World wide AC power
- Hypertext manual
- 832k DOS capable
- LIM 4.0 EMS support
- One Year Warranty
- Freight included

BY0790

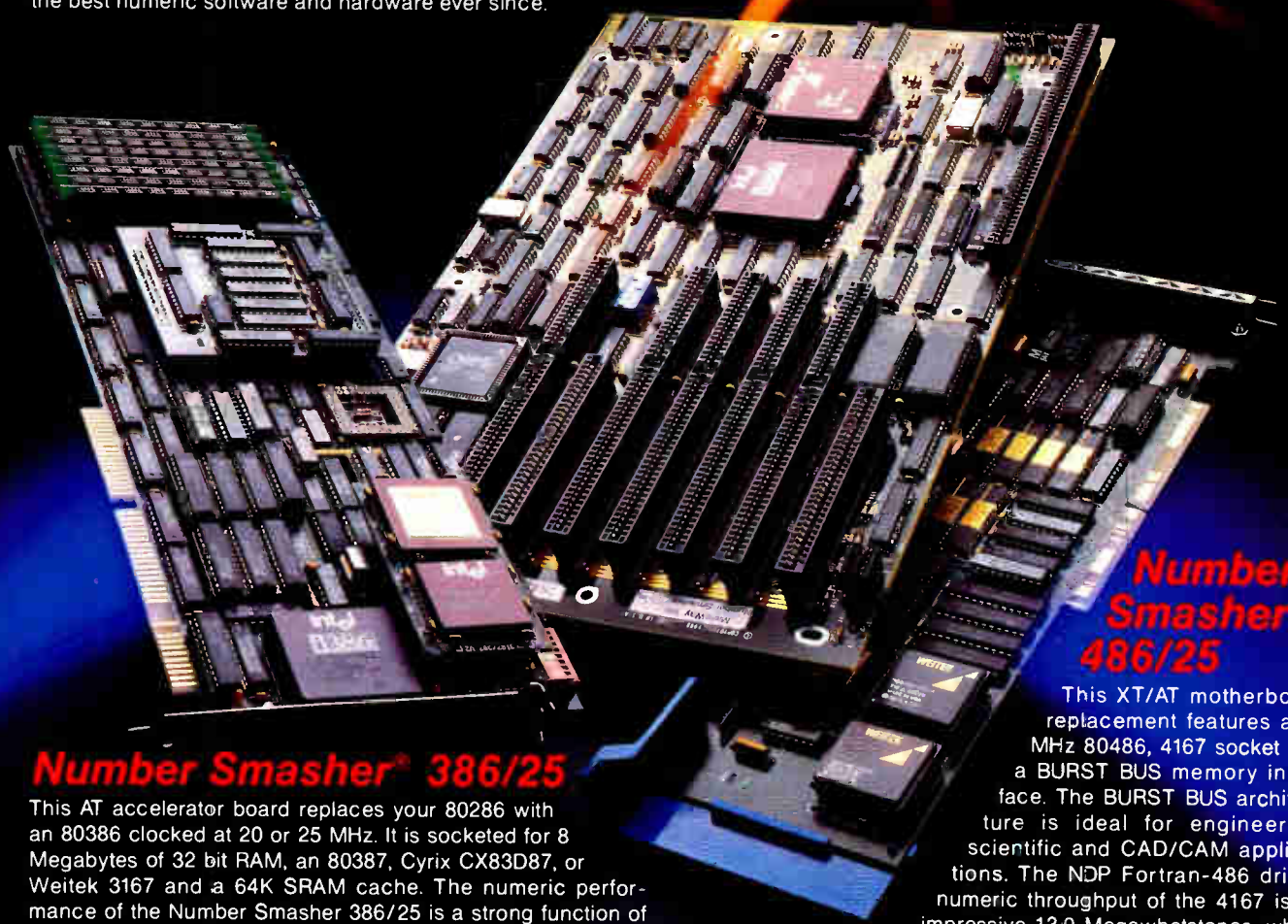
Ergo
A COMPUTER COMPANY

Free 32-Page Catalog
1-800-633-1925
Ergo Computing, Inc., One Intercontinental Way, Peabody, MA 01960
Circle 95 on Reader Service Card
(DEALERS: 96)

World Radio History

25 MHz 486 Speed For Your 286/386 System!

MicroWay manufactures a broad range of products that boost the speed and capacity of your current PC/AT. They include 386 and 386SX accelerators and 486 replacement motherboards. We also offer a complete line of Weitek accessories and stock all of the Intel, Weitek and Cyrix coprocessors. We created the PC numerics industry in 1982 and have been developing, selling and supporting the best numeric software and hardware ever since.



Number Smasher® 386/25

This AT accelerator board replaces your 80286 with an 80386 clocked at 20 or 25 MHz. It is socketed for 8 Megabytes of 32 bit RAM, an 80387, Cyrix CX83D87, or Weitek 3167 and a 64K SRAM cache. The numeric performance of the Number Smasher 386/25 is a strong function of your application and the coprocessor you choose. The 25 MHz NDP Fortran-386 driven Whetstones are 2.1, 3.7 and 5.5 MegaWhetstones running on the 80387, CX83D87 and 3167.

Number Smasher® 486/25

This XT/AT motherboard replacement features a 25 MHz 80486, 4167 socket and a BURST BUS memory interface. The BURST BUS architecture is ideal for engineering, scientific and CAD/CAM applications. The NDP Fortran-486 driven numeric throughput of the 4167 is an impressive 13.0 Megawhetstones, which is 100 times the throughput of an 80287 equipped AT!

Number Smasher 486/25 Numeric Performance

	486	4167
Megawhetstones	5.9	13.0
Megawhetscales	4.1	9.9

MicroWay and Number Smasher are registered trademarks of MicroWay, Inc., 80386, 80387, 80486 are trademarks of Intel Corp., Cyrix and CX83D87 are trademarks of Cyrix Corp., Weitek, 3167 and 4167 are trademarks of Weitek Corp.

mW3167/MCA

Our MCA Weitek card runs in the IBM Model 70 and 80. At 20 MHz, its performance is 2 to 3 times that of an 80387.

NDP Fortran-486 and C-486 are globally optimized mainframe compilers that have been fine tuned for the 80486 and 4167. NDP Fortran-i860 and C-i860 are available in August.

Coming in August: Number Smasher® i860

MicroWay

World Leader in PC Numerics

Corporate Headquarters: P.O. Box 79, Kingston, MA 02364 USA (508) 746-7341
32 High St., Kingston-Upon-Thames, U.K., 81-541-5466 USA FAX (508) 746-4678
Germany 069-75-2023 Italy 02-74.90.749 Holland 40 836455 Japan 3 222 0544

WorldRadioHistory

Bill Catchings and Mark L. Van Name

REVIEW

Power Servers

Until recently, LAN servers were just big, fast PCs. System vendors didn't design machines specifically as file servers. No longer; today, vendor after vendor is announcing systems with special features aimed at the LAN server market.

We looked at two such systems, Storage Dimensions' FileMaster II and Zenith's Z-386/33E. You could use both systems as single-user DOS PCs, but they're clearly meant to be file servers, so that's how we tested them. They also offer similar performance, although they achieve that performance in very different ways.

The FileMaster II is a slightly modified Everex Step 386/33. (Everex markets the same basic machine as the StepServer.) Like all the Everex Step systems to date, the FileMaster II uses the standard AT bus and Everex's proprietary cache controller. But rather than a traditional PC modified-frequency-modulation or ESDI hard disk drive, the FileMaster II uses a SCSI disk subsystem.

The $11,599 base system comes with a 33-MHz 386 processor, a socket that can hold either a 33-MHz 80387 or a Weitek WTL3167 math coprocessor, 4 megabytes of memory, 64K bytes of static RAM (SRAM) cache, a 5¼-inch 1.2-MB Teac floppy disk drive, a 150-MB SCSI Maxtor hard disk drive, two serial ports, two parallel ports, a monochrome video adapter and monitor, MS-DOS 3.3, and a NetWare utilities disk. Our evaluation unit was the FileMaster II, which contains a second 150-MB hard disk drive and sells for $11,999.

Instead of the AT bus, the Zenith Z-386/33E has a 32-bit Extended Industry Standard Architecture (EISA) bus. The Z-386/33E's disk subsystem uses an ESDI drive, but with a new Zenith bus-master caching disk drive controller.

The $11,999 base system includes a 33-MHz 386 CPU, a socket for a 33-MHz 80387 math coprocessor, a socket for a Weitek WTL3167 math coprocessor, 4 MB of memory, 16K bytes of SRAM cache, a 3½-inch 1.44-MB floppy disk drive, a 150-MB ESDI hard disk drive, two serial ports, one parallel port, a VGA video adapter, MS-DOS 4.0 (3.30 on our unit), and Microsoft Windows/386 3.0. Our evaluation unit also included an optional Zenith ZCM1492 FTM (Flat Tension Mask) color monitor ($999) and an extra 4 MB of memory ($499 each), for a total price of $14,994.

The Zenith Z-386/33E (left) and the Storage Dimensions FileMaster II.

To make the systems comparable, we'd need to replace the FTM monitor on the Zenith system with a ZVM1470 monochrome monitor ($299). Such a system would cost $12,298, $699 more than a FileMaster II.

Performance

To see how these two systems would fare as file servers, we loaded them with vanilla copies of NetWare 386. We then copied 4.3 MB of files of all different sizes from LAN clients to the server and back. We tested each server with first one workstation and then four workstations running the test simultaneously. We timed the copying on our fastest client system, an ALR FlexCache 25386 with an 18-millisecond ESDI hard disk drive. Testing with only four workstations might not sound like much, but four workstations that are each sending over 4 MB of data back and forth over the network as fast as possible represents as much data movement as many more workstations doing the occasional disk accesses more typical of real work.

To help put these two servers in perspective, we also timed the test on the ALR system alone, copying to and from its hard disk drive. We also ran the tests on two other servers. To represent a low end typical of what many people are using today, we used a 16-MHz 386 Samsung system that had 4 MB of memory and a smart disk drive controller, and we ran NetWare 286 on it. As the keeper of the high-end flame, we used a Compaq Systempro that had two 33-MHz 386 CPUs, 12 MB of memory, and Compaq's Intelligent Drive Away disk subsystem, and we ran NetWare 386 on it.

We let the vendors supply the Ethernet board of their choice. Zenith furnished a Novell NE3200, which is a bus-master EISA board with its own 80186 processor. Storage Dimensions sent a CNet Technology CN100E board, a dumb 8-bit board compatible with Novell's NE1000. (In the Systempro we used the Novell NE3200; in the Samsung we used an 8-bit Western Digital WD8003.)

Storage Dimensions didn't have ready a final version of its NetWare 386 driver for the FileMaster II's SCSI disk drives (although NetWare 286 ran fine), so we had to use a beta version of that driver. We completed the NetWare 386 tests with that driver, but we had to halve the FileMaster II's bus speed to 8 MHz and add one wait state (with a jumper) to the disk drive controller. When the company finishes its NetWare 386 SCSI drivers, the FileMaster II's performance might improve—how much is anybody's guess.

The four servers performed as you would expect: The Systempro won, the Samsung brought up the rear, and the EISA-bus Z-386/33E beat the AT-bus FileMaster II (see the table on page 168). The FlexCache took 76 seconds to run the test on its own hard disk drive, so the

continued

World Radio History

FileMaster II

Company
Storage Dimensions
2145 Hamilton Ave.
San Jose, CA 95125
(408) 879-0300

Components
Processor: 33-MHz Intel 386 with a socket for a 33-MHz Intel 80387 or a 33-MHz Weitek WTL3167 math coprocessor
Memory: 4 MB of 80-ns DRAM; 64K-byte cache of 20-ns SRAM
Mass storage: 5¼-inch 1.2-MB Teac floppy disk drive; two 150-MB 14-ns full-height Maxtor SCSI hard disk drives
Display: Everex EverVision MN-100 monochrome monitor
Keyboard: 101-key modified IBM Enhanced AT keyboard layout
I/O interfaces: One 9-pin and one 25-pin serial port; two 25-pin parallel ports; six 16-bit and two 8-bit AT-style expansion slots

Price
System as reviewed: $11,999

Inquiry 854.

Z-386/33E

Company
Zenith Data Systems
1501 Feehanville Dr.
Mount Prospect, IL 60056
(800) 553-0331

Components
Processor: 33-MHz Intel 386 with a socket for a 33-MHz Intel 80387 and a socket for a 33-MHz Weitek WTL3167 math coprocessor
Memory: 8 MB of 80-ns DRAM; 16K-byte cache of 15-ns SRAM
Mass storage: 3½-inch 1.44-MB Sony floppy disk drive; 150-MB 16-ms half-height Imprimis ESDI hard disk drive
Display: Zenith FTM color VGA monitor
Keyboard: 101-key modified IBM Enhanced AT keyboard layout
I/O interfaces: Two 9-pin serial ports; one 25-pin parallel port; six 32-bit EISA expansion slots

Price
System as reviewed: $14,994

Inquiry 855.

FILE SERVER THROUGHPUT TEST

Our file server test reads and writes a group of files of varying sizes totaling 4.3 MB to each server. The baseline is the time to run the same test on our ALR FlexCache 25386's local hard disk drive. Server performance degrades as loading increases, but the Z-386/33E proved slightly more robust than the FileMaster II. Times for the Samsung and Systempro aren't directly comparable; we include them as reference points only. (All times in seconds.)

System	One user	Four users	% degradation
ALR baseline server	76	N/A	N/A
Samsung	120	242	102
Storage Dimensions FileMaster II	80	113	41
Zenith Z-386/33E	73	99	36
Compaq Systempro	63	76	21

N/A = Not applicable.

Zenith and Systempro servers actually gave better file transfer performance over a LAN than the FlexCache on its own ESDI hard disk drive. With all four workstations running the test, all the servers slowed down, but they stayed in the same order. While the Z-386/33E beat the FileMaster II, the margin of victory was not great on either test: about 9 percent on the single-workstation test, and about 14 percent on the four-workstation run.

Perhaps a more interesting result, however, is the percentage by which the performance of these two servers degraded from the one-workstation test to the four-workstation test. The FileMaster II got 41 percent slower, while the Z-386/33E slowed by 36 percent. Based largely on the disk architectures of these two systems, we expect that this gap would widen with more users.

These tests do not necessarily represent file transfer activity in a specific real-world application. They do, however, provide a general reference point for overall performance differences.

The BYTE benchmarks for the Z-386/33E and the FileMaster II show that, as a single-user system, neither machine is outstanding. The Z-386/33E still beats the FileMaster II on the overall application index (20.4 versus 17.3), but both of them lose to the 33-MHz FlexCache.

Moving the Bytes

The keys to these systems' strong server performances are their disk subsystems. While Zenith's EISA Mass-Storage Controller consumes only one slot, it's actually three boards linked by stand-offs and edge connectors. The combination sports over 200 chips, including the Intel NG82355 Bus Master Interface Chip application-specific integrated circuit (ASIC). The controller can act as an EISA bus master, so it can take control of the system's bus to speed DMA transfers and avoid tying up the CPU. It also has a 1-MB cache that came in four 256K-byte single in-line memory modules, each of which contained two 256K-byte DRAM chips. You can expand that cache to 4 MB with 1-MB SIMMs.

This controller can support up to four ESDI hard disk drives and up to seven SCSI hard disk drives, as well as up to two floppy disk drives. Based on a controller by Data Technology, the board also has some Zenith-proprietary modifications for *position-sensing*, a technique that lets the controller know how close each drive's heads are to the desired disk data, information that lets the controller minimize head movement. The card was clearly new, with about 30 wires running all over the three boards. A Zenith spokesperson said that the firm plans to come out with a new version of the controller that fits on two boards and eliminates these wires. Our Z-386/33E's hard disk drive was a half-height Imprimis 150-MB ESDI drive with a 16-ms average access time, but Zenith uses similar drives from other vendors as well.

Compared to the Z-386/33E's EISA bus and caching disk drive controller, the FileMaster II seemed almost mundane. Its SCSI controller was an 8-bit card on the system's AT bus. That bus, unlike the bus in normal Everex Step 386/33 systems, can run at 16.5 MHz, but otherwise it's a standard AT bus. The hard disk drive was a full-height, 150-MB 14-ms drive from Maxtor, Storage Dimensions' parent company.

CPU and Memory

Aside from the bus and disk drive controllers, these two systems aren't all that different. The FileMaster II supports its 33-MHz 386 CPU with the standard Everex proprietary cache system, which grows as you add memory. The memory

continued

World Radio History

Zenith Z-386/33E, SD FileMaster II

BYTE LAB

APPLICATION-LEVEL PERFORMANCE

Zenith Z-386/33E **20.4***

WORD PROCESSING	Zenith	SD
XyWrite III+ 3.52	**Med./Large**	**Med./Large**
Load (large)	:10	:11
Word count	:01/:10	:01/:09
Search/replace	:03/:12	:02/:12
End of document	:01/:08	:01/:07
Block move	:08/:08	:02/:02
Spelling check	:04/:28	:04/:28
Microsoft Word 4.0		
Forward delete	:08	:10
Aldus PageMaker 1.0a		
Load document	:07	:07
Change/bold	:13	:14
Align right	:10	:11
Cut 10 pages	:09	:11
Place graphic	:02	:03
Print to file	:57	1:09
Index:	**4.73**	**5.32**

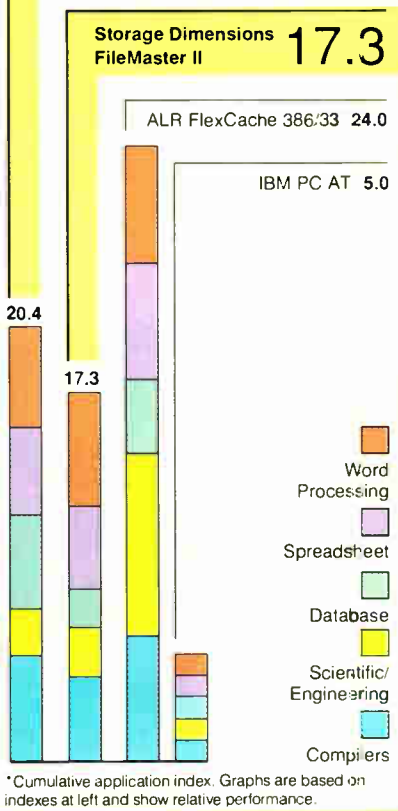
SPREADSHEET	Zenith	SD
Lotus 1-2-3 2.01		
Block copy	:02	:02
Recalc	:01	:01
Load Monte Carlo	:08	:14
Recalc Monte Carlo	:03	:03
Load rlarge3	:02	:04
Recalc rlarge3	:01	:01
Recalc Goal-seek	:02	:02
Microsoft Excel 2.0		
Fill right	:03	:03
Undo fill	1:07	:52
Recalc	:01	:01
Load rlarge3	:12	:14
Recalc rlarge3	:01	:01
Index:	**4.17**	**3.93**

DATABASE	Zenith	SD
dBASE III+ 1.1		
Copy	:18	:43
Index	:06	:18
List	:29	:56
Append	:39	1:33
Delete	:01	:02
Pack	:28	1:13
Count	:04	:16
Sort	:39	1:09
Index:	**4.38**	**1.80**

SCIENTIFIC/ENGINEERING	Zenith	SD
AutoCAD 2.52		
Load SoftWest	1:04	1:03
Regen SoftWest	:58	:55
Load StPauls	:18	:20
Regen StPauls	:16	:16
Hide/redraw	13:15	13:12
STATA 1.5		
Graphics	:28	:24
ANOVA	:16	:16
MathCAD 2.0		
IFS 800 pts.	:31	:30
FFT/IFFT 1024 pts.	:38	:36
Index:	**2.23**	**2.28**

COMPILERS	Zenith	SD
Microsoft C 5.0		
XLisp compile	1:56	2:17
Turbo Pascal 4.0		
Pascal S compile	:02	:03
Index:	**4.91**	**3.96**

All times are in minutes:seconds. Indexes show relative performance; for all indexes, an 8-MHz IBM PC AT = 1.



*Cumulative application index. Graphs are based on indexes at left and show relative performance.

LOW-LEVEL PERFORMANCE[1]

Zenith Z-386/33E

CPU	Zenith	SD
Matrix	2.00	1.97
String Move		
Byte-wide	22.72	12.05
Word-wide:		
Odd-bnd.	17.06	15.05
Even-bnd.	11.35	6.04
Doubleword-wide:		
Odd-bnd.	12.16	12.03
Even-bnd.	5.71	3.02
Sieve	10.43	10.43
Sort	8.22	7.91
Index:	**5.41**	**6.88**

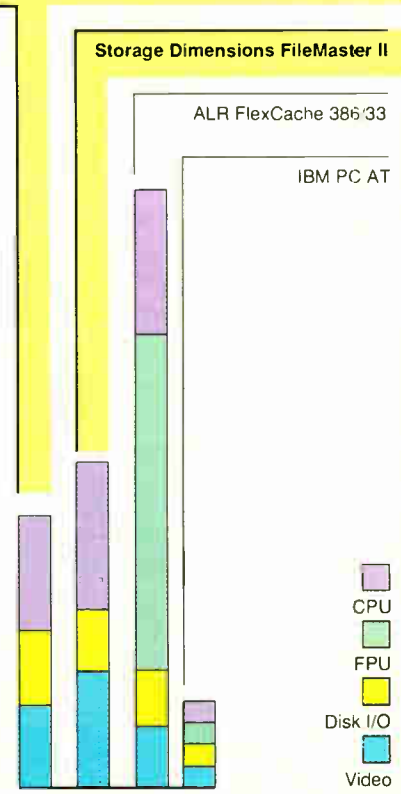
FLOATING POINT[2]	Zenith	SD
Math	N/A	N/A
Error		
Sine(*x*)	N/A	N/A
Error		
e^x	N/A	N/A
Error		
Index:	**N/A**	**N/A**

DISK I/O	Zenith	SD
Hard Seek[3]		
Outer track	N/A	N/A
Inner track	N/A	N/A
Half platter	N/A	N/A
Full platter	N/A	N/A
Average	N/A	N/A
DOS Seek		
1-sector	N/A	N/A
32-sector	N/A	N/A
File I/O[4]		
Seek	0.07	0.02
Read	0.19	0.90
Write	0.60	0.86
1-megabyte		
Write	3.42	2.84
Read	2.88	4.19
Index:	**3.46**	**2.92**

VIDEO	Zenith	SD
Text		
Mode 0	2.48	N/A
Mode 1	2.47	N/A
Mode 2	1.98	N/A
Mode 3	1.92	N/A
Mode 7	N/A	2.28
Graphics		
CGA:		
Mode 4	1.05	N/A
Mode 5	1.04	N/A
Mode 6	0.99	N/A
EGA:		
Mode 13	2.64	N/A
Mode 14	2.58	N/A
Mode 15	N/A	N/A
Mode 16	2.54	N/A
VGA:		
Mode 18	2.64	N/A
Mode 19	0.94	N/A
Hercules	N/A	0.88
Index:	**3.85**	**5.42**

SD = Storage Dimensions.
N/A = Not applicable. Seek times were omitted in the low-level disk tests due to inaccuracies associated with SCSI devices.
[1] All times are in seconds. Figures were generated using the 8088/8086 and 80386 versions (1.1) of Small-C.
[2] The errors for Floating Point indicate the difference between expected and actual values, correct to 10 digits or rounded to 2 digits.
[3] Times reported by the Hard Seek and DOS Seek are for multiple seek operations (number of seeks performed currently set to 100).
[4] Read and write times for File I/O are in seconds per 64K bytes.
[5] For the Livermore Loops and Dhrystone tests only, higher numbers mean faster performance.

CONVENTIONAL BENCHMARKS	Zenith	SD
LINPACK	929.94	918.02
Livermore Loops[5] (MFLOPS)	0.0227	0.0230
Dhrystone (MS C 5.0) (Dhry./sec.)	10845	11520



For a full description of all the benchmarks, see "Introducing the New BYTE Benchmarks," June 1988 BYTE.

World Radio History

is interleaved to further improve performance. Memory comes in small boards that connect like SIMMs. Each board holds 4 MB in 36 1-megabit 80-nanosecond chips, and accompanying each one is a cache card of the same size. Each cache card contains 64K bytes of 20-ns SRAM. Memory upgrades come in similar pairs. You can have up to four such pairs in the system, for a maximum of 16 MB and a total cache of 256K bytes.

The rest of the 12- by 14-inch motherboard is relatively boring, with few surface-mounted ICs and ASICs. One notable ASIC is the Chips & Technologies 82C206 Integrated Peripheral Controller, which is common in AT-bus systems.

The Z-386/33E's slightly smaller motherboard uses numerous surface-mounted ICs. It has few ASICs, although four are notable: two from Zenith and two from Intel (an NG82357 integrated system peripherals chip and an NG82358 EISA bus controller).

The Z-386/33E also eschews a standard cache controller in favor of a proprietary Zenith cache system that has 16K bytes of 15-ns SRAM in a special card slot. A 64K-byte version of that cache is also available. Eight SIMM slots hold the memory, which can come in 1- or 4-MB SIMMs of 80-ns chips. The first four slots can handle only 1-MB SIMMs, so the maximum system memory is 20 MB.

Expansion

The Z-386/33E also has plenty of room to add disk drives. Its single half-height hard disk drive and the floppy disk drive leave one full-height and two half-height bays open. The system starts with a lot of EISA expansion slots (six), but the disk drive controller, VGA card, and LAN adapter fill three of those slots, so only three are open.

The FileMaster II has less drive expansion room but more open slots. The standard system's floppy disk drive and full-height hard disk drive leave only one full-height bay open. There are, however, eight expansion slots—six 16-bit and two 8-bit. The video, disk, I/O, and LAN cards fill four, leaving four free.

The Incidentals

Except for support, the rest of these two systems is almost incidental. They have similar 101-key keyboards that follow the IBM Enhanced AT keyboard layout. Documentation on both systems was adequate, although Zenith's was generally more thorough.

Service, on the other hand, is important, especially for a network server. The FileMaster II comes with a one-year on-site service contract with General Electric. Zenith offers either one year of carry-in service from your dealer or three months of on-site service from its Zenith Data Systems Service Network.

It's not easy to choose between these systems. Each will boost your network performance, but the Z-386/33E offers slightly better performance and less degradation under load. We're a little leery of the many last-minute changes to the Zenith system's motherboard and hard disk drive controller, but we experienced no problems with the machine. Forced to choose between the two systems, we'd go with the Zenith Z-386/33E, but it would be a close call. ■

Bill Catchings and Mark L. Van Name are BYTE contributing editors. Both are also independent computer consultants and freelance writers based in Raleigh, North Carolina. You can reach them on BIX as "wbc3" and "mvanname," respectively.

1000 DPI!

From Your HP LaserJet Series II or III

It's true! We can turn your existing Series II or III printer into a 1000 x 1000 TurboRes™ Plain-Paper Typesetter! National TeleVAR™ (Raster Devices Direct) introduces the **1000 Enhancer Kit™** for your HP Series II or III printer.

By using a new imaging technology called TurboRes™ on our PC-based controller, we can transform your 300 dpi printer into a state-of-the-art Plain-Paper Typesetter that gives you print quality previously undreamed of, even on devices costing over $20,000.

Send us your HP Series II or III laser printer and we will do the rest. We factory install a video board and connector in your Series II or III, and supply a PC/XT/AT or MCA 6Mb printer controller, 135 scaleable fonts, direct driver software for Windows (such as PageMaker, CorelDRAW!, Micrografx Designer, Word for Windows, etc.), GEM (such as Xerox Ventura Publisher, GEM Artline, etc.) and Word Perfect.

CALL NOW! **1-800-468-1732** (In MN: 612-941-4919) and ask about the 1000 Enhancer Kit for your Series II or III printer. The 300 dpi barrier will fall by the wayside as you experience 1000 x 1000 TurboRes. Note that all your existing PCL functionality remains unchanged, so your printer can live in both worlds—PCL and 1000 x 1000 TurboRes!

National TeleVAR™

PrePress Systems Specialists

Formerly Raster Devices Direct, Inc.

©1990. Raster Devices Direct, Inc., National TeleVAR and 1000 Enhancer Kit are trademarks of Raster Devices Corporation. TurboRes is a licensed technology and a trademark of LaserMaster Corporation. All other product and brand names are trademarks and registered trademarks of their respective companies. All prices and specifications are subject to change without notice. Please call for current pricing and warranty details.

VISA, MASTERCARD AND AMERICAN EXPRESS ACCEPTED

Circle 243 on Reader Service Card

World Radio History

State of the art power protection for state of the art power

LAN TIMES READER'S CHOICE 1990

Your premier file-server deserves premier Uninterruptible Power Source (UPS) protection. The UPS 600LS from American Power Conversion features sine wave output, automatic diagnostics, advanced surge suppression and continuous line filtering. An intelligent microprocessor and a communications interface are built-in, so you can use automatic shutdown with NetWare, VINES, LAN Manager, and SCO UNIX. If you're buying the best, don't settle for less than reliable UPS protection from APC. Call 1-800-541-8896 for your Compaq UPS Sizing and Installation Kit.

UPS MONITORING CO-DEVELOPERS Microsoft LAN MANAGER

NOVELL LABS AUTHORIZED TESTED AND APPROVED NetWare Compatible™

American Power Conversion

Lan's Best Friend™

350 Columbia St., Peace Dale, RI 02883

(401) 789-5735 (800) 541-8896

Compaq and System Pro are trademarks of Compaq Computer Corp. Microsoft and the Microsoft logo are trademarks of Microsoft Corporation. Lan's Best Friend and PowerChute are trademarks of American Power Conversion. All other trademarks are the property of their respective owners.

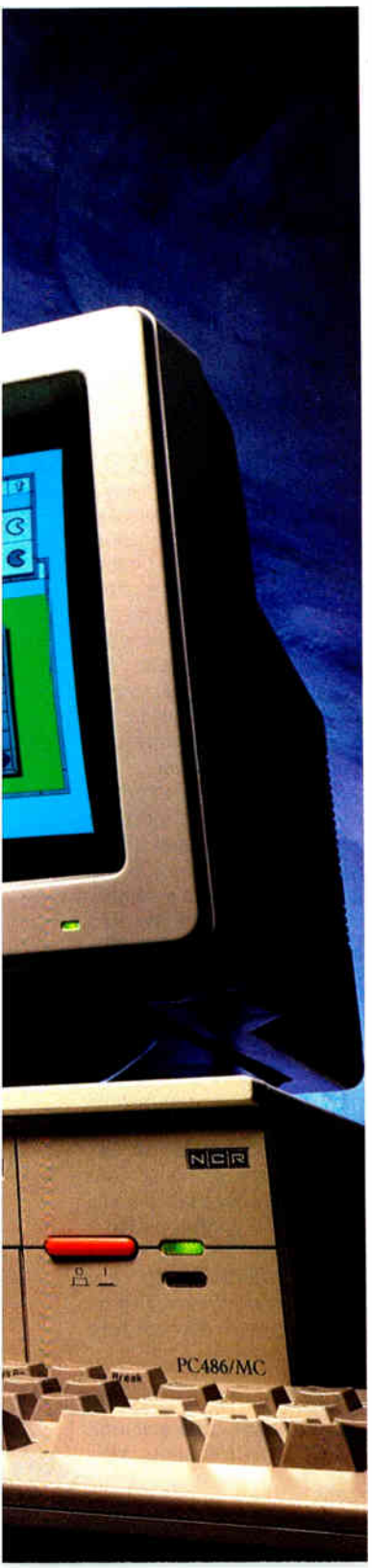
Circle 25 on Reader Service Card (Dealers: 26)

World Radio History

As Fast As And You Can

World Radio History

It Gets. Get It Fast.



The NCR PC486/MC is one fast machine. *PC/Computing* reports "the PC486/MC is on the front edge" of 486 desktops.* With its dual high-speed cache design, the system takes full advantage of the performance potential of the i486™ microprocessor. And its implementation of Micro Channel™ architecture makes it the clear leader in providing full 32-bit performance.

According to *BYTE* Lab benchmarks, the PC486/MC's "mass storage subsystem (with a 100MB SCSI hard drive) turned in the fastest performance we've ever measured."*

Standard Features

- i486 Native Design
- Micro Channel Architecture
- 128KB Of High-Speed Cache Memory
- SuperVGA Display Adapter
- Small Computer System Interface (SCSI) Multi-Peripheral Controller
- Worldwide Service and Support
- Available *Now*

Our PC is the only native design 486 Micro Channel machine from a major vendor now available. We've not only released it for sale, we're delivering it in volume. The competition will eventually release a native-design 486. But how long will it be before they can deliver?

The PC486/MC is ideal for MIPS-hungry applications like large spreadsheets, financial modeling, simulations, CAD, and networking.

It's the first of a family of advanced PCs that will lead the market in speed, power, and availability.

Our PC family also includes high-performing 286™ and 386™-based PCs. Backed by the resources of a $6 billion computer company with service and support in nearly every country in the world. And a commitment to quality that is unequaled.

Call 1 800 544-3333 for a free six-page 486 PC comparison brochure. We'll also put you in touch with the NCR or Businessland representative, or other Authorized NCR Reseller nearest you.

NCR

Open, Cooperative Computing. The Strategy For Managing Change.

Circle 179 on Reader Service Card

NCR is the name and mark of NCR Corporation. Micro Channel is a trademark of IBM Corporation. 486, 386, and 286 are trademarks of Intel Corporation. *Sources: *PC/Computing*, March 1990. *BYTEWEEK*, 11/13/89. © 1990 NCR Corporation.

World Radio History

Ben Smith

REVIEW

Personal Iris: The Dream Maker

The Silicon Graphics Personal Iris Turbo workstation. I created the BYTE logo shown on-screen as a 3-D object. The Iris can set the logo in motion, recalculating and redrawing every polygon in real time.

Personal Iris Model 4D/25 Turbo

Company
Silicon Graphics Computer Systems
2011 North Shoreline Blvd.
P.O. Box 7311
Mountain View, CA 94039
(415) 960-1980

Components
Processor: 20-MHz MIPS R3000 RISC processor; R3010 FPU
Memory: 8-MB RAM; 96K-byte cache
Mass storage: 380-MB SCSI hard disk drive; 150-MB cartridge tape drive
Display: 19-inch, 1280- by 1024-pixel; 16.7 million (24 bits) simultaneously displayable colors
Keyboard: 101-key IBM AT style
I/O interfaces: Two serial ports; one parallel port; SCSI port; Ethernet port; video and audio ports

Software
Irix (Unix System V release 3.2); WorkSpace environment manager; 4-Sight windowing system; X Window System version 11; NeWS graphical environment; Alias QuickModel and QuickPaint; Wavefront Personal Visualizer; a host of 2-D and 3-D graphical demos and source code

Price
System as reviewed: $32,500

Inquiry 856.

Any designer, whether an architect, engineer, planner, or graphic artist, needs to visualize a design while creating it. Rare individuals in this group can generate solid models in their minds. The mental models are so real for these people that they can rotate them, move into them, and investigate the details. But, unfortunately, these imaginings are not easily communicated to others. Wouldn't it be wonderful to display the models on a computer with as much detail and flexibility as in the mind?

That is just what the Silicon Graphics Personal Iris workstations are designed to do, and the new Turbo model does it very fast. It does it so well, in fact, that IBM has selected the same graphics hardware for use in its RISC System/6000 high-end workstations.

Thoughtful Package

Inside its simply designed chocolate-brown case, the Personal Iris Model 4D/25 sports a 20-MHz MIPS R3000 processor with the accompanying FPU. Add to that a 32K-byte data cache and a 64K-byte instruction cache, and you have a serious number cruncher. Feed those numbers into the famous Silicon Graphics specialized display-processing pipeline with the Turbo Graphics option, and you have a machine that can produce real-time animation of solid objects. All this power is contained in a squat tower, with concealment panels to hide the cables in the back and the floppy disk drives and tape drives in the front.

Disk and cartridge tape drives slide in and out of the chassis without tools, so changing system drives is no more difficult than changing tape cartridges. Similarly, changing the electronics assembly requires no expertise or tools: Slide off a plastic panel and remove one screw. The entire circuit cage lifts right out. The system upgrade kits we received included instructions for user installation, all the necessary tools (like a screwdriver for removing that one screw), and grounding straps to protect electronic components while you handle them.

The standard input devices are an AT-style keyboard and an optical mouse. You can add an optional digitizing tablet and a three-dimensional input control called a SpaceBall. The system has two serial ports, a parallel port, an Ethernet port, a SCSI port, and an array of special-purpose connectors for video-recording equipment.

Will It Run DOS?

Despite its size and shape, this machine is far from a PC. It *will* emulate MS-

World Radio History

DOS, but even the most complex DOS program would seem wimpy compared to any native Iris application.

The underlying operating system, Irix, is, as you might guess, an enhanced Unix. All your standard System V release 3.2 utilities and libraries are there, along with some BSD enhancements for interprocess communications and networking. Silicon Graphics has added a rich window manager, along with graphics and window programming libraries. You can also use X Window System, NeWS, and PHIGS graphics. All these window and graphics systems run under the supervision of the Irix window manager. Therefore, if you click on a PostScript file, the Iris creates an appropriate window in which to view it.

Getting It All on Paper

No one can fault Silicon Graphics for failing to adequately document its system and software. There are 21 binders in all, but some of them hold two or three submanuals. Of these, several are devoted to Irix and are mostly reprints of traditional AT&T and Berkeley documentation. Several more cover the graphics extensions and the mountain of demonstration, executable, and source code shipped with the Iris. The overall quality and readability of the documentation is up to normal Unix standards, and the binder labels and section tabs make it somewhat easier to spot your topic of interest from among the thousands of pages.

Four user's manuals—those covering the bundled applications from Alias Research and Wavefront, and Silicon Graphics' own Personal Iris User's Guide—stand apart from the rest. Using them together, you can quickly become familiar with the Iris and its capabilities, without having to open any of the other 20 binders. Each has a "getting started" section, and this group of documents is custom-made for impatient users who can't wait to set their teapots to spinning. On-line manuals round out the set. These include virtually all reference pages, except for demonstration programs and the bundled applications.

Performance

The Iris Model 4D/25 that I reviewed had 8 megabytes of RAM, 96K bytes of cache memory, a 380-MB SCSI hard disk drive, and an internal tape drive. CPU, disk, and floating-point performance, as tested by the BYTE Unix benchmarks, make the system competitive with other workstations in its price range.

continued

Silicon Graphics Personal Iris Turbo

BYTE LAB

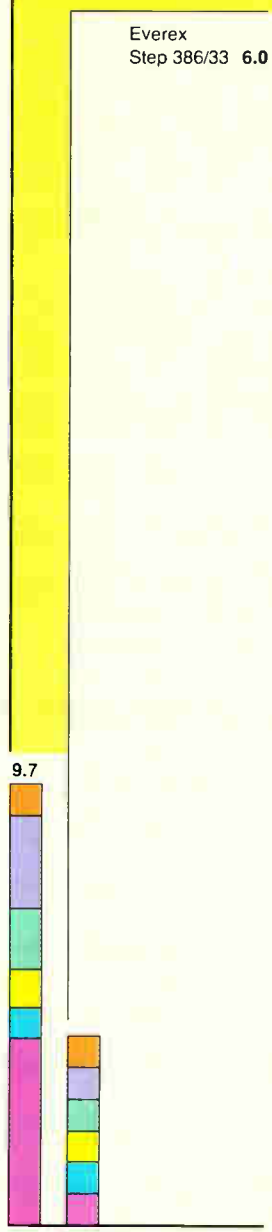
Silicon Graphics Personal Iris Turbo 9.7*

HIGH-LEVEL PERFORMANCE

	Iris		Everex
	Time	Index	Time
C Compiler	2.18	0.95	2.08
DC Arithmetic	0.21	3.00	0.63
Tower of Hanoi (17-disk problem)	0.30	1.87	0.56
System Loading[1]			
1 concurrent background process	3.31	1.23	4.06
2 concurrent background processes	4.00	1.45	5.80
4 concurrent background processes	7.19	1.34	9.60
8 concurrent background processes	11.50	1.50	17.30

LOW-LEVEL PERFORMANCE

	Iris		Everex
	Time	Index	Time
Dhrystone 2 (without registers; Dhry./sec.)	13454	0.97	13847
Arithmetic (10,000 iterations)			
Arithmetic overhead	0.20	3.60	0.72
Register	2.90	1.01	2.92
Short	2.92	1.21	3.52
Integer	2.90	1.08	3.12
Long	2.90	1.08	3.12
Floating Point	2.02	5.90	11.92
Double	1.70	7.78	13.22
Throughput			
System call overhead (5 x 4000 calls)	0.62	1.77	1.10
Pipe throughput (read and write 2048- x 512-byte blocks)	0.45	2.04	0.92
Pipe-based context switching (2 x 500 switches)	0.21	3.00	0.63
Process creation (100 forks)	0.55	2.24	1.23
Excel throughput (100 execs)	0.82	4.18	3.43
Filesystem throughput (1600 1024-byte blocks in Kbytes/sec.)			
Read	564		
Write	564		
Copy	330		



* Cumulative index is formed by summing the indexed performance results for C Compiler, DC Arithmetic, Tower of Hanoi, System Loading (with eight concurrent background processes), Dhrystone 2, and Floating Point tests.

[1] System loading performed using Bourne shell scripts and Unix utilities.

Note: All results are in seconds, unless otherwise specified. Indexes show relative performance. For all indexes, an Everex Step 386/33 running Xenix 2.3.1 = 1.

For a description of all the benchmarks, see "The BYTE Unix Benchmarks," March BYTE.

World Radio History

The benchmarks don't measure the most impressive aspect of the Personal Iris: its graphics performance. According to Silicon Graphics, the 4D/25 Turbo will manipulate 200,000 3-D vectors in a second, or 20,000 polygons per second. These numbers have little meaning out of context, so consider the model in photo 1. Iris renders this model, with over 1000 3-D polygons, smooth shading, and multiple light sources, so quickly that it simulates smooth motion by redrawing the entire model in a slightly different position several times a second.

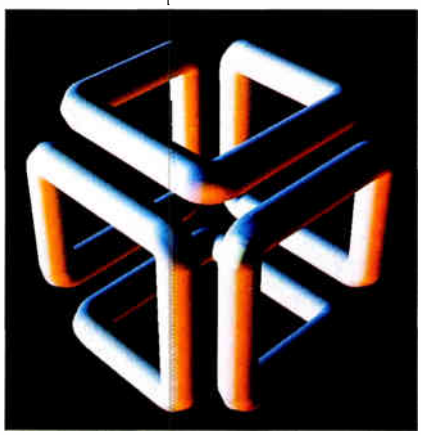


Photo 1: *As rendered here, the Silicon Graphics logo contains roughly 1400 polygons. With solid surfaces, remote and local lighting, calculations of spectral characteristics of surface, and full color rendering, this object can rotate and move in real time. The animation is smooth and convincingly real.*

Put On a Simple Face

The Irix operating system comes with its own window manager, icon-based file manager, and editor, as well as several handy graphics applications, including Alias's QuickModel and QuickPaint and a robust renderer from Wavefront, the Personal Visualizer.

The Irix window system is partly embedded in the operating system instead of built on top of it like Motif. The window manager, 4-Sight, is good compared to what was available a few years ago, but it seems a little archaic when compared to Motif and Open Look. Repositioning overlapping windows, for instance, can turn areas of the screen to mush for several seconds until the window manager cleans things up. Selecting options from cascaded menus requires a delicate hand on the mouse, because there is no way to freeze a menu on the screen while you move to the next level. You must keep the mouse button pressed while you carefully maneuver through the hierarchy of menus.

The icon-based file manager operations are intuitive. As with many other systems, double-clicking on a file icon starts up the application program associated with the icon. Dragging an icon to the dumpster gets the associated file out of the way. Dragging an icon from one directory window (or folder) to another moves the file.

The Irix file manager also manages the WorkSpace, a virtual directory to which you can drag file icons. Instead of moving the file from the directory to the WorkSpace (the action associated with dragging an icon from one directory window to another), the file manager creates a virtual link of the file between the directory and the WorkSpace. I'm familiar with the structure of the Unix file system, and I had trouble understanding how the WorkSpace worked. It may be a gentle approach to file management for those unfamiliar with the subject, but sooner or later they will have to learn the way things are done for real.

The window-based editor, Jot, is probably all that any nonprogrammer will ever need for editing; it is easy to use and has enough features to continue to satisfy users even after they learn its basic capabilities.

QuickModel and QuickPaint are also easy to learn. You can use QuickModel to create 3-D models, and QuickPaint to create 2-D paintings. Then you can use the output from these programs as elements for Wavefront's Personal Visualizer, the full-featured rendering application. QuickModel is an excellent way to become familiar with the 3-D capabilities of the Iris. You can build complex models by creating and manipulating wire frames in three orthographic views and a simultaneous perspective view.

QuickModel gives you basic solid forms—a box, a sphere, and a cone—with which to build. You take each of these shapes as needed and mold them to create your model. You can also generate surfaces by extending and rotating Bézier curves. You can manipulate your perspective viewpoint as you work on the shape. At any point during the design, you can render the model with flat or smooth (Gouraud) shading, color, and local lights, and you can rotate it and zoom in on it for a close inspection (see photo 2).

The documentation provided by Alias and Wavefront for their applications is very good, as far as it goes. These programs are not demos in the conventional sense of the word, but they are running advertisements for higher-level products

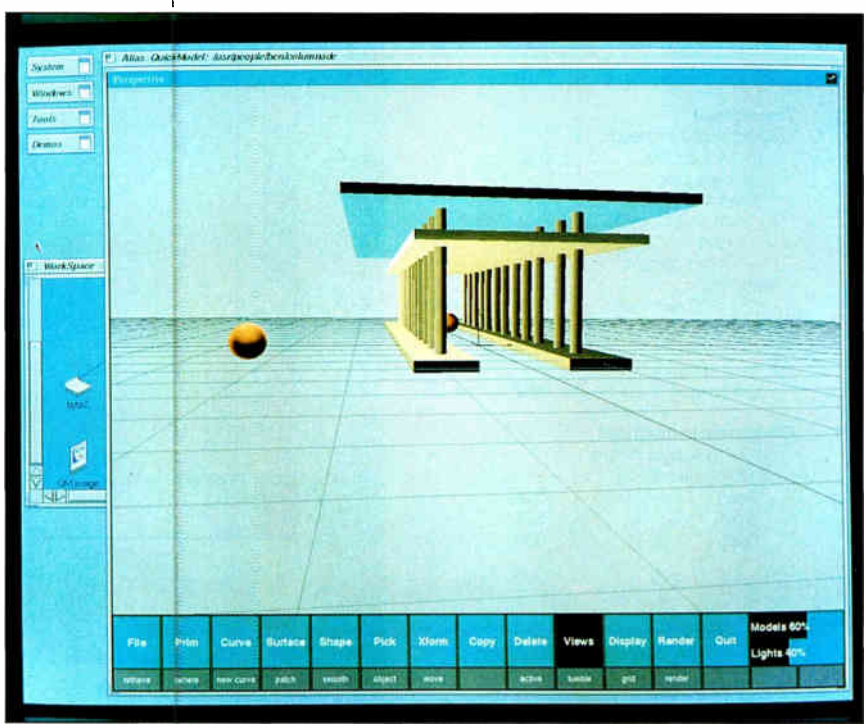


Photo 2: *QuickModel allows you to create models with additive 3-D geometric forms in orthographic views. You can then view them in perspective and export your views to Wavefront's Personal Visualizer, a full rendering program.*

World Radio History

Seagate's Technology

THE FINE ART OF DISC DRIVES

Neon Sculpture by
Lili Lakich
Los Angeles, California

To the naked eye, disc drives haven't changed much in the past few years. While the visible aspects have remained the same, the parts you can't see have improved dramatically. What used to be megabytes are now gigabytes. And Seagate is at the forefront of this technological revolution.

We've not only increased capacities, but we've found ways to make drives faster and more reliable. For example, Zone Bit Recording™ is a recording technique that permits higher capacity and faster average data transfer rates than conventional recording methods. Our straight-arm actuator has 60% less mass than most other designs, giving our Wren™ and Sabre™ families lightning-quick access performance. And by increasing spindle rotation 50% to 5400 RPM, we've significantly increased the transfer rate and reduced the latency in our 1.5 GB Elite™ drive.

As a result of these and other technological improvements, Seagate now offers drives from 20 MB to 2.5 GB in the widest range of form factors and interfaces imaginable, for almost every conceivable application. And we're not through yet.

Like the artist who spends years perfecting his craft, Seagate has spent the past decade mastering the fine art of disc drives. To get a first-hand look at the state-of-the-art, contact your authorized Seagate distributor, or call Seagate directly: 800-468-DISC, or 408-438-6550.

Seagate

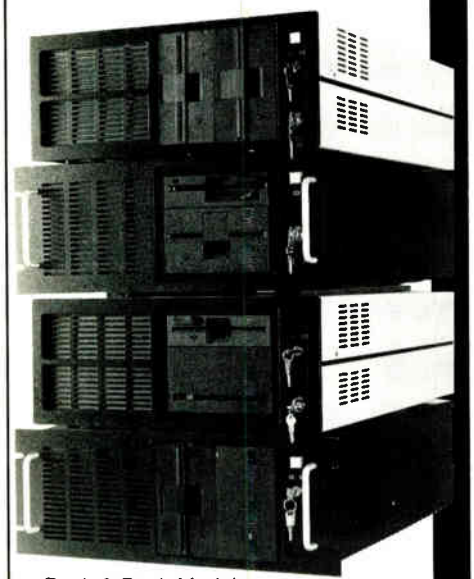
Zone Bit Recording, Wren, Sabre and Elite are trademarks of a wholly-owned subsidiary of Seagate Technology, Inc.
Seagate and the Seagate logo are registered trademarks of Seagate Technology, Inc
©1990 Seagate Technology, Inc.

World Radio History

Circle 122 on Reader Service Card

Rack & Desk PC/AT Chassis

Integrand's new Chassis/System is not another IBM mechanical and electrical clone. An entirely fresh packaging design approach has been taken using modular construction. At present, over 40 optional stock modules allow you to customize our standard chassis to nearly any requirement. Integrand offers high quality, advanced design hardware along with applications and technical support *all at prices competitive with imports.* Why settle for less?



Rack & Desk Models
Accepts PC, XT, AT Motherboards and Passive Backplanes
Doesn't Look Like IBM
Rugged, Modular Construction
Excellent Air Flow & Cooling
Optional Card Cage Fan
Designed to meet FCC
204 Watt Supply, UL Recognized
145W & 85W also available
Reasonably Priced

Now Available
Passive Backplanes

INTEGRAND
RESEARCH CORP.

Call or write for descriptive brochure and prices:
8620 Roosevelt Ave. • Visalia, CA 93291
209/651-1203
TELEX 5106012830 (INTEGRAND UD)
FAX 209/651-1353
We accept Bank Americard/VISA and MasterCard

IBM, PC, XT, AT trademarks of International Business Machines. Drives and computer boards not included.

offered by both companies. I'm always pleased when a hardware vendor includes free software of any kind, and Silicon Graphics distinguishes itself by providing tons of it.

The BYTE Logo Project

To better understand the graphics hardware and the software libraries that facilitate its use, I wrote a C program to generate the solid-form BYTE logo shown in the photo on page 174. You can rotate or translate the object or your viewpoint using the mouse. You can even send the model into a tumbling spin.

The logo model is generated from four tables of 2-D data points. Each table describes the edges of a single letter in the word "BYTE." Two rather lengthy and boring functions use these tables differently to describe the polygons that make the faces of the logo and the polygons that make the edges.

The largest part of the time needed for the project was spent in mathematically describing the model, roughly 230 polygons (I did it by hand, without any CAD tools—not recommended). When I was working on the solid model, the power of the Personal Iris became supremely obvious. But the level of the Irix graphics libraries requires you to know your 3-D analytic geometry. You must describe each polygon *and* its unit normal vector for the Iris to properly calculate the lighting of the polygon's surface. This is a nontrivial problem and remains the responsibility of the programmer. But once you have solved it, the Iris will do all the work of rendering as you rotate and move your viewpoint. Adding mouse control and menus was simple, but again, I had to write all the high-level work of turning mouse and menu operations into program-flow changes and 3-D motion.

During the course of the project, I found that the Irix window-based symbolic debugger, edge, was easy to use and that the Silicon Graphics technical-support people are friendly, knowledgeable, and responsive.

The BYTE logo project took about 40 hours of study and programming. Mind you, most of this time was spent at the low end of the learning curve. To finish another similar project would take only about 10 hours. All in all, I enjoyed programming the Iris, but I would have liked a few more convenience routines to handle more common functions.

Most people will find that there really isn't a need to do any programming for the Iris, since there are plenty of application programs. According to the Silicon Graphics directory of software products, more than 400 commercial applications are available for its machines.

There are 21 different professional animation packages that run on these machines, making the Iris the machine of choice for that kind of work. There are seven packages for building design; dozens for mechanical engineering, aerodynamics and fluid dynamics, and automation; and a host of applications for graphics modeling. The list also includes an assortment of databases, spreadsheets, and editors.

Who Will Buy

Silicon Graphics workstations are already established as the most cost-effective, production-quality, computer-animation workstations. They are also very affordable for applications such as visualization of data from medical scanning equipment (e.g., CAT scans).

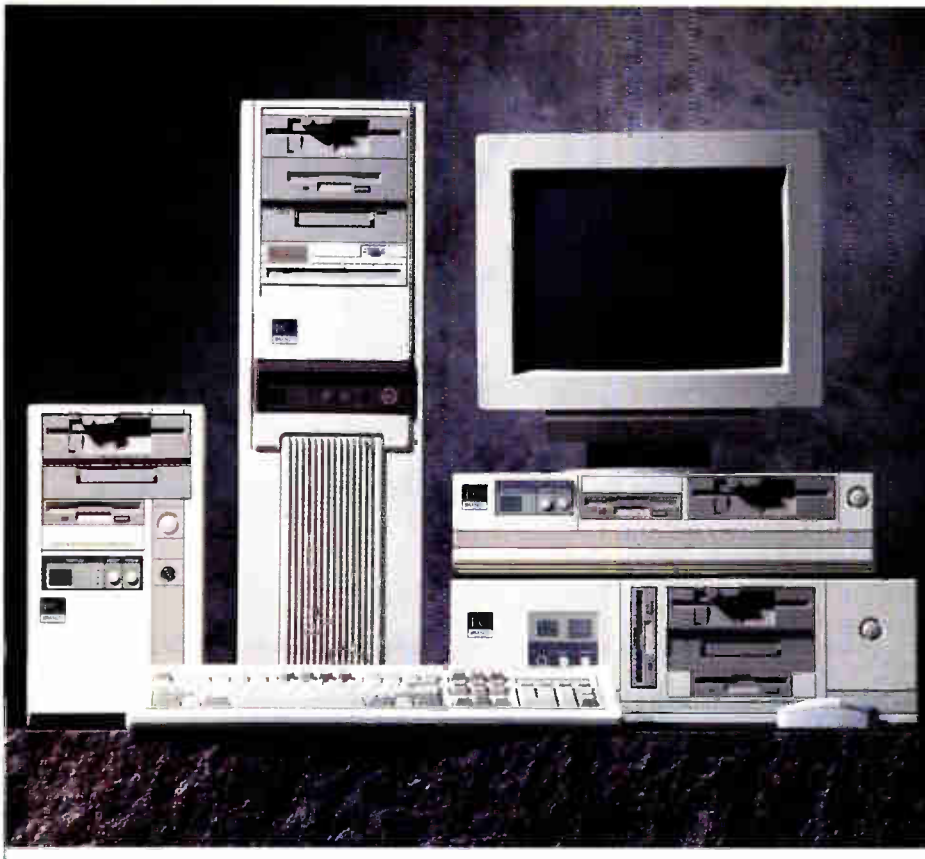
Without question, anyone who wants to do 3-D rendering could profit from a Silicon Graphics Personal Iris Turbo system, but, clearly, not everyone can afford one. A minimal Personal Iris 12.5-MHz system with a 14-inch (1024- by 768-pixel) monitor costs $13,500. This configuration will display only 256 colors out of a palette of 16.7 million. The minimum configuration does not include a hard disk drive; $2000 buys you a 200-MB drive. The drive includes the operating system and all the graphics utilities.

The machine I reviewed had the minimum 8 MB of system memory (out of a possible 32 MB), but it had the 20-MHz processor, the full Super Graphics options that deliver 24-color bit planes (16.7 million colors), 24 z-buffer planes, and eight system planes (see "3-D Graphics: From Alpha to Z-Buffer" on page 271). It also had a 380-MB hard disk drive and a 150-MB quarter-inch SCSI tape drive. The total value of the review system is $32,500. For graphics options, this is the top of the Personal Iris line but the low end of the Silicon Graphics family. Slip the disk drive from the review machine into a $13,000 model, and you can do the same things, but without the same performance or range of colors.

The Personal Iris 4D/25 places real graphics power in the hands of the people who need it most. Designers, engineers, artists, and other dreamers will find this system a willing bridge between the drawings of the mind and the finished product. ■

Ben Smith is a BYTE technical editor. You can reach him on BIX as "ben_smith."

World Radio History



PC BRAND COMPUTERS...

UNTOUCHABLE QUALITY,
UNBELIEVABLE PERFORMANCE,
OUTSTANDING SUPPORT,
AT
ROCK BOTTOM PRICES.

In Our Business, the most important thing is Your Bottom Line.

You're reading a magazine with hundreds of "look-alike" ads for IBM Compatible Computers, they all claim similar performance, outstanding quality, low price and great support.

How do you make your choice?

Price: Some show unusable entry level or giant overkill units, and sock-it-to-you on the drives, monitors and video cards you really need. Some add outrageous freight, handling and customization charges. We don't. We advertise the industries largest selection of complete drive and video configurations all unbelievably priced. All priced delivered to your door.

Quality: Some claim quality but offer only a 30, 60 or 90 day warranty. Our 5 year program is the best and longest in the business...

...PC Magazine, PC Buyers Guide, Computer Shopper, Byte, and Personal Computing all say the same thing about PC Brand in their reviews: "Outstanding quality... Rock Bottom Price." We couldn't have said it better ourselves.

Support: Everybody claims it, but check our facts: 30 Day Money Back Guarantee (no RMA's required), Toll Free Technical Support, Toll Free Customer Service, On-Site Service, On-Site Installation, Leasing and Customized "Built to your Specs" configurations. Even our FAX's are on Toll Free Lines. *Our support is so good it wins us Awards.*

Put it all together and it spells our commitment to you, the *Bottom Line*, the Best one in the Business. Call us at *1-800-PC Brand* Today.

PC BRAND OFFERS A FULL RANGE OF COMPUTER SYSTEMS

NAME BRAND PERIPHERALS AT THE LOWEST PRICES

FREE FREIGHT
TOLL-FREE SERVICE & SUPPORT
5-YEAR WARRANTY‡

30-DAY MONEY BACK GUARANTEE

ON-SITE SERVICE BY TRW*

24-36 MONTH LEASING

PC BRAND

Turn page for PC Brand Systems...

*TRW- National Computer Maintenance Services

‡ 5 Year Limited Warranty, details available on request

Circle 199 on Reader Service Card

World Radio History

Find Out Why We're Rated No.1 for Service & Support.

"PC Brand is the LL Bean of personal computer mail order...
...PC Brand wants no unhappy customers,...it's service and support policies help to insure that."

-Personal Computing's 10 Best Mail Order Companies, Feb. 1989

286 SYSTEMS FROM $599.

NEW, FASTER, HIGHER CAPACITY DRIVES AT THE SAME ROCK BOTTOM PRICES.

PC BRAND 286/12 _____ $599

12 MHz Clock, Zero Wait Operation,
Norton SI 15.3 Landmark ™ Speed 15.1MHz,
512K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard,
2 Serial and 1 Parallel Ports

PC BRAND 286/16_____ $749

16 MHz Clock, Zero Wait Operation,
Norton SI 19.0 Landmark ™Speed 20.6MHz,
512K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard,
2 Serial and 1 Parallel Ports

PC BRAND 286/20_____ $899

20 MHz Clock, Zero Wait Operation,
Norton SI 23.0 Landmark™ Speed 26.7MHz,
512K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard,
2 Serial and 1 Parallel Ports

Standard System Features:*

- 80286-12, 80286-16, 80286-20 operating at 12 MHz, 16MHz, or 20MHz w/Zero Wait
- 512K RAM expandable to 8MB on the System board using 256K or 1MB RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with optional 1024x768 capability
- 1:1 Interleaved Hard/Floppy Drive Controller, 1Mb/Second disk transfer rates on all 40Mb drives or larger
- Enhanced 101-key Click'Tactile Keyboard
- 2 Serial & 1 Parallel ports on std-configurations
- High Capacity System Power supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- AMI BIOS w/full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM and PCNET compatibility
- Built-in System Board LIM 4.0EMS hardware
- User configurable I/O timing permitting compatible operation w/older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/6 Disk Drive bays

Options:

- Low profile Slim Line Case w/3 Disk bays (as pictured above)
- Mini Size desk top Tower* Case w/4 bays
- VGA or CGA Plasma Portable Case
- Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice

NEW, FASTER, HIGHER CAPACITY DRIVES AT THE SAME ROCK BOTTOM PRICES.

PC BRAND 286/12

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	20/40	40/19	71/25	110/17
No Video	$929	$1029	$1209	$1349
Mono	$1049	$1149	$1329	$1469
VGA-Mono	$1229	$1329	$1509	$1649
VGA-Color	$1459	$1559	$1739	$1879
SVGA/Color	$1569	$1669	$1849	$1989

PC BRAND 286/16

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	20/40	40/19	71/25	110/17
No Video	$1079	$1179	$1359	$1499
Mono	$1199	$1299	$1479	$1619
VGA-Mono	$1379	$1479	$1659	$1799
VGA-Color	$1609	$1709	$1889	$2029
SVGA/Color	$1719	$1819	$1999	$2139

PC BRAND 286/20

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	20/40	40/19	71/25	110/17
No Video	$1229	$1329	$1509	$1649
Mono	$1349	$1449	$1629	$1769
VGA-Mono	$1529	$1629	$1809	$1949
VGA-Color	$1759	$1859	$2039	$2179
SVGA/Color	$1869	$1969	$2149	$2289

*Tower is a registered trademark of NCR Corporation

*Features below for 286/16 and 20 only. Call for 286/12

World Radio History

30-DAY MONEY BACK GUARANTEE

FREE FREIGHT

TOLL-FREE SERVICE AND SUPPORT

ON-SITE SERVICE BY TRW

24 or 36 MONTH LEASING

AND A 5-YEAR WARRANTY

Best "Executive Decision" System.

-Personal Computing, Best Bargain Systems, Dec, 1989

"The PC Brand 386/SX-16 performed at least as well as the far costlier Compaq... We simply began marveling at what is surely the biggest bargain in personal computing"

-Computer Buyer's Guide, Cover Story, Oct, 1989

Intel 386 Technology at 286 Prices the 386SX-16 Only $899

PC BRAND 386/SX-16____$899

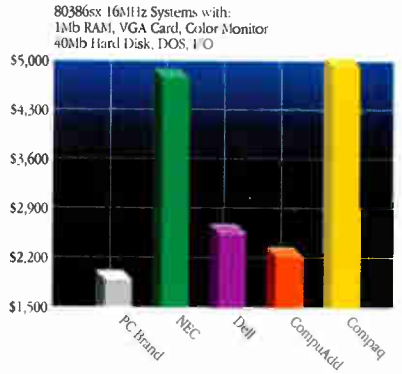
16 MHz Clock, Zero Wait Operation • Norton SI 18.7 Landmark™ 18.3MHz, 512K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard, 2 Serial and 1 Parallel Ports

Standard System Features:

- 80386SX Processor Operating at 16MHz delivering 18MHz Effective Throughput
- 512K RAM expandable to 8MB on the System board using 256K and/or 1MB RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with optional 1024x768 capability
- 1:1 Interleaved Hard/Floppy Drive controllers, 1 Mb/Second disk transfer rates on all 40 Mb drives or larger
- Enhanced 101-key Click/Tactile Keyboard
- 2 Serial & 1Parallel ports on std-configurations
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387SX Co-Processor Support
- AMI BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/6 Disk Drive bays (Shown in optional Mini Size Tower * Case)

Options:

- Low profile Slim Line Case w/3 Disk bays
- Mini Size desk top Tower * Case w/4 Disk Drive bays (as pictured above)
- VGA or CGA Plasma Portable Case
- Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice



NEW, FASTER, HIGHER CAPACITY DRIVES AT THE SAME ROCK BOTTOM PRICES.

PC BRAND 386SX-16

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	20/40	40/19	71/25	110/17
No Video	$1229	$1329	$1509	$1649
Mono	$1349	$1449	$1629	$1769
VGA-Mono	$1529	$1629	$1809	$1949
VGA-Color	$1759	$1859	$2039	$2179
SVGA/Color	$1869	$1969	$2149	$2289

Call 1-800-PC BRAND

(Call 1-800-722-7263) In All 50 States FAX# 1-800-722-7392

PC Brand, Inc. 954 W. Washington St., Chicago, IL 60607 Canadian Fax # 312-633-2888 Canadian Voice # 312-226-5200. We are open Mon. thru Fri.: 8am to 6pm Central Time. MasterCard, VISA, Discover, Checks and Approved P.O.s are Accepted. Prices and specifications subject to change. **BYTE 15-7**

*TRW-National Computer Maintenance Services

World Radio History

(Shown in Medium foot print Desktop Case)

PC BRAND'S
386/20
386/25...

"FASTER THAN A SPEEDING BULLET!"

-Computer Shopper, Cover Story November, 1988

20MHz
FROM $1349

25MHz
FROM $1499

MAXI POWER, MICRO PRICES.

486
AVAILABLE
NOW!

CALL FOR PRICES AND SPECIFICATIONS

"The Best Low-Cost Alternative Around!"

-PC Magazine, 25MHz 386 PC's, Feb. 14, 1989

PC BRAND 386/20 _____ $1349

20 MHz Clock, Zero Wait Operation, Norton SI 23.0 Landmark Speed26.1MHz, 1024K RAM, 1.2MB or 144MB Drive, 101-Keyboard, 2 Serial and 1 Parallel Ports

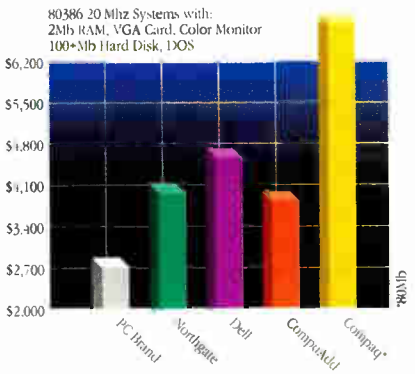
PC BRAND 386/25 ____ $1499

25 MHz Clock, Zero Wait Operation, Norton SI 28.2-Landmark Speed 33.6MHz, Norton SI 31.6-Landmark Speed 43.5 w/Cache, 1024K RAM,1.2MB or 144MB Drive, 101-Keyboard, 2 Serial and 1 Parallel Ports

"The PC Brand 386/25 is a fascinating machine. It offers flexible configuration...at a bargain price..."

"and the company backs it all with what may be the longest warranty on the market...PC Brand makes it possible to buy two complete sytems for less than most competitors charge for just one."

- PC Magazine, 25MHz 386 PC's February 14, 1989



Standard System Features:

- True 20MHz or 25MHzZ Intel 80386 CPU Operating with Zero Wait States
- 1024K RAM standard expandable to 16MB using 256K and/or 1MB RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with optional 1024x768 capability
- 1:1Interleaving Hard Drive/Floppy Drive controllers, 1Mb/Second disk transfer rates on all 40Mb drives or larger
- Enhanced 101-key Click/Tactile Keyboard
- 2 serial & 1 parallel ports on std-configurations
- High Capacity 200Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287, 80387,or Weitek Co-Processor Support
- AMI BIOS with full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/6 Disk Drive bays

Options:

- Low profile Slim-Line Case w/3 Disk bays
- Full Size Tower® Case w/8 Disk Drive bays
- Mini Size Tower® Case w/4 Disk Drive bays
- VGA or CGA Plasma Portable Case
- Custom configurations w/Name Brand peripherals of your choice

NEW, FASTER, HIGHER CAPACITY DRIVES AT THE SAME ROCK BOTTOM PRICES.

PC BRAND 386/20

with Hard Disk Drive, Monitor & Video Card

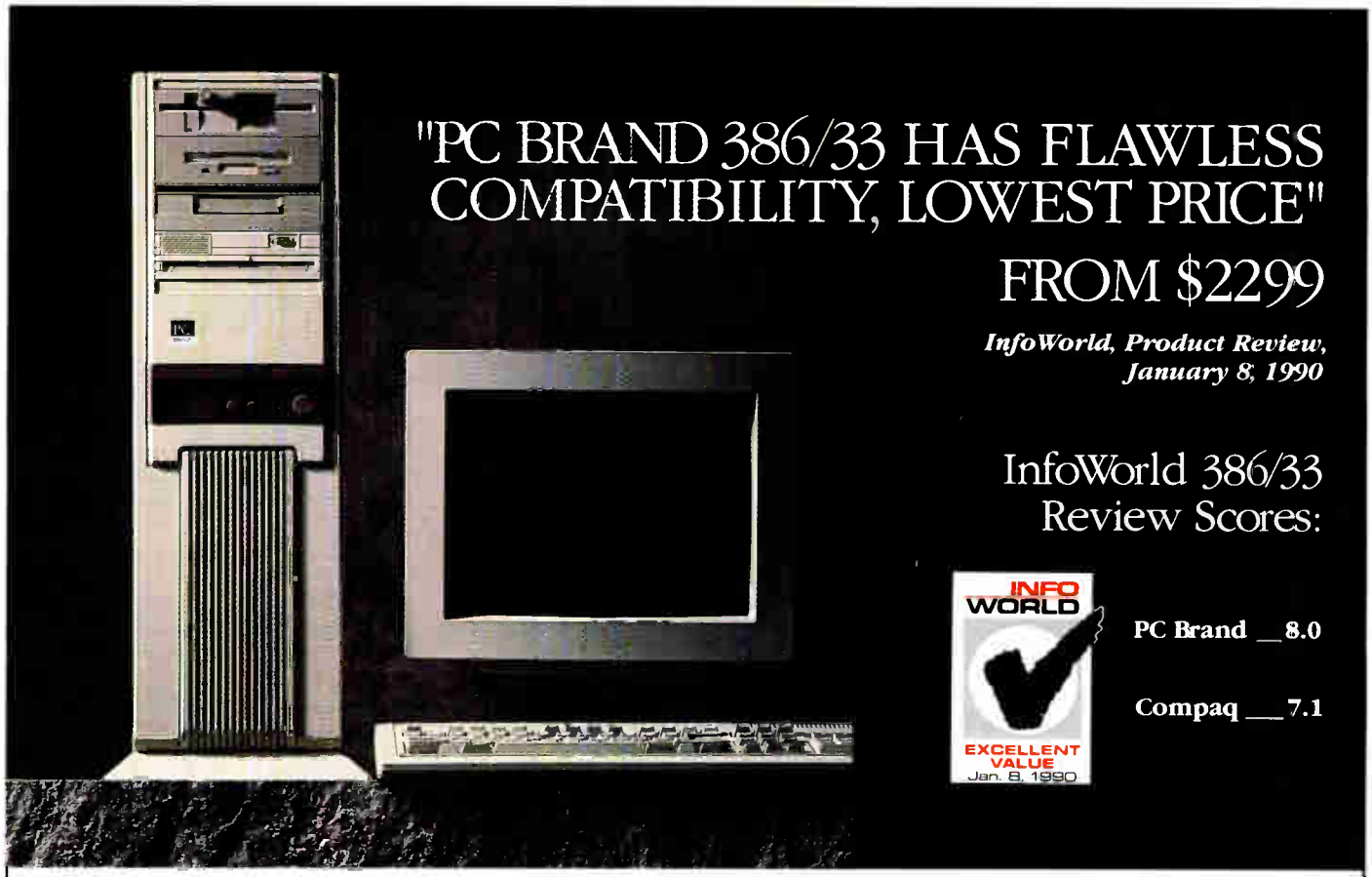
Hard Drives: Mb/Ms	40/19	71/25	110/17	200/19
No Video	$1779	$1959	$2099	$2549
Mono	$1899	$2079	$2219	$2669
VGA-Mono	$2079	$2259	$2399	$2849
VGA-Color	$2309	$2489	$2629	$3079
SVGA/Color	$2419	$2599	$2739	$3189

PC BRAND 386/25

with Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	40/19	71/25	110/17	200/19
No Video	$1929	$2109	$2249	$2699
Mono	$2049	$2229	$2369	$2819
VGA-Mono	$2229	$2409	$2549	$2999
VGA-Color	$2459	$2639	$2779	$3229
SVGA/Color	$2569	$2749	$2889	$3339

World Radio History



"PC BRAND 386/33 HAS FLAWLESS COMPATIBILITY, LOWEST PRICE" FROM $2299

InfoWorld, Product Review, January 8, 1990

InfoWorld 386/33 Review Scores:

INFO WORLD
EXCELLENT VALUE
Jan. 8, 1990

PC Brand __8.0

Compaq __7.1

386/33 CACHE _____ $2299

33 MHz Clock, Zero Wait Operation, Norton SI 45.9 • Landmark 58.7 MHz, 1024K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard, 2 Serial and 1 Parallel Ports

"Here's a price $2799... [Now $2299] Must be stripped to nothing, Right? Wrong...You don't sacrifice quality for low price either. The PC Brand machines are an efficient combination of in-house engineering and top-notch off-the-shelf Parts."

-PC Magazine, 33MHz 386 PC's, October 31, 1989

"...great value. *Period*. ...excellent price performance ratio; high quality."

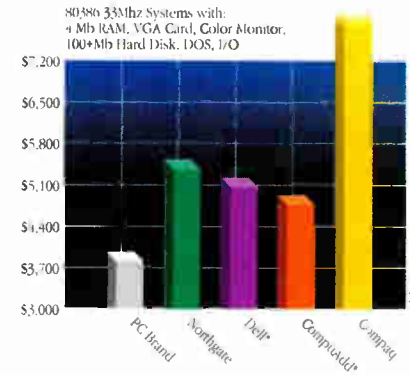
-Computer Buyers Guide, Product Review, February, 1990

Standard System Features:

- True 33 MHz INTEL 80386-33 CPU operating w/Zero Wait States with 58.7 MHz Throughput
- Intel 82385-33 Cache Processor with 32K 25NS Static RAM Standard
- 1024K RAM Standard Expandable to 16MB
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with optional 1024x768 capability
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Hard Drive/Floppy Drive Controllers, 1 Mb/Second disk transfer rates on all 40Mb drives or larger
- Enhanced 101-key Click/Tactile Keyboard
- I/O Ports 2 serial, 1 parallel
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387 or Weitek Co-Processor support
- Phoenix BIOS with Full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- EMS and Disk Cache in ROM
- 8 Slot motherboard design
- Medium foot print case w/6 Disk Drive bays

Options:

- Full size Tower® Case w/8 Disk Drive bays
- Low Profile Slim Line Case w/5 Disk bays
- Mini Sized Tower® Case w/4 Disk Drive bays
- Custom configurations w/Name Brand peripherals of your choice
- Factory Installed Ram Upgrades



NEW, FASTER, HIGHER CAPACITY DRIVES AT THE SAME ROCK BOTTOM PRICES.

PC BRAND 386/33 CACHE
with Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	40/19	71/25	110/17	200/19
No Video	$2679	$2859	$2999	$3449
Mono	$2799	$2979	$3119	$3569
VGA-Mono	$2979	$3159	$3299	$3749
VGA-Color	$3209	$3389	$3529	$3979
SVGA/Color	$3319	$3499	$3639	$4089

Turn the page for Portables & Peripherals

Call 1-800-PC BRAND

(Call 1-800-722-7263) In All 50 States FAX# 1-800-722-7392

PC Brand, Inc. 954 W. Washington St., Chicago, IL 60607 Canadian Fax # 312-633-2888 Canadian Voice # 312-226-5200. We are open Mon thru Fri., 8am to 6pm Central Time. MasterCard, VISA, Discover, Checks and Approved P.O.s are Accepted. Prices and specifications subject to change. **BYTE 15-7**

World Radio History

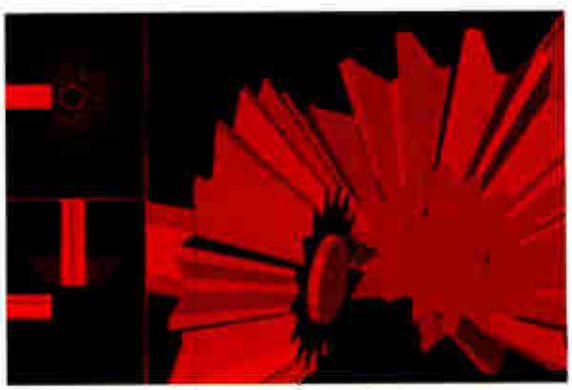
Portables With More Power than Desktops.

512K (286, 386/sx) or 1024K (386) RAM Serial and Parallel Ports, 1.2MB or 1.44MB Floppy, 86-key keyboard

The power, reliability and performance of our desktop system motherboards combine with our portable casing to make our system technically unique!

We support 3 built-in, externally accessible disk drives, enabling dual (3.5" and 5.25") floppys for *total* media compatibility. Including tape CD-ROM drives or other devices to deliver desktop functionality in a Portable Unit.

Simultaneous internal AND external monitor support, VGA functionality, 2 open card slots and our unique 3 drive support, permit this family to be used as a complete *"In the office system"* which you can pick up and take anywhere.



Actual VGA PLASMA Screen Image

Standard System Features:

- All performance and compatibility features as in desktops featured on previous pages
- 16 Grey Scale 640x480 VGA or 4 Grey Scale 640x400 CGA/Mono Graphics Plasma Display

Standard Features Continued:

- 3 Accessible Drive Bays for (2) 5.25" and (1) 3.5" Units
- 2 Available Peripheral Card Slots
- Simultaneous internal & external displays
- 200 Watt Auto Voltage Switching Power Supply

NEW, FASTER, HIGHER CAPACITY DRIVES AT THE SAME ROCK BOTTOM PRICES

VGA Gas Plasma Portables

Drives Mb/Ms	1 Floppy 60/19	1/0/17	110/17	200/19
286/12	$2595	$2995	$3395	$3960
286/20	$2795	$3195	$3595	$4160
386/SX-16	$2895	$3295	$3695	$4260
386/20	$3350	$3750	$4150	$4710
386/25	$3550	$3950	$4350	$4910
386C/25*	$4000	$4400	$4800	$5300
386C/33*	$4300	$4700	$5100	$5600

CGA/MGA Gas Plasma Portables

Drives Mb/Ms	1 Floppy 60/19	1/0/17	110/17	200/19
286/12	$1745	$2145	$2545	$3110
286/20	$1945	$2345	$2745	$3310
386/SX-16	$2045	$2445	$2845	$3410
386/20	$2495	$2895	$3295	$3855
386/25	$2695	$3095	$3495	$4055
386C/25*	$3145	$3545	$3945	$4505
386C/33*	$3445	$3845	$4245	$4805

Monitors

Cornerstone Technology
19" Dualpage Display/16 level $1950/2795

Mitsubishi
1381 14" Diamond Scan (to 800x600) $499
HL6605 16" SVGA/EGA (to 1280x1024) 1195
HL6905 20" SVGA/EGA (to 1280x1024) 2095

NEC
GS-2A 14" MultiMono (to 800x600) $249
2A 14" SVGA (800x600) 479
3D 14" SVGA/EGA (1024x768I) 649
4D 16" SVGA/EGA (1024x768) 1150
5D 20" SVGA/EGA (1280x1024) 2350

Panasonic
C1391 PanaSync (to 800x600) $489
M1500 15" Mono DTP with adapter 1208
M1900 19" Mono DTP with adapter 1498

Princeton Graphics
Max15 14" Mono (to 1028x768I) $249
UltraSync 14" SVGA/EGA (800x600) 520
UltraSync 16" SVGA/EGA (1024x768I) 879

Princeton Publishing Labs
Multiview 15" Mono DTP with adapter $690

Relisys
9503 14" VGA Mono (640x480) $145
9513 14" VGA Color (640x480) 369
1520 15" SVGA (1024x768) 679

Samsung/Leading Technology
14" VGA Color .31DP (640x480) $369
14" VGA Color .41DP (640x480) 299
14" SVGA Color (to 1028x768I) 419

Seiko
1440 14" SVGA (1024x768I) $599

Sony
Multiscan HG 14" SVGA (to 1024x768) $689
GDM-1606 16" CADD (1280x1024) ..... Call
GDM-1953 19" CADD (1280x1024) ..... Call

Zenith
ZCM1492 VGA Flatscreen (640x480) $619

RAM/I-O/Accelerator Boards

Intel
Aboveboard Plus 512K $419
Aboveboard Plus I/O 469
Aboveboard Plus 8 2Mb/I/O 2Mb 599/629
Inboard 386PC with 1M 595
Inboard 386 AT with 0K 859

PC Brand I/O Cards
AT 1P/2S/1G $49
XT 1P/1S/1G/Clock/Calendar 49

Video Cards

ATI
VGA Wonder 256K/512K $245/297

NEC *PC Magazine's Editors Choice*
Graphics Engine 16 (1024x768) $679
Graphics Engine 256 (1024x768) 969

Paradise
EGA Autoswitch 480 ..... $99
VGA 1024 with 256K 199
VGA 1024 with 512K 259
8514/A Plus 569
VGA Upgrade 199

PC Magazine's Editors Choice
Cardinal VGA Cards

PC MAGAZINE EDITORS' CHOICE
April 10 1990
Cardinal VGA600

VGA 100
8 bit 256K . $109

VGA 500
16 bit 256K . 175

VGA 600
16 bit 512K . 209

Video Seven
1024i VGA with 256K/512K $239/299
VRAM VGA with 512K 469

Fax Cards

Complete PC
Complete Fax 4800/9600 ..... $249/399
Complete Communicator 549
Complete Portable Fax 9600 309

Intel
Connection Coprocessor $529

Quadram
4800/9600 ..... $199/495

Modems

ATI
2400ETC Internal with MNP5 ..... $165
2400ETC External with MNP5 205

Hayes
1200B Internal with Smartcom $189
2400B Internal with Smartcom 249
1200 External ..... 285 2400 External 359

PC Brand (*100% Hayes Compatible*)
1200 Internal with software $49
1200 External ..... 70 2400 External 129
2400 Internal with software/MNP5 ..... 75/129

US Robotics
Courier HST 14,400 Int./Ext. $579/599
Courier V.32 9600 External 889
Courier HST/V.32 External 995
Courier HST 9600 Internal 579

Tape Backups

Archive/Maynard
ST600 Int. or FT60 Ext. 60MB w/cont. $590
FT1501 150MB Internal with controller 895
VP150I 150MB Internal Novell certified 895
VP150E 150MB External Novell certified 1175
VP402 Interface Board for VP Series 115
VP409 PS/2 Interface Board for VP Series 230
VP60 Internal/External 639/779
Maynstream 60/150MB Portable $889/1395
Maynstream 2200HS 2.2GB Portable 4350

Colarada Memory Systems
DJ-10 Jumbo 40/80MB Internal $249
KE-10 External Chasis Kit with Interface 139

Floppy Disk Drives

360K 5.25" Half Height Black $75
720K 3.5" Half Height Black 80
1.2M 5.25" Half Height Grey 85
1.44M 3.5" Half Height Grey 95

Sysgen
Bridge-File 5.25" 360K/1.2MB External $229
Bridge-File 3.5" 720K/1.44MB External 229
Bridge-File PC/AT Adapter 59

Hard Disk Drives

Campaq/Canner IDE Upgrades
40M 28ms ..... $459 100M 25ms $679
200M 19ms 1249

Iamega
B1201 20M Int. ... $765 B1441 40M Int. ... $995
B244X Dual 5.25 44M External 1995
PC2/50 Nonbootable Card 169
PC2B/50 Bootable Card 230

Plus Hardcards
Hardcard 20 8 bit $539
Hardcard 40 8 bit or 16 bit 599
Hardcard 80 16 bit 695

Seagate
20M 65ms ST225 Half Height $209
20M 35ms ST125 Half Height 229
30M 35ms ST138 Half Height 245
40M 28ms ST251-1 Half Height 319
40M 24ms ST151 Half Height 419
80M 28ms ST4096 MFM 590

Add $50 for XT Kit for ST1xx, ST2xx

Co-Processors

Intel
8087-1 ..... $189 8087-2 ..... $129
80287-10 ..... 229 80387-SX 309
80387-16 ..... 349 80387-20 399
80387-25 ..... 479 80387-33 599

Weitek
Abacus 20/25/33 ..... Call

World Radio History

NAME BRAND PERIPHERALS AND SOFTWARE AT THE LOWEST PRICES.

CD-ROM

Amdek
Laserdeck 2000 500MB External Kit $619

Microsoft
Bookshelf 1.0 ..... $195 Stat Pack $99
Programmer's Library 295

NEC
CDR80 Internal $499
XT/AT Interface Kit 129
Clipart 3D ..... 285 Image Folio 285

Sony
CDU510 Internal Kit $665
CDU1701 External Kit 779

Printers

(Numbers in Parentheses Indicate Draft/LQ CPS)

Canon
BJ130e 15" ..... $695 LBP4 Laser $995
LBP8-III Laser 8PPM 1650

Citizen
GSX 140 (192) ..... $329 Color Kit $49

Epson
LX810 (180/30) ..... $179 FX850 (330/88) $329
FX1050 (264/84) 439 LQ510 (180/60) 289
LQ850 (330/88) 495 LQ950 (264/88) 495
LQ1010 (150/50) 439 LQ1050 (330/88) 669
LQ2550 (400/108) ..... 899 EPL6000 6 PPM 939

Hewlett Packard
Deskjet Plus ..... $710 LaserJet IIP $1025
Laserjet III ..... 1650 Laserjet IID 2995

Laser Jet Accessories

Pacific Data Products
Plotter in Cart. for II/IIP $249/269
25 in 1 Cartridge 285
Postscript Cart. for II or IIP 375
1M Memory Card for IIP 275

Turn your LaserJet into a Postscript Printer!

CPI
Superfont Cartridge $295
1M Memory Kit 269
2M Memory Kit 549

Princeton Publishing
PS-388 Postscript board $2250

Call about 400dpi Postscript Compatible Laser Printers

Kodok Diconix
150Plus (150/50) $330

NEC
P220XE (192/64) ..... $335 P9XL (400/190) $1030
P5200 ..... 530 P5300 675
LC890 ..... 3190 LC890XL 4495
LC260 ..... Call LC290M ..... Call

Okidata
ML320 (300/62) ..... $345 ML321 (300/62) $479
ML380 (180/60) 359 ML390 (270/90) 475
ML391 (270/90) ..... 655 ML393+ (450/120) 995
OkiLaser 400 4PPM 1010

Panasonic
1180 (192/30) ..... $189 1191 (240/48) $245
1124 (192/63) 299 1624 (192/63) 429
1695 (330/66) ..... 415 4420 Laser ..... Call

Seiko
Smart Label $189

Logical Connection *Print Buffers*
256K ..... $449 512K $529

MEMBER DIRECT MARKETING ASSOCIATION

**Oversized Monitors, Plotters, Laser Printers, and Portables excluded from Free Freight*

Networking Hardware

Gateway
G/Ethernet AT .... $435 for PS/2 ..... $435
G/Ethernet (8 bit) 265

Lantastic
2 MBs Starter Kit/Adapter $419/195
Ethernet Starter Kit/Adapter 575/279

Standard Micro
PS110 Board for PS/2 ..... $395
PC500WS 16 Bit for WS/Server 260/335
PC550WS 16 Bit Tw. Pr. for WS/Server 291/355
PC270E Twisted Pair 139
PC130 Arcnet Board 117
ARCNET passive hubs / active hubs 72/321
ARCNET intelligent hub coax 495
ARCNET intelligent hub twisted pair 609

Synoptics
505UTP Transceiver $139
1000 Conc./2500 Workgroup Conc. 2575/839

Tiora
4 port hubs ..... $49 8 port hubs $285
Lancard/A 8 bit ARCNET 89
Lancard/A 16 bit ARCNET Board 249
Lancard/E 8 bit Ethernet/Twisted Pair 199/329
Lancard/E 16 bit Ethernet Twisted Pair 339

Tops
Repeater ..... $125 Flashcard $155

Western Digital
Ethercard+ 8 bit . $185 Twisted Pair $319
Ethercard+ PS/2 ... 285 /EPB PS/2 285
Ethercard+ 8 bit with ROM Socket 205
Ethercard+ 16 bit 255

Xircom
Pocket ARCNET Adapter Coax or Tw. Pr. $295
Pocket Ethernet Adapter Twisted Pair 489

Plotters

CalComp
1023 ..... $3695 1043DM $5700

Houston Instruments (Call for Prices)
DMP52 ..... DMP52MP DMP61
DMP61DL ..... DMP62 ..... DMP62DL

Imagemaker *(PC Magazine's Editors Choice)* ..... Call

Scanners/Digitizers

Complete PC *Scanners*
Full Page ..... $499 Half Page $189
Hand Scanner 165
Complete OCR Software for HS/Page 235/325

Kurta
IS/One 12X12 ..... $355 IS/One 12x17 ..... $509

Microtek
MSF 300G ..... $1495 MSF 300Z ..... Call
MSF 400G ..... 2750 MSF Edge Feed 1050

Summasketch II *Digitizers*
12x12 ..... $335 12x18 ..... $599

Input Devices

CalComp WIZ 1000 DPI $175

Logitech
Hi-Rez C9 Mouse .. $85 with Paint $99
Trackman 320DPI Serial/Bus 99/109

Microsoft Mice
Serial with Paintbrush/with Windows .. $109/139
Bus Mouse with Paintbrush 105

Novell Networking

(Novell Authorized Sales and Service)

4 User ELS Level I v. 2.12 ..... $489
8 User ELS Level II v.2.15 1049
Advanced Netware v. 2.15 1850
SFT Netware 286/Netware 386 ..... 2850/4550

Network Utilities

Brightwork Development
PS-Print ..... $415 Queue ITI $119

CC: Mail
25 User ..... $495 Expand $445
Remote ..... 235 Gateway 895

Cheyenne Software
Netback ..... $189 Monitrox $505

Da Vinci *eMail Servers*
DOS ..... $849 DOS/Windows $1349

Lan Systems
Lanspace ..... $310 Lanspool $259

Norton-Lambert *Close-up*
Support 3.0 ..... $165 Customer 3.0 ..... $135

Ontrack
Disk Manager -N ... $99 Netutils $85

Tops
NetPrint 2.0 ..... $145 Network Bndl $169

Traveling Software
Desklink 2.2 ..... $95 Laplink III $92

Unix/Xenix Multiuser Products

Digiboard *Intelligent Serial Cards*
4 Port/8 Port $645/795

Wyse Terminals
WY60 ..... $309 WY150 ..... $305
WY370 14" Color 859
(Call on Keyboard options)
WY50/WY86 (both with Keyboard) 389/409

Santa Cruz Operations *CompleteSys*
Xenix 286 ..... $995 Xenix 386 ..... $1150

Xenix Software
Foxbase+ 386 ..... $779 Open Desktop .... Call
Microsoft Word 495
VP/IX 1/3+ User 359/629
Xenix-Net 286/386 ..... 439/479
Word Perfect 5.0 ..... Call

Supplies

Sony 5.25" 360K (box) $9
Sony 5.25" 1.2M (box) 14
Sony 3.5" 720K (box) 13
Sony 3.5" 1.44M (box) 25
5.25" Diskette Case 9
3.5" Diskette Case 11
Toner cartridge for HP DeskJet Plus, Laserjet II and IIp ..... Call

Data Cartridges
DC2000(ea.) . $19 DC600(ea.) .. $27
DC600XL (each) 29

**Free Freight in the Continental U.S.*

Power Protection Products

Tripplite
SK6 Spike Bar ..... $29 CCI+ Isobar $85
IB4 4 Outlet Isobar 45
LC1200 Line Conditioner 159
BC325 Battery Back-up 279
BC450 Battery Back-up 349
OMNI450 or 450LAN Battery Back-up 419
BC750LAN Battery Back-up 549
OMNI1200 Battery Back-up 795

Software

Autosketch Animator $239
Borland Quattro .... 95 Quattro Pro 329
Cacre Omnipage 386 2.1 619
Datastorm ProComm Plus 52
dBase IV ..... 479 R:Base 489
Delrina Perform 2.0 159
Delta Technology Direct Access 59
Deskview 386 v. 2.2 125
Fifth Generation Fastback Plus 109
Foxbase + ... 189
Generic CADD Level 3 205
Harvard Graphics 329
IBM Displaywrite V NEW! ..... Call
Lotus Freelance Plus 329
Lotus 123 r. 2.2 ..... 349 123 r. 3.0 399
Microsoft Works ..... 99 Word 5.0 215
Norton Utilities Advanced 85
Paradox v. 3.0 ..... 445 PC Tools 6.0 85
Peachtree Acctg. III/with Data Query.. 149/225
Pro. Write ..... 145 QEMM 5.0 65
Quicken ..... 39 TimeSlips III 159
Symatec Q&A 3.0 .. 215 Timeline 3.0 379
Timeworks Publish It! 125
Word Perfect 5.1 ... 249 Wordstar Pro .. 225
Ventura Publisher 2.0 499

Software for Windows Applications

Aldus Pagemaker $499
AMI 129
AMI Professional 319
Corel Draw 329
Microsoft Windows 286/386 .. 69/125
Microsoft Excel 2.1 309
Microsoft Word for Windows ... 325
Precision Superbase 2 189
Precision Superbase 4 395
HOC Windows Express or Manager . 49
Crosstalk for Windows 1.0 129

Free Freight*
30-Day Money-Back Guarantee
Toll-Free Service & Support
No Credit Card Surcharges

Call for Prices on Other Peripherals & Software

Call 1-800-PC BRAND

(Call 1-800-722-7263) In All 50 States FAX# 1-800-722-7392

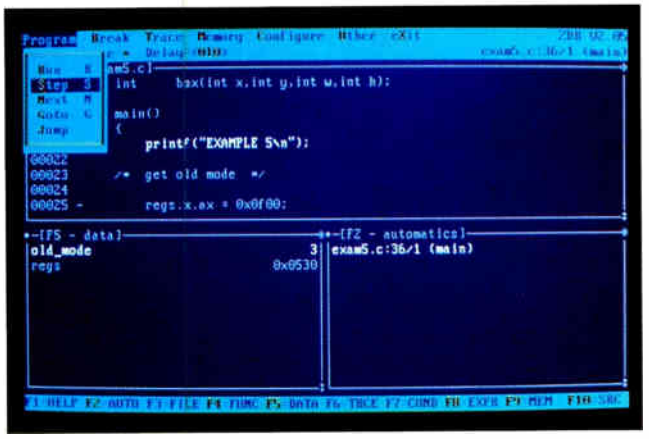
PC Brand, Inc. 954 W. Washington St., Chicago, IL 60607 Canadian Fax # 312-633-2888 Canadian Voice # 312-226-5200. We are open Mon. thru Fri.: 8am to 6pm Central Time. MasterCard, VISA, Discover, Checks and Approved P.O.s are Accepted. Prices and specifications subject to change. **BYTE 15-7**

World Radio History

Steve Spicer

REVIEW

C++, Plus



Zortech's new multiwindowed debugging environment.

You might not know it, but if you write more than a little software, you're already an object-oriented programmer. Every window you open, every C structure you declare, and even most BASIC subroutines you write are nearly objects. Without an object-oriented language, it is impossible to deal with these constructs in an intuitive way. In fact, objects work a lot closer to the way people think than do non-OOP constructs in other languages.

C has reigned supreme for several years now as the language of choice for commercial software production. C++, born at AT&T, is the heir apparent to C's following but has been held back somewhat by the quality of available tools. Most C++ compilers aren't really compilers at all; they simply turn C++ code into C code, which you then compile on your own. Function and variable names get mangled to internal representations. C debuggers can't help you make sense of these names, and they don't understand the C++ constructs and syntax, either. In short, there has been no way for a C programmer to painlessly make the switch to C's more capable offspring. Until now.

Zortech, a pioneer in the PC C++ business, has released the first PC-based compiler compliant with AT&T's latest language specification, version 2.0. The developer's edition of Zortech's product, reviewed here, combines a compiler that is compliant with both AT&T C++ 2.0 and ANSI C specifications, an integrated editor, a true C++ source-level debugger, a Microsoft-compatible linker, full library source code, and a set of ready-made classes (also accompanied by full source code).

AT&T's original language specification was pretty complete, but version 2.0 added some important features. Zortech has stayed close to this new language specification, adding virtually all the changes introduced by AT&T. Chief among these are *multiple inheritance*, whereby a class can inherit members from more than one base class, and *type-safe linkage*, which allows type checking of function arguments across separately compiled modules. The mechanism used allows C, Pascal, and assembly source modules to be easily linked in.

Zortech has also made some PC-specific additions, including new compiler and library (but not class) support for Microsoft Windows development, expanded memory, mouse functions, and TSR programs. All are callable from programs compiled with either C++ or the ANSI C–compliant compiler included in the package. Some library functions now have multiple names to make porting from Microsoft C easier. [Editor's note: *See the text box "But Wait, There's More" for some features added to Zortech C++.*]

Getting It On

Installation is easy. If the setup routine detects a previous installation, it offers to update rather than install everything, which can save some time. It doesn't ask many questions, but you can't change answers without aborting the install process and starting over; this takes slightly under half an hour.

The installation guide refers to the creation of a tools directory, but it never appeared. I even repeated the installation thinking I missed something. I checked the contents of the disks against what got installed, and it was all there. I expect this may be a documentation error, but problems like this during installation can be frustrating.

The Editor as Environment

Zortech's approach to the working environment is a little closer to the Unix way of doing things than to Borland's or Microsoft's. Rather than providing one huge program combining an editor, debugger, and compiler, Zortech's zed editor simply invokes the other tools as needed. This approach contrasts with Quick C and Turbo C, both of which load the entire integrated environment (compiler, debugger, and editor) into memory, leaving less room for each individual module. The zed editor can also run Make instead of calling the compiler directly, which is essential since C++ programs tend to be built from lots of small files.

The editor's mild integration is much better than none at all, but it also brings out a small gripe: zed can only work on five files at a time, and it can only put one file on the screen at a time. Five might be OK if you're working on a small project at home, but it's simply not adequate for a large commercial project. Of course, there's nothing to keep you from using EMACS, Brief, or some other editor that uses windows and handles more files simultaneously.

Despite its shortcomings, the editor has many features that make a professional's life easier. It listens for errors coming back from the compiler and places the cursor on the line in the source where the first error was reported. It remembers compile and link options from session to session, as well as the files you were working on, and the cursor position within each. There is mouse support and also a facility for recording and replaying keystrokes as macros. Brace, bracket, and parenthesis matching make it easier to read and fix nested statements and expressions. Another thoughtful feature is called block indent/outdent: It lets you put the cursor on a brace and press two keys to move the entire block of code in or out one tab stop. It can't be beat for fixing up the indentation after moving some big blocks of code around.

As is common with many programmer's editors, almost everything in zed is configurable. A special configuration program, `zconfig`, sets defaults for search paths, screen colors, and a seemingly endless list of other options. Key

continued

World Radio History

The joy of C-scape

Elegant graphics and text

The C-scape™ Interface Management System is a flexible library of C functions for data entry and validation, menus, text editing, context-sensitive help, and windowing. C-scape's powerful Look & Feel™ Screen Designer lets you create full-featured screens and automatically generates complete C source code.

C-scape includes easily modifiable high-level functions as well as primitives to construct new functions. Its object-oriented design helps you build more functional, more flexible, more portable, and more unique applications—and you'll have more fun doing it.

The industry standout. Many thousands of software developers worldwide have turned to the pleasure of C-scape. The press agrees: "C-scape is by far the best. . . . A joy to use," wrote IEEE *Computer*. Major companies have selected C-scape as a standard for software development.

C-scape's open architecture lets you use it with data base, graphics, or other C and C++ libraries. C-scape runs in text or graphics mode, so you can display text and graphics simultaneously. To port from DOS or OS/2 to UNIX, AIX, QNX, or VMS, just recompile. C-scape also

Graphics. Run in color in text or graphics mode. Read images from PCX files.

Object-oriented architecture. Add custom features and create reusable code modules. C++ compatible.

Mouse support. Fully-integrated mouse support for menu selections, data entry fields, and to move and resize windows.

Portability. Hardware independent code. Supports DOS, OS/2, UNIX, AIX, VMS, others. Autodetects Hercules, CGA, EGA, VGA. Supports Phar Lap and Rational DOS extenders.

Text editing. Text editors with word wrap, block commands, and search and replace.

Field flexibility. Masked, protected, marked, required, no-echo, and named fields with complete data validation. Time, date, money, pop-up list, and many more higher-level functions; create your own.

Windows. Pop-up, tiled, bordered and exploding windows; size and numbers limited only by RAM.

Menus. Pop-up, pull-down, 123-style, or slug menus; create your own.

Context-sensitive help. Link help messages to individual screens or fields. Cross reference messages to create hypertext-like help.

Code generation. Build any type of screen or form with the Look & Feel™ Screen Designer, test it, then automatically convert it to C code.

Screen flexibility. Call screens from files at run time or link them in. Automatic vertical/horizontal scrolling.

International support. Offices in Berlin, Germany, with an international network of technical companies providing local training, support and consulting.

supports Phar Lap and Rational DOS extenders.

Trial with a smile. C-scape is powerful, flexible, portable, and easy to try. Test C-scape for 30 days. It offers a thorough manual and function reference, sample programs with source code, and an optional screen designer and source code generator. Oakland provides access to a 24-hour BBS, telephone services, and an international network of companies providing in-country support. No royalties, runtime licenses, runtime modules. After you register, you get complete library source code at no extra cost.

Call 800-233-3733 (617-491-7311 in Massachusetts, 206-746-8767 in Washington; see below for International). After the joy of C-scape, programming will never be the same.

DOS, OS/2 (Borland and Microsoft support): with Look & Feel, $499; library only, $399; UNIX, etc. start at $999; prices include library source. Training in Cambridge and Seattle each month. Mastercard and Visa accepted.

OAKLAND

Oakland Group, Inc. 675 Massachusetts Ave., Cambridge, MA 02139 USA. FAX: 617-868-4440. **Oakland Group, GmbH.** Alt Moabit 91-B, D-1000 Berlin 21, F.R.G. (030) 391 5045, FAX: (030) 393 4398. **Oakland International Technical Network** (training, support, consulting): **Australia** Noble Systems (02) 564-1200; **Benelux** TM Data (02159) 46814; **Denmark** Ravenholm (042) 887249; **Austria-Germany-Switzerland** ESM 07127/5244; **Norway** Ravenholm (02) 448855; **Sweden** Linsoft (013) 111588; **U.K.** Systemstar (0992) 500919. Photo by Jessica A. Boyatt; Kanji by Kaji Aso. Picture shows a C-scape program combining data entry with video images loaded from PCX files. C-scape and Look & Feel are trademarks of Oakland Group, Inc.; other trademarks belong to their respective companies. Copyright © 1990, by Oakland Group, Inc. Features, prices, and terms subject to change.

Circle 283 on Reader Service Card

World Radio History

C++ 2.0

Company
Zortech, Inc.
1165 Massachusetts Ave.
Arlington, MA 02174
(617) 646-6703

Hardware Needed
IBM PC, XT, AT, PS/2, or compatible with at least 512K bytes of memory and a hard disk drive with 1 to 3 megabytes available

Software Needed
DOS 2.11 or higher

Price
C++ 2.0: $199.95
Developer's edition: $450
OS/2 upgrade: $149.95

Inquiry 881.

bindings are modifiable, so it's possible to make zed behave like another editor entirely. These changes can be made from within the editor, so you can experiment with your changes on the fly.

On-Line Help

Zortech's TSR on-line help program is `ztchelp`. Once the program is installed, you can get C and C++ help from within the zed editor by pressing Shift-F1 when the cursor is over the token for which you want help. This worked nicely for the keywords I tested (i.e., `for`, `#include`, and `void`), but I learned that `ztchelp` can get confused. Asking for help on `<<` got me the help screen for `raise()`. I was puzzled until I noticed that the token `rate` followed the `<<` in my text. Changing `rate` to `foo` produced the help screen for `fopen()`. Apparently `ztchelp` uses a best-guess method to determine the intended subject.

One thing about the help text (and the rest of the documentation) is that Zortech should run its text through spelling and grammar checkers. Typos and misused words may be acceptable in a draft but certainly not in a finished product.

Make My Day

C++ has a Make utility that directs (via a text file called a make file) the compile/link process, and it can also be used as an intelligent batch file to conditionally run tests, install programs, and perform other tasks based on file-age relationships. Its origins, as with many good programming tools, are in the Unix world. Zortech's version of Make has always been better than Microsoft's, and the version included here is better still. Zortech's Make is much closer to the original Unix version, which fully automates the build process, but lets you do it just about any way you please. Microsoft's Make is little better than a DOS batch file; it does the requisite file-age comparisons, but that's the only thing useful about it.

Zortech has also added an `include` directive that lets you reference another make file in much the same way that C and Pascal programmers include header files. With it, you can put all your default how-to-compile rules and macros into one file and then `include` that file into your individual make files. It is also an excellent way to get a team of programmers all working in the same direction.

The Real Thing

Zortech's debugger, `zdb`, is currently the only PC product that supports the source-level debugging of native C++ programs as well as C and assembly code. I admit to a pathological dislike of debuggers in general, but `zdb`'s ability to unmangle C++ names and follow overloaded functions and operators makes the thought of working on someone else's code (there's never a need to debug your own code, right?) less daunting. It's got the usual flashy stuff, too—pull-down menus, multiple windows (15 in all, although you don't see more than three at once), mouse support, and complex data type expansion and expression evaluation—but the real attraction beyond the C++ support is how easy it is to learn.

The `zdb` debugger outguns traditional C debuggers by virtue of its understanding of C++ constructs and syntax. A class window can be opened that allows simple examination of classes and their member functions. This becomes a sort of on-line help for understanding how a C++ program works, and properly written Zortech C++ programs become, to an extent, self-documenting.

Source Included

The sources to the library routines and the tools classes are included with the developer's edition. Conventional wisdom has it that library source is great as a learning tool, or that it's essential if you need to create your own version of a routine because of local conditions. Those are both true, but I've always found that the best use of library source is convincing yourself that the incredibly subtle bug you've been chasing is really yours and not a library bug.

The tools reference guide also contains the source to the tools classes. To its credit, Zortech warns that the code in the book is only a guide, and that you should check the actual source if the details are that important. Take this warning to heart; I found several places where the actual code varies from the code that's in the book.

Real Work

Zortech would like to woo current Microsoft C users (like myself), so my first test was to attempt to compile a complex Microsoft C program with Zortech's ANSI C compiler. I fed a Microsoft C-specific version of the MicroEMACS editor source to Zortech's compiler, and less than an hour later, I had a new (and smaller) program. It was very easy to build a Zortech-style make file to compile the modules. Not all Zortech library function names and argument lists match Microsoft's exactly, but all I had

continued

But Wait, There's More

By the time this review was ready for publication, the face of PC C++ was changing dramatically. Zortech's next release (2.1) is nearly ready. In addition to enhancements to compile speed, the integrated environment, and tools, the new compiler includes virtual code management. Using VCM, a program can contain up to 4 megabytes of code, but it can still run on a 640K-byte PC. The company says that VCM requires no source code changes for most applications. Upgrades to version 2.1 will be available.

Borland, too, is preparing the first release of its compiler, Turbo C++. This is both ANSI C and AT&T 2.0 C++ compliant, and it is built around a revamped programmer's platform that has overlapping windows, an enhanced multifile editor, and mouse support. Turbo C++ also has a new memory management scheme, called the Virtual Run-Time Object-Oriented Memory Manager (VROOMM), which allows large programs to run in 640K bytes.

Turbo C++ will be reviewed in an upcoming BYTE.

World Radio History

C8.0/386

Unleash 386 Power on Your Microsoft C Code.

- ☑ Source-level debugger
- ☑ Graphics Library
- ☑ Fast, tight code
- ☑ Generates high-performance code for 32-bit protected mode
- ☑ Microsoft source and library compatible
- ☑ Supports Phar Lap and Eclipse DOS Extenders
- ☑ Protected-mode version of compiler
- ☑ SAA Compatible
- ☑ Run-time Compatible with WATCOM FORTRAN 77 /386
- ☑ 100% ANSI C Compatible
- ☑ Profiler
- ☑ Remote debugging

Experts Agree on WATCOM C:

"When Novell went looking for a 32-bit compiler for use with the NetWare 386 developer's kit, the company selected WATCOM's... It's clear that Novell chose wisely; this product is a winner."
Fred Hommel
BYTE, December 1989

"WATCOM C broke with tradition to make a fast, efficient C programming environment that has other C compiler designers rethinking their strategy."
Bill Machrone
PC Magazine, January 17, 1989

"Good things do get better."
John Dlugosz
Dr. Dobbs Journal, September 1989

Microsoft library- and source-compatibility makes WATCOM C7.0 /386 ideal for porting DOS applications to 32-bit native mode. This compiler enables full 386 performance without 640K limitations.
Richard M. Smith, President
Phar Lap Software, Inc.

"WATCOM's latest release of its rising star is a clear winner...It is a clearly superior value when compared to all compilers..."
Richard Relph
INFOWORLD, May 22, 1989

"...WATCOM C showed shining performance."
Computer Language, Feb. 1989

Also announcing:

WATCOM FORTRAN 77 /386

- Based on WATCOM C Technology
- Shares WATCOM C Development Tools
- Supports FULL ANSI FORTRAN 77 Language plus Extensions
- SAA Compatible
- Generates High-performance Code for 32-bit 386 Native Mode

WATCOM C8.0 /386

- 100% ANSI C Optimizing Compiler
- 386 Run-time Library Object Code
- 386 Graphics Library
- Windowed Source Level Debugger
- Profiler, Editor, MAKE and Linker
- Object-code Librarian
- Object-code Disassembler
- Protected-mode version of compiler
- Supports Phar Lap and Eclipse DOS extenders

WATCOM F77/386

- 100% ANSI FORTRAN 77 Optimizing Compiler plus extensions
- 386 Run-time Library Object Code
- Windowed Source-level Debugger
- Profiler, Editor, MAKE and Linker
- Object-code Librarian
- Object-code Disassembler
- Protected-mode version of compiler
- Run-time compatible with WATCOM C8.0 /386

1-800-265-4555

WATCOM

WATCOM, 415 Phillip Street, Waterloo, Ontario, Canada N2L 3X2, Telephone: (519) 886-3700, Fax: (519) 747-4971
Trademark/Owner: Phar Lap/Phar Lap, Inc.; Microsoft/Microsoft, Inc.; Eclipse/Eclipse Computer Solutions, Inc.
WATCOM & Express C are trademarks of WATCOM Systems Inc.
© Copyright 1990 WATCOM Products Inc.

Circle 307 on Reader Service Card

World Radio History

to do was watch for "unresolved external" messages from the linker and patch the source to use Zortech's equivalent function.

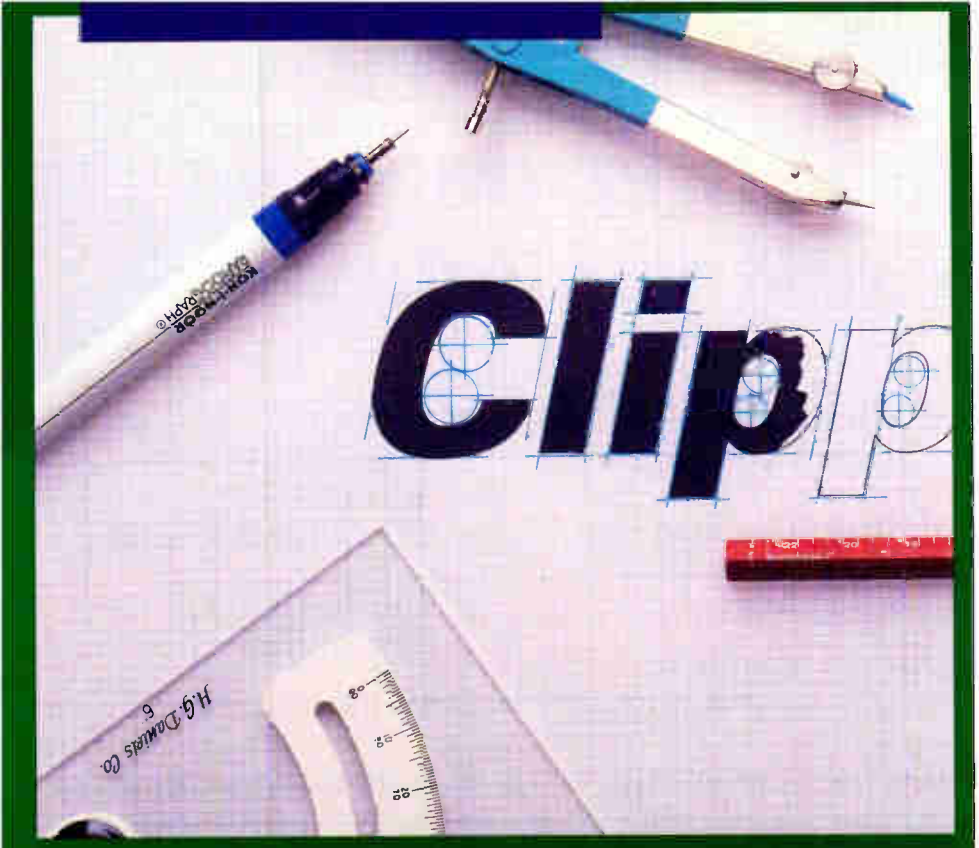
It also seemed reasonable to work up some C++ code from scratch. I wanted to create a simple directory browser that would display a sorted list of files. Using the `directory` class from the tools collection, I quickly put together a function to build an array of filenames and attributes from the contents of a specific directory. It was almost too easy; all I did was declare the darned thing and then use the class's member functions to grab the files. The next step was to combine this with one of my sorting programs to produce sorted listings using various keys (e.g., time stamps and size). The sorted listings were used as data for objects created using the `dlist` doubly linked list class, which I then set up to display using pop-up window objects from the supplied `window` class.

For an encore, I used Zortech's `_handle` data type to allow the data to be stored and sorted in expanded memory. This takes little work beyond using `_handle` in the data declarations—the compiler does the correct magic to use your EMS driver to put the data in expanded memory.

I've worked up small projects like this from scratch in C before, and those efforts have led me to expect that the C++ equivalent would require a similar investment of time—several days. It's amazing how much time you can save by using the right tools; directories, linked lists, and windows are all proper objects, but C's ignorance of objects in general makes even simple projects like this a chore. But with Zortech's C++, I had everything finished in just one evening. What's more, I could have bundled the modules together as a class and declared subclasses to create a file-selection dialog box, an Xtree-type directory manager, or what have you. I'd like to see you do that as easily with C.

Not a Bug?

Zortech has managed to avoid many of the bugs being found in `cfront` (AT&T's C++-to-C translator) versions of C++ 2.0. I have tested quite a few of the reported `cfront` bugs, and Zortech has fixed most of them. One bit of behavior was obviously wrong, though: I couldn't compile some perfectly legal code using virtual functions and derived classes, and it was driving me nuts. It would take another article the size of this one to explain the issue. In the end, I had to use a cast on a function call argument (of a de-



Your Left Brain Needs Clipper.

Organization is everything in business. The left side of your brain knows this. It wants order. Economy. Precision. All reasons your left brain appreciates Clipper 5.0, the premier application development system for PCs.

An open architecture programming system, Clipper provides a flexible environment for developing precisely the application you need, not a messy approximation. Its user-definable commands and functions let you configure the Clipper language for your exact requirements. Its compiler generates .EXE files for rapid execution and cost-free distribution. Its new linker even lets you build and run applications larger than available memory! And its elegant network support yields high performance on even the largest systems.

So, if you're charged with coaxing order out of chaos for your business, put Clipper in your programming arsenal today. It has exactly the programming power you need!

Clipper® 5.0

The Application Development Standard

213/390-7923

Nantucket®

Circle 176 on Reader Service Card

Nantucket Corporation, 12555 West Jefferson Boulevard, Los Angeles, CA 90066 213/390-7923 FAX: 213/397 5467 TELEX: 650-2574125 Nantucket, the Nantucket logo and Clipper are registered trademarks of Nantucket Corporation. Other brand and product names are used for identification purposes only and may be trademarks or registered trademarks of their respective holders. Entire contents copyright 1990 Nantucket Corporation.

rived type) to get the code to compile.

At least with Zortech C++, when I ran the hacked code I got the expected result. With a `cfront`-based compiler, the original code compiled just fine, but it produced the wrong answer. This turns out to be a known `cfront` bug, which, if you're curious, is described thus: The virtual function table is not constructed correctly when a derived object is passed by value as a base object (whew!). I don't know if Zortech has deliberately tried to avoid this problem by forcing the use of casts, or if the refusal to compile is simply a bug. Whichever it is, what matters to me is that Zortech C++ gives the correct output in the end.

A Class Act

In all, Zortech has put together a commendable package long on features, fully suited to professional code development, and at a price that, while not cheap, is within the reach of working programmers. In addition to offering services to conventional DOS programmers, Zortech has also included support for Microsoft Windows and sells an upgrade kit that fixes the compiler to produce OS/2 protected-mode binaries. This support is limited, however, since Zortech's product lacks the classes you'd need to do real OOP for Windows or Presentation Manager. Third-party class libraries are on the horizon, but until they're available, C++'s potential in these areas will go mostly untapped.

If you're a C programmer, you should take a serious look at Zortech's compiler. Large, multimodule C projects become difficult to maintain because the sharing of data among modules is poorly handled. Global variables, unportable code, and the global callability of dangerous internal functions are all killer time wasters, and these are but a few of the problems C++ was invented to solve.

Unlike other OOP languages, C++ is immediately useful to C programmers because it is a superset of C. There's no magic here; it's just as easy (and maybe easier) to write ugly programs in C++ as it is in C. The difference is that the best C++ code will be more portable and more maintainable than the best C code. Zortech's C++ 2.0 and its accompanying tools create a quality environment that can increase the productivity of programmers working on large or complex projects. ■

Steve Spicer is a Unix software engineer for Hewlett-Packard's Apollo division in Chelmsford, Massachusetts. He can be reached on BIX c/o "editors."

Your Right Brain Wants It!

While your left brain duly notes the benefits of Clipper programming, the right half is wild about how you get them! Imagine a programming environment with no limits. The language can be easily extended with your own routines and you can even integrate code from other languages, like C and Assembler. You're always free to configure Clipper to suit your own programming style.

Hey, let's say you want to read and write data stored on larger platforms or in other PC formats. It's no problem since Clipper 5.0 sports a replaceable database driver, even allowing multiple drivers to be used concurrently in the same application! And SQL queries will be a breeze, using familiar Clipper code. There's no end to the possibilities you can pursue with Clipper!

Clipper's open architecture system will fire your imagination with unparalleled freedom. It's an unlimited palette of pigments for a developer's mind. So, if you're ready to let your imagination inspire your applications, indulge yourself with Clipper 5.0. It has everything you need with anything you'd want.

Clipper® 5.0

The Application Development Standard

213/390-7923

Nantucket®

Circle 177 on Reader Service Card.

Nantucket Corporation, 12555 West Jefferson Boulevard, Los Angeles, CA 90066 213/390-7923 FAX: 213/397-5469 TELEX: 650-2574125. Nantucket, the Nantucket logo and Clipper are registered trademarks of Nantucket Corporation. Other brand and product names are used for identification purposes only and may be trademarks or registered trademarks of their respective holders. Entire contents copyright © 1990 Nantucket Corporation.

World Radio History

Make your keyboard A Northgate™ *OmniKey*...

Use One RISK FREE For 60 DAYS!

Hands down, Northgate *OmniKey* keyboards are the choice of experts and users alike! *PC Magazine* picked *OmniKey* from all the rest as their EDITORS' CHOICE. Readers of *Computer Shopper* made it their "Best Buy" selection. In fact, every article ever written about an *OmniKey* has been a rave review!

Every month, thousands of people abandon their perfectly usable keyboards and replace them with Northgate *OmniKeys*.

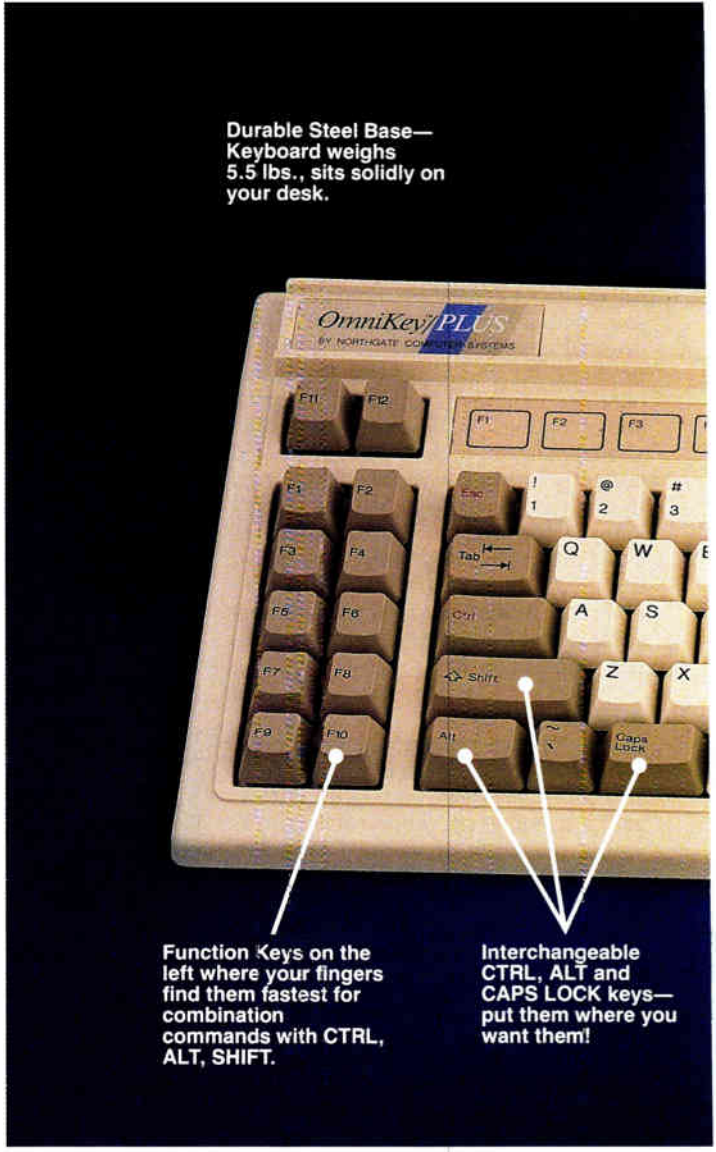
What's all the fuss about? Isn't one keyboard just about like another? Well, until you try an *OmniKey* you can't imagine how much better a keyboard can be. Here's how you can find out.

Use an *OmniKey* for 60 days. If it isn't everything we claim, simply return it. We'll refund **ALL YOUR MONEY,** including ground shipping charges.

You risk nothing! Select your *OmniKey* keyboard and order it now!

Northgate *OmniKey* Keyboards have these Outstanding Features!

- **Unmatched Compatibility;** dip switch settings for all IBM type systems and 17 others as well—Zenith, Tandy, AT&T and more; XT and AT compatible.
- **Alps Click/Tactile Mechanical Key Switches** for a crisp, responsive feel and faster, more accurate typing.
- **LED Indicators** show scroll, caps and number lock status at a glance.
- **Double Injected Key Caps** for long life and durability.
- **FCC Class B Certified**—won't interfere with radio and TV reception.
- **5 Year Warranty**—the industry's strongest! If you have any problems due to materials or workmanship, Northgate will repair or replace your keyboard **AT NO CHARGE!**



OmniKey™/PLUS

Feel the quality ... Hear the precision ... See the results!

Let your fingers dance with *OmniKey*/PLUS—you'll wonder how you got along without it for so long! Its keys are crisp to the touch. The sound is precise. The increased accuracy of your typing or data input will astound you!

And, you don't need to "eye check" the monitor to know you've made an entry. *OmniKey* tells you with sound and sensation.

***OmniKey*/PLUS**
Another Northgate "Smart Tool For Business"™
ONLY $119.00

PC MAGAZINE EDITORS' CHOICE

"Editors' Choice" says *PC Magazine!*

OmniKey/PLUS "... Northgate has mastered the layout that IBM lacked ..."

"Many of us who learned to type on original PC or XT keyboards were thrilled to have the function keys back home where they belong."

World Radio History

Turn the page! See the rest of Northgate's impressive *OmniKey* line!

Computer Shopper readers vote it "Best Buy!"

"By combining the best features of both old and new PC keyboard layouts, Northgate has created a unique input device and one that carries an industry-wide reputation for quality, design and performance."

Check out these exclusive *OmniKey* features:

Better typing begins with a better layout! Most people learned keyboard typing with the function keys on the left for fast one-hand combination commands.

Two independent keypads...

Cursor control pad: All screen controls are on this pad with cursor arrows in a convenient diamond pattern for those who prefer this layout over the IBM™ Inverted T.

NEW! If you do prefer the Inverted T, the key in the center of the cursor arrows is a down arrow cursor key. INSERT and DELETE keys at bottom of pad are large and easy to hit.

Numeric Keypad: No need to use NUMLOCK when you want to enter numbers. Large INSERT and ENTER keys make number manipulation a breeze.

And look, we've added an "EQUAL" key that EXCEL uses so extensively. This little feature alone is further evidence of how advanced the thinking is that goes into *OmniKey* Keyboards.

Never type U>S>A >again! Lock out these < >. When you want to type U.S.A., you don't get U>S>A>! F13 is the magic key.

Instantly change repeat character rate! Press F14 key and you select a repeat rate from 3-120 CPS. Perfect for racing through a spreadsheet. No run-on either!

New—Customize *OmniKey*/PLUS! Select CAPS LOCK, CONTROL and ALT locations. Keep them as shown above or put them in the standard IBM enhanced layout positon; CAPS LOCK next to "a", ALT next to space bar, CONTROL under SHIFT.

You can even swap the ALT and CONTROL keys on the right; Switch the backslash and asterisk keys—it's up to you! **Talk about flexibility!**

Put *OmniKey*/PLUS to work for you—call for your no-risk 60-day trial today!

Phone for the Dealer Nearest You or Place Your Order Direct

800-526-2446

NORTHGATE COMPUTER SYSTEMS™

"We hear you!"

P.O. Box 41000 Minneapolis, Minnesota 55441

Hours: Mon.-Fri., 7 a.m. - 8 p.m.; Sat., 8 a.m. to 4 p.m. Central. Fax Your Order! 612-476-6443. Dealer and Distributor Pricing Available! Notice to the Hearing Impaired: Northgate now has TDD capability. Dial 800-535-0602.

Circle 185 on Reader Service Card

World Radio History

Introducing two all-new 101-style models...

Model 101-I

Model 101-N

...20% smaller footprint and F-keys on top.

OmniKey™/101

Why two models...

Model #101-I—Many people have become accustomed to the standard IBM layout with F keys on top, inverted T cursor layout, etc. For you, we've duplicated ... well, nearly ... the IBM layout, but with a couple changes that improve on IBM.

IBM puts BACKSLASH near BACKSPACE and ENTER keys. By doing so, they must reduce the size of one of the two keys.

Northgate believes the BACKSLASH key is better located on the bottom row next to the righthand SHIFT key. By placing it there, our layout gives you both a double wide BACKSPACE and large L-shaped ENTER key. We believe you'll prefer our layout. If not—send it back!

Model #101-N—Northgate's improvement over the standard IBM. Distinguished primarily by the independent Cursor Pad with diamond-shaped arrow layout. Independent numeric keypad with all the operands grouped around the numbers for faster numeric entry and commands.

More features! ESCAPE Key is positioned next to #1. Plus, we added an asterisk key on bottom row to speed wildcard commands. Includes Comma/Period lockout feature AND adjustable cursor rate capability.

STANDARD FEATURES ON BOTH MODELS:

- Size: 18½ "L x 7 "W; IBM's 101 is 19⅜ "L x 8⅜ "W
- 12 F keys across the top
- Alps Click/Tactile Switches
- Switchable CTRL/CAPS LOCK
- PS/2 Compatible w/Adaptor

New small footprint!

Order now! At this low price, our supplies on hand will move quickly!

Your Choice of *OmniKey*/101 Models ONLY **$89.00**

Same 60-Day No Risk Trial

World Radio History

OmniKey™/102

Northgate put the function keys back on the left!

The first keyboard to get back to the basics with 12 function keys on the left. A modification most people prefer!

Two separate keypads! One IBM style inverted T for cursor control; second for numeric entry functions.

Custom convenience feature! See the control and left caps lock keys? They trade places. Put the CAPS LOCK in the third row right next to "a" key, if you prefer.

Non-skid design. *OmniKey*/102 has a heavy steel base for durability. Weighs 5.5 lbs.—won't slide around no matter how fast you type!

Try an *OmniKey*/102 for 60 days—YOUR SATISFACTION IS FULLY GUARANTEED! The phone call is on us, give us a ring and order now!

OmniKey/102
ONLY $99.00
Same 60-Day No Risk Trial

Call for a 60 day no risk trial today!

See your *OmniKey* Dealer or Call to Place Your 60-Day No Risk Order NOW!

There are some 500 *OmniKey* dealers nationwide. Call us and we'll give you the phone number of the one nearest you. If that's not convenient, order directly from Northgate!

You'll quickly agree Northgate *OmniKey* Keyboards live up to every claim we make. Use it for 60 days. And if you're not 100% satisfied in every way, return it for a full refund including ground freight.

And Remember: Your *OmniKey* Keyboard is backed by the industry's strongest warranty—FIVE FULL YEARS!

Phone for the Dealer Nearest You or Place Your Order Direct

800-526-2446

NORTHGATE COMPUTER SYSTEMS™ "We hear you!"

P.O. Box 41000 Minneapolis, Minnesota 55441

HOURS: Mon.-Fri. 7 a.m. - 8 p.m.; Sat. 8 a.m. - 4 p.m. Central. Fax Your Order! 612-476-6443. For Dealer and Distributor Program Pricing, call 800-526-2446. **Notice to the Hearing Impaired:** Northgate now has TDD capability. Dial 800-535-0602.

©Copyright Northgate Computer Systems, Inc. 1990. All Rights Reserved. Northgate, *OmniKey*/101, *OmniKey*/102, *OmniKey*/PLUS and the Northgate 'N' logo are trademarks of Northgate Computer Systems, Inc. All other product and brand names are trademarks and registered trademarks of their respective companies. Prices and specifications are subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality and performance. All items subject to availability. CHARGE IT! We accept your Visa, MasterCard or Big "N" credit card. All models are subject to occasional inventory shortages.

Circle 186 on Reader Service Card

World Radio History

George Bond

REVIEW

The Personal Network

Lotus Notes deals with information in a familiar file-folder and icon manner.

Lotus Notes 1.0 is a strange beast. It's a hybrid application program that is part E-mail system, part conferencing system, part database manager, and part network connection. When all its parts are combined, Notes forms an interesting distributed-database network.

To its credit, Notes retains the traditional strength of the personal computer—the *personal* part—and melds with the largely untapped strength of a network to support synergistic cooperative work. In other words, Notes helps groups of people communicate with each other using tools to share information.

On the personal level, Notes lets you build your own applications, fashion your own views of information, and maintain your own databases. For example, if you work for a company that uses formal performance ratings based on objectives and goals, you could create a private Notes database to track your progress against these goals. It would be accessible only to you, not anyone else on the network. The information you feed into this private database (e.g., facts about what you're doing and when) could come from other, shared Notes applications used in the daily running of the business. If your job is quality control, you could build your own tools for analyzing trouble reports filed in public areas of the system, working in a way that makes the most sense to you.

The synergy here is a by-product of people sharing information. The mail system is solid and easy to use, but Notes's real potential comes from its ability to emulate conferencing systems. Notes supports applications that distribute information on a many-to-many basis (many individuals communicating with many others, as opposed to mail systems and their one-to-one or one-to-a-few communication pattern). You can link messages and replies and read them at any time in a logical order, freeing discussion participants from constraints of time and space.

Notes also supports traditional static databases, such as policy manuals, catalogs, research reports, and personnel records. In addition, you can use Notes for such diverse functions as a ballot box, a suggestion box, a facility to generate and distribute newsletters and news bulletins, and a facility to maintain central schedules.

You can also set up Notes on multiple servers. Distributed over a single LAN or multiple LANs, or even over continents using wide-area networks (WANs), Notes automatically keeps itself roughly in sync through replication. This means each server exchanges information with the other servers in the system on a scheduled basis.

The technology to do this is far from breathtaking. Programs that do the same thing in bits and pieces are available separately in many forms from vendors of mail, conferencing systems, BBSes, databases, and communications programs. What sets Notes apart is the integration of these technologies for a nontechnical audience.

Notes presents a Microsoft Windows or OS/2 graphical user interface that is easy to learn and use, yet flexible enough to satisfy the demands of most power users. From the user's perspective, person-to-person mail, discussions involving large groups of people, and database manipulation are all done in the same way. You consistently use pull-down menus to select what you want.

There is, unfortunately, a serious flaw in the Notes system. It does not do record locking. This means that two or more users can work on the same record at the same time and each can make his or her own changes to it without knowing other changes are being made. When everyone is finished making changes, the version that was closed last is the one left in the database—whether or not it has the best information. This is a very strange omission from a groupware or enterprise computing product meant to be used concurrently by many people. To its credit, though, Lotus is clear and specific about this shortcoming in the Notes documentation. Lotus also says that it is working to fix the problem.

A Familiar Database

Notes has a familiar structure. Information is entered into fields, which make up forms. Forms are used to construct documents, and documents are stored in databases. Views are used for customized displays of databases.

When creating a form, six data types are available: text, time, number, keyword, rich text, and document author. Text fields can accept multiple values, but each value must be separated by a punctuation mark. Text fields can contain numbers but cannot use them in calculations. The time field is really a time and date field, and you can vary its format.

You can use number fields for computation. The system stores numbers in floating-point format (scientific notation) from E±99, with 14-digit accuracy. Numbers outside of this range are rounded automatically. Notes recognizes integer, decimal-fraction, scientific-notation, and currency formats.

Keyword fields let you create a uniform set of descriptors to make searching a database easier. You can design a form to include a keyword field that users fill in when completing the form. For example, in a memo form you could include a keyword field for a subject to make organizing memos easier. Rich-text fields can include standard text, enhanced text (i.e., attributes including different typefaces, sizes, and color), and pictures. The document-author field automatically records and displays the name of the person creating the document and verifies the author's identity using an internal Notes security check.

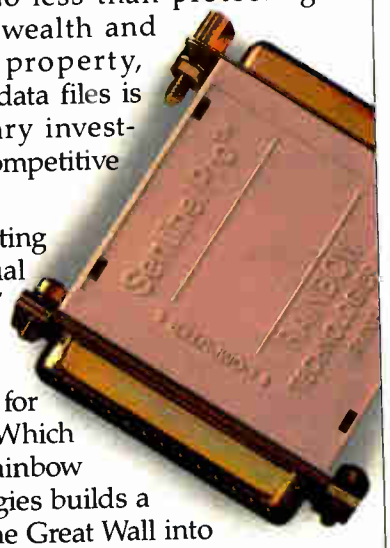
continued

World Radio History

Whether you're protecting frontiers and temples in Manchuria, or software and data on the PC or Mac, the Great Wall is a lesson Rainbow Technologies has learned very well.

Software developers must deal daily with the consequences of unauthorized copies and millions of dollars in lost revenue. At the same time, both individual and corporate users must be able to make and distribute copies within legal guidelines.

Today's information-driven companies must secure their data files against theft and unauthorized access. No less than protecting personal wealth and tangible property, guarding data files is a necessary investment in competitive survival.



Protecting "intellectual property" is the security challenge for the '90s. Which is why Rainbow Technologies builds a little of the Great Wall into every key it makes.

For developers, the Software Sentinel™ family of keys protects IBM, PS/2 and compatible software, while Eve™ guards software for the Mac. Rainbow's DataSentry™ is the solution for PC data protection.

Times Change. The Need To Protect Doesn't.

Software and data protection from Rainbow Technologies. Information on how you can have a little piece of the Great Wall to protect your software and data worldwide is as close as a toll-free call.

RAINBOW TECHNOLOGIES
9292 Jeronimo Road, Irvine, CA 92718
TEL: (714) 454-2100 · (800) 852-8569 (Outside CA)
FAX: (714) 454-8557 · AppleLink: D3058
Rainbow Technologies, Ltd., Shirley Lodge, 470 London Road
Slough, Berkshire SL3 8QY, TEL: 0753-41512 · FAX: 0753-43610

Copyright ©1990 Rainbow Technologies, Inc.

World Radio History

Lotus Notes 1.0

Company
Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500

Hardware Needed
Server: 286-, 386-, or i486-based IBM PC or compatible with 640K bytes of RAM (5 MB for OS/2); a 60-MB hard disk drive (only 40 MB for workstations) with 10 MB of available hard disk space; LAN Manager-compatible network hardware (IBM, 3Com, or Novell); CGA, EGA, VGA, Hercules, or IBM 8514 cards

Software Needed
OS/2 Standard Edition 1.1 with a Novell Requester or 3Com 3+Open package, or Extended Edition 1.1, or DOS 3.1 or higher. For DOS: Novell NetWare 2.10 or higher, IBM PC-LAN 1.2, or 3Com 3+Share 1.3.1 or 3+Open 1.0 or 1.1

Price
$62,500 (includes licenses for 200 servers or workstations, product installation and user training by Lotus representatives at your site, 10 sets of documentation, and six months of support)

Inquiry 884.

Documents can also have *hot links* to other documents. A hot link is a hypertext-like connection to information in other documents, even documents in different databases. Hot links allow both documents to reside in their own database, independent of each other.

A hierarchy of access levels and permissions lets you fine-tune how databases are used. You can give each user anything from the ability to delete a database to no knowledge that it even exists, all controlled by software switches.

Every Notes database has an access control list associated with it. This is the basic security system. The ACL is hierarchical with seven levels of access preprogrammed, plus five privileges as defined by the database designer. You can assign access levels and permissions to individual users, groups or classes of users, or everyone. ACL levels range from full access to no access and include read-only and write-only access. You can easily change these access rights; thus, you can have an engineering database accessible to the engineering and manufacturing staff but off-limits to the marketing staff during a product's development phase, and then you can open the database to marketing when the product is ready to go into production.

You can encrypt individual messages. Each user's system ID includes public- and private-key information that can be used for this.

Hefty Requirements

Lotus Notes runs only on DOS or OS/2. For a Notes server, you need a 286-, 386- or i486-based computer with at least a 60-megabyte hard disk drive (40 MB for workstations), 10 MB of available hard disk space, and LAN Manager–compatible network hardware (e.g., IBM, 3Com, or Novell). You can use a CGA, EGA, VGA, Hercules, or IBM 8514 card. Lotus recommends at least a 386 and a 130-MB or larger hard disk drive for optimum performance.

The OS/2 version requires 5 MB of RAM; 8 MB is recommended. DOS requires 640K bytes of system memory with 490K bytes free after loading network and NetBIOS software, or 460K bytes free if you also have EMS 4.0. You can use OS/2 Standard Edition 1.1 with a Novell Requester or 3Com 3+Open package, or you can use OS/2 Extended Edition 1.1. A Hayes-compatible modem (preferably 9600 bps), an asynchronous communications port, and a direct-dial analog telephone line are required if the system is to be tied into a WAN over dial-up lines.

If you're using DOS, you'll need DOS 3.1 or higher. Microsoft Windows/286 2.1 or Windows/386 2.1 is optional. The Notes program includes a run-time version of Windows. The DOS version supports Novell NetWare 2.10 or higher, IBM PC-LAN 1.2, or 3Com 3+Share 1.3.1 or 3+Open 1.0 or 1.1. You don't need a mouse to work with Notes in either the OS/2 or Windows versions, but I recommend using one.

Client-Server Configuration

Notes is based on a Notes server. This is not a LAN server but, in most cases, a separate computer specific to the Notes program. The Notes server supports client workstations, and both the server and workstations are attached to a LAN. The Notes server can also have a modem connection to make it part of a WAN. Several servers can coexist on the same LAN, and multiple LANs can be interconnected as a Notes network. The client workstations require special Notes software to communicate with the Notes server.

Server maintenance is done directly on the Notes server computer through a

continued

Circle 286 on Reader Service Card (DEALERS: 287)

AUTOMATING ON A SHOESTRING

By Julie R. Caruso

Automating an office on a budget is a common challenge businesses face. The project can be particularly difficult when the company doesn't have the money to replace a diverse base of equipment and software that has been purchased randomly throughout its history, and needs to incorporate these resources into an integrated, smoothly functioning network.

A case in point is the automation of the Fulton County Planning and Economic Development Department in Atlanta, GA. Faced with a limited budget, an odd assortment of computer brands and models, a need to connect four individual departments with 30 users located in two buildings, and a growth plan that demanded a doubling of the initial network solution within a one year period, the County set to work finding the best solution.

"Our major concern was to be able to link all the existing, yet different, types of personal computers, future add-on personal computers, and dumb terminals into a cost-effective system," said Dr. June Woodward, who, as Director of the Georgia Systems Development and Technical Systems Department, oversaw the project.

Woodward turned to National A. I. Lab, Inc., an Atlanta-based national distributor of network solutions, for help. After carefully assessing the County's needs, Jim Williamson, president of National A. I. Lab, recommended a "hybrid" system that combined both shared and distributed processing using PC-MOS and LANLink 5X, both products from The Software Link.

"By combining both types of technology using products that are compatible with the broad base of hardware and software that the county already had in place, we gave them a solution that didn't cost a lot of money and allows the expansion they require," said Williamson.

In fact, the system cost more than $200,000 less than other alternatives the county considered. In three years the network has grown from supporting 30 users to serving more than 104 users through a combination of PC-MOS, LANLink and Novell's NetWare.

"In addition to saving us money, our network has dramatically increased our productivity," said Dr. Woodward. Our word processing capacity has increased by more than 200 percent, and we're doing much more of our work by computer because the network is accessible to everyone who needs it."

Julie Caruso is Managing Director and Director of Sales and Marketing for The Software Link, Inc.

World Radio History

PC-MOS

The Multi-User Solution For The Multi-Dimensional Company

Odds are, you're part of a multi-faceted organization, one that's involved in many different projects and activities. Every day you juggle dozens of tasks. So why are your PCs still doing one thing at a time — for one person at a time?

Today's 286 and 386-based PCs provide the power to do much more. PC-MOS is the multi-user, multi-tasking software that unleashes that power, making your PCs as multi-dimensional as your business.

Minicomputer Power For The Cost Of A PC!

PC-MOS lets several users simultaneously run different programs on a single, high-performance PC. One user can run a spreadsheet, while another uses the word processor and several others access a database — all at the same time! So instead of replicating expensive PCs, each user has an inexpensive monitor or terminal. The benefits are lower cost, more control, better security and consistency across applications. And at $595 for a 5-user version, you can afford to get started today!

DOS Compatibility, NetWare Connectivity

PC-MOS lets users run the popular DOS programs they use now — even Microsoft® Windows 286. Our gateway to NetWare lets you expand your Novell network inexpensively and easily. And PC-MOS requires no expensive wiring, and no network management headaches.

Proven Reliable With 100,000+ Users

Because PC-MOS was the first DOS-compatible multi-user operating system, it offers broad compatibility and the reliability of time-tested software. More than 100,000 satisfied users trust their work to PC-MOS each day. Our latest version features an easy-to-use install program, lets you re-boot individual workstations, and supports high-resolution, bit-mapped color graphics.

Call us today. We'll show you how to add multiple dimensions to your PC.

THE SOFTWARE LINK

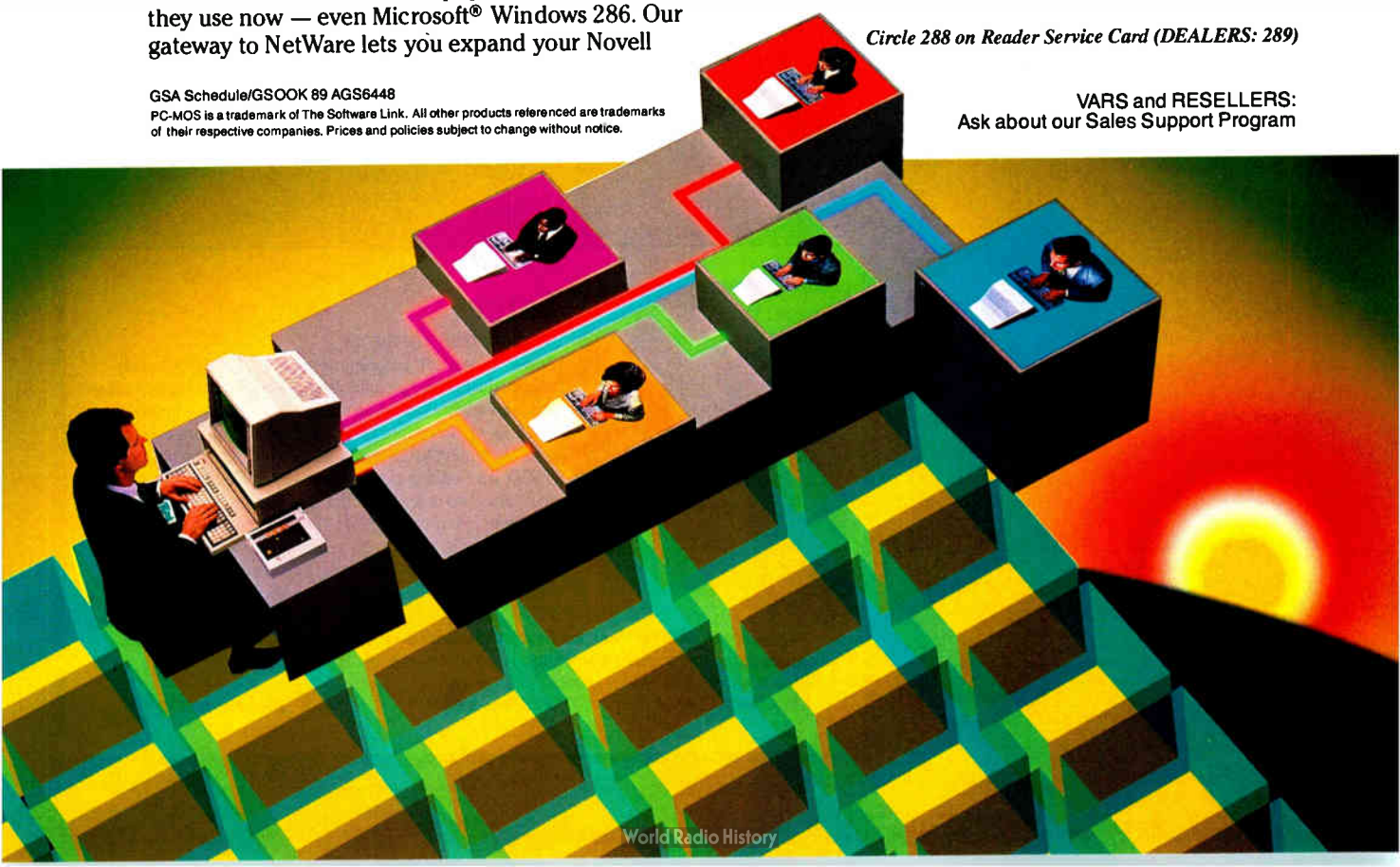
3577 Parkway Lane, Norcross, GA 30092
1-800-451-LINK, (404) 448-5465
FAX: (404) 263-6474 TELEX: 4996147 SWLINK

Circle 288 on Reader Service Card (DEALERS: 289)

GSA Schedule/GSOOK 89 AGS6448

PC-MOS is a trademark of The Software Link. All other products referenced are trademarks of their respective companies. Prices and policies subject to change without notice.

VARS and RESELLERS:
Ask about our Sales Support Program



World Radio History

2,783* Reasons

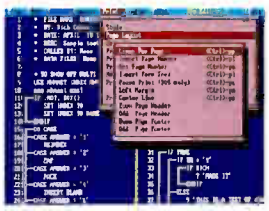
dBXL
by WordTech Systems

dBXL delivers more dBASE than dBASE III Plus providing the speed and flexibility users demand. dBXL language extensions give you windowing, graphs, relational file access - all designed to make you work smarter and faster! dBXL now includes WordTech R&R Relational Reportwriter for no additional cost.

LIST Price $249 **PS Price $209**

FastFaxts 971-003

Circle 209 on Reader Service Card.



Professional Edit
by Buzzwords

Professional Edit is a superior, menu-driven editor. It's simple to use and easy to learn; if you know Wordstar or SideKick, you know Professional Edit. Configure Professional Edit for dBASE or C or use it as a regular text editor. Features include: compiling in Professional Edit, multi-windows supporting multiple open files and users, match pair searches, macros, split-screen with zoom, help tables, and desktop publishing. Professional Edit supports DOS, OS/2, DESQVIEW, WINDOWS 386, AIX, SCO XENIX/UNIX, VMS, SUN, and many networks.

LIST Price $95 **PS Price $Call**

FastFaxts 966-022

QEdit TSR
by Semware

QEdit TSR is a fast, easy-to-use, full-featured, memory-resident text editor. When popped up, QEdit TSR swaps your current application out of memory into extended/expanded memory, allowing editing of files up to 400K. Requires only 9K DOS memory.

LIST Price $99 **PS Price $89**

FastFaxts 1353-006

Circle 210 on Reader Service Card.

386 DEVELOPMENT TOOLS

	List	Ours
386 Max	$ 75	$ 69
DESQview 386	220	189
FoxBASE+/386	595	479
High C - 386	895	875
Hoops exted. DOS MetaWare	795	759
NDP Fortran	595	549
NDP C	595	549
VM/386	245	229
WATCOM C8.0 386	1295	Call

AI-LANGUAGES

ARITY Combination Package	1095	989
PC Scheme LISP- by TI	95	85
TURBO PROLOG V2.0	150	119

ASSEMBLERS

386 IASM/LINK by Pharlap	495	Call
MS MASM	150	105
Turbo Assembler/Debugger	150	109
Visible Computer 80286	100	85

BASIC & ADD-ONS

BAS-C Commercial	495	439
dB/Lib	139	125
MS QuickBASIC V4.5	99	69
ProBas Prof. by Hammerly	149	Call
ProRef by Hammerly	50	Call
QBase	149	139
QuickPak Professional	149	139
Softcode/w Template	100	89

C LANGUAGE COMPILERS

High C-286 - by MetaWare	595	590
Instant C/16M	795	769
Lattice C - 6.0 Compiler	250	189
Microsoft C6.0	495	299
Microsoft QuickC	99	69
w/serial mouse	199	137
Turbo C - by Borland	150	109
WATCOM C7.0	395	Call
Zortech C	90	Call

CASE & PROTOTYPERS

Dan Bricklin Demo II	195	185
EasyCase Plus	225	209
EasyFlow	150	135
Instant Replay III	150	139
Matrix Layout - flow chart	200	179
MetaDesign by Meta Software	350	295
Pro-C w/Workbench Combo	399	349
ProtoFinish by Genesis	300	279
Show Partner F/X	395	279
Visable Analyst Workbench	Call	Call

COBOL

MS COBOL V3.0	900	639
Realia COBOL	995	859

COMMUNICATIONS ADD-ONS

C Asynch Manager 3.0	189	155
Essential COMM by S. Mtn	329	259
Greenleaf Comm Library	299	249
QuickComm	139	129

DBMS

Cause by Maxem	295	259
CLARION Prof. Dev. V2.1	845	549
dbFast Windows	495	415
D the data language	395	359
Magic PC	499	349
Paradox V3.0	725	479
R-BASE for DOS 3.0	795	499
Tas Professional	499	459

DBASE

Clipper Summer '87 MU	695	459
dBASE IV	795	499
dbFAST Windows	495	415
dbFAST/PLUS	345	325
dBMAN V	295	275
dBXL	249	209
Force by Sophco	695	395
FoxPro	795	495
FoxBASE + - V2.1	395	279
QuickSilver Diamond	599	399

DBMS TOOLS & LIBRARIES

AdComm For Clipper	295	279
Artful Lib	200	200
BRIEF w/dBRIEF	285	239
Buzzwords dAnalyst	295	269
CLEAR + for dBASE	200	179
dBase BlackBox	100	89
dBase Online - 6 pop-up refs.	149	129
dBX - dBASE III to C	550	529
dGE 4.0	295	279
dQuery MU	495	469
dSalvage	100	89
FLIPPER Graphics Library	195	179
FUNCky.LIB	195	179
Genifer - code generator	395	269
Net Lib	249	229
Pro Clip	149	125
R&R Relational Reportwriter	149	139
w/Clipper module	165	149
Scrimmage by Synergy	99	89
SilverComm Library	189	179
SilverPaint	100	100
Steve Straley's Toolkit	180	149
Tom Rettig's Library	100	85
UI Programmer Dev's V2.0	595	479

DEBUGGERS/DISASSEMBLERS

DASM	250	225
Dis Doc	130	119
Periscope IV	Varies	Call
RE:Source by Genesoft	150	119
SoftProbe	395	345

BRIEF
by Solution Systems

Power up with the programmer's editor. BRIEF 3.0 is an enormously powerful, astonishingly easy, and highly evolved program editor. You'll find features like infinite windowing, powerful regular expression searching, template editing and smart indenting for all major languages, and the ability to UNDO your editing step-by-step - up to 300 times! What you'll also find is an editor that delights in adapting itself to you. With menu-driven SETUP you can quickly customize indenting style, support for any of 36 compilers, keyboard configuration, and much more. You can even edit BRIEF macros to suit your taste. Or write your own in your choice of a C-like or LISP-like syntax.

"My purchase of BRIEF was the best investment I ever made... If you've ever wished that your editor could support any feature you might dream up, BRIEF is your solution."
Steve Gibson, Info World, 1/1/90

LIST Price $199 **PS Price $ Call** ***FastFaxts 732-005***

THE PROGRAMMERS SHOP
800-421-8006

World Radio History

limited set of commands available in server mode (on a character-based, not graphical, screen) and through a more extensive command set reached using the workstation software.

The first time you install Notes, you'll have a Lotus representative holding your hand as you learn the system. However, after six months, you'll be on your own, unless you get some sort of extended-support contract. To find out what life with Notes would be like without a service contract, the BYTE Lab installed its review system alone. The Notes server was a Tandy 4033LX 33-MHz 386 with 8 MB of RAM and an 80-MB Quantam SCSI hard disk drive. The operating system was MS-DOS 3.3, which was attached to a Novell network running NetWare 2.12A.

Configuring the server is a bit tricky. Using the workstation screens, you create a password-protected certifier ID; this is the master key to the Notes system. It's required to validate new Notes servers and users. Once you have the certifier ID, you move on to creating a domain, naming a server administrator, creating a name and address book for the server, and making a system ID for yourself. This is all done with fill-in-the-box screens, but it requires attention because much of the terminology is unfamiliar.

In theory, the installation of a Notes workstation is about the same as that of a server—fire up a floppy disk and follow the prompts. In reality, it may not be that easy. It wasn't at BYTE.

First, there is the question of memory. A lot of BYTE's computers don't have 490K bytes of memory free in their normal configuration, so the BYTE Lab had to adjust the CONFIG.SYS and AUTOEXEC.BAT files before anything could happen. This required some negotiating with users who were unhappy about losing TSR programs and drivers in the process.

Once enough memory was made available, the workstation installation proceeded smoothly, except for one bothersome glitch—Notes sometimes could not find NetBIOS on the workstation, even though NetBIOS was installed and running; this caused the installation to fail. Needed files were not transferred from the Notes server to the workstation. This requires either cleaning out the Notes directory entirely and starting from scratch, or editing the `notes.ini` file to delete all but its first two lines and starting the workstation installation process again. In either case, it's not something you'd do by choice at a 100-computer site. Lotus says that the problem is most likely caused by operating-system or network operating-system incompatibilities and would have to be diagnosed on a case-by-case basis.

Notes allows remote access over telephone lines. The idea behind this is to let field staff call in and use the Notes databases just as if they were in the office. Notes supports Hayes-compatible modems at speeds of from 1200 bps to 19,200 bps. The installation is simple point-and-shoot selection using Windows' radio buttons and check boxes—

The first time you install Notes, you'll have a Lotus representative holding your hand as you learn the system.

COM1, click; Auto (modem-speed select), click; enable port, click; OK, click. As easy as that. But the hardware end was a bit messier. Notes would not talk at all to the first modem that was tried (a Kyocera 1200-bps external unit). The BYTE Lab eventually got it talking to a Supra 2400-bps internal modem, but only after much switch-fiddling and initialization-string experimentation. Once the hardware and software recognized each other, life got easy again. Calling into Notes is, in fact, just like using Notes on a LAN—but slower. Lotus recommends 9600-bps modems for Notes, and using that speed can help.

User Notes

When you open a Notes workstation on your computer, you see a typical Windows screen with a menu-selection bar across the top and six tabbed, stacked file folders in the main text area. These file folders are your workspaces and basic organizational tools. They hold your address books and other databases. You'll find some icons in one of the folders—at least server and personal name and address books and a mailbox. You can open any of the icons as you would in any Windows application.

You can have many views of a database. Your mail, for example, could be organized by sender, date, or keyword. Notes comes with seven database templates and has an extensive language for creating your own.

Notes will also import and export data from other applications. It recognizes Lotus 1-2-3 and Symphony worksheets; ANSI Metafiles; .GMC, .GMF, and .PIC files; graphics pasted from the Windows or Presentation Manager clipboard; Lotus Agenda files; word processing files from Lotus Manuscript, WordPerfect, Microsoft Word, MultiMate, WordStar, DisplayWrite; and any program that generates a plain ASCII file.

One of the comments from the BYTE staff using Notes was that it's slow. But this is more of a perception problem than a performance problem. A quick-and-dirty benchmark test, loading and saving a 66K-byte database imported from Lotus Agenda, gave times of about 1½ seconds to load and 1 second to close in Notes. In Agenda, the same database took 1 second to load and 1½ seconds to close.

The Target of Notes

Notes is for large businesses. It carries a price tag of $62,500 and comes complete with installation help and training by Lotus representatives. You also get six months of maintenance and telephone hot-line support, and 10 sets of manuals.

That price may sound high, but if your business is large and you want a lot of Notes workstations, it comes out to a typical per-unit price for microcomputer software. Your $62,500 buys you licenses for 200 workstations. That comes to $312.50 per workstation. Additional licenses beyond the original 200 are $295 each and are valid for either a server or a workstation. There is a hidden cost, however. Like a LAN, Notes requires administration—one or more users to take care of it. The complexity of administration is up to the user.

If you can live with the lack of record locking in Notes, and if you have enough workstations to justify the cost, the program is worth a careful consideration. Notes's well-integrated collection of features should be easy for the nontechnical user to learn. And its ability to organize group discussions moves Notes far beyond any capability of regular E-mail. ■

George Bond is a consultant in communications—electronic, traditional print, and person-to-person. He has more than 20 years' experience with major information companies and is cofounder of BIX. You can reach him on BIX as "gbond."

World Radio History

Why Developers

dANALYST for C & C++
by Buzzwords

dANALYST for C and C++ can help you create, debug and document multi-user C source fast with Blocking Diagrams, Var and Function X-Ref and more! Network ready C source Generator for Relational Screen Painter, Report Writer & Menu Designer. Meets the Standard C conditions to run on DOS & Xenix/Unix & OS/2 & Novell.

LIST Price $295 **PS Price $269**

FastFaxts 966-001

Sourcer w/BIOS pre-proc.	140	129
sPORT by WHS	80	Call
Trapper	200	189
Zortech C Debugger	90	Call
DEVELOPMENT TOOLS		
AsmFlow	100	89

CLEAR+ For C
by CLEAR Software

CLEAR helps C developers understand and document their code by automatically producing these high-resolutions diagrams: program flow charts, multi-level tree charts, formatted source listings, function cross references, and prototype files. While it processes C applications, CLEAR analyzes program's logic and reports logical inconsistencies and syntactical errors. Also available for C.

LIST Price $199.95 **PS Price $179**

FastFaxts 873-006

Circle 212 on Reader Service Card.

CLEAR + for C	200	179
Codan	395	349
dAnalyst for C	295	269
Documenter	295	245
Inside	125	119
MKS Lex & Yacc	249	199
MKS RCS	189	175
Poly Doc-SU	199	179
PC-Lint	139	115
Plink w/LTO	695	619
PolyMake	149	135
PVCS Professional	695	659
.RTLINK - by Pocket Soft	295	279
.RTLINK Plus	495	419

Dr. Switch-ASE
by Black & White Int'l., Inc.

Dr. Switch-ASE turns any size Clipper application into a RAM Resident (TSR) program that occupies only 13K of RAM. Dr. Switch-ASE supports both Expanded and Extended memory and is full network compatible. Applications that include Dr. Switch-ASE may be distributed royalty free.

LIST Price $100 **PS Price $95**

FastFaxts 1178-006

Circle 211 on Reader Service Card.

Sbrowse	245	Call
Source Print by Powerline	99	97
TLIB	100	89
Zortech C++ Tools	150	Call
EDITORS		
BRIEF	199	Call
Cheetah	245	199
Edix	195	179
Epsilon	195	169
KEDIT	150	139
QEdit TSR	99	89
RimStar PM:Editor	195	179
Sage Prof Editor	295	249
SPF/PC - V2.1	245	199
Vedit Plus	185	139
EXPERT SYSTEMS		
Exsys Professional	795	695
Knowledge Pro Windows	695	589
Logic Gem by Sterling Castle	99	89
PC Plus - Texas Instruments	1995	1799
VP Expert	249	219
FILE ADD-ONS		
Accsys w/source	795	739
Btrieve ISAM - V5.0	245	199
Btrieve/N - multiuser	595	479
C-Data Manager	295	259
c-tree by Faircom - source	395	329
CBTREE	195	179
CodeBASE 4	295	279
C -Trieve	199	189
C-SQL/APIC	495	429
CQL - full w/ source	395	359
db_FILE/RETRIEVE - SU	295	279
UNIX or XENIX - MU	595	569
Faircom Toolbox Prof.	1095	889
Faircom Toolbox Special	695	539
XQL	795	649
WKS Library	195	189
FORTRAN		
FOR_C - FORTRAN '77 w/so	875	789
Fortran Opt. Compiler	450	309
Lahey FORTRAN F77L	595	549
Lahey Personal FORTRAN	95	Call
MS FORTRAN - CodeView	450	309

BLAST
by Communication Research

BLAST puts powerful data transfer, remote control, scripting, terminal emulation, datacompression, and other communications magic into one product for PC, Unix, Xenix, VAX, Macintosh, and even mainframe communications... all with the same look, feel, menu interface, protocol, and script language! Easy for developers to link into existing applications for automated, 100% error-free data transfer and fast, reliable remote control.

LIST Price $295 **PS Price $269**

FastFaxts 1674-001

GENERAL ADD-ONS		
C Tools Plus - V6.01	149	109
C Utility	185	137
Greenleaf Functions	229	209
Greenleaf SuperFunctions	299	239
Opt-Tech Sort	149	119
Turbo C Tools	149	109
GRAPHIC ADD-ONS		
Codemaster II	289	269
Essential Graphics	399	349
GraphiC	395	319
GSS Dev't Toolkit (Graphics)	595	525
Halo	395	279
Hoops	795	759
Matrix Toolkit 3.0	395	379
MetaWINDOW	250	209
MetaWINDOW/PLUS	325	289
PCX Programmer's Toolkit	195	179
HSC Sunscan	250	229
Sunshow Adv Image Toolkit	250	239
Sunshow C Image	250	229

Clarion Prof. Dev 2.1
by Clarion Software

A powerful, easy-to-use DBMS application developer, can cut development time by 50%. Imports/exports dBase, BASIC, and DIF files; interfaces with routines from C and Assembler. Includes Report Writer for creating ad-hoc reports and queries. Built-in LAN support: no run-time system required for distribution. Recent winner of PCWeek poll of corporations using programmable databases.

LIST Price: $845 **PS Price $549**

FastFaxts 1005-004

THE PROGRAMMER'S SHOP

800-421-8006

GERMANY: 011 49 0231/1766 170

MEMBER MMC of the Direct Marketing Association, Inc.

5 Pond Park Road, Hingham, MA 02043 • Canada 800-446-3846 • Mass. 617-740-2510 • FAX: 617-749-2018

Credit card orders processed ***only*** when product is shipped. All prices subject to change. Int'l. prices will vary. BY790

World Radio History

Call Us First.

Financial Mathlib
by Greenleaf

Financial Mathlib, an unprecedented C library, furnishes programmers with hundreds of financial functions, such as amortizations, cash flow analysis, statistical, and interest calculations. All these are performed without rounding errors, using Greenleaf's exact decimal math. C programmers can now write great financial software easily!

LIST Price $395 **PS Price $339**

FastFaxts 55-028

Microsoft C 6.0
by Microsoft

The long-awaited C 6.0 is an integrated system of powerful tools for professional DOS, Windows and OS/2 developers. Compiled programs are smaller and faster than with C 5.1; new Source Browser allows interactive browsing through a project database.

LIST Price $495 **PS Price $349**

FastFaxts 502-112

Cogent HyperBase
by Cogent Software

The ideal tool for creating intelligent hypermedia-based documentation. HyperBase hypertext, graphics, expert system capabilities of prolog & unlimited access to external programs. HyperBase is being used extensively for creating help desks, adaptive computer based training manuals and intelligent documents. No royalties with Developer Version. Requires MS-DOS, 512K memory.

HyperBase Dev. List $249 **PS Price $219**
HyperBase Pers. List $99 **PS Price $95**

FastFaxts 1353-006

Circle 213 on Reader Service Card.

NETWORKS		
dBXL/LAN	599	519
Netware SQL	595	519
Netware C Interface	295	239
OBJECT-ORIENTED/C++		
Actor	695	639
C Talk/views	450	419
C++ 80386 by Intek	495	469
Smalltalk/V	100	85
Smalltalk/V-286	200	185
Smalltalk/V-PM	495	469
Turbo C ++	200	159
Turbo C ++ Prof.	300	259
Zortech C ++	200	Call
Zortech C++ Debugger	150	Call
Zortech C ++ Dev. Edition	450	Call
OS/MS WINDOWS-SUPPORT		
C - Trieve/Windows	395	329
DESQview	130	109
Graphics Server SDK	495	479
MKS Toolkit - Unix shell	249	229
MS Windows/286	99	69
MS Windows/386	195	139
MS Windows Dev. Toolkit	500	319
OS/286 or 386	495	459
OS/2 PM Toolkit	500	369
OTHER LANGUAGES		
Modula-2 Dev. System	249	229
RPG II Dev. Systems	1600	1469
TopSpeed MODULA-2 Complr	100	89
StonyBrookProf. Modula-2	295	249
OTHER PRODUCTS		
386 Max Professional	130	119
Baler	495	399
Carbon Copy Plus	199	159
CO/SESSION	249	229
Dan Bricklin's PageGarden	100	89
The Duplicator Toolkit-Pro 3.0	129	119
Fastback Plus	189	159
File Shuttle	120	109
Flow Charting II Plus	229	179
Headroom	130	89
HiJaak	149	139
LapLink III	150	129
Link & Locate ++ - ROM MSC	395	349
Math Advantage	495	475
Norton Utilities Advanced	150	109
Paginate by Accumatics	99	89
PC Anywhere III	145	129
PC Tools Deluxe 6.0	129	109
PC Kwik Power Pack	130	119
Pizazz Plus	149	129
QEMM-386	100	89
Remote2	195	139
SpinRite II	89	Call
Time $heet	150	135
Coterm 220	245	219
TURBO PASCAL		
graphics-Menu	149	139
Turbo ASYNCH PLUS	189	169
Turbo Pascal 5.0 by Borland	150	109
Turbo POWER TOOLS PLUS	149	109
Turbo Professional	125	109
Turbo Programmer	300	269
TEXT SCREEN ADD-ONS		
AEWindows	499	459
C Windows Toolkit	100	89
C Worthy w/forms	295	Call
Greenleaf DataWindows	395	339
Hi-Screen XL Professional	325	289
JAM by JYACC	595	469
MEWEL	179	149
POWERSCREEN by Blaise	149	109
Vitamin C - source, menus	225	169
VC Screen - painter	149	139
Vermont Views-Obj+Source	890	819
UNIX/XENIX		
ESIX Systemss		
ESIX/V 386 Devlp (2 user)	595	569
ESIX/V 386 Devl unltd	825	769
Interactive Systems		
Application Devel. 2 user	1445	1349
Network Developer 2 user	1495	1399
Workstation Devel. 2 user	1995	1869
Workstation Starter 2 user	495	469
Santa Cruz Operations		
XENIX 286 Complete Sys.	1495	1279
XENIX 386 Complete Sys.	1595	1369
Recital	995	889
WordTech Quicksilver	995	839

WATCOM C 8.0/386
by WATCOM

WATCOM C 8.0/386 is 100% ANSI C optimizing compiler/runtime library for Intel's 80386 architecture, generating applications for 32-bit protect mode. Features include: protected mode version of the compiler; VIDEO full-screen source-level debugger; MS library-& source-compatibility; execution profiler; high proformance linker; graphics library; supports MetaWare High C 386 runtime calling conventions; SAA compatible.

LIST: $1295 **PS Price: $Call**

FastFaxts 1044-004

See our ad on page 189.

Form Publisher for Windows
by FORMWORX

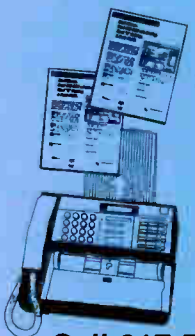
DTP software designed expressly for making forms. Uses unique object-oriented design techniques; incorporate text from other programs; add graphics in PCX, MSP, and TIFF, or scan in your own. Compile forms into HP macros to print from other programs. Over 550 standards forms included.

LIST Price $249 **PS Price $219**

FastFaxts 1493-010

What is FastFaxts?

You now have access to literature on any of our products via FAX machine. Free!



1. Call 617-740-0025 from your FAX machine's phone.
2. Follow the voice computer's instructions and enter your product's code number (listed in each product box or in our catalog).
3. Hang up the phone and await your instant printout of product literature.

Call 617-740-0025 from any fax phone!

*Total products currently sold by **THE PROGRAMMERS SHOP**. For complete catalog call 1-800-421-8006.

World Radio History

Call for
FREE Catalog!
Over 1,750
tools listed.

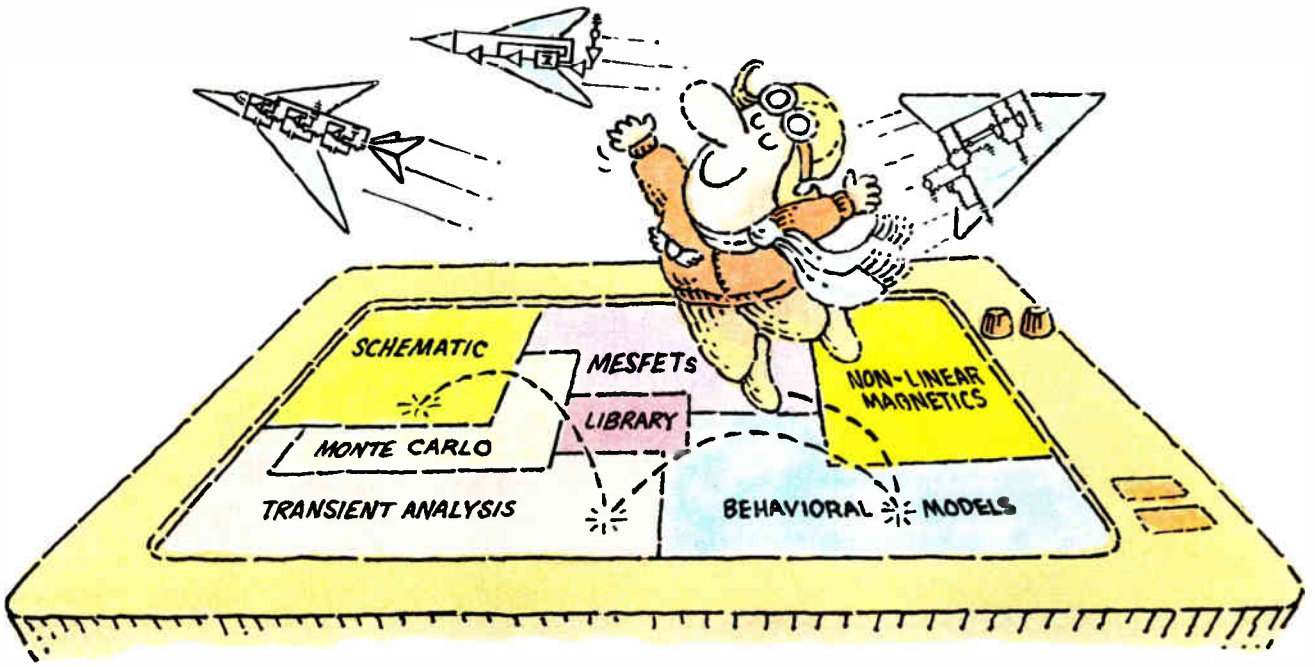
World's Leading
Source for
Development
Software

1-800-421-8006
Germany: 011 49 0231/1766 170*

THE PROGRAMMER'S SHOP

*International prices will vary.

World Radio History



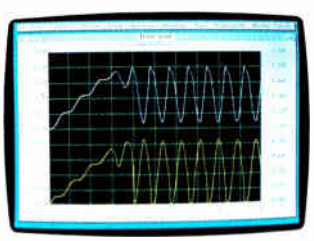
THE NEW MICRO-CAP III.™ SO YOU CAN TEST-FLY EVEN MORE MODELS.

It wasn't easy. But we did it. Made the long-time best-selling IBM® PC-based interactive CAE tool even better.

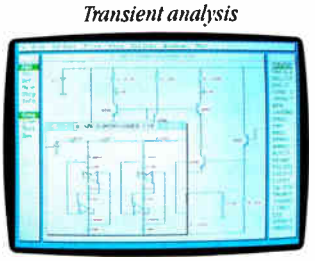
Take modeling power. We've significantly expanded math expression capabilities to permit comprehensive analog behavioral modeling. And, beyond Gummel Poon BJT and Level 3 MOS, you're now ready for nonlinear magnetics modeling. Even MESFET modeling.

Analysis and simulation is faster, too. Because the program's now in "C" and assembly language. That also means more capacity—for simulating even larger circuits.

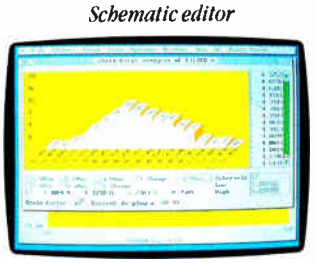
As always, count on fast circuit creation, thanks to window-based operation and a schematic editor. Rapid, right-from-schematics analysis—AC, DC, fourier and transient—via SPICE-like routines. The ability to combine digital/analog circuit simulations using integrated switch models and parameterized macros. And stepped component values that streamline multiple-plot generation.



Transient analysis



Schematic editor



Monte Carlo analysis

And don't forget MICRO-CAP III's extended routine list—from impedance, Nyquist diagrams and BH plots to Monte Carlo for statistical analysis of production yield. The algebraic formula parsers for plotting virtually any function. The support for Hercules, CGA, MCGA, EGA and VGA displays. Output for plotters and laser printers.

Cost? Still only $1495. Evaluation versions still only $150. Brochure and demo disk still free for the asking. Call or write for yours today. And see how easily you can get ideas up and flying.

Spectrum

1021 S. Wolfe Road
Sunnyvale, CA 94086
(408) 738-4387

Circle 266 on Reader Service Card

World Radio History

Computing Without Keyboards

205 **Smoke and Mirrors**
by Bill Buxton

215 **Living in a Virtual World**
by Scott S. Fisher and Jane Morrill Tazelaar

225 **The Spoken Word**
by Kai-Fu Lee, Alexander G. Hauptmann, and Alexander I. Rudnicky

237 **Telltale Gestures**
by Paul McAvinney

Coming Soon to a CAD Lab Near You
by Emanuel Sachs

243 **Sign Here, Please**
by Gale Martin, James Pittman, Kent Wittenburg, Richard Cohen, and Tom Parish

252 **From Hand to Mouth**

People are pretty amazing creatures, if you think about it. Most of us have five senses: sight, touch, taste, hearing, and smell. Most of us have two legs to provide mobility and two hands for manipulation (we even have opposable thumbs to facilitate the task). On top of it all, our species has one of the most highly developed brains on the planet, endowing us with an awareness and intelligence that enable us to handle complex tasks. But only recently have we begun to realize some of these talents and capabilities in how we interface with our computers.

The graphical user interface was the first step toward recognizing that we are more than the sum of our keyboards—but it was only the first step. Although we tend to associate the GUI with the Macintosh, it has actually been around longer than that. In "Smoke and Mirrors," Bill Buxton makes a case for moving on to bigger and better things. After all, the GUI and its requisite sidekick, the mouse, are limiting our input options by letting one of our hands go to waste.

One improvement would be to enter notes and rough sketches directly into your computer without keying them. While this doesn't use more of our abilities, it saves transcribing such things from a notepad to a screen, a mindless task if ever there was one. In "Sign Here, Please," Gale Martin, James Pittman, Kent Wittenburg, Richard Cohen, and Tom Parish discuss the merits and uses of interactive tablets that enable these activities. In fact, you can enter signatures directly into the computer, bypassing the hard-copy step completely.

Another input option is voice. Imagine being able to talk to your computer while you use your hands or eyes for other purposes. What a great way to take notes on a long report. In "The Spoken Word," Kai-Fu Lee, Alexander G. Hauptmann, and Alexander I. Rudnicky delve into voice interfaces, in both theory and practice. The voice interfaces of today have come a long way from those of the past.

No matter how you look at it, the screens of most microcomputers are flat—relatively, if not actually—and require that you work in two dimensions. True, some packages let you create three-dimensional models, but what you see on the screen is either a 2-D flattened image of the model or a 2-D slice of it. Spatial information can make a great deal more sense in 3-D than in 2-D. In "Telltale Gestures," Paul McAvinney looks at various 3-D input options. One of them, 3-Draw, is a design tool that lets you sketch in 3-D. Emanuel Sachs describes it in the text box "Coming Soon to a CAD Lab Near You."

Of course, the pièce de résistance is the virtual environment. Got work to do? Just jump right in and get your feet wet. That may be a slight exaggeration, but the concept is fantastic enough to make you check for wet socks afterward. Actually seeing in 3-D requires some sort of stereoscopic vision. In "Living in a Virtual World," Scott S. Fisher and Jane Morrill Tazelaar examine the 3-D world of virtual environments. No more flat images here. You can get right inside the computer and experience its images in full 3-D.

User interfaces must meet the challenge of using more of our human capabilities. If they do not, they will become candidates for computer museums while they are still in use. Many of tomorrow's technologies are available today. Strange as they may seem at first glance—I too am much attached to my keyboard—they will broaden and expand our horizons and capabilities to meet the challenges of the 1990s and beyond.

—Jane Morrill Tazelaar
Senior Editor, State of the Art

World Radio History

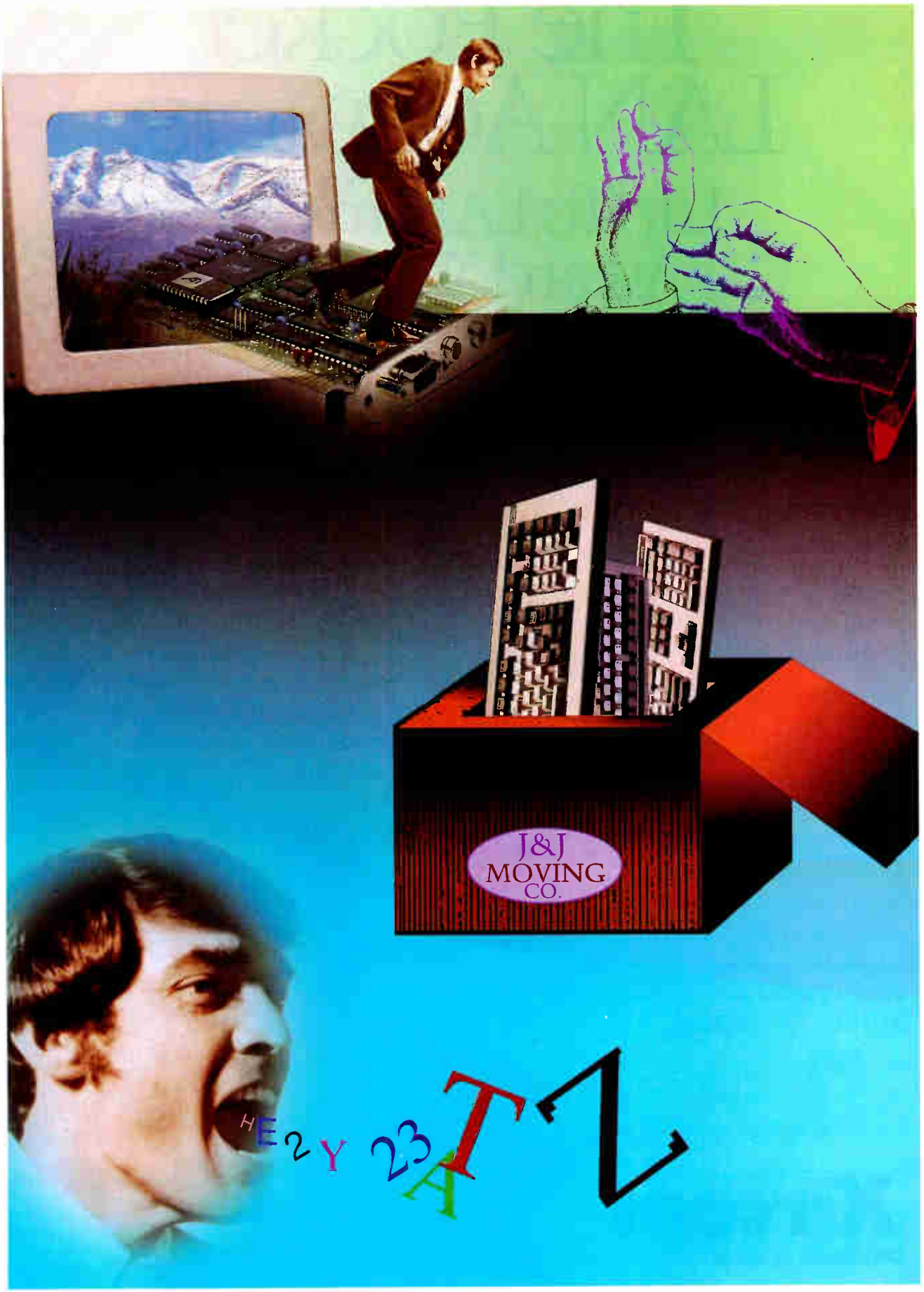


ILLUSTRATION: MARC YANKUS © 1990

World Radio History

Now Supports 3+ Open and Banyan

The Pocket LAN Adapters:

Lap To LAN In One Award-Winning Connection.

1989 BYTE AWARD OF EXCELLENCE

Why all the excitement? Because Xircom lets your laptop access a network wherever, whenever, and however you need it. Whether it's Novell, 3-Com, Banyan or most other operating systems running on Token Ring, Ethernet or Arcnet, the Pocket LAN Adapter gives PC users a quicker, easier LAN solution.

Our philosophy of universal connectivity combined with innovative technology has earned the Pocket LAN Adapters industry-wide recognition in a very short time. It all adds up to a faster, simpler LAN solution for laptop users. By connecting through the parallel port, a Pocket LAN Adapter gives you the freedom to choose whichever laptop fits your needs. It means no more slot problems, no address or interrupt conflicts, and no jumpers to configure.

LAN PRODUCTS OF THE YEAR

And with practically every protocol and operating system supported with certified drivers, there's a Pocket LAN Adapter that will fit your laptop and your pocket with its competitive price. So call (818) 884-8755 for an award-winning solution to your connectivity needs.

BEST of COMDEX BYTEWEEK Best Support Hardware Award FALL 1989

Xircom

LAN solutions for laptops.

22231 Mulholland Highway, Suite 114 • Woodland Hills, CA 91364 • 818/884-8755
Frankrijkei 28 • 2000 Antwerp, Belgium • 32(0)3 225.22.91

Circle 312 on Reader Service Card

World Radio History

Smoke and Mirrors

Every time I read about yet another GUI, I get this feeling of "déjà vu all over again." Isn't it time to move on?

Bill Buxton

Little question remains that computers are more accessible today than they have ever been before. Introduced by the Xerox Star and popularized by machines like the Macintosh, the graphical user interface (GUI) has had a huge impact on the usability, usage, and usefulness of computers.

But now, nine years after the Star's introduction, I feel locked in a time warp. This sensation is reinforced every time I read about yet another GUI. Each one triggers a familiar flash of déjà vu.

Don't get me wrong. I'm not complaining that the PC and Unix worlds are finally becoming fit for human consumption. I have the highest respect for the teams that invented the GUI, but I just can't accept that there are no more significant breakthroughs to come.

In an industry as new as ours, it's too early to rest on our collective laurels. We can do far better than the "we can do GUIs, too" attitude that is all too common today. We can explore and champion some of the emerging alternatives to the GUI—alternatives as creative and important in today's environment as the Xerox Star was in 1982.

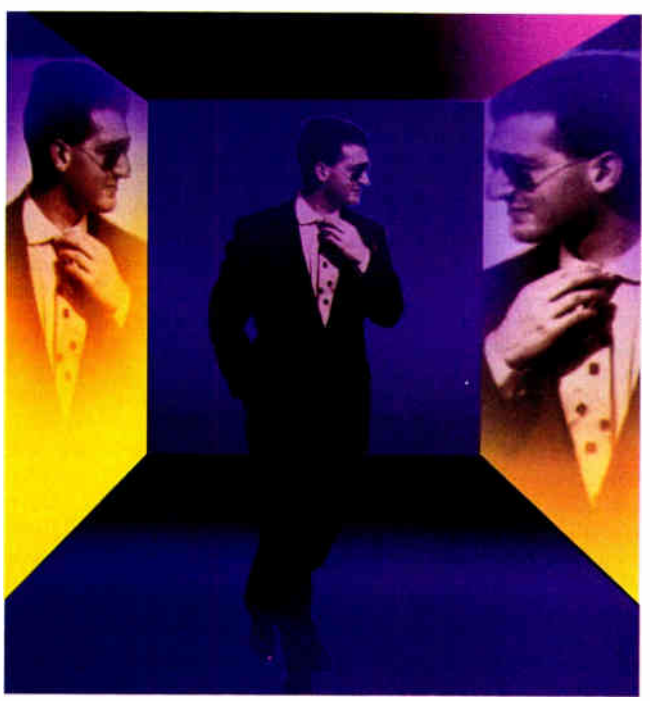


ILLUSTRATION: MARC YANKUS © 1990

In the Looking Glass

Rather than use a crystal ball to look into the future evolution of user-interface development, I prefer to employ a little smoke and three mirrors. Why mirrors? Because they are reflective.

Using the first mirror, you can ask, "How well does the system reflect the human motor/sensory system?" Does it acknowledge, for example, that most people have eyes, ears, feet, and *two* hands?

Using the second, you can ask, "How well does the design reflect the human cognitive or problem-solving mechanisms?" For example, does the system reflect how people think and make decisions?

Finally, the third mirror can test how well the technology reflects the sociopolitical structure of day-to-day life and work. For example, how does the technology reflect or support group activity or affect power structures?

Together, these three mirrors emphasize how user-interface design goes well beyond questions of how to best design menus, or whether to use a joystick or a mouse. To be truly effective, a design must provide a reasonably undistorted reflection from all three mirrors. Very few systems in use today stand up to this test.

Discussions of emerging or future systems tend to include the conflict between technology and user-driven design. Too often, change has been technology-driven, resulting in a tail-wagging-the-dog situation, which creates more problems than it solves. The loser in this conflict is usually the user.

continued

World Radio History

Despite the pitfalls, however, technology is an important element, not as a force to drive future development, but because of the opportunities that it affords. Knowing the technology can help you create a better match between what can be done and what needs to be done. However, you need to approach the problem from both ends simultaneously.

Look and Feel

The concept of "look and feel" has had a lot of attention recently. It encompasses those aspects of the user interface reflected in the first mirror—the motor/sensory system. Today's user interfaces have far more look than feel, and the use of sound is so impoverished that it does not even rate a mention.

Even the concept of "look" is impoverished. It is unidirectional and doesn't take into account the capability of the eyes to indicate direction (or to be used as an input device, as the photo illustrates). In short, the balance is out of all proportion with what people are capable of.

Technology may be able to render wonderful ray-traced images, but without mortgaging my house, I can't purchase a system that lets me draw a line whose thickness varies continuously with pressure (something I can do with a 15-cent pencil). One of the first priorities of the next generation of user interfaces, therefore, is to correct the imbalance that the first mirror reflects.

MultiSomething

Multimedia is another topic that inevitably arises when discussing emerging technologies. The discussion usually includes two principal components: (a) Multimedia is the future! and (b) What is multimedia? The resulting debate is generally more than a little confused.

Much of the excitement about multimedia is well founded. However, by definition, multimedia focuses on the medium or the technology rather than on the application or the user. Therein lies a primary source of confusion. If you take a user-centered approach, you quickly see that it's not the medium per se that is important. Rather, it is the human sensory modalities and the channels of communication that multimedia uses that make it different. Therefore, the following terms might be more appropriate and focused:

- *multisensory*: using multiple sensory modalities;
- *multichannel*: using multiple channels, of the same or different modalities; and
- *multitasking*: recognizing that people can perform more than one task at a time (as driving a car demonstrates).

Seen in this light, the real value of multimedia is the role that it can play in smoothing out the distortions seen in the first mirror. From this perspective, you can reverse the question from "Why do I need two-handed input or audio?" to "Since I have two hands and two ears, why doesn't this system permit me to use them to full advantage?"

The SonicFinder and Beyond

One of the most interesting pieces of software that is circulating in the research underground is something called the SonicFinder. It was developed at Apple Computer's Human Interface Group by Bill Gaver. The SonicFinder is a prototype of the Macintosh Finder based on the novel proposition that most people can hear. This may seem fairly obvious, until you look at the sonic vocabulary most computer systems use.

The SonicFinder uses sound in a way that reflects how it is used in the everyday world. You can "tap" on objects to determine their type (e.g., application, disk, and file folder) and their size (small objects have high-pitched sounds; large objects are low-pitched). When you drag an object, you hear a scraping sound. When a dragged object collides with a container (e.g., a file folder, disk, or the Trashcan), you hear a distinct sound.

All this may seem to suffer from terminal cuteness, but how many times have you missed the Trashcan when deleting a file, or unintentionally dropped a file into a file folder when dragging it from one window to another? Frequently, if you're like me. Yet these are precisely the kinds of errors that disappear when you add sound.

Machines that exploit sound are finally becoming more common. It started with the Commodore Amiga, which comes with rich audio and text-to-speech capabilities. Now, audio is becoming an important ingredient in other platforms (e.g., the NeXT machine). In fact, it is the major interface in some systems (see "The Spoken Word" on page 225).

The challenge is in learning how to use audio effectively, not just for music or to provide an acoustic lollipop, but as a means of providing a sonic landscape that helps you to navigate through complex information spaces.

A One-Handed Waterloo

Just as most people can hear, most can also manipulate items with two hands. Every day, you turn pages with one hand while you write with the other. You steer your car with one hand while changing gears with the other. You hold a ruler or drafting machine with one hand and use a pencil in the other. All these tasks require everyday motor skills that computer systems largely ignore.

It seems to me that the Macintosh was designed for Napoleon: Unless you are typing, you can work all day with one hand tucked into your jacket. This is great if you are one-handed, but a waste if you're not. The image of the user reflected in the technology is lopsided.

"Hands-on" computing is largely a myth. It would be better called "hand-on" or even "finger-on." To accurately reflect human potential, a system should let you scroll through a document by manipulating a trackball with one hand and using the other to point with a mouse. You should be able to scale an object using a potentiometer in one hand, while dragging it into position with the other. Or, in a program like MacDraw, you should be able to move the drawing page under the window using a trackball in one hand and keeping the "pen" in the other.

High-end interactive computer-graphics systems have used this type of interaction for years, but it has not yet penetrated the mainstream microcomputer market. This is about to change.

The Bus Stops Here

Many of the problems of having a variety of inputs are logistical: How do you connect this device to that machine? The Apple Desktop Bus (ADB) is a good attempt to address this class of problem. It provides an electrical, mechanical, and logical standard for connecting input devices to a computer. Thus, it becomes easy to mix, match, and change devices.

But perhaps the most important (albeit hidden) capability of the ADB is its ability to sense and distinguish among different simultaneously connected input devices. At the recent SIGCHI conference, Dan Venolia and Michael Chen of Apple's Human Interface Group demonstrated this capability using a mouse and a trackball together. The result was a prototype utility on the Mac that supported many two-handed transactions. This is a clear case of technology that supports human needs and suggests better things to come.

Handling the Pressure

Just using two hands is not enough, however. Another ability that people have that current technologies don't reflect is

World Radio History

the hands' ability to control and sense pressure. One place where this has been recognized and used is in electronic musical keyboards. Each key has what is known as "aftertouch"—the ability to sense how hard the key is being pressed.

Hopefully, aftertouch will soon be standard on mouse buttons, providing natural control for line thickness, scrolling speed, and the speed of fast-forward or rewind on videos and CD-ROMs. A few manufacturers, such as Wacom and Numonics, already make pressure-sensitive styli for digitizing tablets.

But no matter how well the look, feel, and sound of a user interface are developed, it still may not fit how you think or how you work; therefore, it will fail. Understanding these elements brings the second mirror into focus.

Data Overload

Would-be sages and futurists will tell you that we are in the middle of an information revolution—a revolution whose impact is matched only by the one that followed the invention of the printing press or the industrial revolution. Unfortunately, this is false.

By definition, information is that which informs and can serve as the basis for informed decision-making. Rather than an information revolution, the current situation is more of a data explosion. The combined advances in contemporary telecommunications and computational technologies have helped to spawn an era where true information is more and more difficult to find, and almost impossible to find in a timely manner.

Information technologies that deserve the name are less computational engines than technologies that filter and refine data into a form where it informs. Just as you want systems to reflect how you hear, see, and touch (the first mirror), you want them to accurately reflect and support how you think, learn, solve problems, and make decisions (the second mirror).

The spreadsheet is one of the greatest successes in the microcomputer world because it fits the way that people think about certain problems. Rather than generate masses of new numbers, it helps you refine data into information by enabling you to explore and understand new

continued

A nonintrusive eye tracker. A video camera mounted under the display tracks the position of the eye's pupil and translates the data into screen coordinates. Thus, the eyes can "point." (Photo courtesy of L.C. Technologies, Fairfax, VA)

Here's the world's

STEP*ns*

286/12

286/16

286/20

386*is*

World Radio History

relationships. A similar notion is behind one of the emerging "hot" topics of computer science: scientific visualization. Its objective isn't to make pretty pictures (although many are) but to render complex data in a visual form that enables you to better understand the underlying phenomena.

Thus far, scientific visualization has been primarily a means of presentation. Data is rendered and displayed, but the degree of interaction is minimal (largely due to the computational overhead of the rendering process). However, as machines become more powerful, such rendering techniques will be married to state-of-the-art input technologies, thereby creating rich interactive systems for exploring information space. (The technologies discussed in "Living in a Virtual World" on page 215 and "Telltale Gestures" on page 237 are examples of trends in this direction.)

Alone in the Corner

Back in grade school, when I misbehaved, I was taken out of the group and forced to sit alone, usually facing the wall or a corner. Now that I've grown up and have a computer, where do I find myself?—out of the group, sitting alone, usually facing the wall or a corner. The reasons are different, but the punishment is the same.

The designs of the technologies used in today's workplace have largely ignored the social dynamics (the third mirror) of how people work. You face walls because the backs of the machines are so ugly and full of cables that you want to hide them. You are anchored to your designated position by the umbilical cord connecting your computer to the wall socket. You sit alone because virtually all microcomputer systems assume that you interact with computers one on one, face to face.

Instruments of Change

Technologies have had a major impact on how you work, with whom you work, and who has what power. That isn't likely to change. What can change, however, is who or what is in the driver's seat.

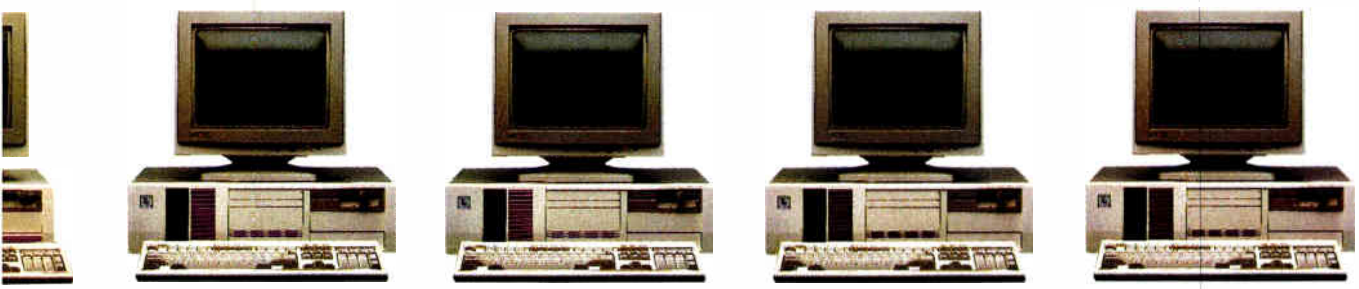
In the past, work has been automated and technologies introduced based on what was possible. If a new technology became available, it was put in the workplace and the organization had to adjust accordingly. Since routine tasks were the easiest to program, they were the first to have technological support.

Of all the user-related changes emerging today, perhaps the most significant is the change from this approach. We are beginning to realize that rather than the technology dictating the organizational structure, the organization should dictate the technology. The key to improved productivity isn't the technology—it's the people and how they work.

I can't overemphasize the importance of this change. No matter how perfectly your icons and menus are designed, or how well a system supports you in performing your job, if you are doing the wrong job, the system is a failure.

For example, putting computers into patrol cars is intended to help police perform their job. But if the technology causes the police to devote more time to relatively minor offenses (e.g., unpaid traffic fines) instead of to major crimes, the system may be a failure. The courts are clogged with minor offenses, and little has been done to help investigate serious crimes.

longest line of high perform



386/20 386/25 386/33 486*is*

EVEREX STEP Workstation, file server, stand-alone PC or node—whatever you need, it's in the Everex™ line.

And all these machines rank at or near the top of their class in performance benchmarks.

There are two main reasons. Zero wait-state design. And Everex's proprietary Advanced Memory Management Architecture (AMMA™). Thanks to AMMA, for example, the STEP 386/33 turns in a smoking 8.3 MIPS.

But if you think that's fast, take a look at Everex's 88000 RISC-based systems. At up to 21 MIPS, the STEP 8820 and 8825 guarantee the highest performance under both UNIX® and MS-DOS.®

Even the STEP*server*™ systems run like

STEP 486*is*, STEP 386*is*, STEP*server*, STEP 386*cis*, 286*c*, AMMA and Everex are trademarks of Everex Systems, Inc. 80386 and 386SX are trademarks of Intel Corporation. Other brand

World Radio History

A New Breed

The past 10 years have seen the development of a new profession: applied psychology. Traditionally, psychology has been a discipline that analyzed and tried to understand and explain human behavior. Now, largely due to problems encountered in human-computer interactions, a new branch of psychology is attempting to apply this understanding in the context of a design art. The shift is from the descriptive to the prescriptive.

Today, a similar phenomenon exists in the discipline of socio-anthropology. If you want the society and social structures of work (and play) to drive technology, the obvious place to look for expertise is in disciplines like sociology and anthropology. Like psychology, these are traditionally analytical, not design, disciplines. However, change is coming, and a new discipline is being born: applied socio-anthropology.

Hence, a new breed of anthropologists, such as Lucy Suchman and Gitte Jordan (who last studied birthing rites in Central America), are stalking the halls of the Xerox Palo Alto Research Center. They are studying the structure of organizations and work, with the intent of laying the foundation for a design art that takes into account the larger social context. Like psychology, socio-anthropology is becoming a prescriptive as well as analytical science.

Group Dynamics

Perhaps these social concerns are most visible in the rapidly emerging areas of computer-supported cooperative work and groupware (see the In Depth section of the December 1988 BYTE). This is a prime example of the outside-in squeeze. On one side, theory is growing out of the applied social sciences; on the other, important enabling technologies—such as LANs, new display technologies, and video conferencing—are emerging.

Architectures like Xerox's prototype System 33 will enable you to create, save, index, annotate, retrieve, and share documents independently of how they were created or stored. Human concerns, such as retinal consistency (i.e., documents' tendency to remain visually consistent) and the reality of different platforms, will drive the design.

Telecommunications, video, and computer LANs are converging, resulting in new forms of collaboration, such as the Cruiser system developed at Bell Communications Research by Robert Root and Bob Kraut, and Xerox's Mediaspace. By integrating a range of technologies, both systems permit a degree of telepresence and remote collaboration previously impossible.

Slowly but surely, the emerging technologies are going to let you come out of the corner to take a full and active role in the group. As all three mirrors start to work together, they will let you do what people do best—namely, be human.

Bringing Blue Sky Down to Earth

The danger in writing about technology and the future is that you quickly fall into the credibility gap. I have used some isolated examples to support my case for the inadequacy of the GUI to meet the needs of today and tomorrow. But are they only isolated examples, or is there some evidence of a new trend?

Evidence for a new approach to user-interface design can be found in machines such as the GridPad, Scenario's

continued

ance desktop computers.

8820

8825

STEP*server* 286

STEP*server* 386

wildfire. The STEP*server* 386, for example, combines a 33MHz 80386™ chip with AMMA, making it the fastest machine in its class. And they're both specifically designed for maximum performance and compatibility with Novell NetWare.®

But the Everex systems offer more than sheer speed. Most are upgradable. All come with a one-year extendable warranty and a one-year renewable on-site service contract that also covers all Everex peripherals in the system.

To find out more, call 1-800-334-4552.

We'll hand you the longest line in the world. And the best performing.

EVEREX

and product names are trademarks or registered trademarks of their respective holders. © 1990 Everex Systems, Inc.

World Radio History

DynaWriter, Toshiba's PenPC, Sony's Palmtop, and Go Corp.'s new laptop. All these machines have portability and on-line character recognition in common (see "Sign Here, Please" on page 243).

These differences lead the way to more than just a change of interaction style. By being portable, the machines are freed of the anchor of their power cord. The technology can go with the worker, rather than the worker going to the technology. This is an important change.

Similarly, compared to the GUI, the stylus-driven interface better matches the style of work and skills that people have built up over a lifetime of work and education. While the systems' recognition skills are still fairly primitive, this style of interface leads toward a way of capturing all kinds of spatial and temporal information, such as the types of figures and annotations found on blackboards and notepads.

Several different techniques have been used for symbol recognition, including template matching, feature recognition, and neural networks. An early but elegant feature-recognition technique, called *trainable character recognition*, was developed by K. S. Ledeen in 1967. It is described in detail in Newman and Sproull's classic *Principles of Interactive Computer Graphics* (McGraw-Hill, 1973 and 1979). [Editor's note: *Pseudocode for the Ledeen character recognizer is available on BIX. See page 5 for details.*]

Being mobile still may mean working alone. But the wireless network communications of the Agilis System point toward a time when mobile workstations will be able to communicate with each other, and with larger systems such as servers.

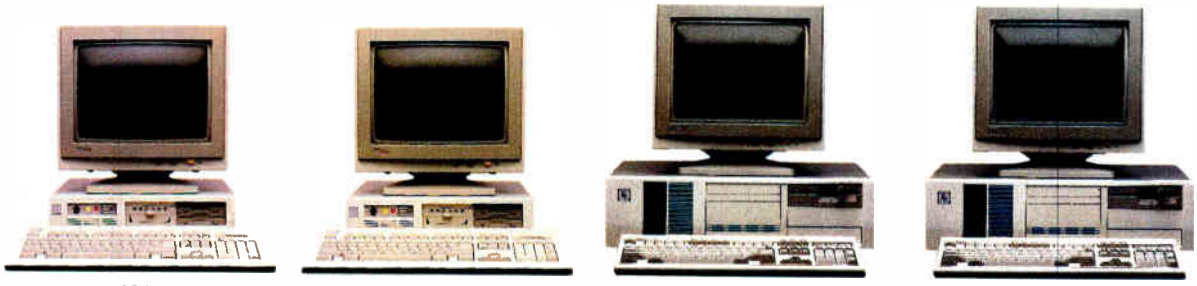
Perhaps nowhere do these concepts come together better than in the new portable from the Active Book Company in Cambridge, England. This package has true workstation power (5 million instructions per second average, 10 MIPS peak) in a portable package powered by the Acorn RISC Machine's RISC processor. In addition to having a stylus-driven interface with character recognition, it includes a touch surface that you can use to "thumb through" the documents you are reading or editing.

The true power and insight of Active Book's machine come, however, from other emerging technologies, especially the new Digital European Cordless Telecommunications standard. In mid-1991, there will be a new pan-European cellular phone network, known as D1, that will have a digital channel with built-in error correction. Portable workstations like Active Book's will be able to network from anywhere in Europe, even when in motion, thus greatly increasing the range and scope of both telecommunications and information technologies.

People should and must be at the center of all these new technologies. As these technologies evolve, the concerns become more complex and demand ever greater attention. But I would argue that there are grounds for optimism. As technologies evolve, so do the methods and theories of design and analysis. New capabilities are emerging, and if you and I so choose, we can reap their full potential by design in human terms. ■

Bill Buxton is an adjunct professor of computer science at the University of Toronto and a consultant for Xerox PARC and Commodore Business Machines. You can reach him on BIX c/o "editors."

And here's four more.



286*c* 386*cis* 486/25 486/33

The world's longest line just got longer.

The 286*c*™ and the 386*cis*™ are based on the 286/12 and 386SX™ processors. (The 286*c* is easily upgraded.) Both feature an attractive, low profile design. And zero-wait state gives them the high performance you expect from Everex.

The new STEP 486/25 and 486/33 are hot even by Everex standards. The 486/33, for example, clocks in at about 20 MIPS—well into mainframe territory.

To find out more, call 1-800-334-4552.

Better hurry. There's no telling how long the line will be if you wait.

EVEREX

Circle 98 on Reader Service Card

World Radio History

C Why dBASE programmers are excited!

Build a multi-user, 85K, dBASE compatible application using pulldown menus, popup windows, and data entry from pick lists.

Portable

When you are done, port your application to Unix, Microsoft Windows and OS/2 without modifying a single line of code.

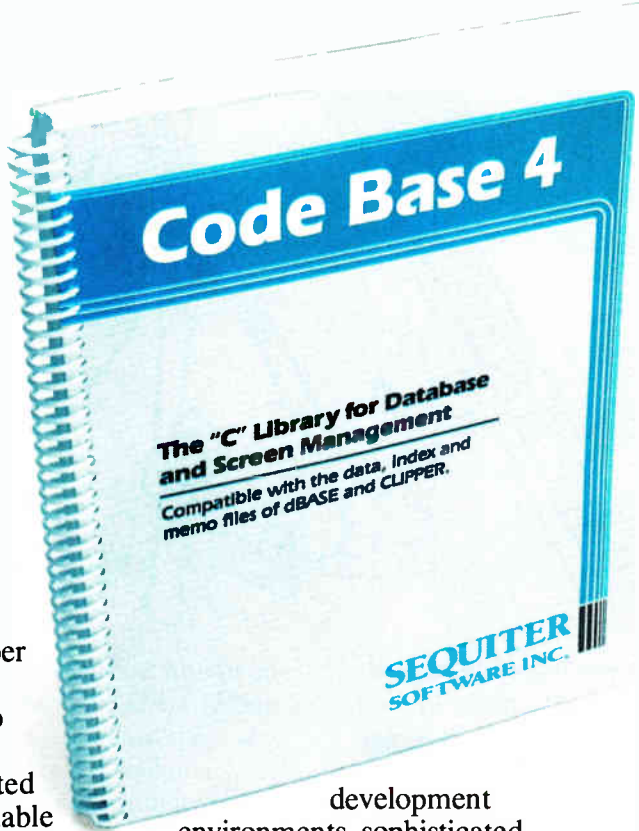
Then watch as your application runs many times faster than corresponding dBASE, Clipper or Foxbase programs.

Finally, you can keep all the profits after you have distributed unlimited numbers of your executable programs royalty free.

Compatible

Code Base 4 lets you access and modify the data, index and memo files of dBASE III, dBASE IV, or Clipper. Consquently, you can take advantage of dBASE compatible tools such as R&R Relational Report Writer.

Switch between Turbo C, Quick C, and Microsoft C. Take advantage of integrated development environments, sophisticated debuggers, and programs which compile and link in seconds.



Learn Code Base 4 by consulting the comprehensive 206 page user's guide while interactively executing Code Base 4 routines from a learning utility. Then try example programs from the diskettes or the user's guide. You will easily remember the Code Base 4 routines which correspond directly to familiar dBASE commands.

Source Included

As you become an expert Code Base 4 user, you will find yourself examining the source code as you read about the internal operating principles of Code Base 4.

Enjoy the benefits of complete dBASE functionality, including data entry, windows, menus, multiple index files per database, dBASE expression evaluation, fields, filters, relations, reindexing, and editing.

Order Today

Order Code Base 4 at $295 and you will soon know why Sequiter Software Inc. and most software dealers are happy to give a 30 day money back guarantee!!

Call (403) 448-0313
Fax (403) 448-0315

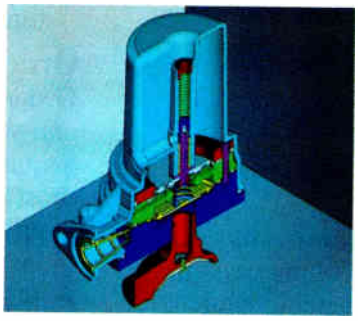
SEQUITER SOFTWARE INC.
P.O. Box 5659, Station L
Edmonton, Alberta
Canada T6C 4G1

Circle 258 on Reader Service Card

World Radio History

The IBM RISC System/
Designing on any other workstation

Whatever you're creating, you'll sail into a whole new age with any of the four POWERstations in the RISC System/6000 family. Because POWER (Performance Optimization With Enhanced RISC) processing can give you performance you've probably only dreamed about:



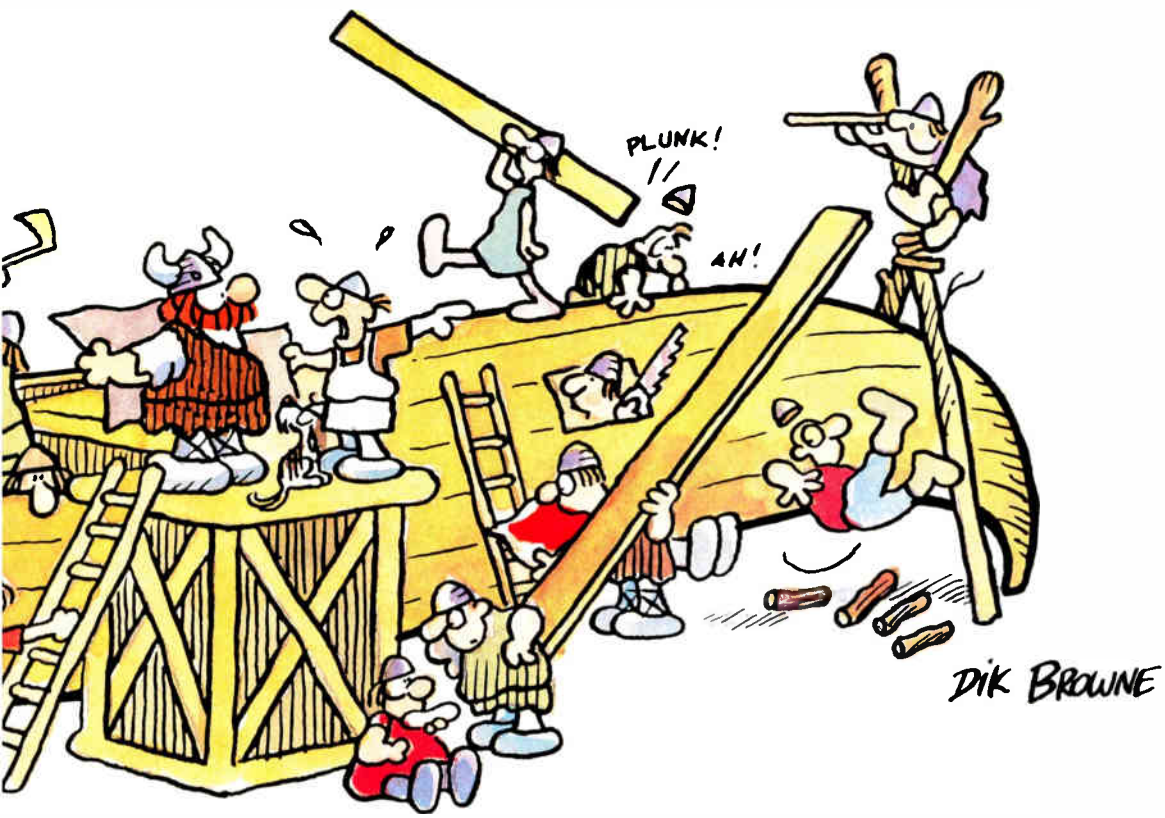
up to four instructions per machine cycle, 42 MIPS and 13 MFLOPS. Suddenly, complex designs don't take eons anymore.

The four RISC System/6000 POWERstations feature a range of graphics processors from grayscale to Supergraphics to satisfy any graphics demand. Great news for Power Seekers working on animation, scientific visualization, medical imaging and engineering solutions like CADAM,™ CAEDS™ and CATIA.™ And for electrical design automation, there's IBM's all new CBDS™ and an arsenal of over 60 EDA appli-

IBM is a registered trademark and RISC System/6000 and CAEDS are trademarks of International Business Machines Corporation. CADAM is a trademark of CADAM INC. CATIA is a trademark of Dassault Systèmes. CBDS is a trademark of Bell Northern Research Corporation.
HAGAR THE HORRIBLE Characters) © 1990 King Features Syndicate, Inc. © IBM Corp. 1990, all rights reserved.

World Radio History

6000™ family.
will seem downright primitive.

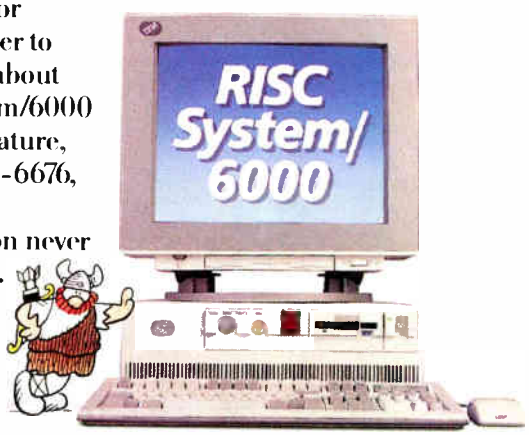


cations from more than a dozen vendors.

With every POWERstation, you can get an almost unimaginable palette of 16 million colors, which gives you 3D images so realistic, they fairly leap off the screen, with super sharp resolution of 1,280x1,024 pixels. And when it's time to call in the heavy artillery, the POWERstation 730 draws nearly one million 3D vectors per second. Like all POWERstations, it can come complete with its own graphics processor, freeing the POWER processor to rapidly create and analyze your designs. All at prices that won't sink anybody's budget.

So if you're tired of paddling upstream with yesterday's performance, call your IBM marketing representative or Business Partner to find out more about the RISC System/6000 family. For literature, call 1 800 IBM-6676, ext. 991.

Civilization never looked so good.



For the Power Seeker.

IBM®

Circle 119 on Reader Service Card

World Radio History

Recently Byte magazine performance tested 26 VGA monitors. 26! Of the 26, one monitor stood out above all the rest. In a burst of eloquence, Byte's Testing Editors called that monitor "a rose among the thorns." *

We call it the CM-1296

You'll call it "remarkable."

We'll send you a *free* reprint of the *Byte* article, complete specifications of the CM-1296, and detailed information about all the monitors in our line. Just send us your business card, or call 1-800-827-2850, ext. 213. Tatung Company of America, Video Display Division, 2850 El Presidio St., Long Beach, CA 90810

TATUNG®

Engineering at its best.

* S. Diehl, H. Eglowstein, BYTE, 3/90

Circle 276 on Reader Service Card

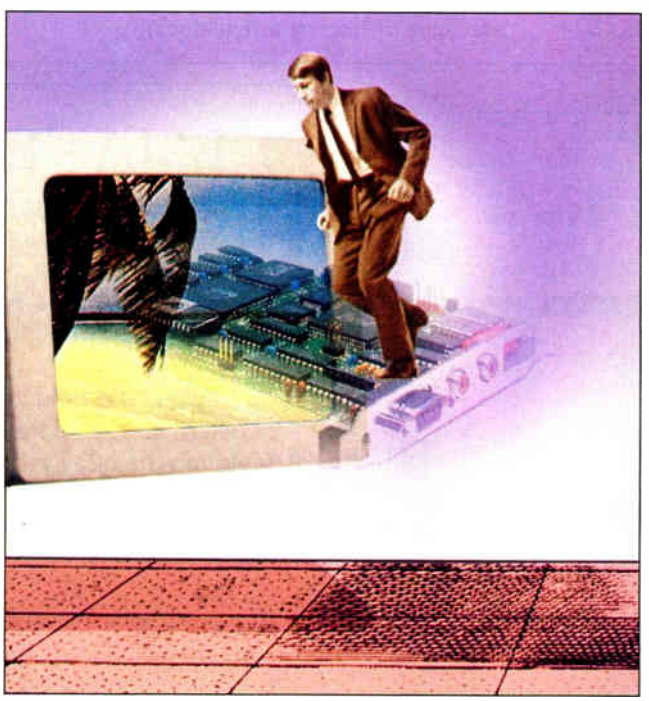
World Radio History

Living in a Virtual World

Stereoscopic vision lets you enter 360-degree 3-D virtual environments—and do real work there

Scott S. Fisher and Jane Morrill Tazelaar

Imagine learning about computers by taking a trip inside them. You can look to the left or the right as your whim dictates because you have a complete 360-degree image-surround viewpoint available. If a particular chip catches your eye, you can approach it and look at it from all sides. You can see firsthand how it connects to the board and how it relates to other chips. You can "walk" the circuits to see where they lead. If you see something that you don't understand, you can pick it up and examine it more fully. Sounds like *Tron*, doesn't it?



Imagine creating a three-dimensional model with a CAD package. But, instead of viewing it on a 2-D screen, you put on a headset or turn to a stereoscopic viewer and move into 3-D space with your model. You move around the model and into it, seeing it from all sides, looking for errors, making sure that what you created was what you intended to create, and fixing problems in real time.

Once again, science fiction is turning into science fact. Three-dimensional virtual space is becoming another option in the panoply of interfaces available. And the more you think about it, the more applications come to mind. Architects could tour their buildings during the planning stages, thus discovering problems while they're easily and inexpensively fixed. Doctors could practice delicate surgery without risk to the patient. Computer operators could enter a virtual data environment, manipulate data and monitor system tasks, move windows around in three dimensions, push simulated buttons on virtual control panels, or reconfigure the system as needed without leaving the console.

A variety of technologies enable this dimensional switch. One is the stereoscopic vision that allows you to see in three dimensions. In the real world, depth and distance perceptions are possible because we have two eyes, each of which sees the world slightly differently. To translate this ability to the virtual world, that perceptual difference must be maintained. Therefore, two screens are necessary, each of which provides a slightly different view of the subject. And for each eye to see only the screen containing its view of the world, these screens must be shown only to the appropriate eye. Head-mounted devices and stereoscopic viewers provide this type of interface.

A New Style of Headgear

One of the leaders in the research into head-mounted devices is NASA's Ames Research Center. The intent is to provide a multisensory, interactive, 3-D interface for use with the space program, but the resulting environments and devices

continued

ILLUSTRATION: MARC YANKUS © 1990

World Radio History

are far more versatile than that focus would suggest. The scientists at Ames have developed the Virtual Interface Environment Workstation (VIEW), a wide-angle, head-mounted, stereoscopic display system that the operator's voice, position, and gestures control (see photo 1). This system enables you to explore all 360 degrees of a virtual environment and interact with it in various ways.

The idea of surrounding an operator in a 360-degree virtual world is not new. In 1958, Philco developed a remote stereo-camera pair and head-mounted display. And Dr. Ivan Sutherland helped to create a head-mounted transparent 3-D display system while he was at Harvard. Some current head-mounted devices show a 2-D display to one eye while the other sees the real world. (See the text box "You Say You Want an Evolution" on page 218.)

The original head-mounted displays developed at NASA Ames were retrofitted into a motorcycle helmet. The visor contained two LCDs, one for each eye, with 100- by 100-pixel screens. The current headset, however, is much lighter and far less claustrophobic than this helmet was. The ultimate aim is to come up with a simple visor-like apparatus. Several devices on this order are currently in prototype. In addition to their 3-D display capabilities, they also include a head-tracking device, a microphone to be used for continuous-speech recognition, and earphones for 3-D sound cueing.

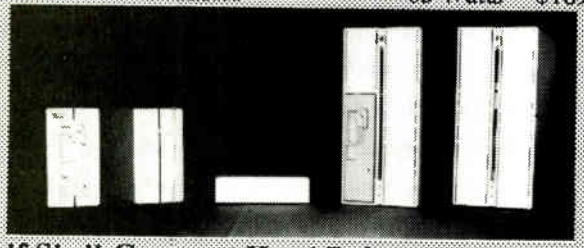
Photo 1: *VIEW is a wide-angle, head-mounted, stereoscopic display system controlled by the operator's voice, position, and gestures.*

The sense of entering a virtual reality is reinforced by the wide-angle image that can be generated in high resolution (up to 1000 by 1000 pixels). The image appears to surround you, and the head-tracking technology (with six degrees of freedom) enables you to change your point of view by simply turning your head. The effect is one of being present within a computer-generated (or remote-camera-recorded) world. To maintain this effect, the image is updated in real time (up to 30 frames per second) when it changes. In addition, the two displays are closely synchronized to present coordinated images to the eyes. Eye cups are used to prevent any ambient light from interfering with the illusion.

As the technology evolved, so did the desire to be able to interact with the virtual environment—to touch its objects, pick them up, examine them, and even speak to or about them. NASA Ames also developed enabling technologies that allow interaction with this virtual world. This interaction can be tactile (using touch-oriented technologies), verbal (using speech recognition), or optical (using eye-tracking technology).

continued

FAST SCSI STORAGE
Compatible with 286/386, Apple II, Tandy, Atari, Amiga, SunMicrosystem, Macintosh, Silicon Graphics, Next
A-Hive - Enclosure for SCSI Drives
•Room for 2-HH or 1-FH drive 30 Watts $119.
•Incl. all internal cables 65 Watts $169.



Half Shell-Compact Hard Drive (1.4"x5.5"x7.5")
low power 40MB $525
Hermit Crab-Portable Hard Drive (2.8"x5.5"x7.5")
32MB to 200MB 28ms to 12ms $399 .....
Hermit Crab Shell $69
SCSI Hard Drive 32MB to 760MB $299 .....
Cartridge Hard Drive 44MB $529
SCSI Tape Drive 50MB to 155MB $389 .....
2HD/4Floppy 286/386 Controller
1:1 16MHz MFM/RLL
XT/AT/286/386 SCSI/ESDI/MCA Controller
TULIN CORPORATION Tel:408-432-9025
2156H O'Toole Ave, San Jose,CA95131 Fax:408-943-0782

DEMAND QUALITY

You've heard all about those "Super-Big-Number-One" cartridges.

We've heard all about you wanting Solutions, not numbers.

Introducing the Solution *II* ™ series of font cartridges, featuring the quality, hand-tuned fonts, most requested by demanding laser printer users.

For those special needs, the Custom Solution *II* ™ cartridge is custom engineered for your unique requirements. Your Custom Solution *II* ™ cartridge will include fonts, logos, signatures or other graphic images.

Mitchell Pacific
Suite 1050, 10303 Jasper Avenue
Edmonton, Alberta Canada T5J 3N6
Phone (403) 425-0100 Fax (403) 420-0900

Circle 297 on Reader Service Card

Circle 165 on Reader Service Card

World Radio History

PERISCOPE® IV

THE *Real* REAL-TIME SOURCE-LEVEL DEBUGGER

With Periscope Model IV, you can debug your software while it runs at full speed, something *no* software-only debugger can do.

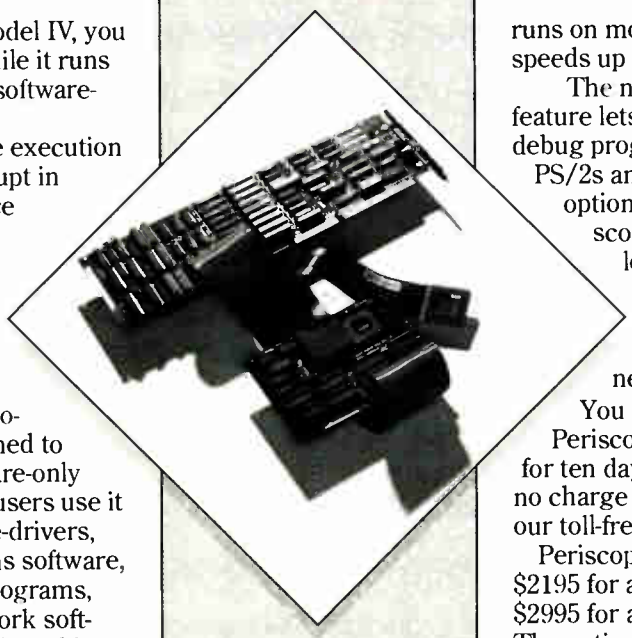
You can also examine the execution history of a hardware interrupt in Periscope IV's real-time trace buffer, something *else* no software-only debugger can do.

When The Going Gets Tough... Periscope IV helps you debug most any program, but is specially designed to debug programs that software-only debuggers can't. Model IV users use it to debug TSRs, ISRs, device-drivers, DOS, BIOS, communications software, real-time data acquisition programs, multitasking software, network software, keyboard drivers, disk caching software, systems software, spread sheets, EMM products, and so forth.

"Periscope is my #1 favorite program... I would rather change my editor than my debugger," writes Phil Mayes, who used Periscope IV to track down some very elusive bugs causing intermittent corruption.

Periscope IV provides source-level support for popular PC compilers and linkers, such as those produced by Microsoft, Borland, and others, and it runs on most any 80286 or 80386 at speeds up to 25MHz.

The new Remote Debugging feature lets you use Periscope IV to debug programs running on IBM PS/2s and compatibles. The optional Plus board keeps Periscope from using any of the lower 640K, so Periscope can't be overwritten and doesn't use the memory your program needs.



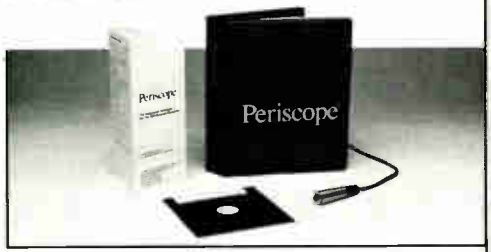
FREE 10-day Evaluation

You can try Periscope IV for ten days at no charge before you buy it. Call our toll-free number for details.

Periscope IV prices range from $2195 for a 16 MHz 80286 system to $2995 for a 25 MHz 80386 system. The optional 512K Periscope PLUS board is $400.

Given the value of your time, can you afford *not* to try it?

The Periscope manual, software, breakout switch and quick-reference card are included with Model IV.



"The Model IV hardware really makes Periscope shine, especially when you've got timing-related problems. I can now track down changing pointers and altered buffers on my 386. I've been using it to debug Crosstalk® Mk. 4 and there's just no better way to do it."

JEFF GARBERS
Director of Software Development
Crosstalk Communications

Call Toll-Free Today for More Information or to Order Your Periscope: 800-722-7006

In the UK call Roundhill Computer Systems at 0672 84 535. In Germany call H+B EDV at 07542 6353 or ComFood at 02534 7093. In Sweden call LinSoft at 013 124780.

The Periscope Company, Inc.
1197 Peachtree St., Plaza Level
Atlanta, GA 30361
404/875-8080 • FAX 404/872-1973

Circle 284 on Reader Service Card (DEALERS: 285)

World Radio History

You Say You Want an Evolution

Bob Ryan

Not all advances in man-machine interfaces involve radical new technology. Some advances are more evolutionary, although they can have revolutionary effects.

A case in point is The Private Eye, a computer monitor from Reflection Technologies (see photo A). Like the CRT display on your desk, it outputs characters and graphics from a personal computer. The difference is that The Private Eye weighs a mere 2¼ ounces and fits easily in the palm of your hand.

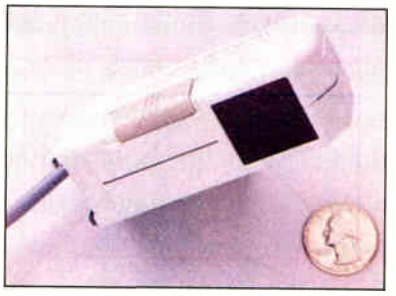


Photo A: *The Private Eye computer monitor is more useful than it may first appear. It lets you view important data while simultaneously working on tasks, and it provides the ultimate in portability.*

Red Lights and Mirrors

The Private Eye uses a 280-element LED, an adjustable lens, a vibrating mirror, and the persistence of your vision to produce a 720- by 280-pixel display in a viewing window less than 1 inch square. It produces CGA text using a 9- by 11-pixel font instead of the normal 8 by 8, and standard 640- by 200-pixel CGA graphics.

Unlike a conventional CRT display, which "paints" its output 1 pixel at a time from the top left to the bottom right of the display, The Private Eye works with whole columns of pixels at once. When attached to a personal computer, for example, it gets each output frame from its specialized display-adapter card and stores the frame in a buffer. It then uses the data for the first column of the display to activate its 280-element LED. A mirror reflects this output into a lens, which focuses it onto your eye.

Next, the second column of the display activates the LED, while the mirror changes angle slightly so that the second column is reflected to the right of the first. It repeats this procedure for all 720 columns of the display, 50 times per second. Because your eye fools your brain into thinking that it sees all 720 columns at the same time, you see the complete 720 by 280 display.

Focal Points

Because The Private Eye uses a lens instead of a screen, you can focus its output to appear close at hand or far away. This is important, because The Private Eye works with one eye only. To prevent eyestrain, you focus both eyes on the same object and then focus The Private Eye so that it appears as far away as the distant object. The output is thus superimposed over the background.

Because you don't constantly change focus between your display and the background, The Private Eye lets you work at other tasks while viewing important data. With the headset attachment, it also frees your hands for other tasks. For example, a surgeon could position The Private Eye for viewing vital patient information with an upward glance without breaking concentration.

In addition to providing freedom for hands and eyes, The Private Eye also obviously redefines the lower limits of portable computing. Systems using it promise to make vest-pocket computers a practical reality. The Private Eye can also enhance the utility of products that don't currently have a full-size display. For example, it can add display capability to a hand-held fax or a radio pager.

Changes in Perception

While The Private Eye uses some very interesting technology, it does not represent a new paradigm for getting information from a computer. It remains a recognizable member of the family of computer displays.

What The Private Eye demonstrates is how an evolutionary advance in technology can change how we interact with computers. By making displays more portable and less obtrusive, it makes many more areas accessible to computers. Imagine what the next evolutionary advance will bring.

Bob Ryan is a BYTE technical editor. He can be reached on BIX as "b.ryan."

It's What's Inside That Counts

Within the headset, the twisted-nematic, monochromatic LCDs accept a standard National Television System Committee signal and need some sort of backlighting (current versions use very bright, miniature fluorescent tubes that create a contrast ratio of about 7 to 1). The current size of each display is 3.9 inches (on the diagonal) with a 4-to-3 aspect ratio.

LCDs were used because they are lightweight, safe, and inexpensive, and they draw little power. Their resolution at present is 640 by 220 pixels with approximately 16 levels of gray scale. They are viewed through a pair of wide-angle magnifying lenses mounted about 5 millimeters from the screens. These lenses distort the displayed image with a "pincushion" effect. To compensate for this distortion, the image capture or generation technology must create a "barrel" distortion compensation in order to represent the image correctly.

The very wide-angle field of view of these optics is also key in the display. The feeling of being in a virtual world requires that the field of vision closely resemble that of human binocular vision. A small window into the virtual world will not suffice. The displays must completely fill your field of vision to give you a true sense of being present in the virtual environment (120 degrees both horizontally and vertically, with up to 90 degrees overlap in the binocular fields).

The headset also contains a tracking device that detects where within the environment you are looking. Currently, NASA Ames is using an electromagnetic device for this purpose, one that can determine where the head is within a magnetic field. It combines azimuth elevation and roll information with x,y,z position information (with 0.03-inch resolution and 0.10-degree accuracy). With this information, the system can refresh the image shown to one that matches the position of your head. New images are drawn so quickly that it feels as if you're

continued

World Radio History

How to plan your LAN.

You'll need a pencil.

That's to write down the telephone number on the bottom of this page. Which will connect you with Samsung's nationwide network of resellers. And the Samsung/Novell co-labeled line of LAN hardware.

With one call you can plan on substantial savings over the big name computers which, despite high clock rates and even higher price tags, are not really optimized for networking.

And you can plan on 100 percent compatibility with all versions of Novell's NetWare®, because Samsung's LAN hardware was co-designed by Novell.

THE TESTING WENT IN BEFORE THE LABEL WENT ON.

Samsung's 386AE and PCterminal/286 have been tested exhaustively and certified by Novell for compatibility with all popular networking products. In fact, Samsung's 386AE is one of 3 fileservers certified by Novell to run NetWare 386.

Novell's engineers successfully tested the PCterminal/286 in 1200 network configurations...with 50 units running at once! No other computer manufacturer can make that claim.

NETWORKING VS. NOTWORKING.

What's the difference? Take our 386AE Fileserver. It includes Novell's Advanced BIOS and 8 expansion slots to accommodate multiple network interface cards and disk controllers. Plus an oversize power supply for driving dual high capacity hard disks and tape backup system. Plus 4 megabytes of memory for disk caching.

Then there's Samsung's PCterminal/286 Diskless Workstation with a built-in Ethernet interface and Remote Boot EPROM.

And not to be overlooked is our 16-bit SE2100 Ethernet Interface Card which provides up to twice the throughput for the price of an 8-bit card.

CALL TODAY.
For the name of the Samsung reseller nearest you, call us today at **1-800-624-8999, ext. 851.**

WINNER OF LAN TIMES READERS CHOICE SAMSUNG/NOVELL PCterminal/286

The 386AE and PCterminal/286. More than affordable. SAMSUNG

©1990 Samsung Information Systems America, Inc. Novell and NetWare are registered trademarks of Novell Inc. PC is a registered trademark of International Business Machines Corporation.

Circle 247 on Reader Service Card (DEALERS: 248)

World Radio History

An Alternative Approach

The counterbalanced CRT-based stereoscopic viewer provides an alternative virtual-environment viewing technology that should be easier to integrate into the typical desktop environment than the head-mounted device. Its display characteristics are similar to those of the headset. However, the CCSV sports handles with which you can move it around to a convenient position, much as you would a pair of binoculars (see photo B).

Although the CCSV is not head-mounted, it is head-coupled. The device is mounted on a counterbalanced kinematic linkage (permitting unrestricted motion within a 35-inch radius from a fixed point of attachment) and includes a dual-CRT-based stereoscopic viewer with wide-angle optics, a dedicated microprocessor system that monitors joint angles in the linkage, and a video-electronics box.

The device includes a dedicated 8088 microprocessor card, an A/D conversion card, and an RS-232C communications card housed in an STD-bus box. The software that is executing on the microprocessor polls the RS-232C line waiting for data requests from the host. When a data request comes, the STD system assembles the current values of the six A/D channels (one for each of the joint readings that the host translates into angles) into a 12-byte packet. Then it sends this packet over the RS-232C interface to the host at speeds of 9600 bps to 19,200 bps. (In the next version of the CCSV, NASA Ames is planning to replace the STD box with an IBM PC or AT.)

The CCSV provides a wide field of vision, 360 degrees of freedom, and a strong three-dimensional illusion, and it lets you easily enter and leave its virtual world. Imagine how awkward it would be to try to take a quick peek at something through a head-mounted device.

How Does It Differ?

This viewer uses two inexpensive ($50) black-and-white TV screens (4½ inches on the diagonal and with a 4-to-3 aspect ratio) with integral implosion protection and meeting radiation x-ray emission standards. CRT faceplates are flat (within 0.006 inch) for both internal and external phosphor-bearing surfaces. In this case, flat matters; the optics of the CCSV were designed assuming a flat-image source.

The CRT screens display about 400 lines each. While this resolution is quite modest, compare it to the headset's LCDs (about 220 lines each). The color mask used by current color LCDs further reduces their effective resolution by more than 50 percent, so the improvement in the resolution is quite noticeable.

Photo B: *The CCSV, a stereoscopic viewer fixed on a counterbalanced kinematic linkage, lets you easily enter and leave the virtual world.*

You can place diffusion filters in front of the LCD to reduce the graininess, but they blur the images. The filters also blend the color triads. Since the CRTs in the CCSV are analog devices, they have no shadow mask. Thus, individual pixels appear as a smooth image rather than as an array of dots.

But It's Not Perfect

The optics in the CCSV introduce a chromatic aberration that appears more pronounced than that in the LCD viewers. It is particularly noticeable along the borders of computer-generated images; the change in contrast creates a blue or yellow fringe effect. This is probably due to the increased contrast ratio of the CRTs. Using color CRTs wouldn't solve the problem, because the shadow mask would be visible through the wide-angle optics.

The CCSV also suffers from the pincushion distortion seen in the headset. Again, this distortion is balanced with an equal but opposite barrel distortion when using a remote camera. Computer-generated graphics, however, don't compensate for this problem, but it's not as distracting as you might think. You have to really look to find it.

Another problem with the CCSV occurs in a group work environment. As you pass the device from one person to another, the viewpoint changes. It would be nice to have some sort of "viewpoint freeze" button on such a unit so you could easily pass the device to someone else and know that he or she will see the exact same point in a 3-D image that you were looking at.

really there (the typical pixel response time is about 32 milliseconds).

There are some disadvantages to the headset approach. For one, while you're wearing a headset, you're pretty well tethered to one place. For another, it's more complicated to switch back and forth between different tasks if you have to take off the headset every time you want to see something outside the virtual world. And you may need to view some things in higher resolution than the current LCD-based headsets allow. Thus, a separate CRT-based stereoscopic viewer was developed to supplement, and in some cases replace, the headset (see the text box "An Alternative Approach" above).

Another technology under investigation at NASA Ames is eye tracking. Eye tracking will reveal the point at which your eyes converge—that is, where they are focused. Thus, you could pull down menus or move a cursor simply by looking at a certain point. In addition, the options for depth-of-field information increase when eye tracking is used. (For more information on eye tracking, see "Between Man and Machine," September 1988 BYTE.)

Plans for the VIEW system's near future include

- correcting the distortion problem on computer-generated images,
- speeding up the frame refresh rate,

World Radio History

- raising the resolution,
- adding color display elements,
- adding spatially correct 3-D sound cueing,
- providing tactile feedback,
- integrating multiple viewpoints, and
- creating multiple workstation configurations that allow the various operators to be present and interactive in the same virtual environment.

A Portable, Interactive Workspace

Unlike most 360-degree virtual environments, such as flight simulators, VIEW doesn't use large, special-purpose projection configurations. It is portable and inexpensive and doesn't require a large amount of space or equipment. Compared to other head-mounted displays, it is unique; it presents a stereoscopic image that is very similar to human binocular vision. It also uses state-of-the-art speech, auditory, and tactile inputs.

The VIEW system provides a level of interaction that can reduce your workload and training requirements while increasing your productivity. It does this by providing a uniform, graphical interface for a variety of tasks, and multimodal channels for speech, touch, and vision inputs. Seeing task-related information in a full 360-degree 3-D environment can increase your awareness and effectiveness in monitoring spatial tasks and spatial portrayals of 2-D tasks. ■

BIBLIOGRAPHY

Fisher, Scott S. "Virtual Interface Environments." *The Art of Human-Computer Interface Design*. Brenda Laurel, ed. Reading, MA: Addison-Wesley, 1990.

Fisher, S. S., E. M. Wenzel, C. Coler, and M. W. McGreevy. "Virtual Interface Environment Workstations." *Proceedings of the Human Factors Society, 32nd Annual Meeting*, 1988.

McDowall, E., M. Bolas, S. Pieper, S. S. Fisher, and J. Humphries. "Implementation and Integration of a Counterbalanced CRT-based Stereoscopic Display for Interactive Viewpoint Control in Virtual Environment Applications." In *Stereoscopic Displays and Applications*. John Merritt and Scott Fisher, eds. *Proceedings of the SPIE 1256*, 1990.

Scott S. Fisher is a research scientist at NASA's Ames Research Center (Moffett Field, CA). You can contact him on BIX c/o "editors." Jane Morrill Tazelaar is BYTE's senior editor in charge of the State of the Art section. You can contact her on BIX as "janetaz."

THE SOLUTION

. . . to your data collection and data entry problems!

The Psion Organiser II & dCAPP

Psion Gives You the Answers!

With eight different Organiser II models to choose from, Psion lets you select the Organiser II that best meets your needs. Standard configurations are available with or without built-in software programs, and provide the options of either two or four lines of LCD display, several different keyboard designs, and from 32K to 96K of internal RAM memory. All Organiser units can use our removable and interchangeable memory modules, allowing the Organiser II to be configured to meet your unique data and program memory requirements.

POWER

The Organiser II is a powerful hand held computer capable of running a broad range of prewritten programs. When an off the shelf program just won't due, you can custom program the Organiser II to the unique requirements of your application. From inventory control to remote sales order entry, the Organiser II has the power to do the job.

PERIPHERALS

For jobs ranging from simple data collection to an RS-485 factory floor network, the Organiser II has the right tools for the job. Peripherals include Bar Code Wands, Laser Scanners, Mag Card Readers, Portable Modems and Printers, Carrying Cases, all the way to a broad range of interfaces which include serial, parallel and multiple types of SPC devices.

dCAPP Gives You the Solution!!

• dCAPP data collection software is completely user configurable allowing even non-programmers the ability to create their own custom data collection program for the Organiser II in a matter of minutes, including its own operating instructions manual. • dCAPP data collection software is completely user configurable. Keyboard, Magnetic Card, or BAR CODE input. • Direct Interface to most Database and Spreadsheet programs; (dBASE 3, dBASE 4, Lotus 123, D.I.F., and many others).

TYPICAL APPLICATIONS: Inventory Control; Stock Taking; Tools and Equipment Control; Sales Route Accounting; Quality Control and Inspection Reporting; Tank Farm Gauging; Stores Accounting; Plant Inspection; and More . . .

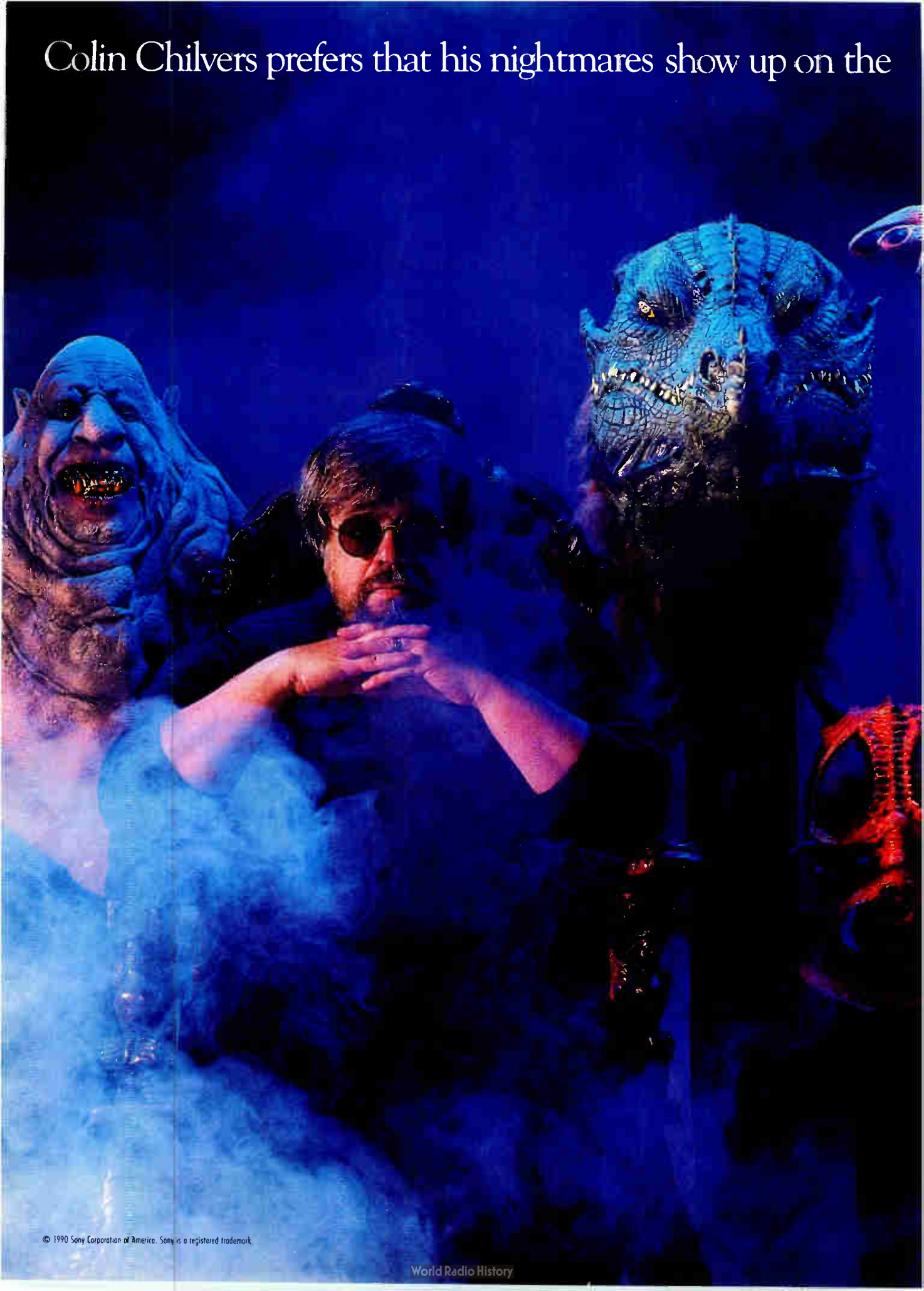
For more information, contact:

XEC Products
13630 58th Street North, Suite #103
Clearwater, Florida 34620
(813) 531-1422

Lotus 123 is a registered trademark of Lotus Development Corp.
dBASE is a registered trademark of Ashton Tate Corp.
IBM-PC is a registered trademark of International Business Machines Corp.

Circle 310 on Reader Service Card

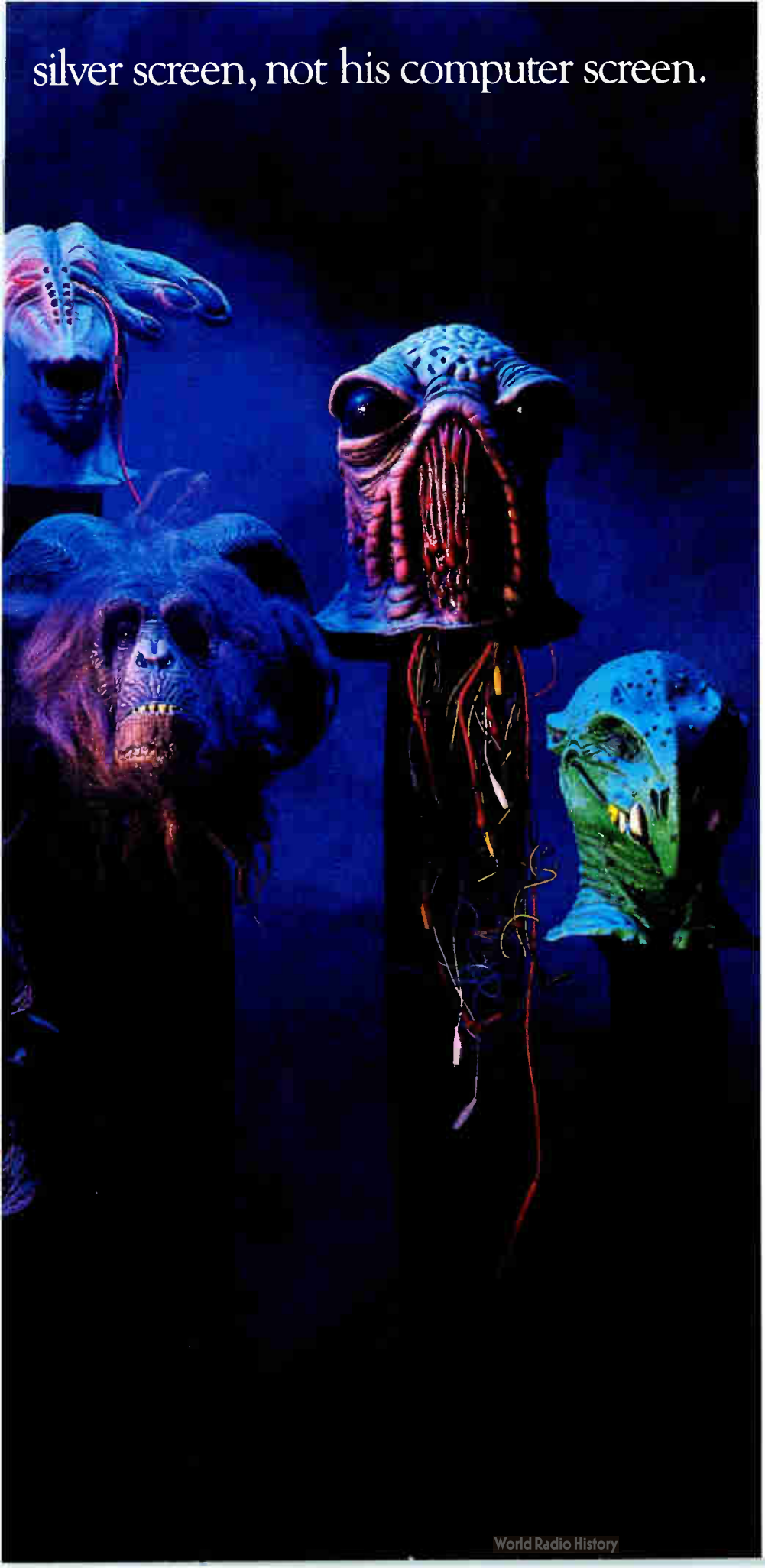
World Radio History



© 1990 Sony Corporation of America. Sony is a registered trademark.

World Radio History

silver screen, not his computer screen.



When you're an Oscar-award winning Special Effects Director with $20 million on the line, there's one demon you never want to see.

A floppy disk that flops.

So Colin Chilvers, the special effects genius behind "The Legend of Hell House," "The Rocky Horror Picture Show," three "Superman" movies, and director of TV's "War of the Worlds," and the "Moonwalker/Smooth Criminal" video, takes no chances.

He relies on Sony, the worldwide innovators who developed the 3.5" floppy disk format.

Because it takes more than talent and money to make a major movie fly. And each of his multi-million dollar productions features vast computer generated data. From script writing and production schedules to shot lists, insurance and crew sheets.

If Chilvers loses just one of these vital bytes, he knows it could cost him his single-minded vision.

So avoid nightmares. Specify Sony floppy disks and data cartridges.

No director can risk a flop. And neither can you.

SONY.

Circle 317 on Reader Service Card

World Radio History

CHEETAH GOLD 425™

Cheetah Gold 425/D™

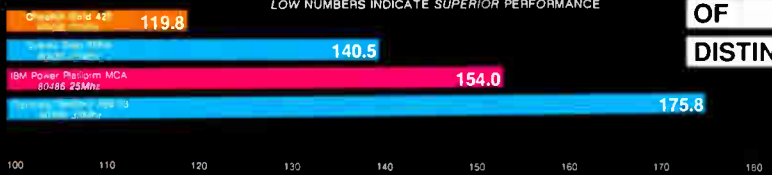
- INTEL 25MHZ i486 CPU/FPU
- FULL 16MB of 70NS System Memory
- Tower Case with 450/W Power Supply
- ESDI Caching Disk Controller with Dedicated Processor and 512K Memory
- Super Fast 383 MB ESDI Hard Drive
- 1024 x 768 Premium VGA Card
- 14" Premium VGA Color Monitor
- 1.2MB & 1.44Mb Floppy Drives
- 2 Serial & 2 Parallel Ports
- 101 Key Keyboard
- Cheetah Gold 425/D $9,995 ! (Other models from $5,995)
  - Price subject to change
  - 20% Refundable deposit required
  - Subject to availability of INTEL 25MHZ 80486 chips. A surcharge may apply if Cheetah's cost of i486 chips exceeds $950 each.
  - VISA, MasterCArd and American Express add 4%
  - Delivery date subject to the availability of i486 chips.

AWESOME . . . PERIOD

1989 BYTE AWARD OF DISTINCTION

BENCHMARKS

LOW NUMBERS INDICATE SUPERIOR PERFORMANCE



Source: Personal Workstation Magazine - *Great Performers* section
Benchmark numbers are the average of: Software Development, Engineering/Scientific, Publishing and Financial from the AIM Benchmarks - UNIX Workstation section

Cheetah Gold 425™ with 8 Omb of memory and DPT caching disk controller

Names are trademarks or registered trademarks of their respective holders

Cheetah International, Inc.
1003 West Cotton Street
Longview, TX 75604

1-800-CHEETAH
(1-800-243-3824)
1-214-757-3001
1-214-753-0589 FAX

Circle 57 on Reader Service Card

World Radio History

The Spoken Word

Replace the "look and feel" of GUIs with the "ask and tell" of voice interfaces

Kai-Fu Lee, Alexander G. Hauptmann, and Alexander I. Rudnicky

Although you no longer use toggle switches to communicate with computers, computer input is still more of a barrier than a gateway for the average person. Voice interfaces offer the possibility of interacting with computers using our most natural and best-developed communication skill—speech.

The promise of speech-recognition technology is that it will remove the communications barrier between people and their machines. It will make the power of computers available to everyone, and it will help those who use computers daily to do so more effectively.

Besides ease of expression, speech offers many other advantages in communicating with your computer. Speed is one: Most people easily speak at rates of 200 words per minute, yet few can type better than 60 wpm. Speech can also remove some of the physical limitations of interacting with computers: You could control your computer while working in the dark (say, in a photographic darkroom) or without sitting at the keyboard (e.g., while rummaging through a file cabinet or reading in information over a telephone).

Speech recognition can even let you use a computer in places where it would otherwise be impossible or dangerous—imagine being able to use a voice-activated navigation assistant while driving your car.

Although speech is not the ultimate mode of input (you might not want to talk for 8 hours straight every day, or describe pictures verbally), it nevertheless offers unique advantages not available in other types of interfaces.

Speech Background

Two decades of R&D have established the importance of the following dimensions in understanding the properties of a given speech-recognition device:

- Speaker dependence versus independence: A speaker-dependent system is trained to recognize only a single voice. A speaker-independent system can recognize anyone's speech, but with less accuracy.
- Discrete words versus continuous speech: A discrete-word system (also called an isolated-word system) requires pauses between words. Continuous-speech recognition lets you speak in a natural manner, but it is more complex and error-prone.
- Vocabulary size and grammar complexity: A system vocabulary defines the set of recognizable words, and the grammar defines the types of sentences (i.e., word sequences) allowed or preferred. Small vocabularies and restrictive grammars are easier for speech recognition,

continued

ILLUSTRATION: MARC YANKUS © 1990

World Radio History

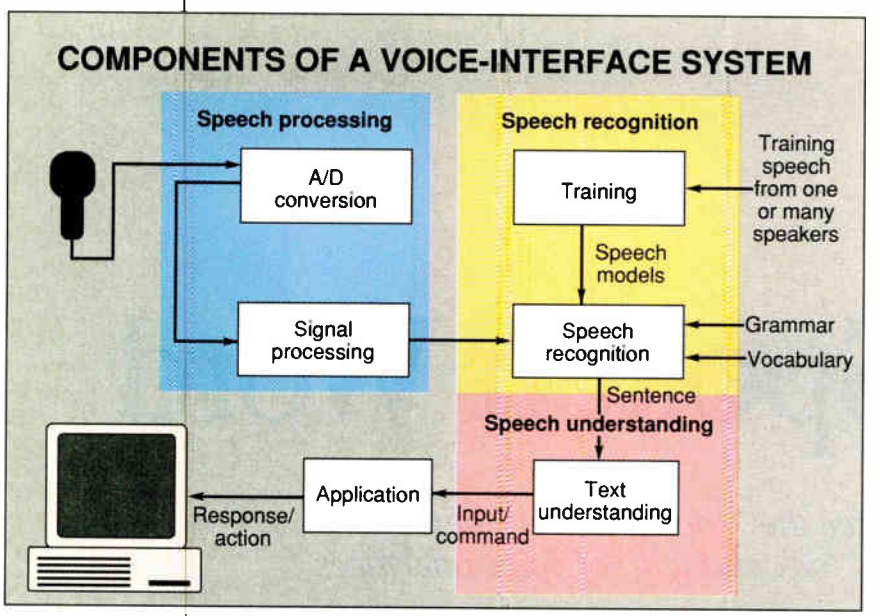


Figure 1: *A voice-input system consists of three primary components. Speech processing converts spoken utterances into a digital representation of the input using A/D conversion and signal-processing techniques. Speech recognition matches the input representation with models built into the system. Vocabulary and grammar constraints eliminate many alternative interpretations. Speech understanding is a higher-level function that tries to make sense of the input. Small domains can be understood fairly well, but current systems don't deal well with unconstrained speech.*

but systems with large vocabularies and loose grammars are more useful.

• Speech recognition versus speech understanding: A speech-recognition device produces a sequence of words, while a speech-understanding system tries to interpret the speaker's intention.

All voice-interface systems—both commercial and research—strive for high accuracy. Invariably, they achieve it, but only by compromising on one or more of the above dimensions. When you select a system, you must carefully consider your needs and understand the capabilities your application requires.

Figure 1 shows a common organization for voice-interface systems. All of them have, in one form or another, three components: speech processing, recognition, and understanding.

Sound Bites

Speech processing is a sequence of transformations that converts an analog speech signal into a compact yet informative digital representation of speech. It is essentially a signal-processing function. A microphone converts the changes that the speech causes in air pressure to voltage variations. The system samples these variations and digitizes them using an A/D converter. A system typically samples spoken input 6000 to 20,000 times per second, with each sample consisting of about 12 bits to ensure adequate representation of the sound. The sequence of numbers thus created is called the *digital waveform*.

In principle, you could try to directly recognize the digital waveform. But because a 5-second utterance may produce up to 100,000 numbers, such processing is prohibitively expensive. Also, the waveform contains both redundant information and unimportant variations; processing it all would also be redundant and inefficient. Accordingly, speech systems apply digital-signal-processing techniques to reduce the redundancy and to enhance the salient features of speech. These techniques typically generate a descriptive vector of about eight to 20 floating-point numbers for each 0.01 second (centisecond) of speech.

Common reduction techniques include filter banks and fast Fourier transforms that, for each centisecond of speech, determine the energy level in different (usually logarithmically scaled) frequency bands, and linear predictive coding, which generates a vector of the coefficients of a linear equation that predicts the spectrum of the current centisecond of speech, based on previous samples.

These techniques produce about 1000 to 2000 floating-point numbers per second of speech, about an order of magnitude reduction from the waveform. Essentially, no information is lost in this representation, because resynthesized speech sounds about the same as the original speech. To gain further efficiency at a small loss in accuracy, some systems compress speech to as few as 200 bytes per second.

Matchmaking

Speech recognition involves comparing an utterance—now a sequence of representation vectors—against prestored speech models, subject to lexical and grammatical constraints. In all cases, you need to train speech models before you can use the system for recognition. These models can be based on a number of speech units, depending on the approach taken. Some of them include whole words or phrases, syllables, and phonemes. Some of the common modeling techniques include the following three:

• *Dynamic time warping*, which matches speech patterns against prestored pattern templates by temporally aligning them using dynamic programming algorithms. DTW models are trained by averaging several exemplars of each word in the vocabulary. DTW is widely used in commercial speech recognizers.

• *The Hidden Markov model*, which abstracts properties of speech in a probabilistic framework. Using automatic algorithms, the system learns probabilities of speech events and their durations. HMMs have superior generalization ability, and they have been found suitable for large vocabularies and continuous-speech, as well as speaker-independent, applications. HMMs are the predominant technology in most research systems and some commercial systems.

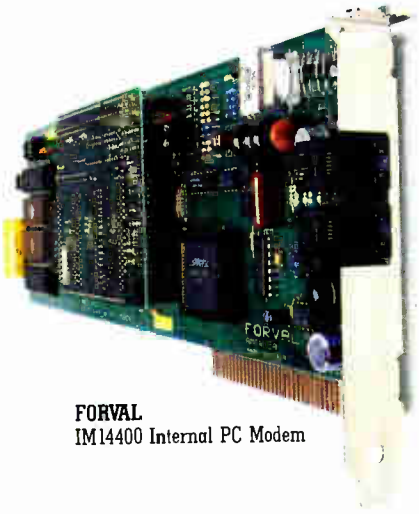
• *Neural networks*, which constitute a promising new technology that codes speech properties in a distributed representation (see "Building Blocks for Speech," August 1989 BYTE). Neural networks have many desirable properties, such as generalization and discriminative capabilities. Although there are no large-scale neural-network speech-recognition systems, they have been used as components of research systems and in some commercial systems.

The sequence of models that are produced by the speech-recognition system

continued

World Radio History

The End Of The Me-Too Modem.



FORVAL
IM14400 Internal PC Modem

When it comes to high speed, dial-up PC modems–we mean the very compatible kind–chances are, you had to settle for one of those me-too modems that look and act pretty much the same, over and over. And over.

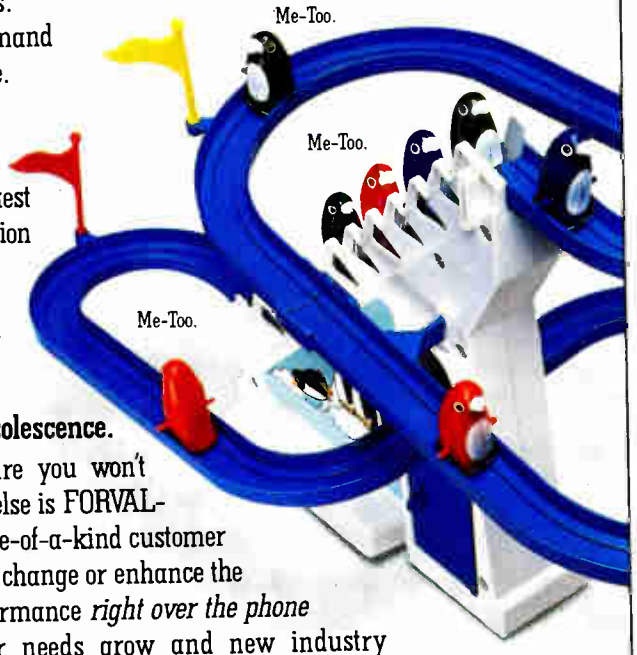
Chances are, you also had to send your data at 9600 or 2400 bits per second. Or slower.

With FORVAL's new IM14400 internal PC modem, you can speed your data over the phone lines at 14,400 bps. And if you're really in a hurry, the IM14400's data compression mode will deliver your files and images up to a very impressive 57,600 bps. That's significantly faster than most me-too modems around.

Of Course, We Do Slow Things Down For The Competition.

Being 14.4/57.6 kbps fast doesn't mean we won't slow down for the me-too's. With the IM14400's automatic step-down mode, we'll talk to them at the CCITT speeds of 9600, 2400, and 1200 bps. Whenever necessary. We also use the Hayes™ AT command set so you can run most popular communications software.

The IM14400 is unmatched when it comes to innovative features and technologies. To ensure accuracy and compatibility, we've incorporated the latest industry standards: the proposed V.32 extended transmission speed, V.42/MNP2-4 error correction, and V.42 bis/MNP-5 data compression. We've also added FORVAL Turbo Interface,™ an extra safeguard to preserve data integrity at speeds over 19,200 bps. Me-too modems don't compare.



IM14400 Features:

- 14.4 kbps (proposed V.32 bis)
- Maximum 57.6 kbps with V.42 bis/MNP-5 compression
- Error Correction V.42 (LAP-M and MNP2-4)
- Hayes™ AT command set compatible
- Automatic/Manual fallback to 9600, 2400 bps and slower
- Full duplex synchronous/asynchronous operation
- FORVAL-Link™ and FORVAL Turbo Interface™
- 5-year limited warranty

AVAILABLE SOON IN STAND-ALONE AND RACK-MOUNT VERSIONS.

The End Of Obsolescence.

One more feature you won't find anywhere else is FORVAL-Link.™ This one-of-a-kind customer service lets you change or enhance the IM14400's performance *right over the phone lines*. As your needs grow and new industry standards emerge (like 19.2 kbps), your investment is still protected.

Call FORVAL toll-free today for more details. Do it now, and get a price that even the me-too modems will find hard to match. **1-800-FORVAL-1**

FORVAL

FORVAL AMERICA, INC. • Modem Division
6985 Union Park Center, Suite 425 Midvale, Utah 84047
Tel: (801) 561-8080 • Fax: (801) 561-8777

Copyright ©1990 FORVAL AMERICA, INC. FORVAL-Link and FORVAL Turbo Interface are trademarks of FORVAL AMERICA, INC.; Hayes: Hayes Microcomputer Products, Inc.; MNP: Microcom, Inc.

Circle 105 on Reader Service Card (DEALERS: 106)

World Radio History

Practically Speaking

Voice interfaces are available to anyone who owns an IBM PC, XT, AT, or compatible. Total vocabulary, however, is not the best measure of a system's performance. The *active* vocabulary—the number of words from which you can choose at any given moment—is a better measure. In addition, rated vocabulary size represents only the capacity of a system and does not imply an adequate accuracy at full capacity.

When the active vocabularies are small, many commercial systems allow applications to switch contexts and load a completely new vocabulary at appropriate points. Thus, even relatively limited active vocabularies can accommodate tasks requiring larger lexicons, as long as you can subdivide them.

The trade-offs that are found in research systems—speaker dependence versus speaker independence, discrete words versus continuous speech, and vocabulary size versus performance—are also evident in commercial systems. In addition, price plays a role.

No recent rigorous testing of recognition accuracy has been performed to compare the different products. While every commercial system claims accuracy rates greater than 90 percent (up to about 99 percent), in practice we have found that these estimates are often quite confusing. They strongly depend on the actual words used to evaluate the systems, the noise environment during the evaluation, and the linguistic-model constraints expressed in the grammar. As a result, we cannot comment on the actual performance accuracy of these systems.

Every supplier of voice-interface technology offers some set of development tools to help you create an interface suitable for your application task. These interfaces may provide facilities for retraining the system to understand words that are poorly recognized and for building a linguistic model that reduces the effective number of words that the system must discriminate. There are also different approaches to error recovery: by keyboard, mouse, or voice alone, and with different types of "error-editing" capabilities.

At the high end of the performance spectrum, you find relatively large vocabulary systems of 5000 words to 40,000 words (from Kurzweil Applied Intelligence, Speech Systems, and Dragon Systems). Dragon Systems' DragonDictate-30K and Kurzweil's VoiceReport system require that you pause slightly between words, while Speech Systems' DS200 accepts continuous voice input. These systems are the most expensive, requiring more processing power and memory and more sophisticated algorithms.

Speech Training

Many systems offer alternate training techniques to avoid having to train a system by repeating each of up to 40,000 words several times. The DS200 splits speakers into males and females and delivers a speaker-independent vocabulary for each group. This eliminates the training process. Note that 40,000 words represents a theoretical limit; actual applications would use smaller vocabularies to achieve higher accuracy and acceptable response speed.

DragonDictate-30K provides a 25,000-word pretrained speaker-independent core vocabulary and lets you augment the system with 5000 other words trained on your own voice. Also, it continuously adapts to your voice when in use, so initial vocabulary-training deficiencies quickly disappear in favor of better, more customized word models.

VoiceReport follows another route. You enter only a phonetically balanced and representative set of words, from which the system generalizes to the complete 5000-word vocabulary. (A recently announced improvement only requires you to speak the digits, as a kind of microphone check.)

While in principle large-vocabulary systems allow large-vocabulary speech recognition, in practice, recognition accuracy may drop if they must discriminate among very many word choices at any one time. Recognition times are directly related to the size of the currently active vocabulary. As a result, it's up to a language model (which provides syntactic, semantic, and pragmatic constraints) to limit the number of words that need to be identified at each point.

In most cases, the application developer chooses the language model and the limits of the active vocabulary. DragonDictate-30K, however, comes with a predefined general language model based on a large body of English text.

Independence and Vocabularies

At the other end of the spectrum, Voice Processing Corp. and Voice Control Systems offer speaker-independent continuous-speech recognition products that can recognize only 13 to 50 words each. The smallest vocabularies are just big enough for a digit-entry task with two command words to control the interface (i.e., the digits 0 through 9, the letter *O*, and the words *yes* and *no*).

Although these systems accept fluent speech from any speaker, the size of the vocabulary limits possible applications. However, the products tend to be much more robust in their recognition accuracy, so they can be used over the telephone. They also cost significantly less.

Middle Ground

In between the two extremes are a few products that allow a moderate vocabulary size of roughly a few hundred words. They are either speaker-dependent continuous-speech-recognition systems or speaker-independent discrete-word systems. The trade-off is clear and should be dictated by the needs of the target application.

For example, Scott Instruments offers a system that recognizes speaker-independent discrete-word speech and has an active vocabulary of about 160 words. The system can provide more flexibility by allowing any English-speaking person to use the system, but at the expense of a smaller vocabulary.

Verbex Voice Systems and Votan both market speaker-dependent continuous-speech-recognition systems with active vocabularies of a few hundred words each. First, you train these systems to your individual voice characteristics. Then, the systems can accept fluently spoken utterances, without artificial pauses between every word.

Again, the cost for this fluency is a reduced vocabulary (when compared to speaker-dependent discrete-word systems). While continuous speech offers speed and ease-of-use advantages over discrete words, the training requirement limits these systems.

Many vendors, including The Voice

World Radio History

Connection, Covox, Voice Recognition Technologies, and Articulate Systems, supply products for speaker-dependent discrete-word speech recognition. The products are often surprisingly inexpensive. Vocabularies usually contain several hundred words, with added features provided on many boards, such as a phone interface, dual-tone multifrequency (DTMF, or Touch-Tone) functions, voice storage and playback, and text-to-speech capabilities. While individual products tend to vary, we expect that this group will provide the highest accuracy recognition, since its approaches are more restrictive and better researched.

The table on page 230 shows a list of commercial products and their capabilities. The systems all include add-on boards that perform digital signal processing in practically real time. But larger vocabularies often produce more-noticeable delays, due to the amount of search involved. Accuracy figures are not included, since the claimed accuracies tend to be for simple applications rather than for the maximum active vocabulary size. Remember, each desirable feature (i.e., speaker independence, continuous speech, and large vocabulary) comes with a performance degradation. In particular, the capacity to handle a large active vocabulary does not imply that the product can recognize that vocabulary accurately.

Balancing Act

Clearly, you have a wide choice of voice technologies, depending on your budget and your requirements. Don't let any particular set of numbers dazzle you. Once you decide on your requirements (e.g., speaker dependence/independence, continuous speech/discrete words, phone-interface requirements, and rough size of the active vocabulary) and budget, you should carefully evaluate the recognition speeds and accuracies of competitive products.

You can overcome any limitations on the total vocabulary size by partitioning application tasks into subvocabularies and swapping them in and out at appropriate points. Determining the actual recognition accuracy that a particular product will give in your application environment is vital to the successful implementation of this technology.

constitutes the system's best guess at what the input is. Since each model in the sequence is known (i.e., specific speech sounds, words, or phrases), you can "recover" what the speaker said by examining the model sequence.

With current technology, matching all sounds (phonemes) against the input provides unacceptably slow performance, so speech recognizers take advantage of lexical constraints to consider only phoneme sequences that represent words. They also apply language constraints to ensure that they consider only legal word sequences (thus reducing the number of active words examined during speech recognition), or to bias the system toward more likely sentences.

Evaluating the model and applying lexical and language constraints are typically combined into a one-step search process. Many applications developers build highly constrained grammars into their systems to obtain the best possible performance, both in response time and accuracy.

Coming to an Understanding

For some applications, such as dictation, voice dialing, and data entry, you only need to recover the sequence of words spoken. But for others, the system must understand the meaning of what was said. For example, the simple database query "How many new customers in Region 6?" may require fairly complex processing (how would you interpret *new*?) that takes into account not only the structure of the sentence itself but also the outcomes of previous queries, as well as general knowledge about the domain of application.

Unconstrained speech and language understanding (something humans perform effortlessly) is very difficult and remains an unresolved problem. But for small domains, natural-language understanding is possible, and spoken-language understanding (which combines speech recognition and natural-language processing) will be available shortly.

Voice Recognition at Work

Voice interfaces are not simply a matter of academic interest; they are here today (see the text box "Practically Speaking" at left). Voice interfaces are most frequently used to control a computer. Such a system accepts voice commands and translates them into a sequence of keyboard commands or macros. One spoken word can translate into a keystroke equivalent involving several hundred characters. The generated keystrokes are then fed to an application that cannot distinguish the transcribed keystrokes from actual keyboard input.

In this way, you can use voice to interface with many off-the-shelf, self-contained keyboard applications, such as spreadsheets or database programs, without completely redesigning them. Of course, there are some shortcomings to this approach related to error handling and correction.

Voice interfaces are often used as aids to the disabled. A blind person can enter queries or commands into the computer verbally rather than with a keyboard. Computer output is spoken through text-to-speech capabilities. There is even one report of a blind skipper successfully using a voice-interface system to query various navigational instruments on board a boat. Physically disabled users, such as quadriplegics or patients with severe arthritis, can also use voice technology to control computers, telephones, and so forth. The ability to control computers without typing is crucial to such users.

You can use voice to interface with many off-the-shelf, self-contained keyboard applications, such as spreadsheets, without completely redesigning them.

Beyond Computers

Voice interfaces are not limited to character-based computers. One interesting application area involves the integration of voice technology with telephones, visual interfaces, fax machines, and voice mail. For instance, Articulate Systems has adapted algorithms developed by Dragon Systems to let you operate a Macintosh by voice input.

Mobile phones can also contain voice-dialing capabilities (one such product is sold by Motorola). In general, these systems are not as sophisticated as some of

continued

World Radio History

VOICE INPUT FOR PERSONAL COMPUTERS

Don't let any particular set of numbers dazzle you. Decide whether you need speaker dependence or independence, continuous speech or discrete words, or a phone interface, and determine the rough size of the active vocabulary you need and how much you have to spend. Then you can evaluate the recognition speeds and accuracies of competitive products.

Company	Product name	PC type	Card/box/ stand-alone	Memory required	Speaker independent/ dependent	Discrete-word/ continuous speech	Maximum active vocabulary	Phone interface
Articulate Systems	Voice Navigator	Mac Plus	Box	2 MB	SD	DW	200	Yes
Cherry Electrical	VoiceScribe 1000 Plus	PC/XT/AT	Card	640K	SD	DW	1000	N/R
Covox	Voice Master Key	PC/XT/AT	Card	256K	SD	DW	64	No
Dragon Systems	DragonDictate-30K	386 (AT)	Card	8 MB	SI	DW	25,000	N/R
	DragonWriter-1000	286 (AT)	Card	512K	SD	DW	1000	N/R
Kurzweil Applied Intelligence	VoiceReport	386 (AT) with 80387 coprocessor	Card	10 MB and 40-MB hard disk	SD	DW	5000+	No
Scott Instruments	SIR Model 20	PC/XT/AT	Card	80K	SI	DW	160	N/R
Speech Systems	DS200	Sun SPARC-Station	Card	8 MB and 140-MB hard disk	SI	CS	40,000	No
Texas Instruments	TI Voice Card	PC/XT/AT	Card	256K and two floppy disk drives	SD	CS	50	Optional
The Voice Connection	Introvoice-5	PC/XT/AT	Card	64K	SD	DW	250	No
	PTVC-756	Portable/PC	Stand-alone	1 MB	SD	DW	250	No
Verbex Voice Systems	Verbex 5000	N/A	Stand-alone	N/A	SD	CS	80	N/R
	Verbex 6000	AT	Card	None	SD	CS	300	N/R
	Verbex 7000	N/A	Stand-alone	N/A	SD	CS	1980	N/R
Voice Control Systems	TeleRec	XT/AT	Card	64K	SI	DW	16	Yes
	VR-4	PC/XT/AT	Card**	64K	SI	DW	50	Yes
Voice Processing Corp.	VPC-1000	AT	Card	None	SI	CS	13	Yes
Voice Recognition Technologies	Voicebox	PC/XT/AT	1/2 card	80K	SD	DW	500	No
Votan	Voice Card VPC-2100	PC/XT/AT	Card	256K	SD	CS	125	Yes

Note: This table includes no claims for the accuracy of the voice interface.
N/R = Not recommended by the vendor.
N/A = Not applicable.

the workstation-based technologies, but they are perfectly adequate. They let you store a spoken list of names in the phone, each with an associated telephone number. Then, using voice commands, the phone will dial the appropriate number based on the spoken name.

Another successful application of voice interfacing is in controlling robotic systems. In hospitals, voice commands can control the position of patient beds. In laboratories, voice commands can control the magnification and position of large microscopes, scanners, or other optical equipment. In such "eyes busy" situations, voice technology provides a significant edge.

Manual Freedom

In typical "hands busy" or "eyes busy" situations, voice technology can successfully save labor. For example, workers sorting packages can use their hands to manipulate the objects while verbally entering information about the package's destination into the computer through their headsets. In other inventory or inspection tasks, workers are often physically moving around the facility to inspect it, or looking through a microscope or at an x-ray machine while simultaneously entering voice data into the computer. The drawbacks of limited vocabularies and having to train operators are insignificant compared to the benefits of voice in these tasks.

Telephone communication is an increasingly important area for voice interfacing. However, businesses usually cannot train their customers' voices in advance. You can't expect customers to adapt to a discrete-word system, and high recognition accuracy is crucial for acceptance.

As a result, currently only speaker-independent continuous-speech-recognition applications with very small vocabularies exist in this domain. The applications generally can distinguish between yes and no (e.g., in collect-call-acceptance questions) and maybe recognize digit sequences for telephone numbers, social security numbers, or bank account codes. However, you can expect rapid growth in this area in the future as more robust speech technology becomes available with larger vocabularies.

Another area where small time savings translate into large dollar amounts is in the medical field. Several intensive efforts are under way to use voice interfaces to aid doctors and nurses.

Both Kurzweil and Lanier Voice products (the latter using Dragon Systems technology) have been used to shorten the report-generation time for radiologists. Kurzweil has also brought voice-interface products into emergency medicine and pathology. Speech Systems markets an application that transcribes spoken medical reports to text.

In each case, medical reporting follows a highly standardized format, in which a limited vocabulary is sufficient to account for almost all situations. In

World Radio History

Text-to-speech capability	Voice playback and storage	DTMF (Touch-Tone) functions	Price	Comments
No	No	Optional	$1295	Toolkit optional; uses Dragon Systems algorithms; connects to SCSI port.
Optional	No	No	$3600	Uses Dragon Systems algorithms.
Optional	Yes	No	$149.95	Toolkit optional.
No	No	No	$9000	Can also be trained to your voice.
No	No	No	$3600	Multiple speakers can be trained into one model.
Optional	Optional	Optional	$26,500	Price includes PC; fax option also available.
No	Yes	No	$1495	Toolkit is optional.
Optional	No	Yes	$33,900	Toolkit included; acceptable accuracy and speed require syntactic language model constraints on active vocabulary.
Yes	Yes	Optional	$995	Toolkit is extra; also available for Xenix systems with 386 processor.
Optional	No	No	$495	
Yes	No	No	$2995	Includes PC with minikeyboard and RS-232C port; full miniature version also available.
Yes	No	No	$5600	Includes toolkit.
Optional	No	No	$5600	Includes toolkit.
Yes	No	No	$9600	Includes toolkit.
No	No*	Yes	$2495	*Voice-prompt playback.
No	No*	Yes	$3600	*Voice-prompt playback. **Card is piggybacked with Dialog/4x voice card from Dialogic Corp.; other daughtercards also available.
No	No	No	$5500	Toolkit included.
			$3500	For evaluation kit.
No	No	No	$395	Includes toolkit.
No	Yes	Optional	$1750	Multibus card available.

addition, voice macros allow report templates to be generated with only a few fields that must be filled in individually.

Typing that is totally "hands-free" is currently beyond the scope of the technology due to its inability to handle unfamiliar, untrained words. But recent increases in vocabularies to 5000 words—and even 30,000 or 40,000 words—show promise for less rigid situations.

Office Communications

Voice technology is used in microcomputers for purposes other than speech recognition or understanding. Its most prevalent use is for voice annotations and voice mail, as well as for synthesized speech output.

Some systems—the NeXT Computer, for example—let you record a spoken message in digitized form on the machine. You can then send the message as E-mail to someone else who has a workstation with playback capability. In that respect, voice mail can function much like an answering machine.

Another use of voice-interface technology currently gaining popularity is voice annotation for documents. This can take the form of a spoken comment inserted into the document at text locations you specify. (Several PC add-on boards available through different vendors provide that kind of capability.)

More sophisticated voice-annotation technology is available in the Wang Freestyle system. It lets you record a spoken commentary synchronized with other inputs. Thus, as you are verbally commenting on a section of text, you can also write comments around the text using an electronic pen and mail the integrated multimedia document to someone else.

Finally, many text-to-speech systems have been developed for personal computers. These convert ASCII text into reasonable-sounding speech. The speech currently still has an unmistakable computer-generated quality, but it is quite intelligible.

Voice in Your Future?

In the future, you will see even more microcomputers offering voice-interface capabilities. Workstations will probably integrate this capability as standard equipment, while microcomputers will offer it in the form of add-on boards.

Future applications software will likely include standard voice-mail capabilities, voice-message storage and playback integrated with text-to-speech capabilities, and fax communication features. You can expect these software packages to integrate multiple modalities (e.g., voice, text, and bit-mapped pictures) for manipulation in many different ways. While current voice-interface products still require plenty of individual customizing before they can be integrated into an application, you can expect more-powerful integration tools in the near future.

Research Trends

Unlike commercial systems, research speech-understanding systems are not concerned with cost. Investigators are thus able to test complex algorithms and more advanced technology on large, expensive computers. Because rapidly improving computer technology may make a personal computer in the 1990s as powerful as a supercomputer was in the 1980s, a look at the research systems of today will give you a good idea of what applications will become possible in the next decade.

For over 10 years, researchers at IBM have been working on a natural-language dictation system that would let you say anything you want. Based on probabilistic expectations learned from 1 billion words of text, the system distinguishes sentences based on their likelihood. Combined with a good speech recognizer, the system attains over 95 percent word accuracy on a 20,000-word discrete-word task, and over 90 percent accuracy on a 5000-word continuous-speech task. The limitation of the system is that you must voice many utterances (100 for the discrete-word system and 2000 for the continuous system) to train the system.

At AT&T Bell Laboratories, researchers have focused on recognizing continuously spoken digits over the telephone. Telephone-based voice-interface systems must deal with different handsets, noise that is introduced during transmission over telephone lines, and frequency bandwidth limitations. Also, such systems must be speaker-independent.

Although commercial products exist

continued

World Radio History

that can handle these tasks, Bell Labs uses more advanced techniques that require much more computation. In a field trial on real speech and real credit card numbers, a Bell system correctly recognized over 98 percent of the number strings—that's about 99.9 percent digit accuracy. This system is the best of its kind and is believed to be good enough for credit card applications.

Finally, at Carnegie Mellon University, we have developed Sphinx, the first large-vocabulary speaker-independent continuous-speech-recognition system. Sphinx can achieve a word accuracy of 96 percent on the 1000-word Naval Resource Management benchmark task.

To understand how a sophisticated speech-recognition capability might be integrated with natural-language capabilities and operate in an unconstrained work environment, we have been building systems that provide, either individually or in combination, a voice interface to common office programs such as spreadsheets, appointment calendars, personal-information databases, voice mail, and applications. Our goal is to create an environment that provides you with multiple input channels (speech, keyboard, and mouse) integrated into a single interface.

Our work, and that of many other researchers, is sponsored by the Department of Defense. For example, MIT and Unisys are developing a voice interface to a graphical directory assistance system. Bolt, Beranek, and Newman is building defense-related training and database-retrieval applications, and SRI is building an automated travel agent. These interactive problem-solving systems require not only speech recognition but also speech understanding. If they succeed, you can expect to see simple interactive-dialogue systems on the market in five to 10 years.

Today and Tomorrow

Current computers insist that you do things their way. Using a computer device requires that you accommodate yourself to how the computer works and constantly monitor the input process. This is quite unnatural and, for most people and applications, requires too much effort.

Useful voice technology is available now, if you are willing to compromise on certain capabilities. When considering products, however, you should remember that almost every desirable capability (e.g., speaker independence, continuous speech, and rejection) also degrades the accuracy of a system. You might want to think twice about whether your application needs all those fancy capabilities.

Most major computer manufacturers recognize that accessible voice input is the next frontier in interface technology. You will see the necessary hardware appear as standard equipment within five years. You can also expect to see the more advanced research systems become available commercially.

The trend in voice interfacing is toward systems that possess more and more of the characteristics of a human listener. These systems will let you realize the full potential of voice-based communication with your computer. ■

The authors research speech interfaces at the school of computer science at Carnegie Mellon University (Pittsburgh, PA). Kai-Fu Lee is an assistant professor, Alexander G. Hauptmann is a Ph.D. candidate, and Alexander I. Rudnicky is a systems scientist. They can be reached on BIX c/o "editors."

Quarter Inch Data Cartridge Interchange

The QICPAK product range provides facilities permitting you to process and create ¼" QIC data cartridges under MS-DOS on the PC or PS/2. Interchange cartridges with mini and mid-range systems using QIC drives, eg AIX, UNIX, VMS etc.

No longer is your ¼" drive gathering dust until the next backup. Our VTAR utility creates UNIX tar compatible Backup cartridges and lets you interchange data the easy way. There's more. With QICPAK-II you can attach two QIC-drives to the system and perform an image copy of a cartridge with the VCOPY utility. This is vital when you have just spent hours waiting for that backup of your system. With QICPAK-III the sky's the limit. We supply you with the source code of all of our utilities enabling you to develop your own applications. Example sources: Microsoft 'C' ver 5.1 & Quick Basic, Turbo 'C' ver 2.0 & Pascal ver 5.0.

QICPAK-I $695.00
QIC-02 controller for the PC-Bus or MCA with the supporting device driver. Software is provided for data interchange and tape positioning. The utilities & VTAR are all provided as executables and in source form. Additional examples are given in 'C', Pascal and Basic.

QICPAK-II $995.00
QICPAK-I and a second PC-Bus or MCA controller. VCOPY in both executable and source with full documentation.

QICPAK-III $1995.00
Includes QICPAK-II plus the QTAPE utility, giving the ability to extract data from the majority of popular tape formats, eg SYTOS, EVEREX, MAYNARD, MOUNTAIN, TAR, NCRTAR, APOLLO, IBM System/36 etc. For example you can directly convert from any of the supported formats and create a TAR or SYTOS cartridge. The source of QTAPE is not supplied.

We can also provide complete subsystems with any of the QICPAK options. If you need help with ¼" or ½" tape then we have almost certainly done it before, including data recovery from damaged ¼" cartridges.

All support is given directly by the development group.

TEL: 44 734 890042
FAX: 44 734 890040

VOGON

NO SURCHARGE FOR CREDIT CARDS

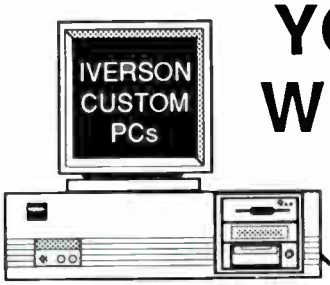
VOGON ENTERPRISES LIMITED
94 Easthampstead Rd, Wokingham, Berkshire, RG11 2JD, ENGLAND

Circle 304 on Reader Service Card

World Radio History

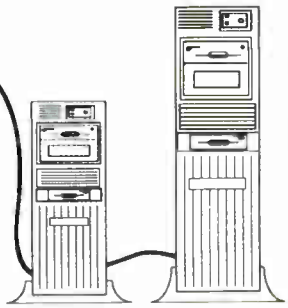
YOU DESIGN

YOUR OWN PC • FILE SERVER • LAN



YOU SPEC – WE BUILD AND WE TOTALLY SUPPORT YOU

We Tailor Mass Storage Systems–Internal/External, Removable, Ruggedized, Secure, Mixed Media for ALL Systems



- We Perform Configuration Management for Initial System and for ALL Future Upgrades to Meet Your Requirements
- We Can Configure YOUR Application Software to a Wide Range of Printers
- We Develop Drivers, Menus, Coding to Your Specs at Competitive Prices
- We Build, Test, Configure, Burn In Each Product to Your Specs
- We Can Install, Warrant and Maintain Your System
- We Can Train Your Staff to Operate and Maintain Your System
- We Load Your Software and Test at the Factory at Competitive Rates

ALL PRODUCTS LABELED...SYSTEMS DESIGNER...(YOUR NAME OR COMPANY LOGO)

TOTAL SERVICE

- **Call 1-800-444-PC90** – Ask For Custom PC Department
- Select 286, 386, or 486 by Desired Speed (MHz)
- Select Any Type of Storage Combination up to 1 Gigabyte Read/Write Optical Cartridge – For Any PC
- Select From a Wide Range of Displays and Adapters
- Select Size, Memory, COM/LAN Cards Plus Miscellaneous Options
- Toll Free 800 Number for Service and Free Technical Support Hotline

FAST TURN-AROUND

- COMPETITIVE PRICES, QUANTITY DISCOUNTS
- OVER 15,000 SYSTEMS INSTALLED WORLD-WIDE
- WORK DIRECTLY WITH FACTORY AND HARDWARE ENGINEERS
- ALL SYSTEMS COMPATIBLE WITH DOS, OS/2™, XENIX™, UNIX™, NOVELL™ AND WINDOWS

VISIT US AT THE WORLD'S LARGEST CUSTOM PC FACTORY AND REPAIR DEPOT IN CLEARWATER, FLORIDA WE HAVE MORE THAN 20 MILLION DOLLARS IN PARTS INVENTORY TO CUSTOMIZE YOUR PRODUCTS QUICKLY!

WE WILL BUILD ONE OR THOUSANDS!

BYTEYD59

For more information return to:
Iverson Computer Corporation, Custom PC Dept.
P. O. Box 6250, McLean, VA 22106-6250

Name _____

Firm _____

Address _____

City/State/Zip _____

Telephone _____

IVERSON COMPUTER CORPORATION

Subsidiary of Iverson Technology Corporation

Telephone	(703) 749-1200
24 Hrs/Voice	(703) 749-1251
Fax	(703) 893-2396
Telex	289 127 ITC UR

P. O. Box 6250 1356 Beverly Road McLean, Virginia 22106-6250

CALL AND TELL US WHAT YOU NEED. WE WILL GLADLY GIVE YOU QUOTES OR ADVICE OVER THE TELEPHONE.

Parent Company Traded on the AMEX (IVT)

Circle 127 on Reader Service Card

World Radio History

New C 6.0. It's not

World Radio History

for tachophobiacs.

Microsoft C Professional Development System

Compiler Performance:
- New based pointers access far data with size and speed of a 16-bit pointer.
- Register parameter passing: _fastcall passes up to 3 parameters in registers, and floating point values are returned on the coprocessor stack.
- Function-level control over optimizations.
- Integrated inline assembler.
- Highly compliant with proposed ANSI standard (we pass 75 of 79 "Plum Hall" tests).
- Incremental compilation in both DOS and OS/2
- Dramatically improved local code-generation.

Programmer's WorkBench:
- Designed by professional programmers, for professional programmers.
- Complete integration of edit, make, debug cycle in both DOS and OS/2.
- New Source Browser provides information on all aspects of your source code.
- Microsoft C Advisor is an on-line reference for the environment, C Language, and Runtime Libraries.
- New MAKE is now a full superset of XENIX/UNIX MAKE facility.
- Specify all build options, including target environment, from within development environment.
- Takes advantage of OS/2 for background operation of components—such as compilation.
- Open architecture 3rd party tools and libraries can be easily installed.

Microsoft CodeView Debugger:
- Completely redesigned user interface.
- Debugs nearly any size application on both 286 and 386 machines under DOS by taking all but 15K of CodeView out of the 640K address space.
- Multiple file debugging.
- Multiple memory views.
- Array browsing.
- Automatic "locals" window.

Advanced Programming Techniques Manual answers the most popular programming questions with extensive commentary and sample code.

If you love the rush of adrenalin that comes with sudden acceleration, we've got a C that's just your speed: the exhilarating new Microsoft® C 6.0 Professional Development System.

Designed to get your blood racing in nothing flat with the fastest,* slickest code available in the shortest, smoothest time possible.

Thanks to some of the most sophisticated code optimizations around.

With this C, you get everything from register-based parameter passing to a globally optimizing code generator to complete loop optimizations. Plus new super-efficient based pointers that access far data instantly.

And your code isn't all that moves faster.

Whether you're developing for MS-DOS,® Microsoft Windows™ or MS® OS/2 Presentation Manager systems, our brilliantly integrated Programmer's WorkBench propels you through the creative process with precision tools.

Including a new souped-up CodeView® Debugger that not only debugs any size DOS or OS/2 application program, on any 286 or 386 machine, but also gives you data-browsing so you don't have to constantly guess at values.

To save even more time, our C Advisor is on-line and on-time whenever you need it. This complete hypertext reference not only gives you sample coding solutions, but it even lets you copy and paste them directly into your program.

If you want to review part of your handiwork, our Source Browser helps you find it with a full call tree that literally draws you a map.

For a free white paper with more details, just call us toll-free at (800) 426-9400.

Then get your hands on Microsoft C 6.0.

The development system specially created for people whose only fear is being left behind.

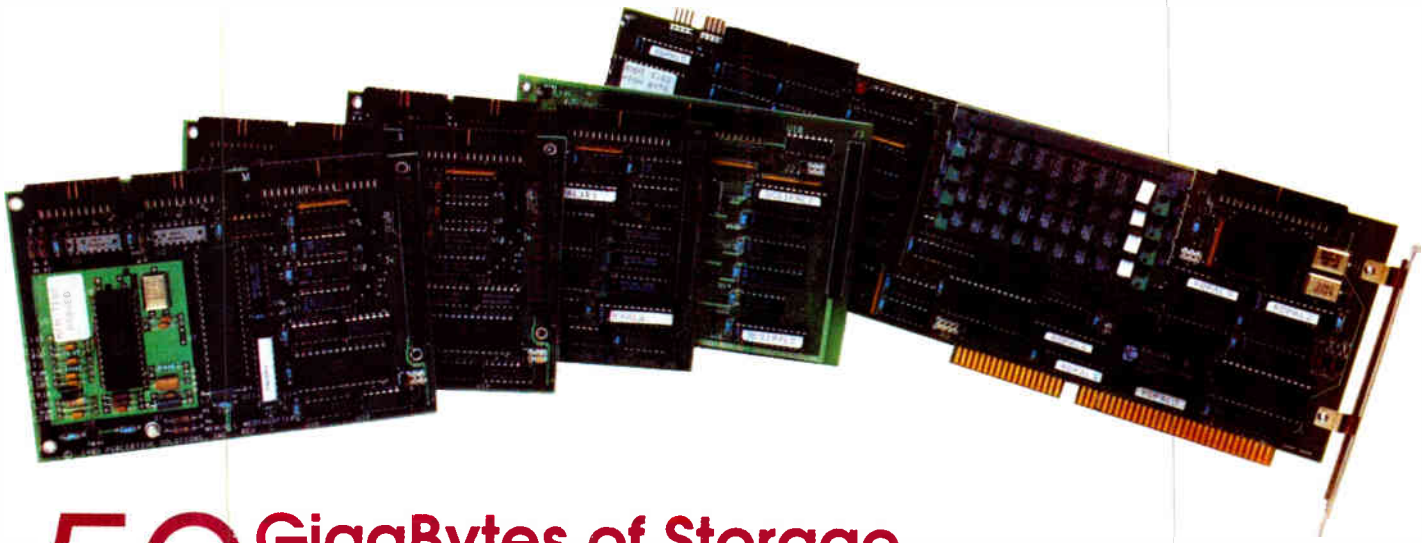
Microsoft®

Making it all make sense™

Comprehensive benchmark tests performed at Microsoft on an 8Mhz IBM PC/AT® with 2816K RAM and 80287 coprocessor. Customers within the 50 United States, call (800) 426-9400. Customers in Canada, call (416) 673-7638. Outside the U.S. and Canada, call (206) 882-8661. *© 1990 Microsoft Corporation. All rights reserved. Microsoft, the Microsoft logo, MS-DOS, MS and CodeView are registered trademarks and Windows and Making it all make sense are trademarks of Microsoft Corporation. PC/AT is a registered trademark of International Business Machines Corporation.*

World Radio History

If you need disk performance, PSI's got your number...



50 GigaBytes of Storage

The hyperSTORE supports an incredible 50.4GigaBytes of nigh performance on-line storage using today's drive technology. And as drive standards and capacities improve, the unique *controller plus Mediadapter™* design protects your investment by allowing you to add new drive interfaces.

28 Hard Disk Drives

The hyperSTORE controls up to 8 MFM, RLL, or ESDI drives, up to 28 SCSI drives, or any combination of drives, each group on an independant interface for improved performance through *true simultaneous operation*. And all drives are cached in the hyperSTORE's on-board cache memory.

20 MegaBytes of Cache

Add as little as 512KBytes of RAM to a *zero-K* hyperSTORE and enter the fast lane of computing. As your needs increase, simply plug in standard SIMM memory to add to the cache. After filling the 4MByte on-board capacity, our 16MByte expansion card brings the total to 20MBytes.

4 MegaBytes per Second

Data transfer rates of 4MBytes/second burst and over 2.5MBytes/second *sustained* make your disk-intensive applications run amazingly fast. Imagine jobs that used to take an hour, now taking as little as seven minutes. That's the kind of real-world performance the hyperSTORE delivers.

4 Interface Standards

Mediadapters allow the hyperSTORE to *concurrently* control MFM, RLL, ESDI, and SCSI drives. So you can mix and match to build the ideal controller for *your* appplication. And when you add a new drive, you can upgrade to the latest technology without throwing away your old drives.

2 Compatibility Modes

Select WD-1003 mode for 100% compatibility with standard operating systems like Unix, Xenix, and Netware-386. Or switch to native mode and take advantage of the benefits provided by our SSP (Standard Storage Protocol) interface under DOS, PC-MOS, Windows, and Netware-286.

PSi

hyperSTORE·1600™

Dual-Mode Caching Disk Controller

©1989 by PSI. All rights reserved. · hyperSTORE, Mediadapter, and the PSI logo are trademarks of Perceptive Solutions, Inc. Other brand and product names are trademarks or registered trademarks of their respective companies. Specifications subject to change. Ad Code: PW90C-1

Perceptive Solutions, Inc. • 2700 Flora Street • Dallas, Texas 75201
(800) 486-FAST • (214) 954-1774 • Fax: (214) 953-1774
European Inquiries: 415-284-9505 • Fax: 415-284-3238

Domestic inquiries: Circle Reader Service No. 200

International inquiries: Circle Reader Service No. 201

World Radio History

Telltale Gestures

3-D applications need 3-D input

Paul McAvinney

ILLUSTRATION: MARC YANKUS © 1990

Even before they begin to speak, children acquire plenty of spatial knowledge about the world around them. In time, this knowledge translates into discernible skills. For example, many young children can thread a nut onto a bolt before they go to school. This task requires more than six degrees of freedom per hand (i.e., positioning and orienting the object in three-dimensional space, plus grasping it).

Most workstations available today allow (in the case of a mouse) simultaneous manipulation of only two independent spatial parameters. While it's possible to specify and manipulate representations of 3-D objects with a mouse, decomposing a six-parameter task into at least three sequential two-parameter tasks is time-consuming, counterintuitive, and error-prone. It is also a waste of time, given advances in the field of gesture-based input devices.

One problem associated with direct-manipulation interfaces in a design environment is that a particular user may not be skilled or precise enough to achieve the desired result. You can alleviate this problem by using virtual tools. Displayed on a computer monitor, virtual tools are analogous to real tools used for cutting, smoothing, shaping, and joining operations.

Virtual tools map multifinger two-dimensional and 3-D gestures into the operations performed by the "business end" of the tool (e.g., the blade of a cutting tool), with constraints imposed by the model of the tool itself, the material or workpiece being operated on, and your objectives. The virtual tool lets you sculpt a smooth 3-D surface, varying the curvature or even the smoothness of a curve as you draw it.

You might use virtual tools to add material to a workpiece, to cut material, or to extrude it. You might filter the motion of a tool, for example, with the distance between two fingers controlling the filter-cutoff frequency.

As hierarchies of virtual tools evolve, productivity will hopefully increase. If you can significantly shorten design time, customization will be easier. As virtual tools cut design time, learning time will also be shorter, in relation to productivity. This is especially true if you can see immediate feedback on your latest design at low cost.

The Gesture Workstation

What capabilities would you want in a workstation that you intend to use to design or modify a 3-D object, such as a piece of furniture, a molecule, or a nozzle for a rocket engine? You'd want it to permit rapid prototyping of real-world objects. You'd want it to let you interac-

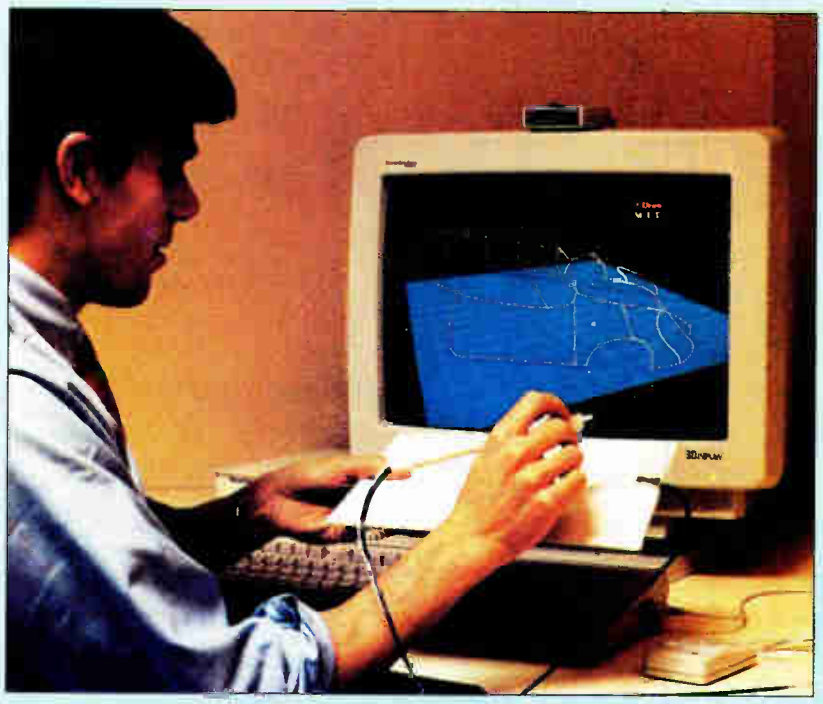
continued

World Radio History

Coming Soon to a CAD Lab Near You

Emanuel Sachs

If you've ever drawn in the air with a Fourth of July sparkler, you'll feel right at home with 3-Draw. 3-Draw is a computer-based design tool under development at the CAD Lab at MIT. It provides an intuitive, natural, easy-to-use interface so that you can sketch out your ideas directly in three dimensions.



Using 3-Draw to design an automobile body. One of its creators, Andrew Roberts, is holding the object sensor—the palette—in one hand and the drawing stylus in the other.

Defining the Elements

3-Draw's user interface is based on two six-degree-of-freedom input devices, one held in each hand. Two sensors enable you to position and orient objects relative to each other in a displayed virtual world with the same ease as manipulating two hand-held objects. The simultaneous use of two sensors takes advantage of most people's innate ability to know where their hands are, relative to each other.

Using 3-Draw is just like holding an object in one hand and a tool in the other. The photo shows Andrew Roberts using it to create an automobile fender. (3-Draw's creators include Roberts, David Stoops, and me.)

Roberts is holding an object sensor in his left hand. This sensor is in the form of a palette, and it corresponds to a moving reference frame located in the virtual world. Objects created in the virtual world are automatically attached to this reference frame and, hence, continuously move in response to motions of the palette hand. In his right hand, Roberts is holding a stylus that corresponds to a configurable drawing and editing tool in the virtual world.

A "floor" in the virtual world is also shown in the photo. This planar graphical aid is an analog of the real-world floor and provides a static reference frame with which you can orient yourself. Shadows of objects in the virtual world can be projected onto this floor to provide positioning cues.

You can also rotate the object shown in the photo. Rotation automatically results in a different perspective view. 3-Draw lets you rotate and translate the object while you are creating and editing curves.

A Polhemus 3Space Tracker provides the two sensors used in 3-Draw. In the setup at the MIT CAD Lab, the sensors are interfaced to a Silicon Graphics Iris 4D/70 GT graphics workstation. The system is so fast that very little time lag occurs between rotating the object sensor and seeing the corresponding rotation of the model on the display.

Free from Constraints

The current set of features can be grouped into three broad categories, each of which uses the configurable stylus in a different way. You can use it as a pencil to create free-form curves with a sweep of the hand, to move curves around as if they were rigid bodies, and to change the shapes of existing curves.

3-Draw can be used to create unconstrained 3-D curves, thus allowing for a high degree of freedom of expression. In some cases, however, you may want to use a feature that allows you to prespecify some constraints on the curve you are going to draw.

For example, you can prespecify the endpoints of a curve. You can then draw the curve anywhere in space and to any scale. After you have finished, it will be automatically scaled and snapped into place. You can then specify the desired

tively specify or modify the shape of an object using spatial gestures and virtual tools. You'd also want it to build the object as rapidly as possible. Let's call this new type of workstation a desktop manufacturing (DTM) workstation. It should include the following components:

- A powerful CAD workstation that displays colored, shaded 3-D objects, with full-motion video capability.
- A "3-D copier" similar to the stereolithography device manufactured by 3-D Systems Corp. This device, or some variation on it, could quickly fabricate a prototype or a custom part. Currently, at least three companies are working on this aspect of DTM technology, and the number will probably increase.
- A 3-D gesture sensor, with gesture-recognition software and a virtual-tool-maker's toolkit.

World Radio History

angular orientation of the curve by rotating the stylus, which twists the curve around the line connecting its endpoints. You can also create curves by mirroring them around a reflection plane. In these ways, you can concentrate on getting just the right shape, independent of scaling and positioning.

After you've drawn a curve, you can move it as a rigid body using several translation and rotation features, each of which applies different constraints to the curve. For example, the "ball and socket" feature allows you to grab the curve and rotate it with one endpoint fixed as if it were in a ball-and-socket joint. The "axis twist" feature rotates a curve around the line connecting its endpoints.

After drawing a curve, you can modify it using several features. The "force gun," for example, makes the stylus behave like a tool that gently pushes the curve into the desired shape. It uses a physically based modeling technique (developed by George Celniker under the supervision of Professor David Gossard, director of the MIT CAD Lab).

New and Improved

Several new features are currently under development. One will allow you to work on models projected by a stereoscopic display (see "Living in a Virtual World" on page 215). Another feature will let you skin a surface over the wireframe models and modify it to the final desired form.

User interfaces like 3-Draw will become an integral part of CAD systems in the future. While industrial design is the first application expected, mechanical CAD, architectural CAD, and animation are sure to follow.

Emanuel Sachs is a professor of mechanical engineering at MIT, specializing in design and manufacturing. You can reach him on BIX c/o "editors."

• An optional 3-D laser scanner for scanning 3-D shapes.

Capturing 3-D input is one of the last obstacles in realizing a DTM workstation. One method is described in the text box above. Other approaches use hand gestures to manipulate spatial objects.

The DataGlove from VPL Research and the Dexterous Hand Master (DHM) from Exos both sense finger-flexing motions. The DataGlove also senses your hand position and orientation using a Polhemus sensor developed by McDonnell Douglas. The Polhemus sensor determines the position and orientation of the hand using an externally generated oscillating electromagnetic field (see "Reach Out and Touch Your Data" on page 283).

A DataGlove with a Polhemus sensor can sense relatively large-scale hand positions and orientations. Given the position and orientation of the palm of your hand, a program can use knowledge of finger-joint flexure to determine fingertip position, and use it in grasping and tool-manipulation applications. In addition, by inserting piezoelectric transducers in the fingertips of the glove, you could conceivably provide some degree of touch feedback.

Force feedback is a more difficult problem. The DHM has the advantage here; its determination of finger-joint flexure appears to be considerably more accurate and repeatable than that of production DataGloves. On the other hand, it does not currently provide hand position and orientation, although this could probably be implemented if market demand warranted it. According to people who have used it, DHM is lighter and less encumbering than it looks, although the time required to fit it to the hand seems to preclude casual use.

Glove Limitations

Using glove-like sensors to sense gestures poses some problems. Currently, these devices use a cable to transmit data from the glove to the workstation, making casual use difficult. Hand-position sensing (as opposed to detection of finger-joint flexure) requires the relatively expensive Polhemus sensor, and its use can be complicated by the presence and movement of ferrous metals in its vicinity. A variation of the DataGlove developed for Nintendo games, the Power Glove, uses sonar devices mounted in the glove, but this severely constrains the possible orientation of the hand.

Another problem with glove-like sensors is that all users need their own gloves. A workstation supporting the device must have multiple gloves available to support left- and right-handed persons with varying hand sizes. Also, neither the DataGlove nor the DHM yet provides fingertip-position information that is sufficiently accurate and repeatable to use in a virtual-tool environment. This fact argues against using glove-like devices in a virtual-tool (as opposed to virtual-reality) environment. Nevertheless, for many applications, they provide a reasonably cost-effective solution.

The Gloves Come Off

One alternative to glove-like devices is the Spaceball from Spatial Systems—essentially a 3-D joystick. It is slightly larger than a tennis ball and mounted in a way that makes extended use very comfortable. The Spaceball is excellent for positioning and orienting displayed 3-D objects as well as for modifying your view of a stationary object. It is accurate and repeatable. Because it functions like a joystick, it has some of the joystick's disadvantages (compared to a mouse), and it has only six degrees of freedom. While that's adequate for positioning and orienting objects, you need more to manipulate virtual tools. Once the tool is positioned, you must do more things with it to make it work; therein lies the problem.

Another possibility is the Flying Mouse from SimGraphics Engineering. It's a three-button mouse with a Polhemus sensor inside, designed to be easy to pick up. You can position and orient it in space and then press the buttons. It's almost good enough for virtual tools, but not quite. For virtual tools, you'd prefer the buttons to be more pressure-sensitive. A convenient feature of the Flying Mouse is that it can function as a normal 2-D mouse when on a tabletop. The company is emphasizing the development of software necessary for future "virtual tool" environments. This is a plus.

These technologies are in their infancy and subject to rapid change. Many of my reservations about current products may become quickly outdated as they evolve and mature.

Further On Down the Road

A different approach to the problem of sensing multifinger gestures involves the use of vision-based systems. Computer-vision systems that analyze complex real-world scenes in real time remain just beyond the state of the art. Nevertheless, in some applications, such as visual inspection, where scenes are specialized and predictable, systems are approaching feasibility. Simple, low-level computer vision may also be useful in observing human gestures.

In the present context, a gesture is a set of points that describes the path of a group of fingers in space and time. The

continued

World Radio History

utility of gestures for pointing at objects is readily apparent to those who use mice and touchscreens. What is less obvious is their utility for manipulating spatial representations of objects (e.g., sculpting and extruding solid shapes, cutting, smoothing, and joining surfaces, and using virtual tools).

Sensor Frame Corp. is developing a gesture-input device called the Sensor Cube. It is an outgrowth of the Sensor Frame, a 2-D optical finger-tracking device developed jointly at Sensor Frame Corp. and Carnegie Mellon University. Using four sensors, the Sensor Frame reliably tracks up to three fingers in two dimensions at 30 Hz even though fingers sometimes block one another from some of the sensors. This ability to track multiple fingers distinguishes the Sensor Frame from common touchscreens.

3-D Sensing

The Sensor Cube was intended to be simply a "thicker" version of the Sensor Frame. However, recent research results indicate that the Sensor Cube can be built using fewer sensors than the Sensor Frame, yet can still track up to three fingertips in three dimensions.

Several important considerations drive the design of the Sensor Cube:

- It must allow for at least 10 degrees of freedom per hand. This would allow positioning and orientation of a virtual tool relative to a workpiece, followed by x,y manipulation of analog inputs on the tool itself by two opposed fingers.
- It must allow casual use. This becomes especially important as increasingly powerful virtual tools permit a given operation to be completed in a short time, so you can do something else that may not require using the gesture-sensing device. Good virtual tools should preclude the need for constant use. This would lessen concern about the fatigue caused by holding your hand in the air all day.
- It must leave your hands free to use other devices, such as keyboards and telephones. This might preclude the use of gloves and/or wires.
- It must sense the position of fingers relative to screen objects.
- It should be able to sense fingers in the vicinity of a video monitor. You should be able to attach it to the monitor so that you don't need to sacrifice desk space.
- It should operate independently of the video monitor so that it can be mounted in another location.
- It should be inexpensive in mass production to encourage general use and standardization of application and user-interface software.

The Sensor Cube is still under development. Nevertheless, it has helped to define the requirements for a DTM workstation.

One Is Not Enough

Gestures are appropriate for quantifying many parameters in parallel and for spatially constraining the scope of an operation. Speech compares poorly with them when you are specifying quantitative things, especially in parallel.

However, simple disconnected speech is good at selecting one of many operations from a menu, especially a large menu. Using gestures may sound like a good idea at first, but if you have to learn American Sign Language to use a device, it probably won't be too successful.

Interfaces should use gestures where appropriate and speech where appropriate. By mixing the two, you might have a tool more powerful than either one taken alone. Such a system, for example, might let you use three or four fingers to surround certain objects displayed on a monitor, while it responds to the spoken word "green" to color those objects.

Space Is the Place

Transferring spatial knowledge from people to computers has been an intractable bottleneck in CAD applications, possibly because today's formal computer languages represent that knowledge inappropriately. By gaining the ability to capture human expression, computers can provide a better alternative to traditional manual methods of design.

Much of the motivation for building gesture-based systems comes from the potential to increase productivity in the future. Today, most spatial input devices have some drawbacks. But as technologies improve, 3-D input will permit you to perform design functions in a more natural and intuitive manner. ■

Paul McAvinney is the founder and chairman of the board of Sensor Frame Corp. (Pittsburgh, PA) and inventor of the Sensor Cube, Stage Frame, and VideoHarp. He can be reached on BIX c/o "editors."

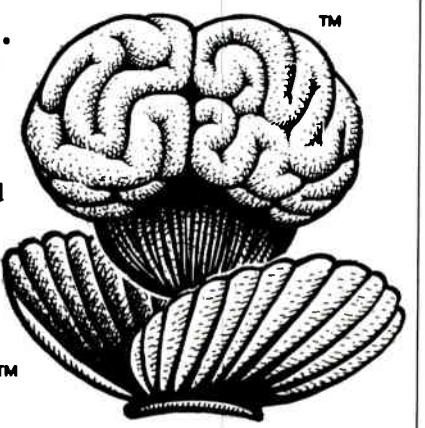
Neural Networks are Solving Real Problems

Here's What NeuroShell Users are Doing:

Circuit board problem diagnosis • Psychiatric evaluations • Stock market predictions • Sales forecasts • Oil exploration • Optimizing biological experiment results • Price forecasts • Analysis of medical tests • Optimizing scheduled machine maintenance • Predicting student performance • Horse racing picks • Factory and shop problem analysis • Optimizing raw material orders • Spectral analysis • Selection of criminal investigation targets • Employee selection • Process control • and much, much more.

Since NeuroShell learns by example, handles fuzzy logic, can give tight data fits, and doesn't try to capture knowledge in rules, it is also being used as an alternative in many cases to expert systems, the ID3 algorithm, and regression analysis.

NeuroShell is ready to use for real problems on your IBM PC or compatible, and still only $195. No programming or Ph.D. required! Free telephone assistance (including setting up *your* problem). Free shipping by mail in US, Canada, and Mexico ($9 elsewhere). Add 5% tax in MD.



Ward Systems Group, Inc.
245 West Patrick St. / Frederick, MD 21701
TEL (301) 662-7950 FAX (301) 663-6656

NeuroShell™
Now anyone can use neural networks

NeuroShell is a trademark of Ward Systems Group, Inc. IBM PC is a registered trademark of International Business Machines

Circle 305 on Reader Service Card (DEALERS: 306)

World Radio History

TO ORDER CALL TOLL FREE:

1-800-822-8088

"COME INTO OUR NEW SHOWROOM AND DISCOVER WHAT LOW PRICES, FAST SERVICE AND GREAT SELECTION IS ALL ABOUT."

★ SUPER SPECIALS ★

PC Tools Deluxe 6.0 .... $79	Xerox Formbase $299
PC Anywhere III $59	M.S. QUICK C 2.0 ..... $58
Drawperfect $259	M.S. Quickbasic 4.5 .... $58

"Give Us the Opportunity to BEAT any Advertised Price!"

★ CALL FOR OUR FREE CATALOG ★

ACCOUNTING

	$
Accpac Easy G/A, Payroll ea.	54
Accpac Plus G/L, A/R, A/P 5.0 ea.	499
Accpac Plus I/C, O/E, R/I 5.1 ea.	499
Accpac Plus Windowing System	159
Accpac Plus Payroll, Job Cost	499
Accpac BPI G/A, A/R, A/P, I/C ea.	229
Bedford Accounting (NEW)	139
DAC Easy Bonus PAK	159
DAC Easy 4.1 Accounting/Payroll	79/69
Managing Your Money 6.0	117
Peachtree Complete III Accounting	145
Peachtree w/Data Query III	209
Quicken 3.0	39
Timeslips III	159
Turbo Tax Pro Series	209

C.A.D.

Autocad v. 10	2499
Autocad 386	2699
Autosketch 2.0	89
DesignCad 4.0	145
DesignCad 3D 3.0	199
Drafix CAD Ultra	239
Generic CADD Level III w/Dot Plot	195
MathCad 2.5	272
Turbo CAD	59

COMMUNICATIONS

Carbon Copy Plus 5.2	102
Close-Up Customer	119
Close-Up Support	155
Co/Session	145
Cross TALK For Windows	119
Desklink 2.2	92
LANtastic Starter Kit	389
Lap Link III	82
Mirror III	49
PC Anywhere III	59
Procom Plus	47
Relay Gold	155

DATABASE

Alpha IV	309
AskSam 4.2	157
Clipper Summer '87	399
Dataease	459
Dataperfect	279
dBase IV	459
dBase IV Developer's Kit	779
dBXL Diamond v. 1.3	149
Foxbase Plus 2.1-Single User	182
Foxbase Plus 2.1-S/U runtime	255
Foxbase Plus 2.1 LAN	289
Foxbase Plus LAN runtime	369
Foxbase Plus 386	279
Fox Pro	427
Fox Pro LAN	599
Fox Pro Runtime	289
Paradox 3.0	429
PC File 5.0	79
PFS Professional File	179
Oracle Professional	899
Q & A 3.0	215
Quicksilver Diamond	329
Reflex 2.0	159
R&R Code Generator	109
R&R Reportwriter (dBase)	109
R&R Clipper/Foxbase Module	49
UI Programmer 2.0	349

DESKTOP PUBLISHING

	$
First Publisher 3.0	89
GEM Desktop Publisher	165
Newsmaster II	49
Newsroom Pro	22
Publisher's Paintbrush	149
Publisher's Type Foundry	289
Ventura Publisher 2.0	485
Ventura Professional Extension	359
Pagemaker 3.0	479
Publish It	105

BUSINESS GRAPHICS

Chartmaster	209
Graph-In-The-Box 2.2	79
Harvard Graphics 2.13	279
GEM/3 Graph	159
Micrografx Graph Plus	329
Microsoft Chart	239
Picture Perfect	229
Statgraphics 4.0	579

PAINTING

Animator	175
Arts & Letters Graphics Editor	449
Calendar Creator Plus	35
Corel Draw	305
Designer 3.0	449
Dr. Halo III	29
Draw Perfect	259
Flowcharting II+	139
Formfiller 2.0	79
Formtools	54
Formworx w/fill n' file	85
GEM 3/Artline	269
GEM 3/Draw Plus	159
Lotus Freelance Plus 3.01	319
Org Plus Advanced	72
PC Paintbrush Plus	79
PC Paintbrush IV Plus	109
Per: Form 2.0	159
Printmaster Plus	33
Printshop	35
Xerox Formbase	299

INTEGRATED

Enable OA	409
First Choice w Quicken	99
Framework III	419
Lotus Symphony 2.0 Plus	439
Microsoft Works 2.0	95
Smartware II	449

MICE

DFI Scanner (HS-3000+)	179
Logitech Hires (NEW)	69
Logitech Hires Bus	75
Logitech Hires w/Paintshow (NEW)	89
Logitech Scanman Plus	175
Logitek Trackman	85
Microsoft Mouse w/Paintbrush	99
Microsoft Mouse w/Windows 286	129

PROGRAMMING

APL Plus/PC v. 8.0	399
Brief Editor	159
C Tools Plus	125
Clarion Personal Developer 2.0	109
Clarion Professional Developer	365
Matrix Layout	139
Microsoft C Compiler 5.1	272
Microsoft Cobol Compiler	559
Microsoft Fortran 5.0	272
Microsoft Macro Assembler 5.1	89
Microsoft Quick Pascal	62
Microsoft Quick C 2.0	62
Microsoft Quickbasic 4.5	62
M.S. Basic PDS 7.0	299
M.S. Quick C/Assembler	129
MS Windows Development Kit	309
RM Cobol 85-Full System	869
SPF/PC	159
Turbo Assembler/Debugger	92
Powerbasic	79
Turbo C 2.0	92
Turbo C Professional 2.0	159
Turbo C Tools	125
Turbo Pascal 5.5	92
Turbo Pascal Professional 5.5	159
Turbo Prolog 2.0	95

PROJECT MANAGEMENT

Harvard Project Manager 3.0	419
Project Scheduler IV	459
Superproject Expert	409
Timeline 4.0	449

SPREADSHEETS

Lotus 1-2-3 2.2 (new)	329
Lotus 1-2-3 v 3.0	389
LUCID 3D	59
Microsoft Excel 2.1	295
Microsoft Multiplan 4.01	119
Quattro	89
Quattro Pro	269
R&R Worksheet Utilities	109
Supercalc V	299
Twin Advanced	59
Twin Classic	35
VP Planner 3-D	149

UTILITIES

386 to the Max	49
386 to the Max Professional	79
4Word	65
Above Disc	59
Allways	79
Battery Watch 2.0	32
Brooklyn Bridge 3.0	77
Check-It	79
Copy II PC	25
Copy II PC Deluxe Option Board	105
Corporate Ladder	55
Cruise Control	35
Dan Bricklins Page Garden	65
Desqview 2.2	69
Desqview 386 2.26	115
Direct Access	55
Disk Optimizer 4.0	44
Disk Technician Advanced	89
Documentor (Wallsoft)	189
QEMM 5.0	59
Fastback Plus 2.09	97
Fastrax	25
Flash	49
Flight Simulator 4.0	39
Go-Script	89
Go-Script Plus	179
Gofer	45
Headroom	69
HDC Windows Express	45
Hi-jaak	95
H/Test H/Format H/Optimum 3.0	85
Hyperpad	79
Impress	69
Keyworks Advanced	99
Labels Unlimited	45
Le Menu	49
Look 'n' Link	59
Lotus Agenda	125
Lotus Magellan 2.0	89
Mace 1990	79
Mace Utilities 5.0	55
Memory Mate	45
Microsoft DOS 3.3 w/GWBasic	75
Microsoft DOS 4.01 w/GWBasic	79
Microsoft Windows 286 2.11	62
Microsoft Windows 386 2.11	119
Microsoft Learning DOS	35
Norton Advanced Utilities 4.5	79
Norton Commander 3.0	79
Norton Editor	45
Optune	49
OS/2 Extended	699
OS/2 Standard	299
Pathminder 4.11	45
PC Tools Deluxe 6.0 (new)	79
Pop-Drop 3.1	39
Pop-Drop Plus	59
Print-Q 4.0	79
QDOS II	42
Sidekick Plus	127
Sideways 3.21	39
Softcraft Font Solution Pak 2.0	349
Software Carousel 3.0	47
Speedstor	39
SpinRite II	69
Super PC-Kwik	49
Super PC-Kwik/Power Pak	79
SQZ Plus	65
Tornado w/Library	75
Turbo EMS	65
Typing Tutor IV +	29
Ultrascript PC	129
Ultrascript PC Plus	279
VM 386	149
Who-What-When	112
Wonder Plus 3.0	49
Word for Word Professional	105
Worksheet Utilities	59
Unix 386 Operating	599
Xenix 286/AT Operating System	459
Xenix 286/AT Development System	449
Xenix 286/AT Complete	929
Xenix 386/AT Operating System	469
Xenix 386/AT Development System	599
Xenix 386/AT Complete	1079
Xtree Pro	49
Xtree Pro Gold	69

WORDPROCESSING

Ami Professional	299
Grammatik IV	47
Microsoft Word 5.0	209
Microsoft Word For Windows	299
Multimate 4.0	279
Personal Lawyer	45
PFS: Professional Write 2.1	139
Rightwriter 3.1	47
Sprint	119
Word Perfect Xenix SCO	799
Workperfect 5.1	245
Wordperfect Library 2.0	69
Wordperfect Network 5.0	349
Wordperfect Office	269
Wordperfect for UNIX	699
Wordstar Professional 5.5	175
Xywrite III +	215
Zyindex Personal 3.0	59
Zyindex Professional 3.0	165

"Where America Shops for PC Software"

OUR FAX #:
215-639-7234
For Products not Listed call:
215-639-7110
Please send all correspondence to:
Software Add-Ons
Two Greenwood Square
3331 Street Rd., Suite #155
Bensalem, PA 19020
Prices, terms, and availability subject to change without notice

VISA
MasterCard
DISCOVER

Policies:
1- We accept VISA, Mastercard, & Discover - No Surcharge
2- a) Shipping - any 1 item - $6
- any 2 items - $7.
- 3 or more add 2%
OUR HOURS: 9:00-6:00 M-F
b) NEXT DAY DELIVERY AVAILABLE UPON REQUEST
3- COD Charge of $5 per order.
4- Purchase Orders must be approved.
5- International Orders welcome (except Canada).
6- DEALERS & VAR INQUIRIES WELCOME.
7- Returns are subject to approval - 10% restocking fee.

Circle 262 on Reader Service Card

World Radio History

A 486 With Zero Wait.

If you've been waiting for the right 486 system to come along, wait no more.

Configured with either the Industry Standard (ISA) bus or the Extended Industry Standard (EISA), CSS Laboratories MaxSys™ systems are the right choice in multi-user file servers.

Compare our features with anybody else's:

- 12 slot motherboard for maximum expandability, longer return on investment
- Systems with 5 or 10 half-height drive bays — enough for the most storage-intensive applications
- 400 watt power supply and two cooling fans for reliable performance under the heaviest workloads
- Proven to run Novell® Netware,™ SCO Xenix,™ ISC Unix,™ IBM® OS/2EE,™ Microsoft® OS/2,™ Quarterdeck® DESQview™
- Exclusive CSS Silent Memory Bus,™ triple-grounded for maximum reliability
- Up to 64 MB RAM*
- On-board support for the Weitek 4167 math co-processor
- Zero wait state cache memory access — plus a special 32-bit Burst Mode memory transfer that outperforms zero wait state in sequential applications
- 25 or 33 MHz available**

With features like these available today, why wait? Call a CSS representative today for more information on the MaxSys line as well as our other product families, including network B&W and color laser printers, desktop workstations, and more.

CSS LABORATORIES, INC.

A Solid Investment.

In the U.S.A. (714) 852-8161
In Canada (416) 882-0260; In Australia HYPEC 61-2-808-3666

Ask about ON-SITE SERVICE

*64 MB with EISA, 16 MB with ISA.
**33 MHz availability based on Intel chip release.

In the U.S.A.: 1641 McGaw Ave., Irvine, CA 92714. TEL: (714) 852-8161. FAX: (714) 852-1844. In Canada: 60 Mural St., Suite 1, Richmond Hill, Ontario L4B 3H6. TEL: (416) 882-0260. FAX: (416) 881-0161.
AT is a registered trademark of International Business Machines. Silent Memory Bus, MaxSys and the CSS logo are registered trademarks or trademarks of CSS Laboratories, Inc. All other brand or product names are trademarks or registered trademarks of their respective companies. © 1990 CSS Laboratories, Inc.

Circle 71 on Reader Service Card
(READERS: 71)

World Radio History

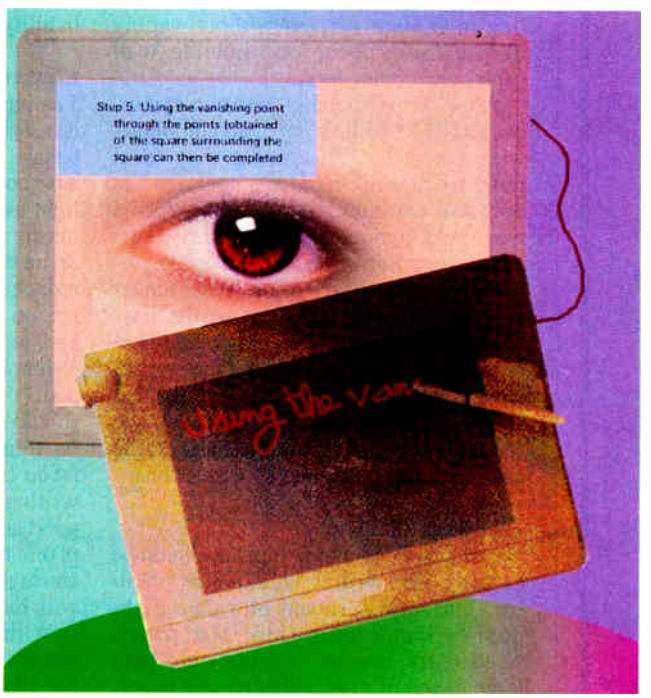
Sign Here, Please

With interactive tablets, you can input signatures, hastily jotted notes, and rough sketches directly into your computer

Gale Martin, James Pittman, Kent Wittenburg, Richard Cohen, and Tom Parish

Like new species, new technologies emerge to fill niches of opportunity. VCRs, fax machines, and microwave ovens have become commonplace because they satisfy widespread needs, and because the state of technology is sufficient to build reliable products. On the horizon for the 1990s is a new technology—computer-based interactive tablets—that promises to bring computer power to everyday activities.

Interactive tablets will look more like checkbooks, notebooks, or drafting tables than today's workstations, with their keyboards, mice, and CRT monitors. You will communicate with them through handwriting and sketching, and they will communicate to other computers through radio-link technology.



Pen and Paper

Modern culture has evolved using pen and paper to communicate. Your day-to-day activities bear the artifacts of this history: calendars, checkbooks, notebooks, insurance forms, sales receipts, blueprints, bills, address books, even Post-it notes. Standard computer workstations, although more than sufficient for many tasks, stand in the way of automating many of life's most common activities. In some cases, they're not portable enough, or they're too big for the work area. These are the niches that interactive tablets will fill.

Standard workstations also fail when the information you enter departs from standard text. For example, you'd be hard pressed to find a keyboard that lets you enter Japanese and Chinese characters, sign your name, write math equations, or sketch PERT charts and flowcharts. Graphics design tasks are also difficult with standard workstations. Several years ago, we watched VLSI designers using a CAD system and were surprised to find that a large part of their activities centered around pen and paper rather than the system itself. Recent comparisons of CAD tools for designing power supplies reveal that traditional paper methods are three to 10 times faster. CAD tools offer designers powerful capabilities; workstations should not block access to them.

Future Perfect

Although available now for limited, specialized applications, interactive tablets have a long way to go before they realize their full potential. The technology requires the development of a true electronic equivalent of pen-and-paper media.

Advances in portability will come from a variety of sources, from research into wireless LANs to the international initiative for high-definition TV, which includes a push to build low-cost, flat-

continued

ILLUSTRATION: MARC YANKUS © 1990

World Radio History

Circle 133 on Reader Service Card

AMX™

REAL-TIME MULTITASKING KERNEL

8086/88, 80x86/88 80386
Z80, 64180, 8080/85 68000/10/20

- Fast, reliable operation
- Compact and ROMable
- PC peripheral support
- DOS file access
- C language support
- Preemptive scheduler
- Time slicing available
- Configuration Builder
- Complete documentation
- Intertask messages
- Message exchanges
- Dynamic operations
  - — task create/delete
  - — task priorities
  - — memory allocation
- Event Manager
- Semaphore Manager
- List Manager
- InSight™ Debugging Tool

THE BEST

Join over 600 developers such as IBM®, Xerox, Hewlett Packard, Hayes, Hughes Aircraft and NASA.

CHOOSE AMX

The best low-cost, high-performance real-time multitasking system available today.

No Royalties
Source Code Included

Demo Disk	$25 US	Call for prices for other processors.
Manual only	$75 US	
AMX 86	$3000 US	

(Shipping/handling extra)

IBM is a registered trademark of IBM Corp.
Z80 is a trademark of Zilog, Inc.
AMX, AMX 86, InSight are trademarks of KADAK Products Ltd.

KADAK Products Ltd.
206-1847 West Broadway
Vancouver, B.C., Canada
V6J 1Y5
Telephone: (604) 734-2796
Fax: (604) 734-8114

SIGN HERE, PLEASE

Standard computer workstations stand in the way of automating life's most common activities.

panel displays of all sizes. Neural-network and AI blackboard architectures hold the promise of interpreting free-form input. But what technologies are required to make interactive tablets an everyday reality?

The Communications Factor

Interactive tablets must be able to communicate easily with existing personal computers and computer networks. Imagine getting your E-mail or uploading your recent meeting notes while sitting in O'Hare Airport without waiting in line for a phone or fumbling with cables and connectors.

A recent partnership between Motorola and IBM to link portable computers with a host by transmitting over local radio frequencies heralds a new trend in wireless communications. The Agilis hand-held computer also features transparent communications via a radio-frequency transmitter. Many researchers are investigating how to best use the now-crowded radio spectrum to provide low-power, in-office radio LANs. One promising approach is a cellular network that shares the spectrum presently set aside for cellular phones. Another involves the use of laser and infrared transmissions.

Electronic Paper

Writing on an interactive tablet should be as much like writing on paper as possible. The display should provide a high-quality image on a thin, flat panel. Needed for interactive tablets are both large desktop- or blackboard-size panels and small hand-held units with low power consumption.

The three available flat-panel display technologies are LCD, plasma, and electroluminescent (see the BYTE In Depth section, September 1988). All three technologies sandwich some active material between two "container" walls, which are usually made of glass. The walls contain electrodes that apply a voltage across a pixel to turn it on or off. With LCD panels, the active material is a liquid of crystals that reorients or twists when the voltage is applied. Transparency or polarization properties change during the twist. With a gas-plasma panel, the active material is a gas that glows when the voltage is applied. With the electroluminescent panel, the glowing material is a phosphor film.

Each technology has its strengths and weaknesses. At present, all are suitable for small, monochrome interactive tablets. Plasma and electroluminescent panels have higher-contrast, more-readable displays than LCDs, but LCDs consume less power, which can be critically important for portable, hand-held units. Most vendors package the displays with EGA or VGA display drivers, making them compatible with current software.

On the horizon for the 1990s are larger, full-color displays. LCDs seem to be the best prospect for color, but they are the weakest with respect to scaling up to larger sizes. Plasma panels have the best record with respect to large displays. Electroluminescent displays are intermediate; their special strength lies in the reliability of the technology.

Electronic Pens and Beyond

The input device for an interactive tablet is a stylus, which ideally should feel and behave like a pen. Recent stylus products have come close to this goal. Some are as light and as small as pens and avoid the mushy feel of excessive tip-switch travel. Some have shed their cables; others have reduced cable bulk to the point that they are no worse than the chained pens at bank counters.

Just as a stylus should emulate a real pen, the "electronic ink" it produces should act like real ink. Parallax should be minimized by minimizing the distance between the image plane and the writing plane. The calibration should be good enough to register the exact display pixel. Many styli provide resolution far above that of the display and then waste it with bad calibration.

With an interactive tablet, you can also use the stylus to indicate mode changes, act like a paintbrush, or appear as a mouse. This allows the stylus to drive popular software without modification.

But a stylus has to be more than a mouse. The stylus software should echo the ink stroke, and do so fast enough to keep up with the stylus movement. It should be able to erase the strokes after handwriting recognition takes place so that you can replace them with an icon or a diagram, and do so without disturbing

continued

World Radio History

Double your work space.
Triple your real power.
Access 100% of your memory.

If you are now using a 286 based system, what the ALL CHARGECARD™ will do for you is nothing short of spectacular.

Instead of spending thousands of dollars on new 386 equipment, you can upgrade with ALL CHARGECARD™ from as little as $299.

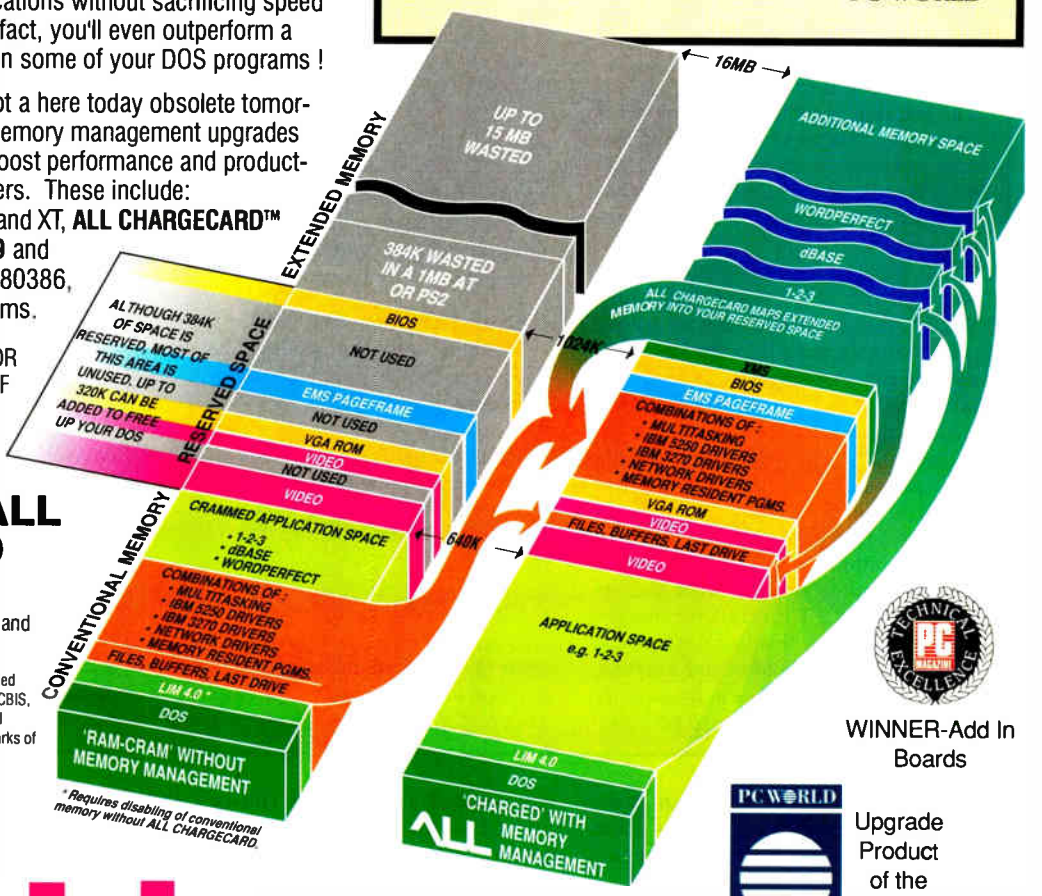
You won't have to disable system board memory to multitask Windows™ or DESQview™ under EMS 4.0 ! Plus you'll be able to move memory resident programs, like any network shell, and Files, Buffers, Lastdrive and Device Drivers, out of your conventional DOS space, above 640K.

You'll be able to load those monster spreadsheets and switch instantly between applications without sacrificing speed or the use of your network. In fact, you'll even outperform a 386 of the same clock speed on some of your DOS programs !

ALL CHARGECARD™ is not a here today obsolete tomorrow idea. It's one in a line of memory management upgrades which have been designed to boost performance and productivity in all your present computers. These include:
ALL CARD™ at **$395** for the PC and XT, **ALL CHARGECARD™** for 286 based systems at **$299** and **ALL CHARGE 386™** at **$99** for 80386, 386SX and 80486 based systems.

CALL ALL COMPUTERS TODAY FOR MORE DETAILS AND THE NAME OF YOUR LOCAL DEALER.

> *"ALL CHARGECARD gives AT systems 386 power ..."* - PC WEEK
>
> *"ALL CHARGECARD squeezes the last ounce of RAM out of your 286 ..."* - PC MAGAZINE
>
> *"The biggest shock of all? ALL CHARGECARD actually works as claimed ... a must buy ..."* - PC WORLD



1-800-MAP IT ALL
(1-800-627-4825)

Available at IBM Authorized dealers, Businessland, selected Computerlands and other fine computer outlets.

Nationally distributed through Ingram Micro D. Certified by Lotus, Ashton-Tate, Novell, Banyan, 3Com, IBM, CBIS, TOPS, 10Net and many others. All brand names and product names are trademarks or registered trademarks of their respective companies.

WINNER-Add In Boards

Upgrade Product of the Year

ALL COMPUTERS INC.

All you'll ever need for memory management and upgrade technology

ALL COMPUTERS INC., 1220 YONGE ST., TORONTO, ONTARIO M4T 1W1 (416) 960-0111

Circle 17 on Reader Service Card (DEALERS: 18)

World Radio History

The Blackboard Metaphor

The blackboard model is based on a computational metaphor suggested by Allen Newell in the early 1960s. The metaphor suggests that several people cooperating to solve a problem cannot talk to each other, but can communicate only by writing information related to the problem on a blackboard.

Each participant has different knowledge and can solve different parts of the problem. When participants see subproblems on the blackboard that they can solve, they step up to the board and write something they think may contribute to solving the overall problem.

The blackboard model was originally used in building AI programs. But it can be useful in many situations where extensibility and flexible control flow are important, whether the platform is a PC or a mainframe.

The Computational Model

The blackboard computational model is composed of a set of modules (knowledge sources), a central database (the blackboard), and a scheduling mechanism for determining the order of execution of the modules.

The modules can share information through the blackboard (and only through the blackboard) and do not retain their own state information. Each module can transform or combine certain types of data on the blackboard as steps toward a possible solution to the problem.

Each module can "look" at new data added to the blackboard and indicate whether it may be able to contribute toward a solution using the new data (possibly in conjunction with other data on the blackboard). The scheduler chooses from the modules that can work on the data on the blackboard, and executes one of them. This module may add more information to the blackboard (if it succeeds), or it may not (if it fails).

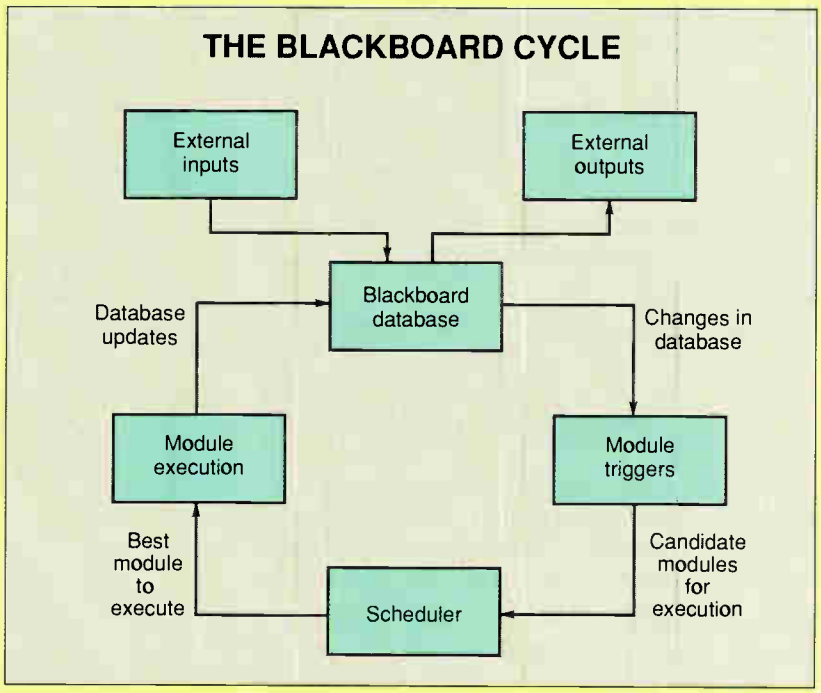


Figure A: *A blackboard system lets multiple modules work on the same input. In an interactive-tablet system, the modules might consist of a neural network, lexical insertion, and a spacial parser.*

The blackboard repeats the following cycle over and over until the problem is solved (see figure A):

1. Choose a module.
2. Execute the module.
3. Update the blackboard data as specified by the module.
4. Go to step 1.

The blackboard architecture provides a structure for a set of separate modules, each of which can contribute part of a solution to a problem. The module execution is triggered by changes to the database and controlled by the heuristics of the scheduler. The implementor chooses what should be represented in the database, how to decompose the various steps in building a problem solution, and the scheduler heuristics that control the order in which steps in the problem solution are tried.

A key aspect of blackboard architecture is the separation of heuristic control from the individual knowledge sources. This allows some flexibility in deciding how to apply the different knowledge sources to the problem, separate from deciding what knowledge sources to use and how they should work internally.

nearby graphics. This could mean placing echo ink in a separate graphics plane or keeping tables of strokes for precise erasure.

Matters of Interpretation

It is tempting to interpret stylus input in a straightforward manner with a simple loop that reads, echoes, and records strokes. When a time-out occurs or the next stroke is too distant, such a system assumes that a notation is finished and sends it to the handwriting-recognition system. Once a symbol is recognized and an appropriate action taken, the input loop is repeated.

This was the initial approach we took at Microelectronics and Computer Technology Corp. (MCC), where we are developing interactive-tablet technology. However, we found that such simple event-loop architecture does not give rise to a product-quality system. Quite simply, with an interactive tablet, you can't count on strokes being drawn in a particular order (e.g., you may cross your *t*s after you've written a word or wait until you've finished the sentence), so the particular recognition sequence may have to be rerun at any time.

Recognizing and interpreting free-form input involves many interdependent processes: segmenting characters, gen-

World Radio History

Typical blackboards used in AI applications support powerful mechanisms for triggering knowledge sources (often using mechanisms similar to those of rule-based systems). A blackboard also requires a truth-maintenance system to support asserting and retracting information on it.

These characteristics provide a powerful blackboard substrate for AI applications, often at the expense of computation time and space. Luckily, the requirements for user interfaces permit significant simplifications and efficiencies compared to these applications.

The blackboard architecture supports integration of multiple input modes, combining mode-dependent and mode-independent modules. Several modules can contribute toward a solution that none could produce individually. The modules interact as peers rather than as masters and slaves.

For example, several techniques may need to be combined in order to resolve the meaning of seemingly ambiguous input. The architecture can also support parallel, heuristic, opportunistic searches, possibly at several levels of granularity.

Next-Generation User Interfaces

The 1990s will see a coalescing of standards for the look and feel of graphical user interfaces (GUIs). However, user interfaces will push beyond these standards as people begin interacting more ambitiously with their computers via stylus, touch, voice, keyboard, and mouse.

The blackboard architecture provides enabling technology for building advanced computer interfaces. From a blackboard architecture tuned to the requirements of GUIs, the next generation of human-machine interfaces will emerge.

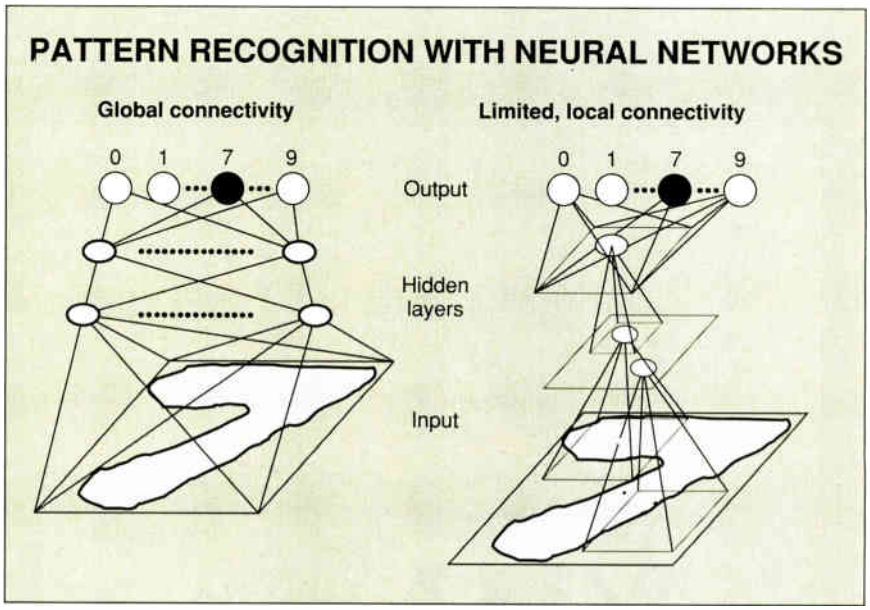


Figure 1: *Back-propagation techniques enable a neural network that starts out with randomly valued connections to learn to correctly recognize input patterns. Network architectures with limited connectivity represent one way to make these recognition systems compact enough to fit on small machines.*

erating best-guess recognition decisions, and incorporating context into handwriting recognition. The bottom line is that every component depends on every other component, and each wants to run last so that it can use the output of the others.

At MCC, we've embodied these free-form handwriting-recognition requirements in an AI blackboard system (see the text box "The Blackboard Metaphor" above). The system provides a control structure in which very different technologies, such as neural-network character recognizers and AI-based natural-language parsers, cooperate and share information. These different software components run whenever the system makes enough data available to them. The system posts results in a common format that other software components can use as input.

The blackboard can support parallel competing interpretations of input. Later input may confirm or refute an interpretation. Thus, the system combines the strengths of different strategies and technologies, all working on the same problem at the same time.

Handwriting Recognition

Recognizing handwriting is an involved process. An interactive tablet should be able to accurately recognize a large vocabulary of both hand-printed and handwritten symbols. This includes uppercase and lowercase letters, numbers, punctuation marks, math symbols, editing marks, graphics symbols, and other symbols you create on the fly. Handwriting-recognition accuracy should improve with context and by adapting to your idiosyncrasies. A good handwriting-recognition system should not restrict your writing to little, predefined boxes.

The tablet should handle the details of segmenting input into individual symbols. Handwriting-recognition decisions should also reflect alternative guesses and levels of certainty, not just a binary choice. Finally, the tablet should recognize symbols in a fraction of a second on a low-end personal computer and have a nice functional interface for current and future applications.

No current technology satisfies all these requirements. Most available systems severely limit their symbol vocabularies, typically to uppercase letters. Current systems accomplish symbol segmentation either by constraining you to write in boxes or through ad hoc techniques that fail when you write naturally.

Reported accuracy rates are typically in the 90 percent range. But these figures are ambiguous. Accuracy varies depending on test samples and conditions. Current technology is adequate for very constrained, limited applications, but it falls short of what you need to make interactive tablets commonplace and generally useful. The buyer should beware.

Some of these problems can be overcome by moving away from traditional pattern-recognition techniques to neural-network techniques (see figure 1). Traditional approaches divide development into feature selection and classification. You choose what seems to be a good set of features for representing inputs and a statistical or syntactic classification technique for defining category membership. When accuracy is too low,

continued

World Radio History

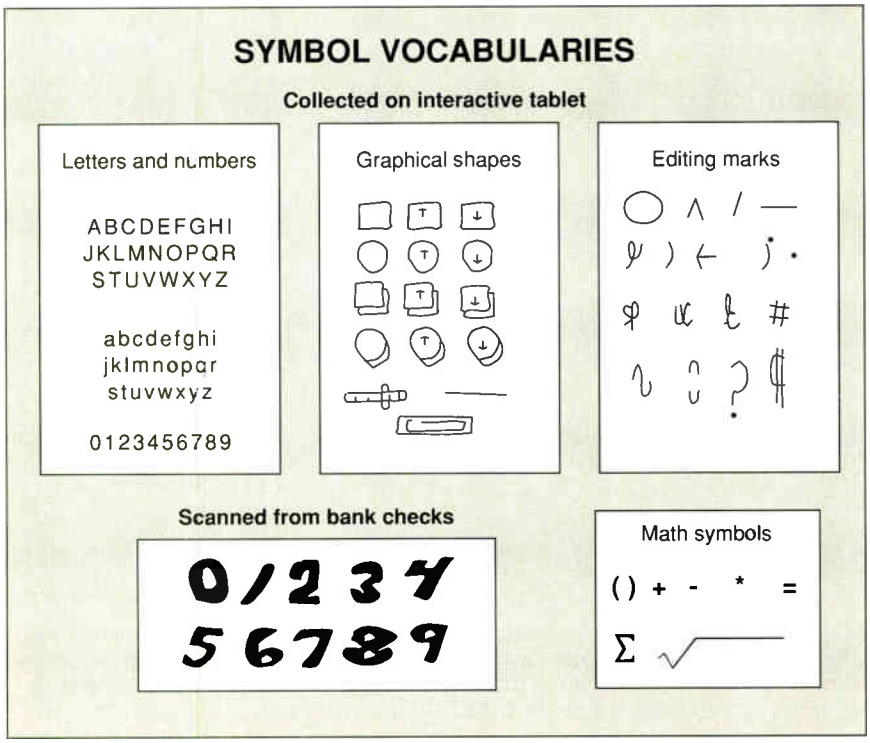


Figure 2: *Neural networks at MCC have been trained to recognize a variety of handwritten symbols. This technology makes it easy to train the system in alternate pattern types.*

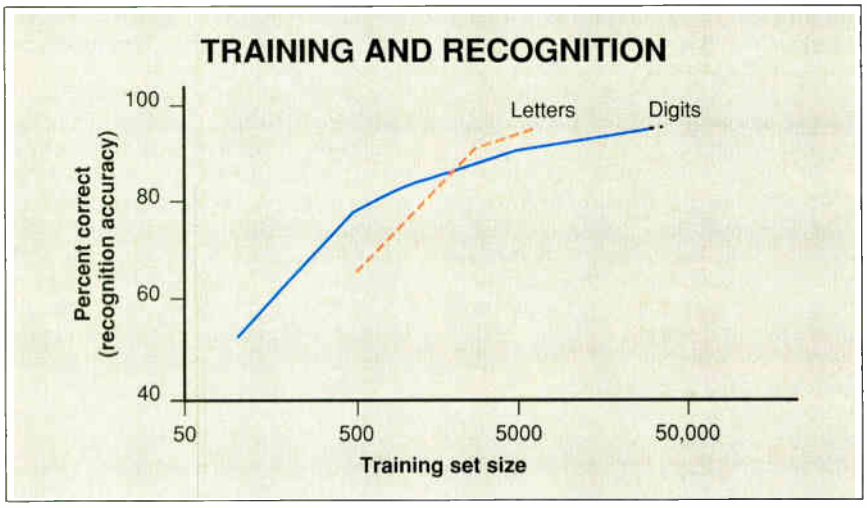


Figure 3: *The figure plots accuracy rate versus the size of a training set for a back-propagation neural network. You need large training sets to achieve high accuracy rates.*

you tinker. This approach leads to slow development and brittle systems. Expansion to new symbol sets essentially requires that you begin again from scratch.

The Neural-Network Connection

Neural-network techniques avoid these problems by combining feature selection with classification, and automating the complete process so that very little intervention is required. At MCC, we use presegmented bit-map arrays, not featural representations, as input to a back-propagation network, and we obtain high accuracy rates (in the mid to high 90 percent range).

The network outputs are continuously valued variables that reflect the certainty of the handwriting-recognition decision. This lets the system query you about ambiguous inputs and achieve near-perfect performance on the remainder of the patterns. Extension to other symbol vocabularies (see figure 2) is relatively automatic, using essentially the same type of network and network parameters.

The only change we have had to make is to increase the size of the network. Also, we have trained networks on a combined set of uppercase and lowercase letters and numbers. While the overall accuracy rates are lower, the errors tend to occur where humans would also make errors, such as confusing *C* with *c*, 1 with *l*, and 5 with *S*. The buyer should still beware, but the future looks more promising.

One disadvantage of the back-propagation neural-network approach is that you need to use very large training sets to achieve high handwriting-recognition rates (see figure 3). You may also need to train the network for days or even weeks. This makes it difficult to build a system that adapts to the idiosyncratic style of a primary writer or to new symbols created on the fly. It also means that systems development requires collecting or borrowing large training samples.

Training samples, and not the underlying algorithms (which are widely available in scientific literature), therefore become the critical, proprietary aspect of developing handwriting-recognition systems. Similarly, critical tools for systems development become facilities for processing large training sets, not facilities for tinkering with the underlying algorithms.

Another often-heard complaint about using neural networks for low-end personal computer applications is that they are computationally intensive and require large amounts of memory. This limitation, however, will probably disappear.

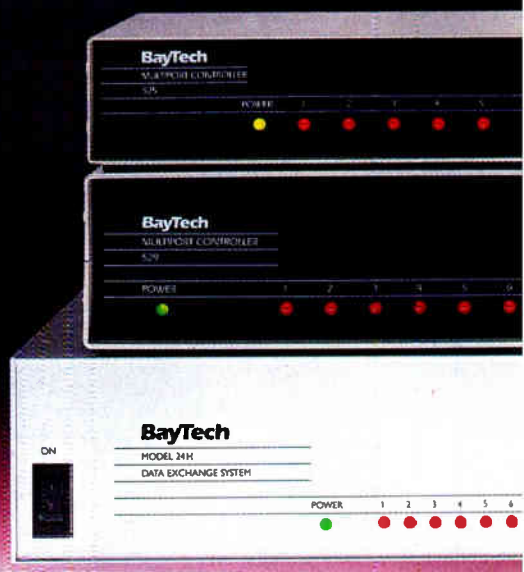
Once a network has been trained, it can be represented in a low-precision format without hurting accuracy. Networks trained with limited connectivity, such as that in figure 1, also cut down on memory requirements as well as, in some cases, on processing needs. Finally, digital-signal-processing chips represent an inexpensive path to giving low-end personal computers high-end performance. We've found the 24-bit precision available on some of these chips sufficient to train networks for hand-printed symbol recognition.

continued

World Radio History

BAYTECH MULTIPLEXER-CONTROLLERS

14 Years of Quality Multiplexing



CONTROL & DATA ACQUISITION

Enter the picture...the BayTech H-Series Multiport Controllers—stand-alone multiplexers that connect one host computer to as many as 23 peripheral devices. By cascading, the number of devices you can connect is practically unlimited. Full duplex transmission of asynchronous data is provided at speeds up to 38,400 bps. These intelligent multiports will operate with any RS-232C serial computer or peripheral device. (Optional RS-422A).

The H-Series models have been used extensively in each of these areas:

- security and environmental sensing, to improve monitoring capabilities for large and small businesses

Security

Courtesy Honeywell Protection Services.

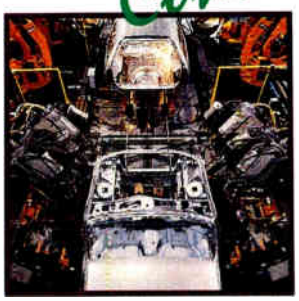
- medical data monitoring environments, where speedy responses are vital and critical information must reach the host computer immediately

Medical Data Systems

Courtesy Siemens Life Support Systems.

- industrial robotics-control environments, where multiple numerical or assembly-line machines can be centrally controlled

Process Control



Courtesy Ford Motor Company.

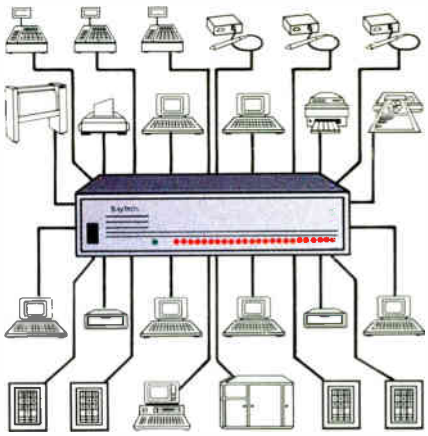
- data exchange among point-of-sale devices, through which a myriad of business equipment can be operated from one computer

Point of Sale

Courtesy Hugin Sweda.

SIX MODES OF MULTIPLEXING

To meet individual needs, these flexible, multifunctional devices are easily tailored by selecting one of six modes of multiplexing: time-division, port expansion/sharing, and four modes of buffered message multiplexing. In a typical application, the host port may be connected to a computer and the peripheral ports may be connected to such devices as: bar code readers, cash registers, fire alarms, numerical machines, modems, plotters, printers, security systems, and terminals (see illus.).



PRODUCT SUPPORT

BayTech offers unlimited hotline technical support before and after you purchase a unit. Designed and manufactured in the USA, the reliable H-Series is UL- and CSA-listed and fully covered by a one-year warranty.

So put yourself into the picture...call us today to learn about the many ways the H-Series Multiplexer-Controllers can benefit *your* business.

BayTech

Bay Technical Associates, Inc.
Data Communications Products Division
200 N. Second Street, P.O. Box 387
Bay St. Louis, MS 39520 USA
FAX: 601-467-4551
Phone: 601-467-8231 or toll-free
800-523-2702

Circle 38 on Reader Service Card (DEALERS: 39)

World Radio History

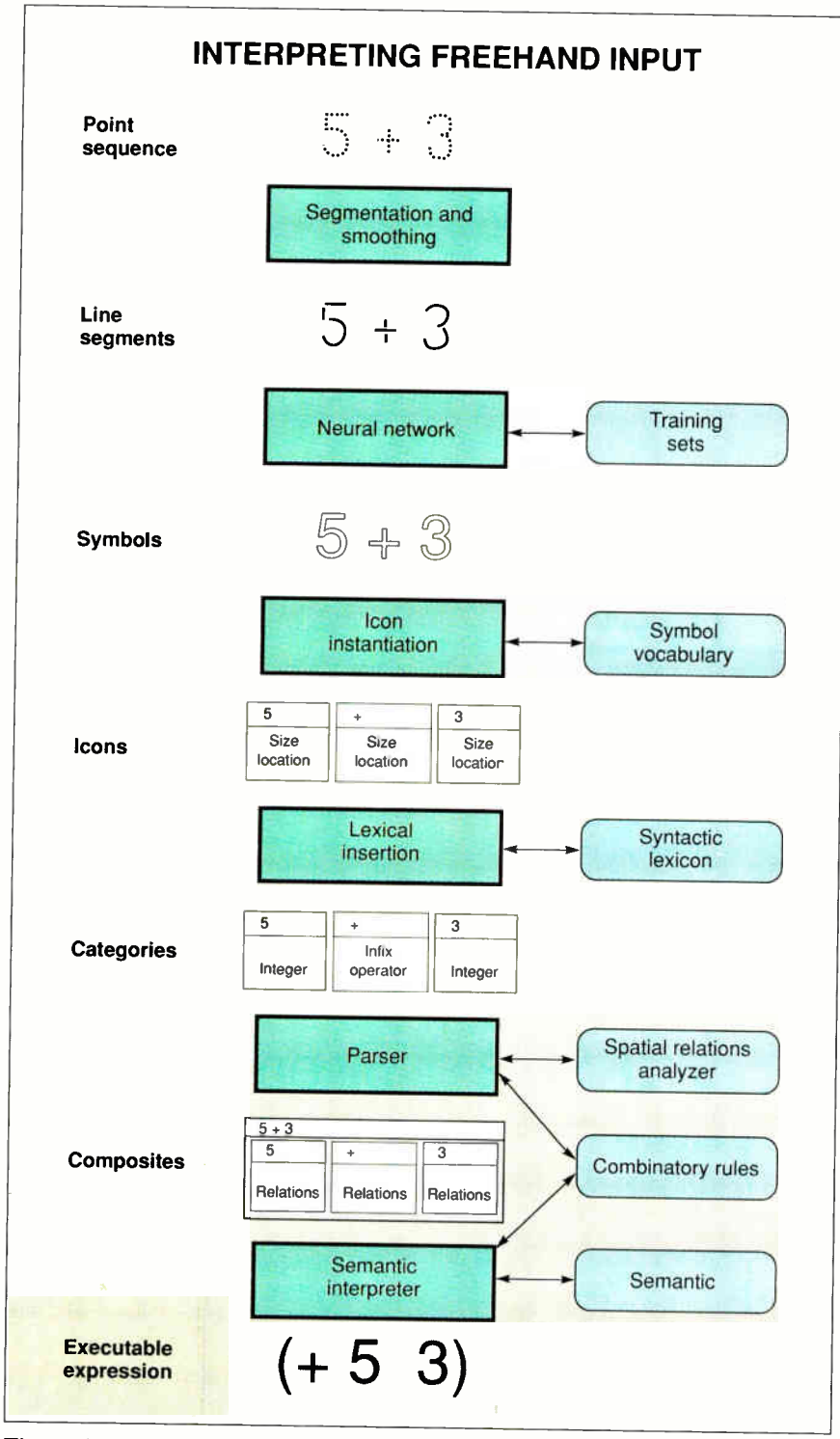


Figure 4: *This figure shows how an interactive-tablet system interprets freehand input. The input is a digitized point sequence (shown at top); the result is an executable mathematical expression (shown at bottom). Knowledge sources in the middle column transform the data types in the left column using the data banks listed in the right column. Segmentation and recognition transforms the input into strokes and a set of symbols, respectively. Visual parsing works with symbol sets located in space (icons) and forms a composite expression using a visual grammar and lexicon. A semantic interpreter converts the parser output into an executable form.*

The critical milestones for neural-network or any other symbol-recognition technology lie in combining symbol segmentation with recognition and incorporating higher-level constraints to improve recognition accuracy. Higher-level constraints refer to the fact that different sequences of symbols, such as a string of letters constituting a sentence, are not equally likely. Language and the physical world impose constraints that can be used to improve symbol-recognition accuracy.

We believe that it will be fruitful to push neural-network technology as far as it will go in achieving these milestones. One approach is to combine solutions to the segmentation and higher-level constraint problems. You train a network to recognize a letter in a larger input field, where it is surrounded by its natural context as dictated by typical letter strings appearing in natural language. Ultimately, though, it will probably be necessary to use hybrid systems that combine neural-network techniques with state-of-the-art parsing techniques, because context operates at multiple levels.

Beyond Recognition

Assume your interactive tablet can recognize and differentiate your *t*s and *i*s. You can write a number sequence, as with pencil and paper, and the machine will recognize your 7s, whether or not you cross them. What's next?

If you glance through the notebooks and sketchpads you use in meetings, in classes, or at home, you will find that many of your jottings gather their meaning not just from the linear sequence of symbols or characters, but also from their relative location in space.

For example, consider math calculations. A horizontal line can indicate subtraction (a minus sign), division (a fraction line), a negative number, or simply a boundary marker to total the calculations in the column above it. Which of the meanings is the right one? It depends on the other symbols in the immediate context and where they are relative to each other.

Other languages that have a spatial element are those of musical notation, editing corrections, engineering layouts and diagrams, flowcharts, PERT charts, and family trees. In fact, most designers first sketch a design on paper in a notation specific to their domain (e.g., architecture or engineering). Only when the initial set of problems is solved through the sketching activity will the design be translated through a series of commands and/or direct-manipulation actions and

World Radio History

transferred into, say, a CAD program.

Spatial language parsing will cut out "the middle man" by allowing you to sketch as you always have, in the spatial languages most suited to solving your particular design problems. Parsers will then be able to interpret the sketches directly and allow earlier interaction with back-end applications (see figure 4).

Spatial Parsing

The problem of assigning meaning to aggregations of symbols based on spatial relations is to some extent analogous to parsing linear languages—for example, programming languages, natural human languages appearing as text or speech, and command or mouse-based languages appearing in user interfaces.

What all these one-dimensional languages have in common is that a simple concatenation of symbols, characters, or events of some kind forms the basis of the input. Moving into two-dimensional space brings some new twists, including the need to separate the temporal sequence of the input from the 2-D space in which it exists.

For one-dimensional languages, you can generally assume that space and time are 1-to-1. The data structures and methods reflect this assumption. For example, classic table-driven parsing technologies for command languages and programming languages parse left-to-right over the input stream, predicting, and thereby constraining, the next possible input.

Spatially based languages, however, generally don't have just one temporal order for forming complex expressions. For example, you don't necessarily draw the bubbles and arcs of PERT charts from the top down or from left to right.

One approach is to ignore the temporal order of the input and impose an ordering over the 2-D space that will be convenient for the parser. For example, the system could start from the upper left corner of a 2-D space and proceed left to right, from the top down, whether or not you entered your input in that order.

This is an appropriate response for parsing static displays. However, in a dynamic sketching situation, where the system must use the constraints of parsing to help with basic symbol or character recognition, it seems inappropriate. Further, the temporal information is at least a heuristic for interpretation and should probably not be ignored altogether.

In other words, although most 2-D notations don't have a single enumeration order, humans tend to work outward from a beginning symbol by enumerating adjacent symbols rather than by jumping all over the place. Parsers for interactive tablets need to be able to work incrementally with your temporal ordering and thus be flexible with respect to the enumeration in 2-D space.

Another challenge in parsing 2-D stylus-based input is in segmentation and closure. Mouse and keyboard devices automatically segment the input into a series of primitive events or characters. For example, a particular keystroke or mouse-click explicitly indicates the end of a "sentence."

On the other hand, freehand sketching on a display does not provide such an easy method of determining the set of primitives involved in a 2-D expression. Strokes can span logically separate symbols. And you must expect individual variation in the number and order of strokes required to make a single symbol or character.

While symbol- and character-recognition technologies are designed to cope with these problems, you can expect a certain amount of indeterminacy at this low level. Parsing, then, is still another source of constraints on a particular segmentation of symbols.

Independent knowledge sources must work together to solve the overall interpretation problem. Blackboard technologies promise to help solve some of these problems by providing a framework in which communication can be coordinated across different constraining knowledge sources.

Moving into Common Usage

Simply developing reliable technologies won't make interactive tablets commonplace, however. Mitch Kapor, founder of Lotus Development, notes, "The problem of making computers useful to people as communication and information devices is not an engineering problem. It's a design problem. Engineers are trained to eliminate the subjective factors. But it's exactly the subjective factors that are critical."

Using currently available interactive tablets can be frustrating; they often violate expectations built up from experiences with pen and paper and standard workstations, and they are new. They haven't gone through the evolutionary process in which problems are discovered at the expense of initial users and solved through iterative design.

This evolutionary process can proceed along two paths. The first is to introduce new products on a small scale, such as the Sony Palmtop or the Canon AI Notebook. These products run very real risks of failure because seemingly small design problems can make them unusable. Often, you become aware of these problems only when the product is on the market.

Alternately or additionally, the R&D world can develop realistic full-blown prototype applications and get extensive feedback from potential users. MCC's Interactive Worksurface Project and IBM's Paper-Like Interface Project fall into this category.

Designing good interfaces and developing the underlying technologies necessary to make them fully functional is essential to making interactive tablets a part of everyday life. We believe that the coming decade will witness the wide availability of full-functionality tablets that recognize and interpret handwritten and sketched input, and that use wireless communications to link to other computer systems. The state of technology is close to being sufficient to create them now. The challenge is to establish a smooth migration path to move toward more generally useful systems. ■

BIBLIOGRAPHY

Hii, H. P. "Blackboard Systems" (Parts 1 and 2). *AI Magazine*, vol. 7, nos. 2 and 3, 1986.

Engelmore, R., and T. Morgan. *Blackboard Systems*. Reading, MA: Addison-Wesley, 1988.

Jagannathan, V., R. Dodhiawala, and L. S. Baum. *Blackboard Architectures and Applications*. Troy, MO: Academic Press, 1989.

Erman, L. D., F. Hayes-Roth, V. R. Lesser, and D. R. Reddy. "The Hearsay-II Speech Understanding System: Integrating Knowledge to Resolve Uncertainty." *ACM Computing Surveys*, vol. 12, no. 2, 1980.

ACKNOWLEDGMENT

We would like to acknowledge the contributions of David Chapman, Joyce Connor, Bill Gooch, Mosfeq Rashid, and Louis Weitzman to this article and to the Interactive Worksurface Project.

The authors are contributors to the Interactive Worksurface Project at MCC. Gale Martin and James Pittman specialize in neural-network-based handwriting recognition. Kent Wittenburg specializes in parsing natural and visual languages. Richard Cohen researches the use of blackboard architectures in human-computer interfaces. Tom Parish markets and transfers MCC technology to shareholder companies. The authors can be reached on BIX c/o "editors."

World Radio History

From Hand to Mouth

Despite advances in interface design, working with a computer still constitutes an "unnatural act" for the vast majority of people. This State of the Art section examines the latest efforts of researchers to make computers more accessible to everyone. For more information on the products and processes described in this section, contact the companies and organizations listed below.

Dextrous Hand Master
Exos, Inc.
8 Blanchard Rd.
Burlington, MA 01803
(617) 229-2075
Inquiry 1105.

DragonDictate-30K
DragonWriter-1000
Dragon Systems
90 Bridge St.
Newton, MA 02158
(617) 965-5200
Inquiry 1106.

DS200
Speech Systems, Inc.
18356 Oxnard St.
Tarzana, CA 91356
(818) 881-0885
Inquiry 1107.

Freestyle
Wang Laboratories, Inc.
One Industrial Ave.
Lowell, MA 01851
(800) 522-9264
(508) 522-5000
Inquiry 1108.

Interactive Worksurface Project
Microelectronics and Computer Technology Corp. (MCC)
3500 West Balcones Center Dr.
Austin, TX 78759
(512) 343-0978
Inquiry 1109.

Introvoice-5
PTVC-756
The Voice Connection
17835 Skypark Cir., Suite C
Irvine, CA 92714
(714) 261-2366
Inquiry 1110.

The Private Eye
Reflection Technology
240 Bear Hill Rd.
Waltham, MA 02154
(617) 890-5905
Inquiry 1111.

Sensor Cube
Sensor Frame Corp.
4516 Henry St.
Pittsburgh, PA 15213
(412) 683-9500
Inquiry 1112.

SIR Model 20
Scott Instruments Corp.
1111 Willow Springs Dr.
Denton, TX 76205
(817) 387-9514
Inquiry 1113.

SonicFinder
Human Interface Group
Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010
Inquiry 1114.

TeleRec
VR-4
Voice Control Systems, Inc.
14140 Midway Rd., Suite 100
Dallas, TX 75244
(214) 386-0300
Inquiry 1115.

3-Draw
MIT CAD Lab
Massachusetts Institute of Technology
Cambridge, MA 02139
(617) 253-3542
Inquiry 1116.

TI Voice Card
Texas Instruments, Inc.
P.O. Box 2909, MS 2243
Austin, TX 78769
(800) 527-3500
(512) 250-4114 (demo)
Inquiry 1117.

Verbex 5000
Verbex 6000
Verbex 7000
Verbex Voice Systems, Inc.
185 Ridgedale Ave.
Cedar Knolls, NJ 07927
(201) 267-7507
Inquiry 1118.

Virtual Interface Environment Workstation (VIEW)
NASA Ames Research Center
Moffett Field, CA 94035
(415) 965-5091
Inquiry 1119.

Voicebox
Voice Recognition Technologies, Inc.
Computer Voice Systems Division
6290 Montrose Rd.
Rockville, MD 20852
(301) 984-1400
Inquiry 1037.

Voice Card VPC-2100
Votan, Inc.
4487 Technology Dr.
Fremont, CA 94538
(415) 490-7600
(415) 490-7979 (demo)
Inquiry 1038.

Voice Master Key
Covox, Inc.
675 Conger St.
Eugene, OR 97402
(503) 342-1271
Inquiry 1039.

Voice Navigator
Articulate Systems
99 Erie St.
Cambridge, MA 02139
(617) 876-5236
Inquiry 1040.

VoiceReport
Kurzweil Applied Intelligence, Inc.
411 Waverly Oaks Rd.
Waltham, MA 02154
(617) 893-5151
Inquiry 1041.

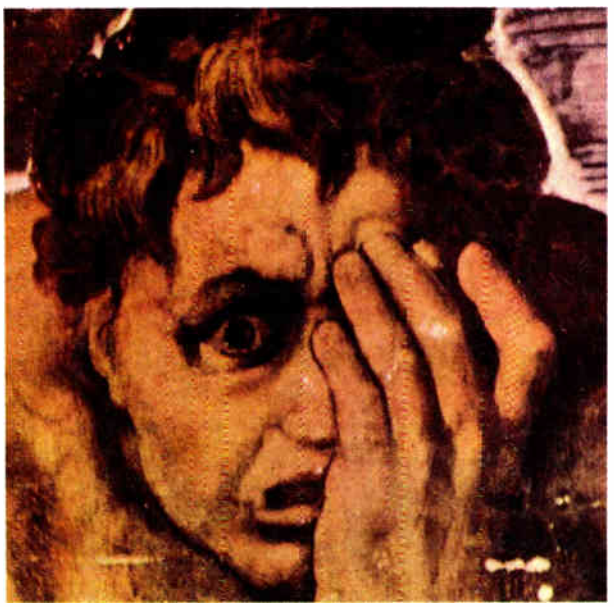
VoiceScribe 1000 Plus
Cherry Electrical, Inc.
3600 Sunset Ave.
Waukegan, IL 60087
(708) 360-3523
Inquiry 1042.

VPC-1000
Voice Processing Corp.
1 Main St.
Cambridge, MA 02142
(617) 494-0100
Inquiry 1043.

This resource guide lists information sources for the major concepts and products listed in this State of the Art section. Inclusion in the resource guide should not be taken as a BYTE endorsement or recommendation. Likewise, omission from the guide should not be taken negatively. The information here was believed to be accurate at the time of writing, but BYTE cannot be responsible for omissions, errors, or changes that occur after compilation of the guide.

World Radio History

Death Taxes Software Piracy



We can save you from one of them.

Sorry. Death we can't do anything about. As for taxes, when you use our product you'll probably wind up paying more. But software piracy: there we offer some help. Our family of software protection devices (dongles) have improved unit sales for over 2,000 companies around the world. Our products can be used in the MS-DOS, OS/2 and Macintosh environments.

Build Your Own Custom Protection Environment

Use our patented "dual-locking" ASIC chip as the basic building platform. Next, add options like: on-the-fly read/write memory, write-once or multiple-write locking codes, and encryption shells. Then add your own programming creativity to build a protection environment best suited to your product.

Users attach the device to their parallel port, and programs won't run without it. Back-up copies, hard disk and LAN operation are not interfered with.

Your Intellectual Property Belongs To You

And if you don't protect it, who will? Our products offer the most equitable way to protect your interests without sacrificing the rights of your customers. Call us today for information and demonstration units.

Software Security

USA
1011 High Ridge Road
Stamford, CT 06905
1-800 333-0407 ext. 101
203 329-8870
Fax 203 329-7428
BBS 203 329-7263
Apple Link D2379

Europe Ltd.
Selborne House
Old Avenue
Weybridge, Surrey
UK, KT13 OPQ
44-932-821-230
Fax 44-932-246-268

UK Ltd.
21 A The Precinct
High Street
Egham, Surrey
UK,TWO20 9-HE
44-784-430-060
Fax 784-430-050

Macintosh is a trade mark of Apple Computer Inc., Activator, Mactivator are trade marks of Software Security, Inc. illustration: detail from Michelangelo's Last Judgement

Circle 263 on Reader Service Card

World Radio History

Genuine 486™ System... Amazing 386™ PRICE!

Yes, full powered 80486 computer systems with all the traditional Northgate features and performance.

And a price that says "BUY NOW!"

$5,895.00

Delivered to Your Home or Office

YOU CAN'T IMAGINE WHAT SPEED REALLY IS until you have Northgate's new Elegance 486 under your fingertips. Feel the power! It delivers everything a 486 should do ... **AND MORE!** Applications—even CAD—appear on the screen almost before you release the keys. Gone is the aggravation of waiting!

Sizzling performance requires the hottest components ... and that's what Northgate delivers.

486 processor combines the capabilities of an enhanced 386, fast 387 math coprocessor, an advanced cache controller and 8K of supporting static cache memory. Result? Incredible processing speed!

Now add in Northgate's new proprietary motherboard. Unique design maximizes the power and features of the 486 processor.

And look at this! A Maxtor 200Mb hard drive. Breaks performance barriers with 15MS speed ... yet doesn't make a peep.

Impressed? There's more. 4Mb of RAM (expandable to 16Mb). And 64K of 25NS read/write-back cache. If that's not enough, you get Microsoft® WINDOWS™ 3.0 and a genuine Microsoft mouse. Of course, it comes with a Northgate *OmniKey*™ keyboard—your choice of PLUS or ULTRA models.

PLUS, Northgate has a full range of expansion options! Monitors, hard drives, tape backups, memory cards, printers, modems, and more. Custom configure the system that's right for you.

Use a Northgate 486/25 for 30 days. If it fails to do everything we say, just return it.

ORDER TODAY! Be sure to ask about custom configurations, leasing and financing programs.

CALL TOLL-FREE 24 HOURS A DAY

800-548-1993

NORTHGATE COMPUTER SYSTEMS™

"We hear you!"

P.O. Box 41000, Minneapolis, Minnesota 55441

Financing: Use your Northgate Big 'N' revolving credit card. We have millions in financing available. We accept Visa and MasterCard, too. Lease it with Northgate, up to five-year terms available.

World Radio History

Elegance™ 486/25 system configuration

- 25 MHz Intel 80486™ processor with 80387-compatible floating point coprocessor
- Industry Standard Architecture (ISA) bus
- 4Mb of 32-bit DRAM (expandable to 8Mb on the motherboard; total system RAM expandable to 16Mb with an optional memory card)
- Proprietary, U.S.-made motherboard
- 200Mb Maxtor hard drive with 15 MS access time
- 64K SRAM read/write-back cache (optional 256K cache available)
- High density 1.2Mb-5.25" and 1.44Mb-3.25" floppy drives; also reads, writes and formats low density disks
- Eight expansion card slots; one 32-bit, six 16-bit and one 8-bit
- Weitek numeric co-processor support
- Two serial and one parallel ports
- 14" monochrome monitor
- Hercules compatible video controller
- MS-DOS 4.01 and GW-BASIC software; Smart Drive disk caching software
- On-line users guide to system and MS-DOS 4.01
- 220 watt power supply
- Elegance 7 drive-bay custom tower cabinet pictured (desktop style available)
- Clock/calendar with 5 year battery backup
- Microsoft® Windows™ 3.0
- Microsoft Mouse
- Your choice of exclusive award-winning *OmniKey*/PLUS or ULTRA keyboard
- Park utility
- Front mounted controls for high/low speed operation, system reset, and keyboard lockout
- Total compatibility with all of your existing AT peripherals and I/O boards

Superior Northgate Support

Famous 30-Day Performance Guarantee. Northgate backs every system with our famous no-risk policy. If you aren't 100% satisfied, return it—no questions asked.

Warranties. Your system is covered by a 1-year limited warranty (5 years on keyboard). If a part fails, we'll ship a new one overnight at our expense—before we receive your troubled part.

Industry's Best Unlimited Toll-Free Technical Support. February 7, 1990, *BYTE* Magazine, Dr. Jerry Pournelle,* on Northgate technical support ... "has become the standard that other mail order computer companies must match."

Our system consultants are on duty 24 hours a day, 7 days a week to answer your questions. **On-site service** is available to most locations if we can't solve your problems over the phone.

Prices and specifications subject to change without notice. Northgate reserves the right to substitute components of equal or greater quality or performance. All items subject to availability.

©Copyright Northgate Computer Systems, Inc., 1990. All rights reserved. Northgate, *OmniKey* and the Northgate 'N' logo are registered trademarks of Northgate Computer Systems. 80386 and 80486 are trademarks of Intel. Microsoft and Windows are registered trademarks of the Microsoft Corporation. All other products and brand names are trademarks and registered trademarks of their respective companies.

Circle 187 on Reader Service Card

World Radio History

THE WORLD ACCORDING TO MICROS

Maps used to be written in stone; today's world atlas software is dynamic, fun, interactive, and useful

Robert Mandel

Have you ever bought something that was labeled "Made in Brunei" or read a news story about independence coming to Namibia? When you see references mentioning obscure places such as these, do you have the foggiest notion where they are?

Recent studies have shown that many people know little about where various countries and cities are located. They also are unaware of the differences in their demographics, economics, politics, or cultures. Even international experts in government, business, or university settings have been unable to look at a map and visually identify relevant patterns such as supply and demand.

This lack of geographical familiarity has been attributed to a decreasing emphasis in schools on the basics of geography, the difficulties of finding comprehensive and up-to-date global reference data, and the unavailability of map displays showing pertinent data distributions. Even recently published atlases, almanacs, and gazetteers frequently contain outdated or incomplete information.

Electronic World at Your Fingertips

Fortunately, the recent introduction of interactive electronic world atlases has provided a remedy for this problem. This atlas software simultaneously addresses the gaps in general background knowledge and links this information to other kinds of data and spatial map patterns.

With the recent vast improvements in computer graphics, color, and storage capacity at relatively low costs, the microcomputer now provides a feasible cost-effective alternative to the traditional hardbound atlas. You can use this sophisticated world atlas software in today's PCs and Macintoshes. With it, you can easily spot changing international relationships.

An amazing number of packages have appeared that could be considered "world atlas software." Some programs provide both global mapping and world statistical database capabilities, while others focus on one or the other. Some programs let you modify their maps and information categories or create your own, while other programs provide a fixed map and information database.

This field contains packages whose focus is very narrow, such as those that deal with only one subject (i.e., the U.S., entertainment, travel tips, clip-art maps, and raw data). It also contains software whose scope is very broad—multipurpose programs and full-blown geographical information system (GIS) packages. These programs are beyond the scope of this article; I will concentrate on the self-contained world atlas software.

Because of the focus on programs useful in a wide variety of contexts, I will cover only those that run on PCs or Macintoshes. (One exception is World Geograph, which runs only on the Apple IIGS.) Of the 24 packages I looked at, six run on the Mac: Azimuth, EarthPlot, Geographics, HyperAtlas, MacChoro II, and MapMaker. Only four run on multiple systems: Atlas Explorer, Global Data Manager, World Factbook, and World Geography Series.

Useful atlas programs have been produced as commercial software as well as shareware or public domain software. Among shareware and public domain offerings, you will find some very inexpensive hidden gems. A few of these offerings require a control program. (A control program provides a way of displaying and manipulating the boundary coordinates in the map database.)

Due to the volatility of these products distributed through electronic BBSes, on-line networks, user groups, and shareware distribution outfits, I've included only a sprinkling of the available offerings. None of either kind of software is copy-protected, and most of it is updated at regular intervals. Such updates are most critical when you cannot alter the supplied data.

The software falls into four distinct types: fixed maps with data, customizable maps and data, maps without data, and data without maps. The table provides a comparison of the mapping and geographical database capabilities of the 24 packages.

continued

World Radio History

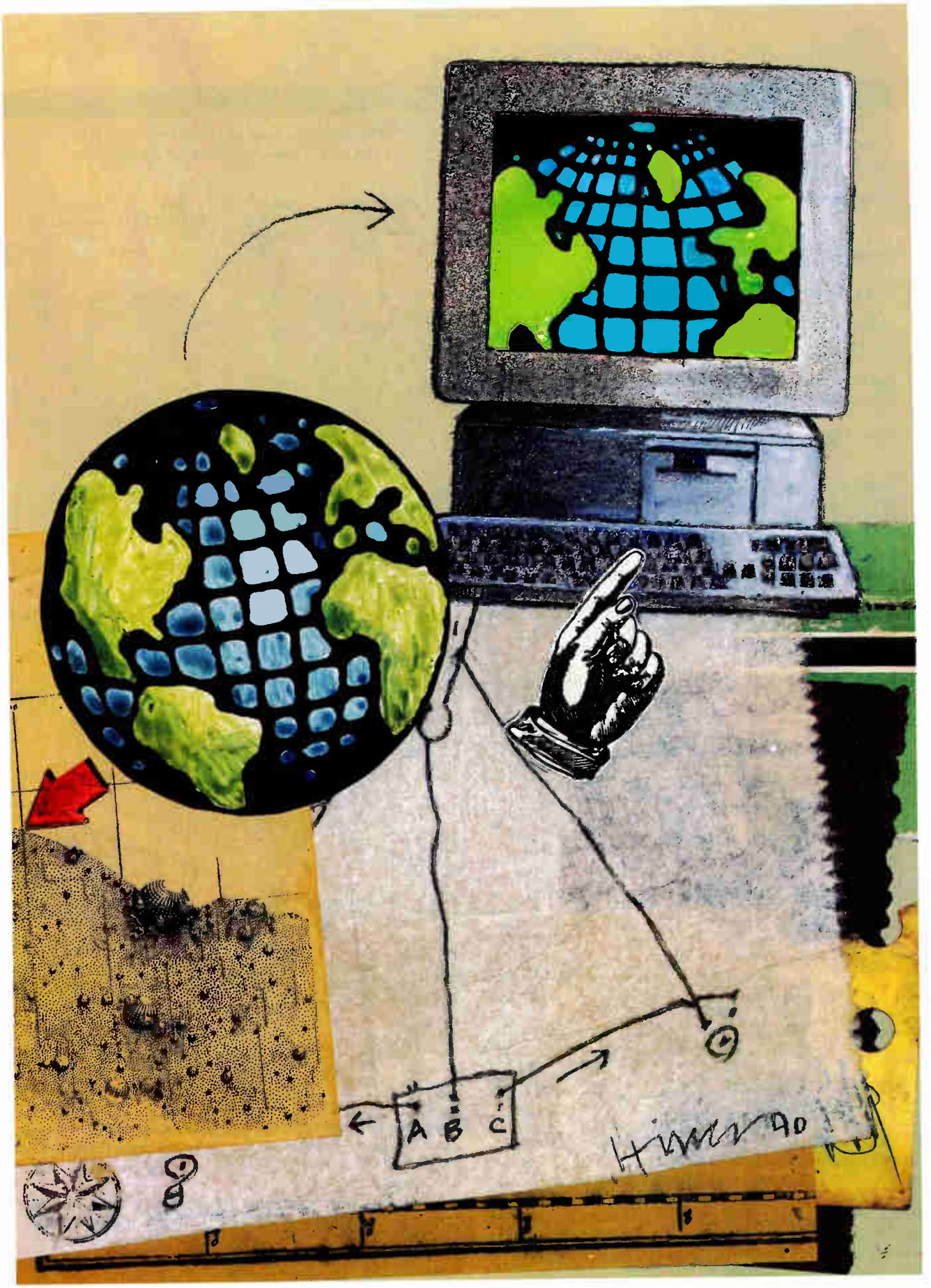


ILLUSTRATION: STEVEN HINES © 1990

World Radio History

WORLD ATLAS SOFTWARE CAPABILITIES

World atlas programs vary significantly in their capabilities. With the better packages, you can create or modify map boundaries or geographical data. With the most powerful programs, you can access quite detailed maps and perform substantial data analysis (●=yes; ○=no; N/A = not applicable).

Program name	Map coverage	Map size/ projection control	Map import/ export capability	Map alteration capability	Map graphics quality	Data display modes
Atlas Explorer	World, main regions	○	○	○	Low	Text
Atlas Graphics	6 continents, nations	●	●	●	High	Maps
Azimuth	World, nations	Size only	●	●	Medium	N/A
EarthPlot	World map with zoom	○	○	○	Medium	N/A
Geographics	Selected regions	●	●	●	Medium	N/A
Global Data Manager	World	○	○	○	Low	Map and charts
HyperAtlas	World, main regions	○	○	●	Medium	Text
MacChoro II	World, main regions	Size only	●	●	Medium	Maps and charts
Map Collection	World, some regions	●	Import only	●	High	Maps
MapInfo	World, nations	●	●	●	High	Maps
Mapit	7 continents, nations	Size only	○	●	Low	Maps
MapMaker	World, 9 regions, 259 cities	●	●	●	Medium	Maps
Map-Master	World, main regions	●	○	●	Medium	Maps
Micro World Data Bank II	World map with zoom	Size only	Export only	○	High	N/A
PC Globe	World, 8 regions, 177 nations	○	Export only	○	High	Maps and charts
Software Toolworks World Atlas	World, 14 regions, 198 nations	○	Export only	○	High	Maps and charts
Windows/On the World	World map with zoom	●	●	●	High	Maps
World	World map with zoom	●	○	●	High	Maps
World Atlas	N/A	N/A	N/A	N/A	N/A	Text
World Digitized	7 continents with zoom	●	●	○	High	N/A
World Factbook 1989	World, 12 regions, 248 nations	○	○	○	Medium	Text
World GeoGraph	World, 6 continents, 21 regions	○	○	○	Medium	Maps and charts
World Geography Series	N/A	N/A	N/A	N/A	N/A	Text
World29	World map with zoom	○	Export only	●	Medium	N/A

Fixed Maps with Data

This first group of software packages provides an enormous amount of global maps and data. These programs are the closest in form and purpose to traditional hardbound world atlases.

The goal of *Atlas Explorer* is to improve people's geographical knowledge in a classroom setting. It is the only drill-and-practice program that combines mapping capabilities with a text database on each nation. A mouse is almost essential for the program, which operates in two modes: tutorial mode, in which you can explore the world at your own pace; and quiz mode, in which you are tested on what you have learned. The program has a nice record-keeping feature to keep track of test performance.

Unfortunately, this program's map resolution and detail are quite poor (with no support for color or high-resolution graphics), and you may find the learning process sterile and boring. Furthermore, the choice of map features appears somewhat arbitrary, and the quiz questions often seem trivial.

World Radio History

Global data coverage	Data import/ export capability	Data alteration capability	Data analysis capability
Population, area, currency, language	○	○	Low
23 demographic categories	●	●	Medium
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A
Over 180 diverse categories	●	●	High
25 demographic and economic categories	Import only	●	Low
None	Import only	●	High
None	Import only	●	Medium
Population	●	●	High
Population	○	●	Low
20 demographic categories	●	●	Medium
None	Import only	●	Medium
N/A	N/A	N/A	N/A
Over 80 diverse categories	Export only	●	High
Over 80 diverse categories	●	●	High
None	●	●	Low
None	○	●	Low
Population, location, area	○	○	Low
N/A	N/A	N/A	N/A
Over 60 diverse categories	○	●	Low
55 diverse categories	Export only	●	High
Economics, location, area	○	○	Low
N/A	N/A	N/A	N/A

Software Toolworks World Atlas (formerly Electromap World Atlas) strives to be a combination world atlas and gazetteer and succeeds admirably at both. Compared to the other packages in this category, Software Toolworks World Atlas is the winner. None of the other programs contains the diversity and quality of the international maps in this package. The cartography is truly reminiscent of the best hardbound atlases (see photo 1).

The map implementation using the mouse is more complete and intuitive than in any other atlas program—you can click directly from world to region to country levels with ease. The data coverage is comprehensive and logically grouped into geography, people, government, economy, and communications categories. The software includes a nice feature that combines map and background information into a unified hard-copy report on any country.

The newly released version lets you do substantial graphical analysis and comparison of data as well as edit the geographical database itself. The only thing missing is a fuller range of customization tools.

HyperAtlas is a series of HyperCard stacks of maps and global information linked together in a geographical data management system. The program, which has separate but linked stacks for the world and the U.S., is intuitively laid out and easy to use. You can add an unlimited number of information stacks, modify existing information, or even change the maps. However, the maps are not very detailed, and the information provided regarding each country is sparse.

PC Globe is a comprehensive computerized atlas of the world's nations. I award it an honorable mention (second only to Software Toolworks World Atlas) for its manufacturer-supplied maps and data. The program is very fast and is a snap to run by either keyboard or mouse. The global, regional, and country maps are clear and detailed. Its huge amount of background and statistical information may be viewed on maps, bar charts, and tables. This is the only program that indicates on maps the membership of major international organizations such as NATO or the European Economic Community.

PC Globe's printer support is excellent, as is its ability to export maps and data for other uses. An optional add-on program—PC Nations—displays national flags and plays national anthems. About to be released is an open-architecture version of this program, Mapworks. It differs from the standard version in letting you customize maps and import data from other sources.

On the downside, it would be nice to be able to import maps, and the selection of data categories seems a bit odd. While PC Globe contains incredibly detailed national statistics on issues such as health (including the number of dentists and nurses), it ignores a few major topics, such as energy consumption.

World GeoGraph is a geography-learning tool designed primarily for classroom use. It has a highly interactive relationship between the maps and the database. This Apple IIGS program is designed around five geographical themes—location, place, relationships within areas, movement, and regions. It beautifully integrates these concepts in a way that stimulates users to think creatively and analytically.

The manual and accompanying classroom guide are excellent, and the program is quite intuitive to use. Despite the Apple IIGS monitor's course resolution (640 by 200 pixels), the global and regional maps are clear and reasonably detailed. World GeoGraph's developers thought out and clearly organized its data categories.

Although the speed of execution is sometimes a bit slow, you will find World GeoGraph flexible in displaying its data with maps, graphs, and tables. The package contains a feature (similar to that in Software Toolworks World Atlas) that combines maps and data into a finished report. World GeoGraph's search function for comparative analysis across areas—allowing and/or combinations of search criteria—is among the most powerful of all these programs. While this program does not permit much customization, you can add three new data categories and have them fully integrated into the system.

continued

World Radio History

Customizable Maps and Data

Programs in this second group give you the freedom to tailor maps and data to your own needs. The software generally includes extensive tools for mapmaking and data creation.

Atlas Graphics is a powerful and well-established package linking maps to data. I award this program an honorable mention (just behind MapInfo) in this category. Atlas Graphics has extensive tools for developing presentation-quality thematic maps. They include using color, cross-hatching, or dot-density map patterns; inserting a wide variety of special symbols and icons; adding text, legends, titles, and labels; and generating output on a wide variety of printers and plotters.

The package is easy to use and has a clear menu structure. The biggest drawback is what isn't included in the basic package. You have to purchase international maps and data separately from the manufacturer, and you may need two costly add-on programs: Atlas Draw, which permits detailed digitization or on-screen drawing of new maps; and Atlas Import/Export, which lets you transfer maps to and from other software.

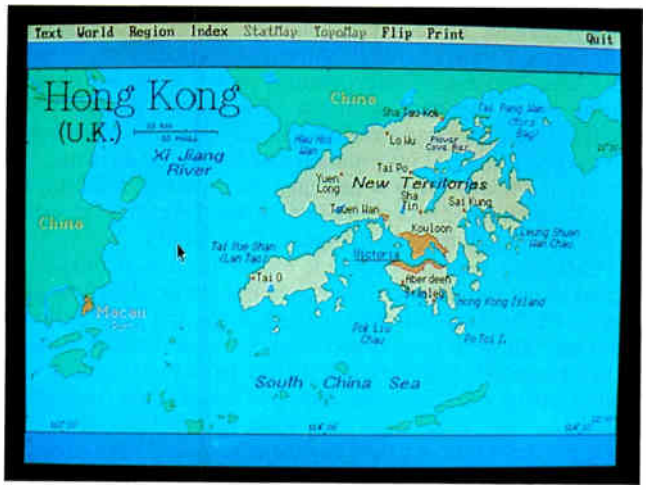


Photo 1: *This map of Hong Kong illustrates the cartographic detail and sophistication contained in Software Toolworks World Atlas.*

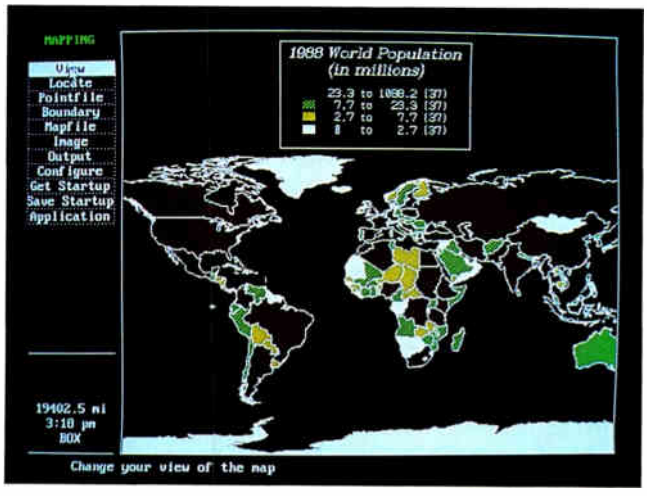


Photo 2: *MapInfo's advanced mouse-driven menu structure works well with many kinds of maps, such as this one showing world population distribution.*

MacChoro II is a remarkably compact package with an innovative presentation of thematic choropleth maps (i.e., maps that display data patterns on them). The program's unique feature is map animation. It dynamically displays data distributions (up to 60 per second) in such a way that you can immediately see whether areas that are high in one category are also high in another.

This software incorporates multiple windows, including one for drawing graphics, one for spreadsheet data, and a text-editor window for output of classification statistics. MacChoro II's main limitations include the absence of global data supplied or available with the software, and the omission of many map-data customization capabilities common among full-featured programs of this type.

Map Collection is an inexpensive and unusually versatile package that displays attribute data values on maps. The program's mapping capabilities include displaying various kinds of symbols, showing geographical contours, and even graphing three-dimensional surfaces. You can digitize, edit, and scale maps, and use over 20 map projections. (The term "projection" refers to the way the round earth is displayed on a flat map.)

One oddity about the program is that even if you use a hard disk drive, you must always boot from a floppy disk to install IBM's Virtual Device Interface for the map graphics. World map boundary coordinates are available but not automatically supplied with the package. Map Collection has two major drawbacks: the lack of integration among the software's many independent program modules, and its counterintuitive keystroke combinations.

MapInfo is the most powerful desktop mapping software I ran—its capabilities are staggering. Among software in this category, MapInfo stands at the head of the group. The package can do virtually anything the other programs in this category do—and better. The user interface is more intuitive and easier to use than any other package with flexible links between maps and data. Both the manual and the mouse implementation are excellent.

The program features map creation (with digitizing as an option), customization (with control over boundaries, legends, text, and graphics), and panning. You can also zoom and locate a specific address location on the maps, and create, modify, and visually display almost any kind of data.

With MapInfo, you can analyze and graphically display data trends (see photo 2). While map importing or exporting requires a separate package available from the manufacturer, you can readily perform data importing or exporting. There is also a built-in networking capability. This software's major limitation is the minuscule amount of global statistical data it has or makes available to you.

Mapit is a no-frills attempt to provide basic mapping and data display capabilities. The output, which is primarily designed for hard-copy printouts rather than for monitors, is crude compared to the more costly professional mapping packages.

The command structure is straightforward and relatively easy to learn but not intuitive or user-friendly. Mapit lets you create and customize maps (including control of titles, labels, scaling, and fill patterns) and insert your own data. Overall, the program succeeds in achieving its goals, but they may well be too modest for most sophisticated mapping needs.

MapMaker's aim is to give you the tools you need to create and design publication-quality maps. Its toolkit and presentation graphics capabilities are impressive. For example, data can appear on map areas through color crosshatch patterns, dot density representations, or area cartograms (in which each

continued

World Radio History

Which terminal emulation keyboard would you rather use?

A.

B.

We thought so too. The *PowerStation* is an exact VT200/VT300 layout keyboard that plugs into your PC. The *PowerStation* brings VAX applications to your PC without having to rely on messy labels.

Here's the opportunity to standardize on one keyboard throughout your department. The *PowerStation* keyboard has been designed to work on PCs, XTs, ATs, PS/2s, and the AT&T PC. And you can switch effortlessly between real VTs and the *PowerStation*.

The *PowerStation* eliminates keyboard remapping when you run PC versions of your favorite VAX applications, including EDT+, WPS-PC, WPS-PLUS/DOS, and nu/TPU. *And* the keyboard can be used with regular DOS applications.

The *PowerStation* keyboard comes with ZSTEM 240 or ZSTEM 220 terminal emulation software for connecting to your VAX. ZSTEM 240 includes full VT241 emulation and complete VT340 16 color ReGIS & sixel graphics. If you only need text, ZSTEM 220 will give you fast, accurate and complete VT220/320 emulation.

With KEA's top-notch technical support and documentation, plus a solid warranty, you can be assured of quality products backed by quality people. Find out why Digital Review Labs says KEA's *PowerStation* is "a godsend." Call today!

KEA Systems Ltd.
3738 North Fraser Way, Unit 101
Burnaby, B.C., Canada V5J 5G1
Phone: 604-431-0727
Fax: 604-431-0818

Toll-Free Order Desk
800-876-6089

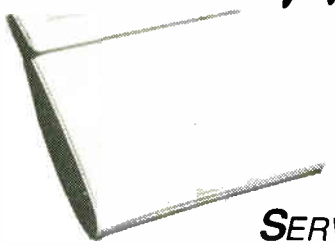
KEA

PowerStation, ZSTEM and the KEA logo are trademarks of KEA Systems Ltd. All other brand and product names are trademarks or registered trademarks of their respective holders.
©Copyright KEA Systems Ltd., 1989. All rights reserved.

Circle 134 on Reader Service Card

World Radio History

Want to save Time, Money, & Headaches?



GET SUPERSOFT's
SERVICE DIAGNOSTICS

All the software, alignment diskettes, parallel/serial wrap-around plugs, ROM POSTs and extensive, professional documentation to provide the most comprehensive testing available for IBM PCs, XTs,ATs and *all compatibles* under DOS or Stand Alone. No other diagnostics offers such in-depth testing on as many different types of equipment by isolating problems to the board and chip level.

NEW: SuperSoft's **ROM POST** performs the most advanced **Power-on-Self-Test** available for system boards that are compatible with the IBM ROM BIOS. It works even in circumstances when the Service Diagnostics diskette cannot be loaded.

NEW: 386 diagnostics for hybrids and **PS/2s!**

For over nine years, major manufacturers have been relying on SuperSoft's diagnostics software to help them and their customers repair microcomputers. End users have been relying on SuperSoft's Diagnostics II for the most thorough hardware error isolation available. Now versions of Service Diagnostics are available to save everyone (including every serious repair technician) time, money, and headaches in fixing their computers, even non-IBM equipment.

All CPUs & Numeric Co-processors
System Expansion & Extended Memory
Floppy, Fixed & Non-standard Disk Drives
Standard & Non-standard Printers
System Board: DMA, Timers, Interrupt, Real-time Clock & CMOS config. RAM
All Color Graphics & Monochrome Monitors
Parallel & Serial Ports
Mono, CGA, Hercules & EGA Adapters
All Keyboards & the 8042 Controller

NEW: Manufacturer's burn-in diagnostics now available for IBM and compatible PC, XT, AT, 386, 486 and PS 2 systems.

Service Diagnostics for PC, PC/XT, and compatibles only	$169
Alignment Diskette for PC, PC/XT and compatibles (48 tpi drives)	$ 50
Wrap-around Plug for PC, PC/XT and compatibles (parallel and serial)	$ 30
Service Diagnostics for AT and compatibles only	$169
Alignment Diskette for AT and compatibles (96 tpi drives)	$ 50
Wrap-around Plug for AT (serial)	$ 15
ROM POST for PC, PC/XT and compatibles only	$245
ROM POST for AT and compatibles only	$245
Service Diagnostics: The KIT (includes all of the above—save $502)	**$495**
Service Diagnostics for PS/2 models 25/30 50/60 or 70/80 and compatibles (please specify)	$195
Service Diagnostics for 386 or V2, V30, or Harris, etc. (please specify)	$195
Diagnostics II is the solution to the service problems of users of all CP/M-80, CP/M-86 and MS-DOS computers	$125
Alignment Diskette for PS/2 and compatibles (3.5 inch)	$ 50

To order, call 800-678-3600 or 408-745-0234
FAX 408-745-0231, or write SuperSoft.

your microcomputer repair solution

SuperSoft

FIRST IN SOFTWARE TECHNOLOGY P.O. Box 611328, San Jose, CA 95161-1328 (408) 745-0234 Telex 270365

SUPERSOFT is a registered trademark of SuperSoft, Inc.; CDC of Control Data Corp.; IBM PC, AT & XT of International Business Machines Corp.; MS-DOS of MicroSoft Corp.; NEC of NEC Information Systems, Inc., PRIME of PRIME INC.; Sony of Sony Corp.

The overall quality of these packages is surprisingly high and promises to get even better.

area's size is proportionate to its data value). In addition, the program can use multiple map projections and sizes and even lets you create new boundaries from latitude and longitude coordinates.

With MapMaker, you can create, import, export, or compare maps and statistical data. This is the only package that contains worldwide city maps. However, the program is relatively slow and difficult to use, and the quality of the country maps is crude for such a powerful package.

Similarly, *Map-Master* attempts to create presentation-quality maps showing data relationships. It has powerful customization capabilities (though not nearly up to the level of highest-quality software). Among these features are the ability to create special regions, zoom, and add symbols, text, and lines to maps.

After a cumbersome installation process, I found Map-Master to be easy to use and logically laid out. But the program also has some severe limitations: It will not support VGA graphics (640 by 480 pixels), and its maps are not well detailed. Map-Master permits neither the creation of new maps (but you can modify existing ones) nor importing/exporting of maps. And while it allows you to create or import new data, you cannot export data. Although the package includes (or makes available) considerable statistical data on the U.S., it provides no such global information.

Windows/On the World is a particularly flexible and open mapping system. It lets you create overlays of graphics, text, and symbols, and it can display distance-bearing and position information. Running under Microsoft Windows, this program can link up well with the increasingly powerful range of Windows applications.

At present, the global boundary coordinates contained in Windows/On the World are less detailed than the U.S. data available on CD-ROM. The global mapping information is extracted from the Micro World Data Bank and is free to any registered user. But the Defense Mapping Agency (a government branch) has recently selected the creator of this program to help develop a future product called Digital Chart of the World.

Maps Without Data

This category provides full cartographic capabilities, but its programs generally lack the ability to display data distributions on the maps. These packages are especially useful for generating different kinds of long-range global views.

Azimuth is a full-featured map-drawing/-drafting program that lets you view the earth from any distance or angle. Its capabilities include rotation, scaling, creation of a library of symbols, and map layering, and it lets you import and export maps. The package contains clear (though complex) instructions.

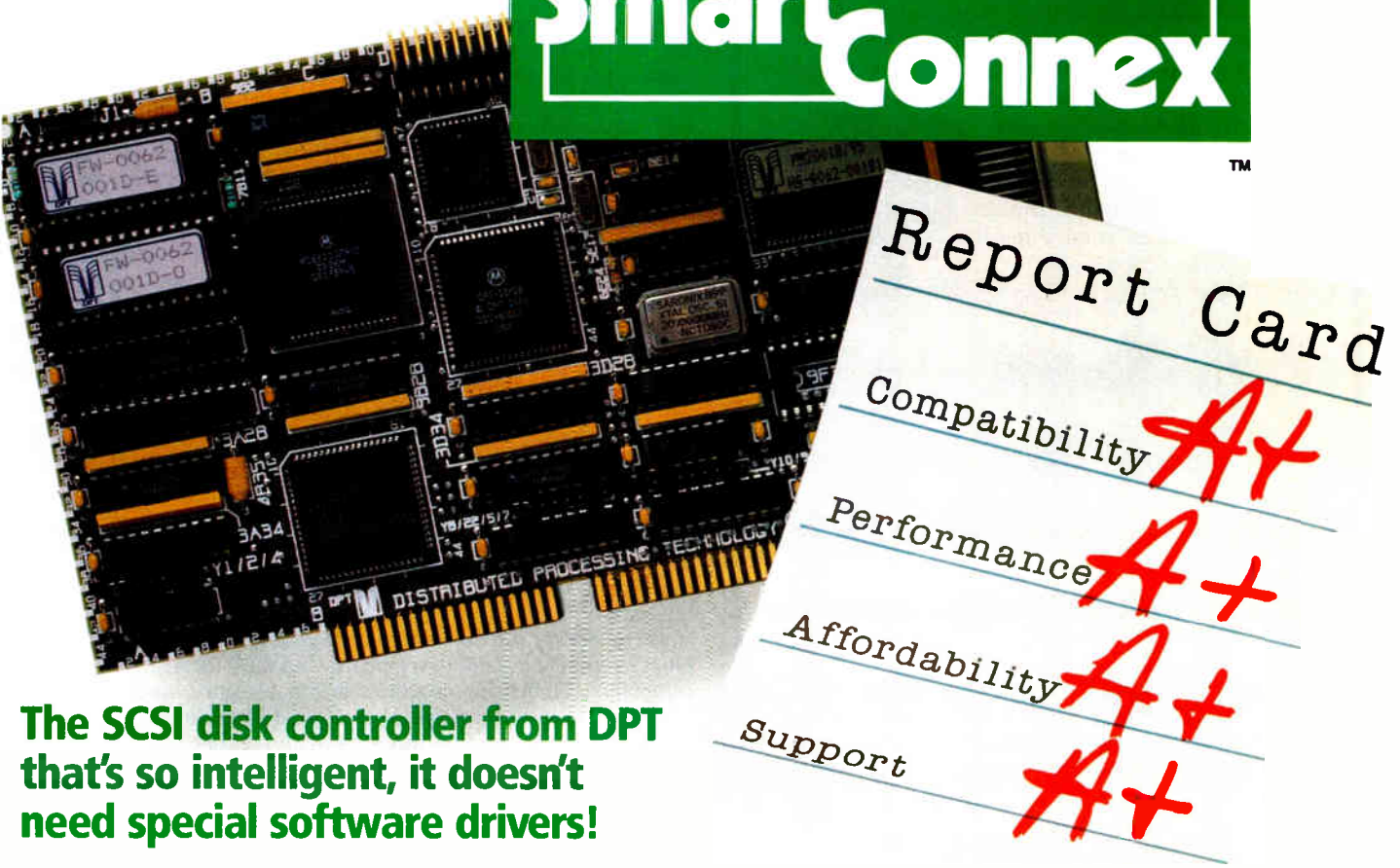
continued

Circle 272 on Reader Service Card

World Radio History

Announcing the end of the SCSI compatibility crisis:

SmartConnex™



The SCSI disk controller from DPT that's so intelligent, it doesn't need special software drivers!

Makes the grade without software drivers

SCSI connectivity hassles are a thing of the past! SmartConnex makes it possible for the first time to run SCSI disk drives without special software drivers or BIOS ROMS that cause compatibility problems. Just plug in SmartConnex and you're all set—exactly as though you were using a standard ST506 drive. And, you'll enjoy optional connectivity to hundreds of other peripherals with appropriate software, including tape and optical drives.

A Ph.D. in compatibility

SmartConnex is compatible with *all* PC ATs and operating systems, and is guaranteed to work with *all* existing AT applications. So it isn't necessary to buy new programs or make any changes to system software. No matter what operating system or SCSI disk drive you use, you won't have to worry about controller compatibility.

A 68000 I.Q. on board

SmartConnex's on-board 68000 processor and custom-designed ASIC chips make it the highest-performance controller on the market. Its unique design pushes the fastest SCSI disk drives to their top performance limits!

An A+ in affordability

SmartConnex costs less and performs better than other products—it's that simple. When you consider cost along with SmartConnex's other great advantages, there's no smarter move!

Backed by the best: DPT

Distributed Processing Technology was the first to develop caching disk controllers and hardware disk mirroring for microcomputers, and is the recognized leader in the industry. Our products have been at work for over a decade, speeding up minis and mainframes. We offer a 1-year warranty, clear documentation, and outstanding technical support.

Put SmartConnex to the test!

Call today and find out more about the end of the SCSI compatibility crisis—with SmartConnex, from DPT.

DPT
Distributed Processing Technology

132 Candace Drive
Maitland, FL 32751
Phone: (407) 830-5522
FAX: (407) 260-5366

Circle 87 on Reader Service Card (DEALERS: 88)

World Radio History

Circle 16 on Reader Service Card

ALF's *Quick Copy* is your Disk Copying Solution

The ***Quick Copy*** stand-alone duplicators copy disks quickly and reliably. No computer or computer knowledge is required. There are no complicated commands to learn, no keyboard to search, and no thick manual to read. To view step-by-step instructions on the built-in display, just press the "Explain" button at any time. Anyone who's ever used a toaster can make perfect copies with ***Quick Copy***.

Models are available for most all 5¼" and 3½" disks. Prices start at just $1495. Call for details.

Call 1-800-321-4668 today!

(Hours 8–5 MST, M–F. Inside Colorado call, 303-423-0371.)

ALF

ALF Products Inc.
3940 Youngfield St.
Wheat Ridge, CO 80033

Does *CHAOS* Lurk In Your System?

DYNAMICAL SYSTEMS, INC.

DYNAMICAL SOFTWARE: A complete package for the practical application of nonlinear dynamics and chaos to real world data and theoretical studies.

Easily interfaced with instrumental output and your own programs. Use *DYNAMICAL SOFTWARE* to study scientific, medical, engineering and economics time series.

Written manuals include comprehensive introduction to nonlinear dynamics and chaos for the chaotic novitiate.

CHAOS IN THE CLASSROOM: Self-contained programs for use in the classroom and independent study.

For IBM PC's and Compatibles.
***Dynamical Software* (Two Package Set) $550;**
Chaos in the Classroom I/II. . . . . $49.95/$59.95 — Both $99.95

JOIN THE NONLINEAR REVOLUTION!

DYNAMICAL SYSTEMS, INC.
P. O. Box 35241 • Tucson, AZ 85740 • (602) 292-1962

However, Azimuth contains a number of limitations. It does not let you use alternative map projections, it allows only limited use of color, it does not execute very quickly, and—most important—it does not contain the level of boundary detail (particularly for smaller nations) of the best mapping packages. With a forthcoming version, Azimuth developers plan to address these drawbacks and offer optional world data to complement the world boundary files.

EarthPlot is one of the pioneer public domain programs for displaying views of the world from outer space. It is designed for long-range viewing—from 1000 to 160,000 miles up, any latitude and longitude, with or without grid lines. But the boundary data excludes both Antarctica and country borders, and the program is slow. You will find that EarthPlot's close-up views are inaccurate, you can't save the maps you create, and the program does not support hard-copy printout.

Geographics is a dynamic atlas program. With it, you can create and display points of information either on the supplied maps or on maps you create or import. The program allows you considerable latitude to scale and edit maps, but it contains only select international boundary files, and you will not find using it intuitive. Furthermore, the toolkit for map customization is much more limited than those provided by other packages in this category.

Micro World Data Bank II is a condensation of the 6-million-point World Data Bank developed by the CIA for mainframe computers. Comparing programs in this category, the World package got top honors, and Micro World Data Bank was the next best program. The microcomputer version contains 179,000 latitude and longitude points detailing coastlines, islands, and countries, as well as American state borders, lakes, and rivers.

You can generate maps from any latitude/longitude point and a huge range of altitudes, and you can choose from five levels of detail. The level with the finest detail produces maps surpassing most other available mapping programs. This program's developer designed the database so that it can be incorporated into other mapping programs.

PlotMWDB is a powerful control program. With it, you can easily customize the size, shape, and position of world maps. In addition, you can produce hard-copy outputs via several plotters. You can also export maps to other applications.

World is the best program included in this discussion with a mapping focus. World's most amazing feature is its ability to draw maps using over 100 different cartographic projections. It can also rotate, scale, and shade maps and incorporate great circle arcs, range rings, symbols, labels, and titles.

The program can use a variety of map boundary files, ranging from those that are quite generalized to a highly detailed file using Micro World Data Bank. This program's biggest disadvantages are its user interface (which is neither intuitive nor easy to use), and the fact that, with a one-monitor system, it overprints text and graphics.

World Digitized provides over 100,000 points of coastline, island, lake, and national boundary coordinates organized by continent. You can obtain two control programs for displaying this database. In both cases, you must substantially transform the data.

The first option—the Simple Display Program—supports the use of the mouse, complex zooming and positioning, distance measurement, and integration of maps into BASIC programs. With the other option—the Map Control Program—you can use a variety of map projections, viewing angles, positions, altitudes, and imported map coordinates including Micro World

continued

 Circle 91 on Reader Service Card

World Radio History

12 Mhz 286 VGA COMBO KIT

- 80286-12 CPU
- 1 Meg RAM
- 1.2 Meg Floppy Drive
- 1.44 Meg Floppy Drive
- 40 Meg 28 ms Hard Drive
- 16 bit VGA Board
- 14" VGA color Monitor (640×480)
- 2S/1P/1G ports
- 101-key Keyboard
- Genius Mouse
- M/S DOS 4.01
- Panasonic 1180 printer
- Surge Protector

$1795

16 Mhz 386SX VGA

- 80386-16SX CPU
- 2 Meg RAM
- 1.2 Meg Floppy Drive
- 1.44 Meg Floppy Drive
- 66 Meg 25 ms Hard Drive
- 16 bit VGA Board
- 14" VGA color Monitor (640×480)
- 2S/1P/1G ports
- 101-key Keyboard
- Genius Mouse
- M/S DOS 4.01

$1995

20 Mhz 386 VGA

- 80386-20 CPU
- 2 Meg RAM
- 1.2 Meg Floppy Drive
- 1.44 Meg Floppy Drive
- 66 Meg 25 ms Hard Drive
- 16 bit VGA Board
- 14" VGA color Monitor (640×480)
- 2S/1P/1G ports
- 101-key Keyboard
- Genius Mouse
- M/S DOS 4.01

$2295

25 Mhz 386 VGA

- 80386-25 CPU
- 4 Meg RAM
- 1.2 Meg Floppy Drive
- 1.44 Meg Floppy Drive
- 105 Meg IDE Hard Drive
- 16 bit VGA Board
- 14" VGA color Monitor (1024×768)
- 2S/1P/1G ports
- 101-key Keyboard
- Genius Mouse
- M/S DOS 4.01

$2995

25 Mhz CACHE 386 VGA

- 80386-25 CPU
- 32K 25ns Cache Memory
- 4 Meg RAM
- 1.2 Meg Floppy Drive
- 1.44 Meg Floppy Drive
- 105 Meg IDE Hard Drive
- Dual HD/FL IDE Controller
- 16 bit VGA Board
- 14" VGA color Monitor (1024×768)
- 2S/1P/1G ports
- 101-key Keyboard
- Genius Mouse
- M/S DOS 4.01

$3795

33 Mhz CACHE 386 VGA

- 80386-33 CPU
- 32K 25ns Cache Memory
- 4 Meg RAM
- 1.2 Meg Floppy Drive
- 1.44 Meg Floppy Drive
- 150 Meg 18 ms ESDI Drive
- 32K Fast Cache ESDI Controller
- 16 bit VGA Board
- 14" VGA color Monitor (1024×768)
- 2S/1P/1G ports
- 101-key Keyboard
- Genius Mouse
- M/S DOS 4.01

$3895

PC MAGAZINE

"ALTEC Zip 386s are solid machines featuring brand-names parts. A good buy, they are clearly affordable." PC Magazine May 30, 1989"

New Release 486 system is available. Call now.

The ALTEC-286 turned in some of the best performance times of all the machines tested." PC Magazine Feb. 14, 1988

Free 4 Months On-Site Service

The Altec Collection- Pillars of Success

Policy:
- Same day shipments with standard configurations for order before 3:00 pm E.S.T.
- Shipping and handling extra. Personal and company checks require 10 days to clear. Prices are subject to change and all items are subject to availability. All returns must be shipped prepaid, insured, in original condition and complete with documentation. All returns must have RMA #

ALTEC
Technology Corp.
1-800-255-9971

Altec's Another Standout-Service
- 30 Day Money Back Guarantee
- 1 Year Warranty for Parts and Labor
- Free 4 Months On-Site Service
- Lifetime Toll-Free Technical Support

18555 East Gale Ave.
Industry, CA 91748
Tel: 818/912-8688
FAX: 818/912-8048

VISA MasterCard

Circle 22 on Reader Service Card

World Radio History

ITEMS DISCUSSED

Atlas Explorer 1.0 ..... $50
Spinnaker Software
1 Kendall Sq.
Cambridge, MA 02139
(800) 826-0706
Inquiry 1051.

Atlas Graphics 3.0.....$790
Basic package $495, plus $295 for international boundary and data files.
MapMaker 4.01.....$395
Strategic Mapping, Inc.
4030 Moorpark Ave., Suite 250
San Jose, CA 95117
(408) 985-7400
Inquiry 1052.

Azimuth 1.0 .....$395
Graphsoft, Inc.
8370 Court Ave., Suite 202
Ellicott City, MD 21043
(301) 461-9488
Inquiry 1053.

EarthPlot 3.0 (public domain)..... $11
Geographics 1.4 (shareware)..... $11
Educorp Computer Services
531 Stevens Ave., Suite B
Solana Beach, CA 92075
(800) 843-9497
Inquiry 1054.

Global Data Manager 2.3.....$125
World Game Institute
University City Science Center
3508 Market St.
Philadelphia, PA 19104
(215) 387-0220
Inquiry 1055.

HyperAtlas 1.1..... $100
Micromaps Software, Inc.
P.O. Box 757
Lambertville, NJ 08530
(800) 334-4291
Inquiry 1056.

MacChoro II 1.0.....$345
Basic package $295, plus $50 for international boundary files.
Image Mapping Systems
516 South 51st St.
Omaha, NE 68106
(402) 553-2246
Inquiry 1057.

Map Collection 2.01
for commercial use..... $300
for schools.....$150
MapWare
P.O. Box 50168
Long Beach, CA 90815
(213) 985-7808
Inquiry 1058.

MapInfo 4.05.....$750
MapInfo Corp.
200 Broadway
Troy, NY 12180
(800) 327-8627
Inquiry 1059.

Mapit 2.0..... $100
Questionnaire Service Co.
P.O. Box 778
East Lansing, MI 48826
(517) 641-4428
Inquiry 1060.

Map-Master 6.01 .....$395
Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502
(800) 437-4329
Inquiry 1061.

Micro World Data Bank II
(public domain) $20
Includes the control program PlotMWDB 2.4 (shareware).
Micro Doc
3108 Jackson St.
Bellevue, NE 68005
(402) 291-0795
Inquiry 1062.

PC Globe 3.0 ..... $74
PC Globe, Inc.
4700 South McClintock, Suite 150
Tempe, AZ 85282
(800) 255-2789
Inquiry 1063.

Software Toolworks
World Atlas 2.0
floppy disk version..... $60
CD-ROM version.....$160
The Software Toolworks
19808 Nordhoff Place
Chatsworth, CA 91311
(800) 231-3088
Inquiry 1064.

Windows/On the World 2.36 .....$495
Geovision, Inc.
5680 Peachtree Pkwy., Suite B
Norcross, GA 30092
(404) 448-8224
Inquiry 1065.

World 4.04 .....$250
Philip Voxland, Social Science
University of Minnesota
Research Facilities Center
25 Blegen Hall
269 South 19th Ave.
Minneapolis, MN 55455
(612) 625-8556
Inquiry 1066.

World Atlas (public domain) $10
Public Brand Software
P.O. Box 51315
Indianapolis, IN 46251
(800) 426-3475
Inquiry 1068.

World Digitized 1.4 (shareware)
with the Simple Display
Program 2.0 ..... $30
The World Digitized
166 Shady Lane
Apollo, PA 15613
(412) 778-5072
Inquiry 1069.
or
World Digitized 1.4
with Map 2.3..... $24
Public (Software) Library
P.O. Box 35705
Houston, TX 77235
(713) 665-7017
Inquiry 1070.

World Factbook 1989
(CD-ROM).....$104
Quanta Press, Inc.
2550 University Ave. W, Suite 245N
St. Paul, MN 55114
(612) 641-0714
Inquiry 1181.
or
World Factbook 1989 ..... $90
Shryer Publishing, Inc.
1866 West Shryer Ave.
Roseville, MN 55113
(612) 633-3865
Inquiry 1182.

World GeoGraph 1.1 .....$139
MECC
3490 Lexington Ave. N
St. Paul, MN 55126
(800) 228-3504
Inquiry 1183.

World Geography Series.....$240
Intellectual Software
Queue, Inc.
338 Commerce Dr.
Fairfield, CT 06430
(800) 232-2224
Inquiry 1184.

World 29 2.98 (shareware) $15
Robert Lloyd
191 Via DeLaReina
Merritt Island, FL 32953
(407) 452-4937

World Radio History

Data Bank's boundary files. World Digitized is not quite as detailed as Micro World Data Bank and contains some minor boundary errors.

World29 is a well-thought-out map-drawing program with many unusual features. It contains a nice menu system with which you can draw maps from a wide range of altitudes based on either latitude/longitude positions or city/country/region names. World29 also offers an intriguing quiz option, in which a city location and its immediate environs are shown on a map and you have to guess the city name.

In addition, with World29, you acquire the capacity to track storms and extensive tools to customize and save generated maps. However, the program does not support VGA graphics (640 by 480 resolution), and—more important—its map boundary detail is inadequate for most professional purposes.

Data Without Maps

This type of package provides a more extensive range of data than the others but generally does not permit you to view the data on maps. Thus, these programs fill in holes in our knowledge about critical differences among nations.

Global Data Manager attempts to provide a comprehensive inventory of statistical data. This program does indeed contain a dazzling array of information. Among offerings of this type, Global Data Manager emerges in first place. It includes unusual categories such as time-series AIDS data and solar energy potential for each country.

Global Data Manager's database is extremely flexible in letting you alter, import, or export data, and compare or combine any parts of it. (There is only one map available with this package; see photo 3.) Although basically a dedicated spreadsheet, Global Data Manager permits you to view data in bar charts or even on a primitive map display. This program's major drawbacks are its sketchy manual and the difficult and counterintuitive user interface.

World Atlas is really designed to be a gazetteer, as it contains no maps. But it does provide useful textual information about continents, countries, islands, cities, oceans, mountains, lakes, and rivers. The program contains an interesting geography trivia quiz, and it has an effective means of comparing areas. But the information is dated, not modifiable, and not in a form suitable for serious aggregate data analysis.

World Factbook 1989 is a microcomputer version of a CIA-prepared annual reference volume—the most definitive and comprehensive global data the American government provides to the public. One version on CD-ROM contains the crude TextWare Plus information retrieval system. Cards exist for each of 256 countries and territories. You can search using indexed keywords, or you can add or edit data cards, but you need a standard desktop publishing or graphics package to view the black-and-white and color maps.

Another version of World Factbook 1989 that runs on floppy disks includes the far more efficient, flexible, and easy-to-use Folio Views software for organizing the data so you can search through the information in many different ways. So far, though, this version does not include the maps and does not permit modification of the data. (Plans are in the works to improve this.) The biggest drawback of both programs is that you cannot meaningfully use the presented information to perform aggregate comparative data analysis (such as in quantitative studies using spreadsheets or statistical packages).

World Geography Series aims to provide text-oriented drill-and-practice geography lessons for classroom use. The program (which includes wall maps) provides short tutorials emphasizing relationships among geographical features. Its coverage includes country and city locations, national economic data, and topographical highlights.

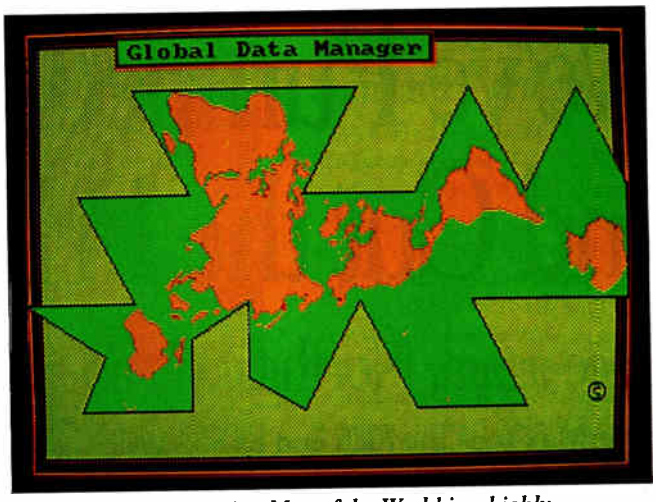


Photo 3: *The Dymaxion Map of the World is a highly unorthodox map projection designed by Buckminster Fuller. It is the only map available in the statistics-oriented Global Data Manager.*

Each World Geography Series tutorial is followed by a short quiz on the material. The biggest problem with this package is that the presentation style is so simplistic and the questions so elementary (given the tutorial that immediately precedes it) that users may quickly tire of the program and not retain the small amount of information on which they are tested.

The New Wave

Obviously, how you evaluate the relative merit of the various world atlas software packages depends to some degree on your particular goal, application, or sophistication level.

The overall quality of these packages is surprisingly high and promises to get even better. This improvement is due to increasing competition, with new market entrants and exploding product demands. Multinational corporations, national governments, and international organizations have found useful applications for this software to solve practical problems. For example, some businesses have been able to spot geographical relationships among areas of greatest sales demand, product supply, and competition.

The next stage in the development of this exciting microcomputer software may be the creation of artificially intelligent rule-based expert systems for mapping/geography databases. Programs could be developed that anticipate the kinds of information users should be seeking and relationships they should be forming. This next wave of atlas software may even provide you with advice concerning optimal decisions or actions. Technology from this generation of world atlas software may enable you to achieve a greater understanding of the complex international setting. ■

ACKNOWLEDGMENT

My thanks to Inset Systems, Inc., for the use of its HiJaak and Inset graphics-conversion and screen-capture software.

Robert Mandel is professor of international affairs at Lewis and Clark College in Portland, Oregon. Mandel is a consultant/reviewer dealing with global mapping and simulation software. He can be reached on BIX c/o "editors."

©Copyright Northgate Computer Systems, Inc., 1990. All rights reserved. Northgate, *OmniKey* and the Northgate 'N' logo are registered trademarks of Northgate Computer Systems. 80386 and 80486 are trademarks of Intel. Microsoft and Windows are registered trademarks of the Microsoft Corporation. All other products and brand names are trademarks and registered trademarks of their respective companies.

Circle 188 on Reader Service Card

World Radio History

Recording the Past...
...Plotting the Future

Our reputation precedes us! From 5 subsidiaries and 35 distributors in more than 40 countries worldwide, thousands of customers purchased more in 1989 than ever before. And they were able to choose new products from an ever-expanding array of plotters, penless plotters, digitizers, recorders and supplies.

The Graphtec reputation is one of building products that work well and last a long time. We earned that reputation the hard way, by delivering over 40 years of the best innovation, support, and after-sales service in the industry.

One of the finest examples of Graphtec innovation is incorporated into our new TM1110/1210 series of thermal plotters. These plotters are unique thanks to the world's first single-substrate, large-format thermal head. The single head ensures a uniform, high-quality printout with superb 406 dpi (16 dots/mm) resolution.

Hard copies can be made on three types of media: regular, thermal transfer and clear film. Also, RS-232C and Centronics interfaces come standard, as do GP-GL and HP-GL™ command sets.

TM1110 A1-size Thermal Plotter

GRAPHTEC

GRAPHTEC CORPORATION Mita 43rd Mori Bldg., 13-16, Mita 3-chome, Minato-ku, Tokyo 108, Japan Tel: (03) 453-0511 Telex: 02422687 (GRAPH-J)
U.S.A.: American Graphtec, Inc. Tel:(714)261-7568 (800)654-7568 Fax:(714)833-7568
Australia: Southern Graphtec Pty. Ltd. Tel:(02)748-4888 Fax:(02)748-4882
Europe: Graphtec Europe GmbH Tel:(040)511-5059 Telex:2165630 (GTEC D)
United Kingdom: Graphtec (UK) Ltd. Tel:(0270)625-115 Fax:(0270)626-733

*HP-GL is a trademark of the Hewlett-Packard Company.

Circle 108 on Reader Service Card

World Radio History

3-D GRAPHICS, FROM ALPHA TO Z-BUFFER

Graphics workstations have memory that is dedicated to the special needs of rendering in three dimensions

Ron M. Brinkmann

If you want to see where personal computers are headed, take a look at workstations. Features that are now common in PCs (e.g., windows, networking, and 32-bit CPUs) were considered part of the standard workstation package long before they began appearing in high-end microcomputers.

The next major migration of technology from the workstation to the PC will be the sophisticated general-purpose graphics hardware now found on the mid- to high-end workstations. For example, there will be a dramatic increase in the size of frame buffers available for a PC, and in the use of specialized graphics transform processors used for three-dimensional rendering. But PC standards and support are lacking.

3-D Needs

Although the ability to quickly render 3-D solids is not a universal need, certain applications benefit from it: in particular, the design of mechanical parts and, in general, any sort of 3-D drafting. Designers become more efficient if they are able to quickly visualize their designs in three dimensions. A fast 3-D rendering system lets designers view their models from any direction and distance, effectively "spinning" the object in space. If they wish to modify their models' attributes, such as color or lighting, the system can quickly display the new results. Even though this functionality is available on a limited basis for PCs, it is usually implemented using special-purpose hardware driven by specialized, nonstandard graphics calls. This is in contrast to workstations, where most graphics subsystems use industry standards such as PHIGS or GKS.

To assess the pieces needed for 3-D functionality, compare the architecture of a graphics workstation with that of a current PC with VGA display. When dealing with a 3-D model, you must first be able to convert the information about the object (in real-world coordinates) into the 2-D representation that will appear on the screen. In a system (workstation or PC) that has no specialized 3-D hardware, this conversion has to be done by the main CPU and, consequently, can be very time-consuming.

A graphics workstation, on the other hand, usually contains a specialized floating-point processor, the *transform engine* (see figure 1). Tuned to convert images from 3-D to 2-D, it will dramatically speed up the transformation. Once converted, this display-specific information is then stored in the graphics subsystem's screen memory, the *frame buffer*. The video-conversion system continuously scans the frame buffer to determine which phosphors to light on the screen.

continued

ILLUSTRATION: DON BAKER © 1990

World Radio History

Introduction

C++ / Views™

for Microsoft Windows

An application development framework with the **most complete C++ object class library** for MS Windows development.

A powerful object oriented development environment with **the first, fully functional object class Browser for C++.**

A cost-effective and essential productivity tool for the next generation of software systems. **Order today** at the introductory price of **$495.00** (plus shipping). **Comes with full source code for over 60 classes - NO Royalties.**

CNS, Inc. - Software Products
7090 Shady Oak Rd., Minneapolis, MN 55344
612-944-0170, Fax 612-944-0923

CNS® *. . . providing and advancing object-oriented methodology.*

Video Textbook Training • Video Textbook Training •

The Ultimate Training Solution

- The **UNIX** Operating System, **Utilities** and **Bourne Shell** Programming
- The **UNIX** Operating System, **Utilities** and **C Shell** Programming
- The **ANS C** Programming Language and Libraries
- Programming with **QUICK C**
- Programming with **TURBO C**
- Programming with **INFORMIX/SQL**
- Programming with **INFORMIX/4GL**
- Programming with **ADA**
- Programming with **C-scape**

In-depth training for people who will be developing software using what we teach. Each course consists of 10 VHS video cassettes and includes a workbook. Exercises, solutions and examples available on floppy.

The price of each course is an affordable $150 plus S/H. Floppy disks are $25.

Video Textbook Training

200 Lakeside Drive, Building A4
Morgantown, WV 26505
(304) 292-0917 FAX (304) 296-4032

UNIX is a registered trademark of AT&T. INFORMIX/SQL and 4GL are registered trademarks of INFORMIX Software, Inc. QUICK C is a registered trademark of Microsoft Corporation. TURBO C is a registered trademark of Borland International. C-scape is a registered trademark of Oakland Group, Inc.

Video Textbook Training • Video Textbook Training •

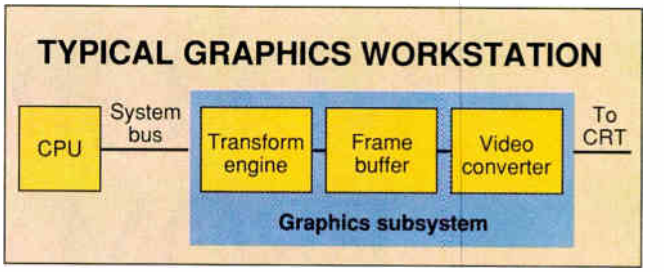


Figure 1: *When dealing with a 3-D model, the system's main CPU passes the information about the object to the transform engine (in the graphics subsystem). This specialized floating-point processor converts the information into the 2-D screen image, which is stored in the frame buffer. The video converter reads the frame buffer to create video scan information.*

The design of the graphics processing pipeline varies from system to system. Given a fast-enough CPU in a multiprocessor configuration, the transforms can be done by the system's main processor instead of on an auxiliary specialized engine. Specialized graphics-transform hardware is unlikely to ever become widely available on PCs—not enough applications require it. Also, as the speed of general-purpose CPUs increases, the need for special-purpose engines goes away. This is particularly true if (as in the workstation community) multiple-CPU machines become common. Unlike dedicated 3-D hardware, screen memory in the PC will continue to be more important.

Screen Resolution

A display's resolution is the number of addressable points, or *pixels*. Unlike VGA, which gives you 640 by 480 pixels—about

continued

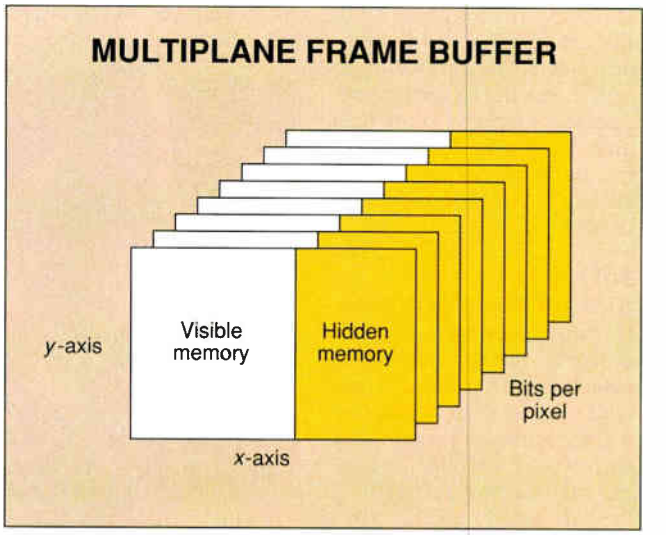


Figure 2: *A graphical display with a single plane allows only monochrome images. Increasing the screen depth allows more colors, double-buffering for animation, z-buffering for 3-D rendering, alpha buffering for transparency, or antialiasing. The system shown here has 8 bits per pixel, which provides 2^8 options (256 color choices), and a portion of nondisplayable (hidden) screen memory, which can be used for fast generation of bit-mapped text, texture mapping, and pattern tiling.*

Circle 302 on Reader Service Card (DEALERS: 303)

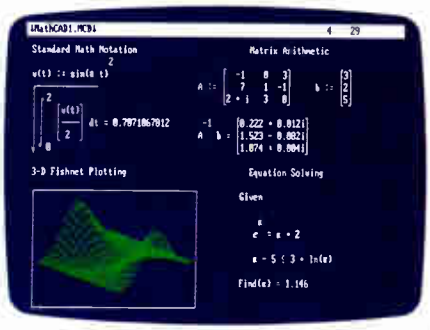
World Radio History

After centuries of practice, mankind perfects engineering calculations: MathCAD.

Announcing MathCAD 2.5: The Dawn of a New Age.

What the historians will call it, only time will tell.

Perhaps the Century of Speed, or the Era of Ease. But whatever the name, this is the age of MathCAD 2.5, the only math package that looks and works the way you think.



MathCAD 2.5 includes 3-D plotting, HPGL sketch import, and PostScript output.

MathCAD is far and away the best-selling math package in the world. Because it lets you perform engineering and scientific calculations in a way that's faster, more natural and less error-prone than the way you're doing them now—whether you're using a scratchpad, calculator, spreadsheet or program that you wrote yourself.

And now there's MathCAD 2.5, a dramatically improved version that includes three-dimensional plotting, enhanced numerical analysis, PostScript® printer support, and HPGL file import from popular CAD programs like AutoCAD.®

And like before, MathCAD's live document interface™ lets you enter equations anywhere on the screen, add text to support your work, and graph the results. Then print your

analysis in presentation-quality documents.

It has over 120 commonly used functions built right in, for handling equations and formulas, as well as exponentials, differentials, cubic splines, FFTs and matrices.

UNIX version now available.

No matter what kind of math you do, MathCAD 2.5 has a solution for you. In fact, it's used by over 90,000 engineers and scientists, including electrical, industrial, and mechanical engineers, physicists, biologists and economists.

But don't take our word for it; just ask the experts. PC Magazine recently described MathCAD as "everything you have ever dreamed of in a mathematical toolbox."

PC MAGAZINE EDITOR'S CHOICE
March 14, 1989 issue.
Best of '88
Best of '87

And for Macintosh® users, we present MathCAD, rewritten to take full advantage of the Macintosh interface. Entering operators and Greek letters into equations is pure simplicity!

Look for MathCAD 2.5 at your local software dealer, or give us a call. For more information, a free demo disk, or upgrade information, dial 1-800-MATHCAD (in MA, 617-577-1017).

Available for IBM® compatibles and Macintosh computers.
Call for UNIX platform availability.

TM and ® signify manufacturer's trademark or manufacturer's registered trademark respectively.

MathCAD®

MathSoft, Inc. 201 Broadway, Cambridge, MA 02139

U.K.: Adept Scientific 0462-480055; **France:** ISE CEGOS 1-46092768; **Germany:** Softline 07802-4036; **Japan:** CRC 03-665-9762; **Finland:** Zenex Oy 90-692 7677 *PE #3*

Circle 155 on Reader Service Card

World Radio History

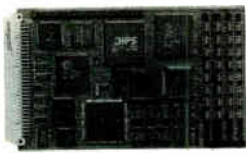
Circle 158 on Reader Service Card

PC Compatible
Single Board Computers
for the OEM
DR DOS® Now Available

Quark®/PC +

- NEC V-40® Processor
- Video/LCD Controller
- 8 or 10 MHz Frequency
- Up to 768K Memory

4" x 6"



4" x 6"

Quark®/PC II

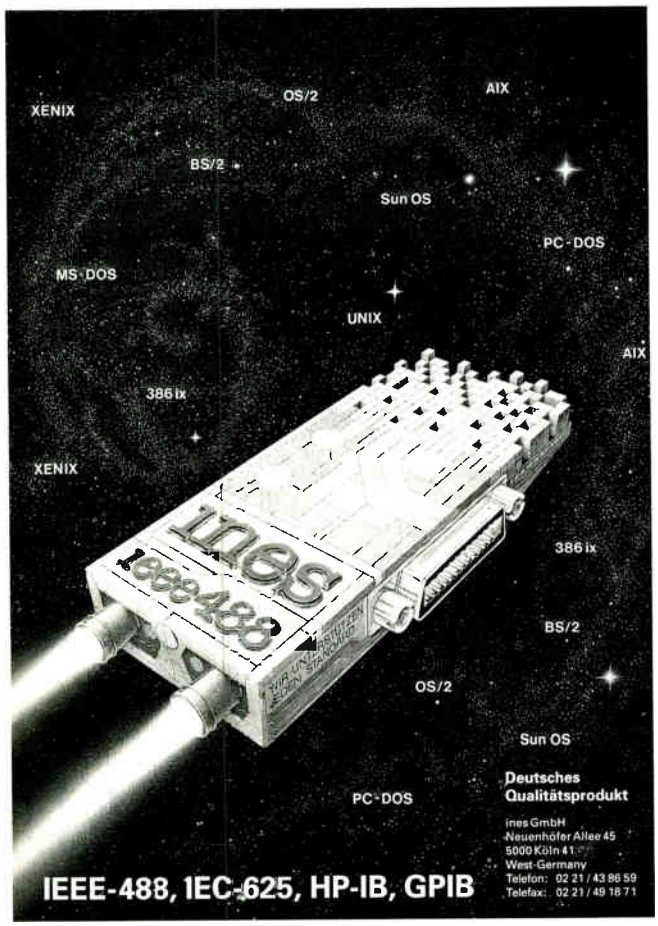
- 80386 SX based
- EGA® Video/Color LCD Controller
- SCSI Hard Disk Control
- Floppy Disk Control
- Up to 4 Mbytes Memory

To order or enquire call us today.
Megatel Computer Corporation
(416) 245-2953 FAX (416) 245-6505
125 Wendell Ave., Weston, Ontario M9N 3K9

REPS: Italy 39 331 256 524
W. Germany 49 6074 98031
U.K. 44 959 71011
Netherlands 31 838 541 301
Australia 61 03 568 0988
France 1 47 46 94 52
Austria 43 222 587 6475
Finland 358 0757 1711
Sweden 46 4097 1090
Norway 47 986 9970
Denmark 45 244 0488

Trademarks: Quark - F. + K. Manufacturing Co.
DRDOS - Digital Research Ltd. EGA - IBM Corp. V-40 - NEC Corp.

megatel



300,000 pixels of resolution—most high-end graphics workstations offer at least a million pixels, typically 1280 horizontal by 1024 vertical. Display systems with resolution that is higher than VGA are available for PCs (e.g., Super VGA and TIGA), but they are expensive and lack a standard. Consequently, there are few applications that take advantage of these ultra-high-end PC display systems.

Graphics workstations not only have higher resolution, but often also have nondisplayable banks of screen memory, or *hidden memory*. This gives you a sort of display memory scratchpad to help with such things as fast generation of bit-mapped text, texture mapping, and pattern tiling. These effects rely on block memory transfers, which are much quicker when going from one section of screen memory to another (rather than from main memory to screen memory). Not only is screen memory itself faster than main memory, but there is no need to convert from the bit layout used in main memory to the bit layout of screen memory.

Larger banks of hidden memory are becoming more common, and, in fact, some systems let you interactively change which portion of screen memory is visible. This is of particular interest to users who deal with very large bit maps, since they can scroll through an image larger than the system's display resolution by merely respecifying which portion of screen memory is to be displayed.

Screen Depth

A less familiar term, *screen depth*, refers to the number of bits of information that a pixel contains. A common way of denoting a screen's depth is by specifying the number of *planes* available. Thus, a system with 8 bits per pixel is an 8-plane system. The use of multiple-plane systems in workstations has grown in the last few years. There are several systems with dozens of bits per pixel (see figure 2).

The most common reason to increase screen depth is to broaden the palette of colors available. A single bit per pixel can specify only whether a point is on (white) or off (black). Eight bits per pixel gives you 2^8 options, or 256 colors. Such a configuration is usually called *pseudocolor*, due to the fact that the eye can easily distinguish differences between adjacent colors in the palette. Twenty-four planes is the point at which there are enough colors to accurately represent the full visual range. Such a system is known as a true-color system and can produce over 16 million color variations.

Frame buffers are not always fixed into a certain configuration or layout. Often you can trade higher resolution for a deeper palette. A 640- by 480-pixel by 24-plane frame buffer contains the same amount of memory as one laid out as 1024 by 900 pixels by 8 planes. A number of graphics cards can run in more than one mode. Anything beyond 24 planes on a PC is rare. Once again, there is no PC industry standard for this option, and only a few software packages can take advantage of these products.

Double Buffering

The next technique that requires additional screen memory is usually referred to as *double buffering*. This is used for smoothly animating a rapidly changing image. Even with a simple model and fast hardware, continuously redrawing the object can result in a noticeable flicker. The flicker is caused by the need to clear the display before the system begins drawing the object in its next position. To eliminate this, double buffering lets the system draw an image in an undisplayed portion of screen memory and then flip the primary image buffer and this

continued

Circle 121 on Reader Service Card

World Radio History

It Now Costs Less To Put The Best Digitizer To Work For You.

It's New. . .It Installs Itself. . .It's Programmable. . .It's User-Friendly. . .And It's Portable! The All-New GP-9 Sonic Digitizer From Science Accessories. It's The Professional's Choice.

From radiology to CAD/CAM, sonic digitizing technology saves time and expense in thousands of applications. And the sound technology of Science Accessories is behind the most powerful digitizer available today.

The GP-9 is versatile, handling an active area up to 36" × 48" with precision and ease. What's more, this digitizer is portable, so you can use its capabilities wherever they are needed. . .at the drafting table, light table, on site or in the field.

GP-9; the first digitizer that is universally compatible with any software that supports any digitizer. Why?. . .because the GP-9 is the only digitizer that has user-programmable output.

Its standard 32 function template can be used to direct software functions. Use them to increase processing speed and enhance user interaction.

With all this power and flexibility, you'd probably guess that the GP-9 is a bear to install. . .but it's a snap! The one-piece unit pops out of its packaging ready to plug in and start working. It's that simple. . .the GP-9 is even self-calibrating to ensure precision performance.

You Can't Afford Not To Digitize With The GP-9.

SAC® SCIENCE ACCESSORIES CORPORATION

200 Watson Boulevard P.O. Box 587
Stratford, CT 06497
(203) 386-9978 FAX (203) 381-9270 Telex 964300

Circle 252 on Reader Service Card (DEALERS: 253)

World Radio History

secondary image buffer to immediately redisplay the object in its new position.

In effect, this technique is really respecifying a certain number of planes (the secondary image buffer) as hidden memory and then flipping the two buffers so that the primary image buffer is undisplayed, or hidden. If you are dealing with pseudocolor images, then you need two 8-plane memory blocks, or a total of 16 planes, to accomplish this. If you wish to double-buffer true-color images, then a total of 48 planes is necessary. Only when the secondary drawing is completed do you inform the video system to change its scanning range, and thus the next frame is already drawn when needed. Note that this does not allow you to draw the frames any faster, it just produces a much more realistic feeling of motion. While it is theoretically possible to generate double-buffered, pseudocolored images on a PC, there is very little software support for this.

Z-Buffering

To understand z-buffering (also known by the more descriptive, less convenient term "the depth-conditional replace-pixel algorithm"), you must first look briefly at how graphics workstations usually model 3-D objects.

An object is modeled as a collection of adjacent polygons, which appears as a solid. Even smoothly curved surfaces (e.g., spheres) will actually be internally represented by some sort of polyhedron. The smaller a curved surface is subdivided, the smoother it will appear. (After determining other factors, the rendering program will use specialized lighting and shading techniques to eliminate the faceted look.) At this point, no attempt is made to determine which pixels or polygons are visually obscured by others.

The transform engine translates the model's 3-D coordinate system into 2-D screen coordinates, but each pixel has a depth (or z-value) associated with it, along with its x,y coordinate and color value. The result is a list of overlapping 2-D polygons that are in the theoretical plane of the video screen. The list needs to be sorted by depth. Graphics workstations designed for solid modeling, such as the Apollo DN 4500DVS, the HP 9000 Series 835 TurboSRX, and the Silicon Graphics Personal Iris (see "Personal Iris: The Dream Maker" on page 174) have special hardware for this work. A system that has no hardware must sort this list as part of the application program; only then can the polygons be drawn in a sequence that ensures that a distant polygon is not drawn over a nearer polygon. There are several algorithms for this sort, but for a model with a large number of polygons, the technique is very time-consuming. A much simpler method is to retain the z-value of each pixel as it is drawn and place it in a specialized memory position, known as the *z-buffer*.

Removal of Hidden Surfaces

Having a polygon list is the preliminary stage to removing hidden surfaces. The solid-modeling software progresses through the list of 2-D polygons, processing each pixel of the corresponding image. If the pixel's z-value is greater than the existing z-value, then it is behind the existing pixel (relative to the person sitting at the workstation) and consequently does not need to be displayed. If, however, its z-value indicates that it is

BYTE BACK ISSUES

Issues Available

	1987	1988	1989	1990
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
Inside the IBM PCs				

World Radio History

in front of the existing pixel, then it becomes the displayed pixel. The result is that the displayed pixel becomes the color of the pixel just evaluated, and the display's z-value reflects the new depth. Objects then appear in the order in which the renderer processes the display list. The end result is an image that is visually consistent with the original model.

Just how much extra screen memory do you need to properly represent these depth values? Eight bits per pixel of z-buffer allows for 256 depth values. For simple models, this may be enough. It would be impractical to represent every possible depth that an object could have, so first you need to place limits on the largest and smallest z-values you will deal with. If the 3-D object you are dealing with is, for instance, about 5 centimeters square, then you're probably safe in limiting the range of depth values to a 10-cm range. Eight bits of z-buffer lets you divide this into 256 values, or increments of about a third of a millimeter. Rounding errors may produce a few incorrectly drawn pixels, but for most situations, the representation will be accurate.

Current high-end graphics workstations offer much larger z-buffers—up to 32 bits—effectively allowing you to deal with over 4 billion different depth gradations. There are times when such precision is needed.

A common misconception is that a model of a larger space, say one that is 50 meters square, would need a larger z-buffer. This is not necessarily the case, particularly if everything in the model is on a larger scale. The difficulties arise when you need to deal with models that have both small and large variations in their depth values.

Consider a model that consists of two small objects connected by a 50-meter cylinder. Assuming that you need at least ½ mm of depth resolution to accurately portray the small objects, you must now divide a distance of at least 50 meters into such increments. This means over 100,000 different z-values, or at least a 17-bit z-buffer. When you consider some of today's larger models (e.g., a space station that has components ranging from small bolts to huge solar collectors), deep z-buffers become increasingly important. Fortunately, you don't need to have twice as much z-buffering when you wish to double-buffer an image. Once an image is drawn in one of the buffers, the z-buffer memory can immediately be cleared and used by the secondary buffer.

Alpha Buffering

Just as a z-buffer provides a way to keep track of pixel depth values, alpha buffering is a method used to assign a transparency value to a pixel. This is also known as *blending*. The 256 transparency options from 8 bits of alpha buffering is generally more than sufficient. An alpha value of 255 would indicate that the object is nontransparent, or opaque. It is assumed that a pixel that is closer to the viewer will completely wipe out any pixels behind it.

However, consider an alpha value of 200. The pixel is now about 22 percent transparent, meaning the new pixel to be drawn obtains 78 percent of its color from the nearer (smaller z-value) pixel and 22 percent from the existing pixel. Obviously, an object that is 100 percent transparent need not be drawn.

continued

F O R S A L E

Rates (postage and handling included):

1987-'90 BYTE Issues	**$6.00***	1985 Inside The IBM PCs	**$4.00**
BYTE '83-'84 Index	**$4.00**	1986 Inside The IBM PCs	**$5.00**
BYTE 1985 Index	**$4.00**	1988 Inside The IBM PCs	**$6.00**
BYTE 1988 Index	**$4.00**		

*June 1988 (Benchmarks) **$3.00**
*December 1988 **$3.00**

The above prices include postage in the US. Please add $.50 per copy for Canada and Mexico; and $2.00 per copy to foreign countries (surface delivery). European customers please refer to Back Issue order form in International Advertising section of book.

Please indicate which issues you would like by checking (✓) the boxes. Send requests with payment to:

BYTE Back Issues, One Phoenix Mill Lane, Peterborough, NH 03458, (603) 924-9281

☐ Check enclosed

Charge: ☐ MasterCard ☐ VISA

Card # _____ Exp. Date _____

Signature _____

Name _____

Address _____

City _____

State _____ Zip _____

All orders must be prepaid. Please allow four weeks for delivery.

World Radio History

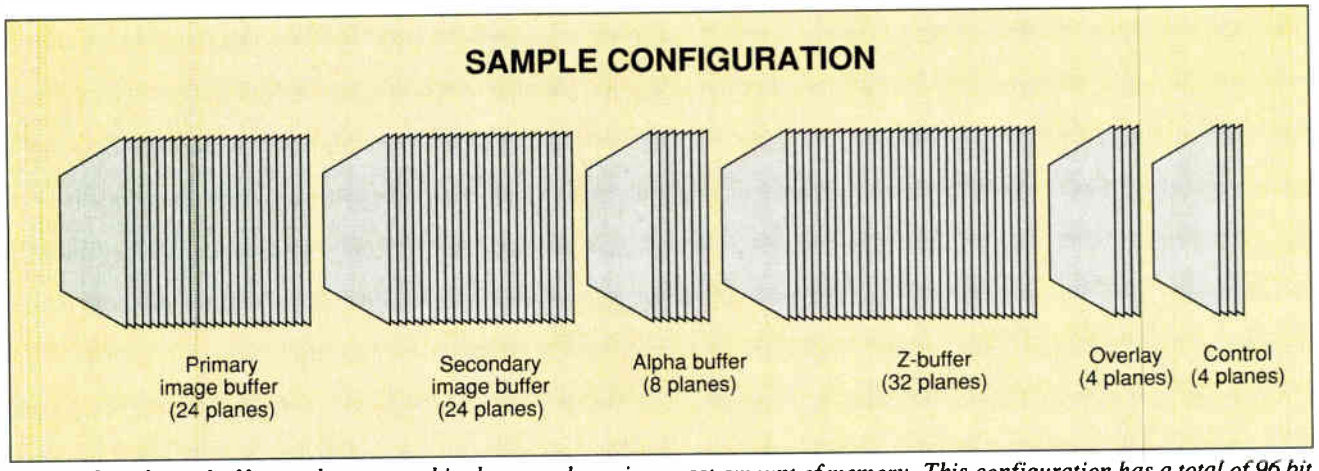


Figure 3: *A frame buffer can have many bit planes and require a vast amount of memory. This configuration has a total of 96 bit planes. Assuming a screen resolution of 1280 by 1024 pixels, this represents 125,829,120 bits, or nearly 16 million bytes.*

Alpha buffering is not really an accurate method of modeling translucent substances. No attempt is made to deal with reflection or refraction. A lens-shaped object with a high transparency value will exhibit no magnifying-glass properties; for that you need optical ray tracing. The alpha buffer technique's usefulness lies in its ability to show the interior of a solid object without losing much information about the exterior.

Alternatively, the graphics system can use the alpha buffer to keep lines or polygon edges from looking jagged by simulating the display of partially filled pixels. The technique is called *antialiasing*. With it, a pixel that is slightly obscured is assigned a color value that is based on both the new polygon and the original background. In effect, antialiasing retains the subpixel information and uses it to give an alpha value to the edge pixel. The result is a more gradual transition from the foreground to the background object, eliminating the jagged and rough appearance of lines and edges. (See "Smooth Views," May BYTE.)

Overlay Planes

Every time the graphics system scans the video memory to produce the current image, it finishes with the overlay plane's information. Consequently, the overlay plane takes precedence over whatever is in the rest of the screen memory. Overlay planes are really nothing more than additional planes of screen memory, except that pixels with a color value of 0 are not drawn. Overlay planes are typically used to keep track of either cursor position or text. This is important, because overlay planes can be modified without destroying the information about the primary image on the screen.

Consider the case of a cursor. Without an overlay plane, every time you move the cursor over an existing screen image the system would have to modify the bits that the cursor crosses over and then restore them to their original state. This can prove expensive in terms of system performance. Instead, the system uses an overlay plane to keep track of the cursor's position. In many ways, the overlay plane can be thought of as a transparent layer that contains only the cursor's image. The same rules apply for overlay planes in terms of color palette. If you wish to have cursors or text with more than two colors, additional bits are needed. Four overlay planes allow for 16 different text colors, which is usually sufficient. While not nearly as common, some systems might also feature underlay planes, which are primarily useful for background images.

Control Planes

The graphics system can also have bit planes to keep track of things like window relationships. (A workstation without windowing is considered unusable by today's standards.) Often, screen memory needs to be configured differently for the variety of uses of the different windows. One window may need only line-drawing functions, another the full gambit of 3-D controls, a third only monochrome text. A system with only 30 planes or so should be able to display a true-color image in one window while animating a 12-bit pseudocolor image using double buffering in another window; both combinations use the same number of bit planes.

The system may need to use additional bit planes to flag the pixels of certain window types so it can properly deal with them. Memory bit planes for these bookkeeping functions are known as *control planes*.

Growth Trend

As you can see in figure 3, you may need a system with an extremely large frame buffer. The example, assuming a resolution of 1280 by 1024 pixels, has nearly 16 million bytes of screen memory.

Some of the techniques discussed, particularly z-buffering and alpha buffering, are specifically used for 3-D rendering. Others are applied to nearly all applications. Keep in mind that bandwidth is critical throughout the graphics pipeline. Each piece of the pipelined drawing process is of little or no value unless the other pieces can keep pace.

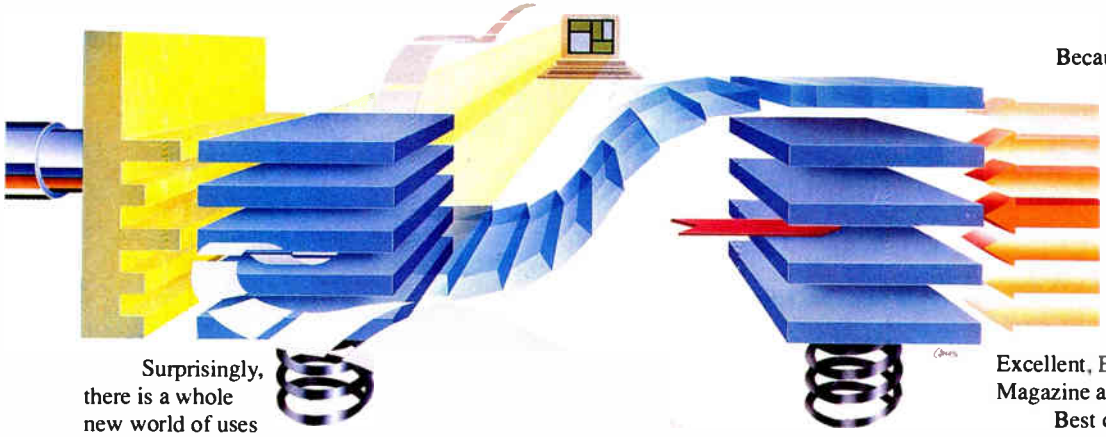
As new techniques develop, and with the continuing drop in memory prices, all computers capable of graphics will likely be built with increasingly larger frame buffers.

Without a doubt, you will see the resolution of PCs continue to grow. Very few applications would not benefit from a denser, clearer display, and there are really only two things slowing market acceptance: the cost and the lack of a well-defined standard. The cost of memory (video and otherwise) continues to drop, as does (although a bit more slowly) the cost of high-resolution monitors. The migration of resolution-independent display protocols to the PC platform will take care of the other problem. ■

Ron M. Brinkmann is a technical consultant with Hewlett-Packard's Apollo Systems Division in Rolling Meadows, Illinois. He can be reached on BIX c/o "editors."

World Radio History

Announcing the fastest new $99 way to deal with notes, ideas, lists, plans, projects ...



Surprisingly, there is a whole new world of uses for your computer! You can use your computer to deal with all the countless bits of "random" information you handle every day: plans, notes, lists, actions, contacts, ideas, and much more. INFO SELECT™ will not only give you instant access to this important information ... it will help you make better decisions and see important new relationships. Try INFO SELECT risk-free and discover a whole new dimension of computing.

Photographic memory

INFO SELECT is like having a 'photographic memory' that gives you perfect superfast recall of up to 64,000 items of information.

INFO SELECT is even better than a personal secretary. You can ask for information and get the answer -- faster than a secretary could walk into your office!

INFO SELECT is easy to use - yet powerful.

INFO SELECT is versatile. You can: 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.

When Harry calls you on the phone, you'll display the six windows on Harry before he finishes his first sentence! No more embarrassing pauses or scrambling for information.

INFO SELECT also includes the world's first "3-D" wordprocessor. You'll be amazed how it works.

Instead of one window or ten, imagine up to 64,000! The uses are endless. If you can "type" it - you can "INFO SELECT" it.

Were you born with a memory situated squarely on the tip of your tongue? Do you forget things like which day you placed an order or important numbers? If you are forgetful you need INFO SELECT - the software that remembers almost everything for you.

Better than a PIM

INFO SELECT is better than a desktop organizer and better than a Personal Information Manager (PIM). For example, Sidekick can't show the multi-views of Agenda. Agenda takes weeks to learn and can't add one plus one. Grandview can show an outline of the features of Sidekick but can't dial a phone number! INFO SELECT combines many of the benefits of all these types of software and then goes even further. It costs less too!

Because INFO SELECT is memory resident (if you choose) you can quickly jump in from other programs.

Award winning TORNADO

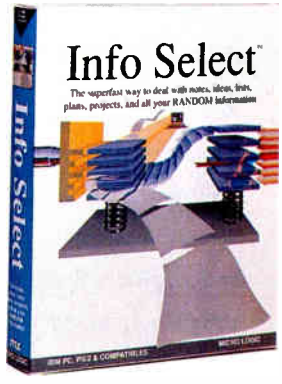
INFO SELECT is based on the pioneering TORNADO™ software PC World called "Excellent, Excellent, Excellent, Excellent" and PC Magazine awarded Editor's Choice - twice.

Best of all, INFO SELECT is easy to learn. You'll know the basics in 15 minutes.

INFO SELECT has an introductory price of just $99.95! You can even try it risk-free with a 30-day money back guarantee. But hurry - this is a limited time offer.

Doesn't it make sense to get the software package that can open up a whole new world of important uses for your computer?

For the name of your nearest dealer or to order direct, call today toll-free **(800) 342-5930** and get ready for a new dimension of computing.



Micro Logic

POB 70 • Dept A602
100 Second St. • Hackensack, NJ 07602
Call toll-free: (800) 342-5930 / (201) 342-6518

BASIC OPERATION: You will see several windows of different sizes side-by-side on your screen. Info Select windows can hold: notes, plans, lists, facts, letters, contacts, and much more. You can: open a new window. type into it, and shape it; edit an existing window; resize, remove, or print a window; browse through windows with the arrow keys; search for a group of windows related by a word or phrase; hot-key between INFO SELECT and a wordprocessor or spreadsheet; and much more. **EASY POWERFUL FEATURES:** five ways to see overviews; hypertext; fast sort; line drawing; date tickler; dialer; searching by text or date ranges; add columns of numbers; 3-D wordprocessing; support of some commands of popular wordprocessors; can store data in EMS; template or free-form windows; import and export files, screens, and databases; move, join, and duplicate windows; efficient on portables; stand-alone or memory-resident; pull-across menus; and much more. Data is structured in multiple stacks of intelligent text windows; uses a unique easy powerful system of parallel text processing and progressive resolution searching without keywords. Version available with LAN file locking and sharing. **SPECIFICATIONS:** infobases up to 10 megabytes; text searches up to 700kb/sec; up to 32,000 characters per window; up to 64,000 windows per infobase; takes just 7K in swap mode; for the IBM PC/XT/AT/PS2 and true compatibles; not copy protected. **MAIL ORDERS:** Send name, address, phone number, and payment by check, Visa, or MC to address shown. Please include $3.50 shipping ($10 outside continental USA). 30 day money back guarantee. **TORNADO OWNERS:** INFO SELECT includes everything in Tornado and much more. Call today for our special limited time trade-up offer. **EUROPEAN CUSTOMERS:** Contact Atlantex U.S.A. (203) 655-6980. **TRADEMARKS:** Trademark (owner): Tornado and Info Select (Micro Logic), Agenda (Lotus Development), Sidekick (Borland International), Grandview (Symantec), IBM PC, XT, AT, PS/2 (IBM). © 1990 Micro Logic Corp. U.S.A.

World Radio History

■ **BIX opens Telecomm Exchange.** Let your fingers do the walking and your hardware do the talking. Edited by Steve Satchell, this newest BIX Exchange is the place to call for insight, information, and advice on every aspect of computer-telecommunication. Our July dialog will begin with such topics as FAX, the future impact of ISDN, the drawbacks of the new telephone *Caller ID* capability, BITNET/USENET access from microcomputers that aren't running Unix, how to get the most out of your terminal emulator program on your IBM PC or Mac, and the use of Tymnet and BIX.

The Telecomm.ex will feature these conferences:

bbs	Dial-up BBSes
conferencing	Computerized teleconferencing
networks	Information networks
packet.nets	Packet-switching networks
protocols	Small-computer communications protocols
sysops	For BBS sysops only
telecomm.pgms	Telecommunications programs
telecom.tech	New telecommunications technology

BIX Conference News and Special Events

■ **Explore the world of exotic adaptive microcomputing systems** such as voice synthesis, optical character recognition, Braille desktop publishing, word predictors—in the Handicapped Conference. (join handicapped)

■ **Professional ethics** should be of specific interest to anyone concerned about his or her rights and responsibilities as a computer user. With the press likely to focus on the misbehavior of a notorious few computer users, it's extremely important that *we* define what constitutes proper computer conduct before someone else defines

BIX COMMUNITY CALENDAR JULY 1990

it for us. (join philosophy)

■ **Just because your computer doesn't have a fancy name** on it doesn't mean you love it any less. Or that you have any fewer problems with it. If you're one of the many BIXen who uses a less popular brand of computer, our Other Brands Conference can provide you with the support you've always wanted. Discuss everything from the earliest of micros to the cutting edge of CPUs. (join other.brands)

Meanwhile, back at the other BIX Exchanges...

■ **Amiga Exchange**

amiga.user	Exchange ideas, solve problems, compare notes
amiga.sw	Amiga programming and developer issues
amiga.hw	Amiga hardware design, use, and hookup
amiga.arts	Artistry using the Amiga
amiga.int	Developing for the international Amiga
amiga.special	Special guests and events
amiga.dev	Commodore's conference for developers

■ **IBM Exchange**

ibm.pc	The venerable PC
ibm.at	The AT series and workalikes
ibm.ps	The PS/2 series
ibm.os2	OS/2 operating system
ibm.dos	PC/DOS & MS/DOS
ibm.os.386	Alternative 386 operating systems
ibm.utils	Utility software
ibm.repair-shop	Garage and Tune-up Shop
ibm.new.-prods	New products for IBM computers
ibm.exchange	IBM Exchange clearinghouse
ibm.listings	Index to IBM files
ibm.other	Applications, printers, modems, etc.
microsoft	Products from Microsoft

■ **Mac Exchange**

mac.apple	The word from Cupertino
mac.business	Macs in the office
mac.desktop	Publishing with a Mac
mac.external	Information from all over
mac.hack	Technical info about all aspects of the Mac
mac.news	Up-to-the-minute information
mac.novice	For beginners
mac.products	Listings of new hardware and software
mac.sandbox	For off-hours fun

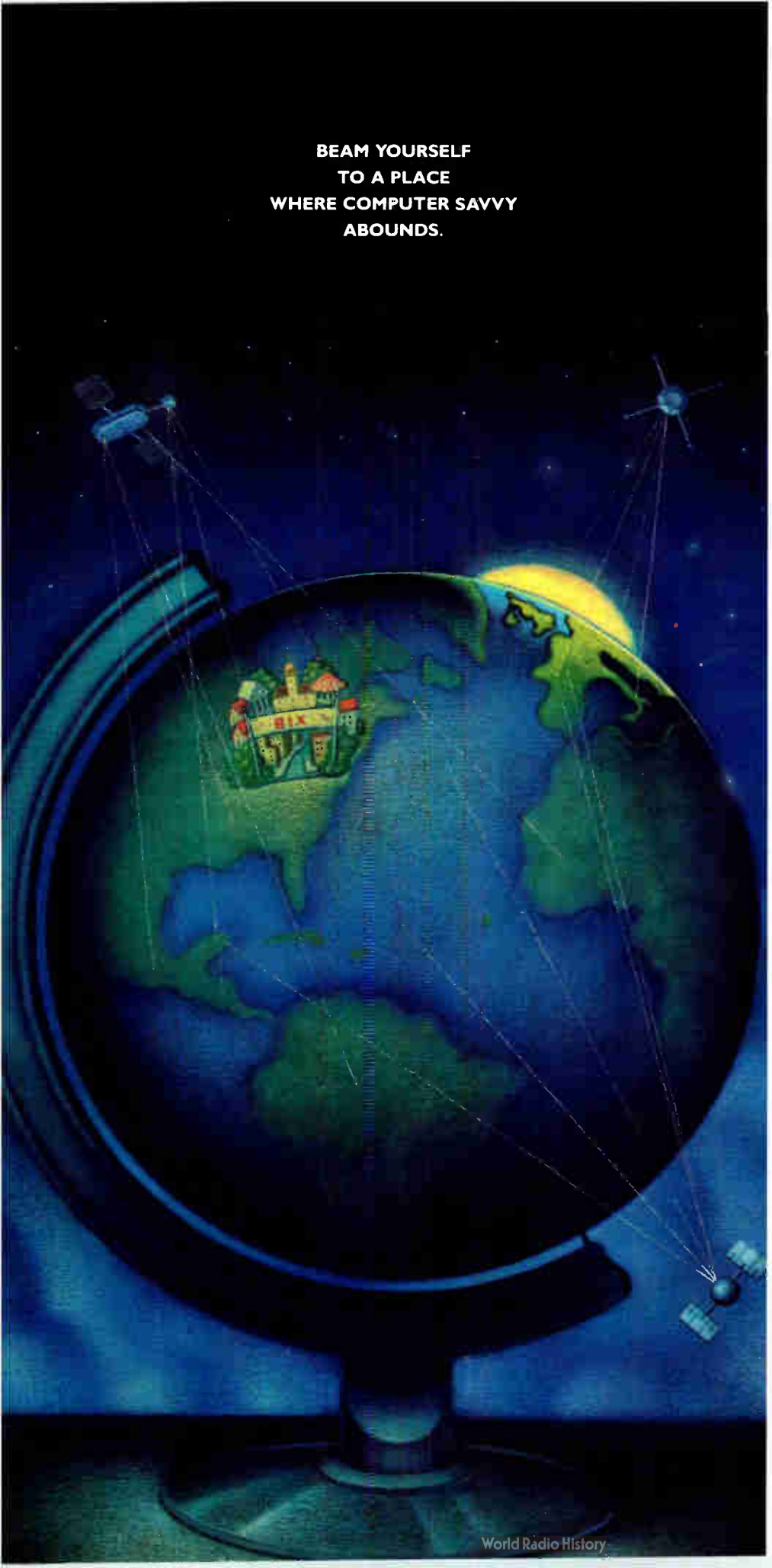
■ **Writers' Exchange**

desktop.pub	Using microcomputers for publishing
journalism	Reporting and writing
journalism.-pro	Interaction for working press only
marketing	High Tech PR
new.writers	Getting started in the writing business
poetry.pros	Writing both types of English
sf	For Science Fiction, Star Trek, and fantasy fans
sfwa	The Science Fiction Writers of America
tech.news	Discuss news
word.pro-cessor	Word-processing programs
write.fiction	On writing fiction
writers	Writers hang out
writers.pros	For pros only
writers.talk	Insights and conversation from professional writers

■ **Tojerry Exchange**

tojerry	Jerry Pournelle
technology	Fusion, space, electronics
sciences	Science
space	Space exploration and habitation
contact	Science meets science fiction
disasters	Natural and man-made disasters
education	Computers in American classrooms
mathematics	High-level mathematics

World Radio History



■ Imagine a setting in which communal wisdom is on tap. A place that has the fit and feel of a small, friendly town, yet the sophistication and resources of a global community. One which you can visit electronically—to increase your knowledge of computers and their applications, hone your skills, share insights with thousands of other computer pros, and have fun. Such a community would be called BIX.

Subscribe to BIX, the flat-fee, on-line information service.

BIX is your access to industry news. And to many special interest Exchanges—such as our *Amiga*, *IBM*, *Mac*, *Writers'*, and *Interactive Games* Exchanges—which include thousands of free, downloadable programs. All for just $39 per quarter.*

Subscribe via your computer...

Set your program for full duplex, 7 bits, even parity, 1 stop bit. Call BIX on our registration-only number: 800-225-4129. In MA: call 617-861-9767. International: call NU1310690157800. Then hit the return key, and respond:

Prompt:	**You Enter:**
login	bix
Name?	bix.ville

You may buy off-peak access via *Tymnet* at $20 per month or $3 per hour, or you may buy peak access at $6 per hour.**

*Based on a $156 annual fee, billed quarterly. Telecommunications charges are extra. You may cancel at any time without future charges.

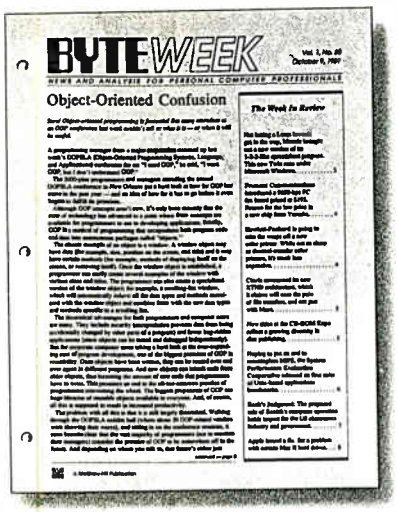
**Available only in contiguous 48 states. Tymnet rates subject to change.

800-227-2983 • In NH 603-924-7681

BIX

World Radio History

The Cream. The Crop.


BYTEWEEK

NEWS AND ANALYSIS FOR PERSONAL COMPUTER PROFESSIONALS

Object-Oriented Confusion

The Week in Review

There are plenty of places to get information in this industry. Too many. But if you want the best quality information, there's only one that rises to the top: BYTE*WEEK*.

BYTE*WEEK* is a weekly newsletter from the same professionals who produce BYTE Magazine. Each week, the most important news and information from the previous week is presented in a readable and concise manner. BYTE*WEEK* offers you what no other publication can: timely news on the rapidly-evolving computer industry as it happens with the interpretation and evaluation that only BYTE's experienced editorial staff can provide.

Subscribe now and take advantage of a special subscription rate of $395 ($495 outside the U.S. and Canada). Your subscription to BYTE*WEEK* also includes a free subscription to BIX, BYTE's exclusive on-line conferencing system. *Don't miss this opportunity!*

For fastest service, call toll-free **1-800-258-5485** (in N.H., call **603-924-9281**) and charge to a major credit card or we'll bill you.

BYTEWEEK

One Phoenix Mill Lane, Peterborough, NH 03458.

BYTE*WEEK* offers a money-back guarantee if you are not completely satisfied.

Clip Coupon Here

☐ **YES! Sign me up as a subscriber to the Cream of the Crop, BYTE*WEEK* at the special subscription rate of $395 a year for 50 issues ($495 a year outside the U.S. and Canada).**

Name _____
Title _____
Company _____
Mail Address _____
City/State/Zip _____
Business Phone _____

☐ MasterCard ☐ VISA
☐ Check enclosed ☐ Bill me

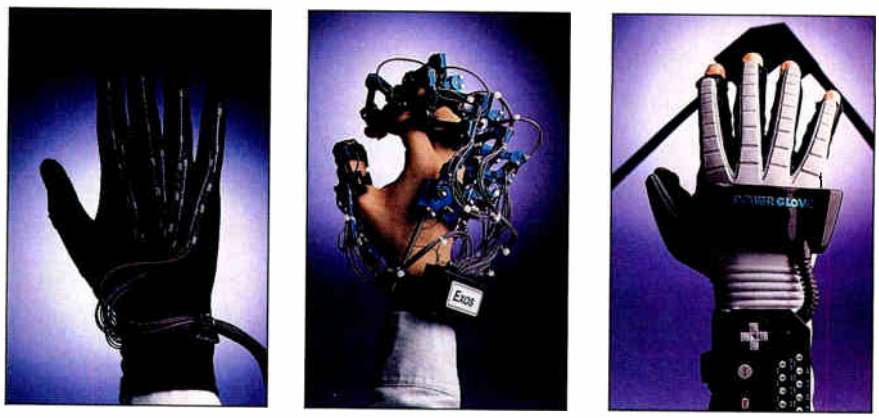
Card # _____
Exp. _____
Signature _____

BYTEWEEK One Phoenix Mill Lane
Peterborough, NH 03458

World Radio History

REACH OUT AND TOUCH YOUR DATA

Three commercial hand trackers sense your every move



Left: Perhaps the best-known hand-tracking device, the VPL DataGlove relies on fiber optics to track finger motions. Center: The Dexterous Hand Master from Exos uses an intricate exoskeleton, made of lightweight aluminum, that fits over the back of the hand. Right: Mattel's Power Glove shares a common heritage with VPL's DataGlove, but it was designed for the home video market. As such, it's a lot less expensive and a lot more rugged. Nevertheless, you can easily adapt it to work with a PC-compatible computer.

Make a fist and shake it at your computer screen. Nothing happens? That's because you're not wearing a hand-tracking device. Although keyboards and mice convert hand movements into data,. they can't capture the sweeping gestures and subtle articulation of a hand moving in space.

Three commercial products purport to do just that: VPL Research's DataGlove, Exos's Dexterous Hand Master, and Mattel's Power Glove. When you wear one of these devices, it measures how much your fingers are flexed. A controlling computer, sampling the instrument's sensors at a rapid clip, can figure out the shape of your hand. Add a way to locate the hand in space, and you've got hand tracking. Imagine literally grabbing a dBASE record or rotating an AutoCAD model with a twist of your wrist. There is a world of possibilities; see "Telltale Gestures" on page 237 for more applications now in development.

It's Not Polite to Point

Each product discussed here uses its own method to track the fingers. Two of them use magnetic field interference to track hand motion, and one uses ultrasound triangulation.

VPL's DataGlove, perhaps the best-known hand-tracking device, relies on fiber optics. When you bend a fiber-optic cable, the light dims in proportion to the amount of flex. The DataGlove uses loops of fiber-optic strands that run up the back of your hand. A part of each loop, which is fixed over the knuckle and first joint of each finger, forms a sensor (see figure 1).

One end of the fiber loop connects to a constant light source, the other to a sensitive photo detector. A microprocessor scans through each of the 10 detectors in turn and takes a light reading. As the light intensity diminishes, the processor records more bend.

After the whole hand has been read, the real fun begins. Calculating the angle of each joint requires knowing a lot about the physical nature of the hand and the makeup of the optical sensors. The microprocessor in the DataGlove controller takes care of managing that model and performing the needed computations.

Precise measurements require that the fibers line up properly over the joint. The DataGlove relies on a snug-fitting Lycra glove that fits, well, like a glove. The fibers, sewn onto the back of each finger, collect at the base of the glove on the back of the hand, as shown in photo 1. A separate unit, the size of a pocket calculator, houses the light source and sensors. A computer interface manages the scanning of the sensors and the communications with the host computer. The DataGlove uses a standard RS-232C serial port, which makes it compatible with most computers.

Somewhere, My Glove

Now the computer can tell what the fingers are doing. The next thing it needs to know is the position of the hand relative to a fixed point. VPL has incorporated the Polhemus Navigation Sciences' 3Space Tracker into the DataGlove. The Tracker measures magnetic interference in three dimensions. Users of Exos's Dexterous Hand Master typically employ the Tracker, too.

Any coil charged with an electrical current generates an electromagnetic field. The field is strong in the direction of the coil's radius, and it is relatively weak in the perpendicular direction. Similarly, a magnetic field passing through a coil of wire generates an electric current proportional to the field's strength.

continued

World Radio History

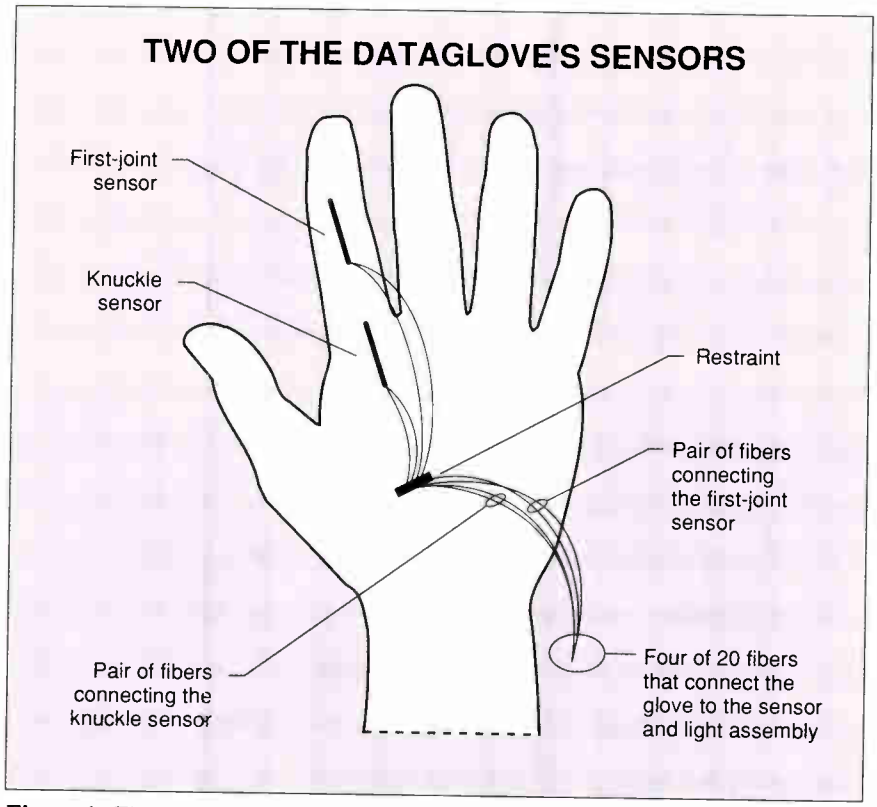


Figure 1: *The DataGlove's sensors are glued to the glove, arranged directly over each joint. Loose fibers connect each sensor to a light source/receiver pair for measurement.*

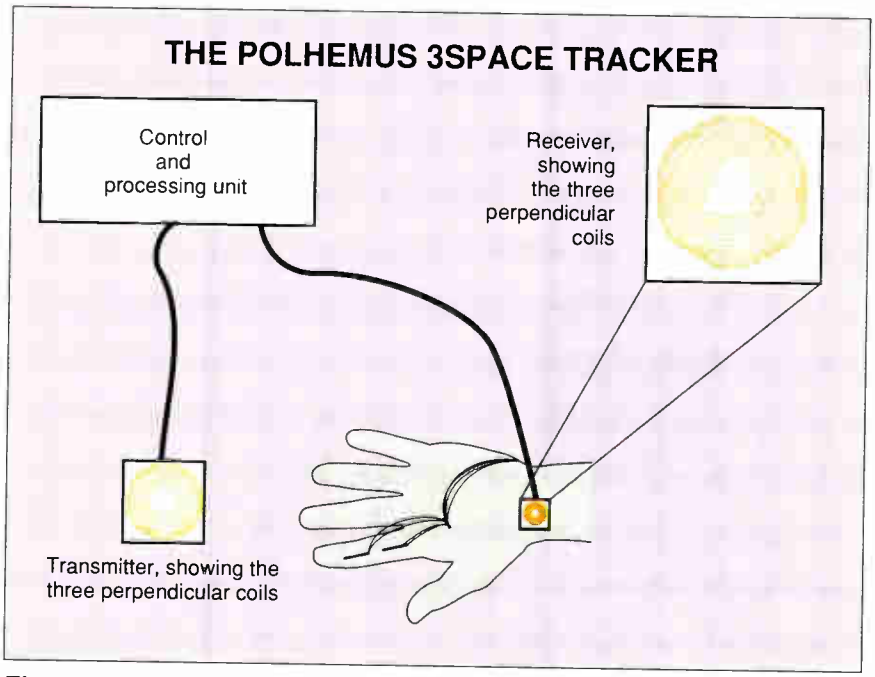


Figure 2: *Designed to report the relative location of the user's hand in space, the Polhemus 3Space Tracker consists of a small cube mounted on the hand, and a slightly larger transmitter that rests on a stationary stand nearby. The cutaway views show the three perpendicular coils in both the transmitter and the receiver.*

The Tracker uses a transmitter with three coils of wire, each perpendicular to the other two. A similar receiver has the same arrangement (see figure 2). The Tracker's controller pulses each of the transmitter's coils in turn and reads the current generated in each of the three receiving coils, for a total of nine readings. Determining the receiver's orientation and distance from the transmitter requires plenty of math—more than you'll need to do your taxes.

Knowing that the strongest readings come from coils that lie on the same plane as the transmitter, the microprocessor can determine the orientation of the receiver in space (relative to the transmitter), as well as the distance in x, y, and z directions. The system works amazingly well. It can determine the relative positioning to the nearest tenth of an inch and to within half a degree, anywhere within a 3-foot radius.

The receiver is a small, lightweight plastic cube, about the size of a sugar cube, that mounts on the back of your wrist. The transmitter, a slightly larger cube, rests near the DataGlove wearer on a stationary stand. Both the receiver and the transmitter connect to a control unit that handles the pulsing and sensing; the control unit connects to the host computer by way of a standard serial or parallel interface.

Double-Jointed

The DataGlove emphasizes comfort with a good degree of precision. However, unless you are an alien from the planet Zambodia, your fingers have three joints, not two. Exos's Dexterous Hand Master (see photo 2) delivers precise measurements at the expense of form.

The Hand Master uses an intricate exoskeleton that fits over the back of your hand. Velcro bands and finger pads attach this framework to the midpoint of each finger segment, and a hinged joint connects each of the finger pads. Figure 3 shows the arrangement of the joints. Make no mistake—this thing looks bizarre; it's not really a glove at all. But it's considerably more comfortable than it looks.

The skeleton is made of lightweight aluminum. Each of the joints contains a small magnet and a Hall-effect sensor to measure the bending angle. The sensor, built into the hinge assembly, responds with a voltage that is proportional to the strength of a nearby magnetic field. A small magnet bound to the sensor moves closer to or farther from it as the joint bends. The Hand Master connects to any standard AT-bus (Industry Standard Ar-

World Radio History

chitecture) PC compatible through a custom data-acquisition board. The PC software reads the voltage from each of the sensors in turn to measure the position of the fingers.

Thumb Fun

Oops—I almost forgot about the side-to-side motion. Happily, Exos didn't. Fingers can do more than go up and down; they go left and right, too, especially the thumb. Extra sensors on the Hand Master take care of the left and right motions, while allowing for measuring the full range of thumb motion.

Like the DataGlove, the Hand Master can't detect the position of the entire hand. Hand Master applications typically use the same Polhemus Tracker that DataGlove applications use.

Mattel's Power Glove is a completely different animal than the DataGlove, yet the two share a common heritage.

Clearly, the Hand Master uses a different approach to hand sensing than the DataGlove does. However, both cost as much as a new car. The DataGlove in its standard configuration will set you back about $8800. If you prefer the added precision of the Hand Master, plan on handing over $15,000. But if you need that level of precision and reliability, both are cheap at the price.

The same can be said of computers. Not everyone needs megabytes of memory and a hard disk drive, as the home video game manufacturers have known for years. Case in point: that Nintendo Entertainment System you bought for your kids. Did you know it has the same processor that the Apple II uses? Did you know that Mattel makes a hand-sensing glove for the Nintendo? One that you can buy for about $100?

Mattel's Power Glove is a completely different animal than the DataGlove, yet the two share a common heritage. The Power Glove's basic design derives from the DataGlove's, with a few obvious modifications for the home video market. Most notably, it's a lot more rugged (see photo 3).

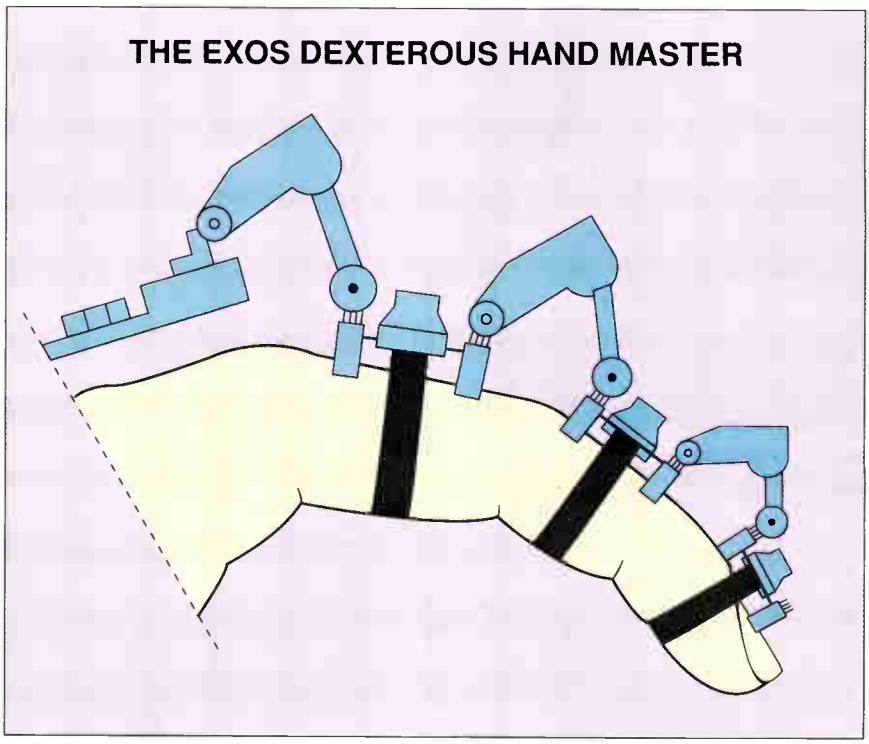


Figure 3: *The Hand Master consists of an exoskeletal arrangement of sensors. The sensors are held over each finger joint by lightweight pads and Velcro straps. Each sensor houses both a Hall-effect magnetic pickup and a magnet.*

Glove at First Sight

The optical fibers on the DataGlove are fully exposed, glued to a lightweight Lycra glove. Not only is that construction expensive, but video-gaming kids would destroy the thing in 10 seconds flat. Mattel replaced the delicate fibers with a flat plastic strain gauge.

The strain gauge has a convoluted history. In the early 1980s, engineers developing the Koala touchpad needed a tough, flexible plastic with a constant resistive surface. During development, there were a number of rejects—one of which changed resistance as it was bent. That material, which is now manufactured by Amtec, forms the basis of the sensor technology that the Power Glove uses in its fingers.

The sensors are 3½-inch strips of polyester, coated with 0.6 mils of a specially formulated ink. As the sensor bends over the normal range of finger movement, the resistance changes. One sensor in each finger measures all the joints at once. This precludes measuring the individual joints, but does Mario really care if you bent your first or second joint? For Nintendo games and many PC applications, it's reasonable to measure the whole finger with some degree of precision and make assumptions about the individual joints.

So, you've got five sensors, one for each finger. That means you also need an A/D converter to read the sensors, and some kind of processing power. The Power Glove uses an 8-bit processor to watch the fingers, communicate with the host computer, and handle the ultrasonics. Ultrasonics? What for?

You Don't Know Where That Hand Has Been

Polhemus's Tracker technology would be far too expensive to include in a $100 retail product, so Mattel had to come up with something else.

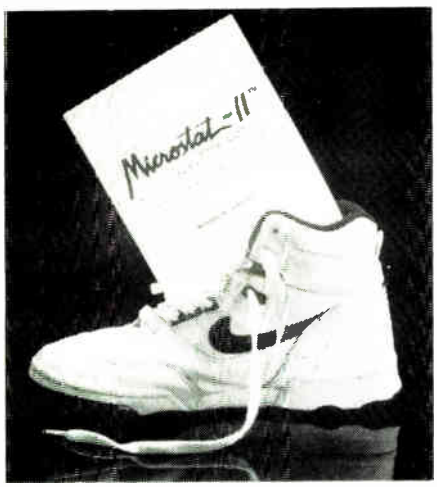
The solution that Mattel chose was an ultrasonic ranging system similar to that on modern Polaroid cameras. A small transducer located on the back of the Power Glove sends out a short click. Three receivers, one each to the left top, right top, and right bottom of your monitor, receive the click. They all hear the same sound, so the time it takes them to

continued

World Radio History

Circle 92 on Reader Service Card

FREE



FITTING

Try a free Microstat-II demo-pack *and see if it isn't a perfect fit for your statistical computing needs. You'll get your work done faster, easier, without costly training. Microstat-II is easy to use - there's no complex command language to learn. You'll be running Microstat-II in minutes rather than weeks.*

"...using Microstat-II is a breeze."
PC Magazine

Microstat-II has what you need, from descriptive statistics to multivariate analysis.

"Microstat-II by Ecosoft is a genuinely excellent menu-driven statistics package at a moderate price."
Computer Language

"Microstat-II provides you more tools at less than half the competition's price."
Review Responses
InfoWorld

Microstat-II is up to eight times faster than other packages without compromising accuracy.

"...one of the fastest IBM PC statistical packages we have tested."
InfoWorld

"Results are unusually accurate."
Computer Language

Try our free Microstat-II demo and see if it can't simplify your statistical workload. This free demo offer is good only while supplies last, so order yours today!

Microstat-II™

Ecosoft Inc.
8295 Indy Court
Indianapolis, Indiana 46214
1-317-271-5551 (Info.)
1-317-271-5561 (FAX)
1-800-952-0472 (Orders)

ECOSOFT

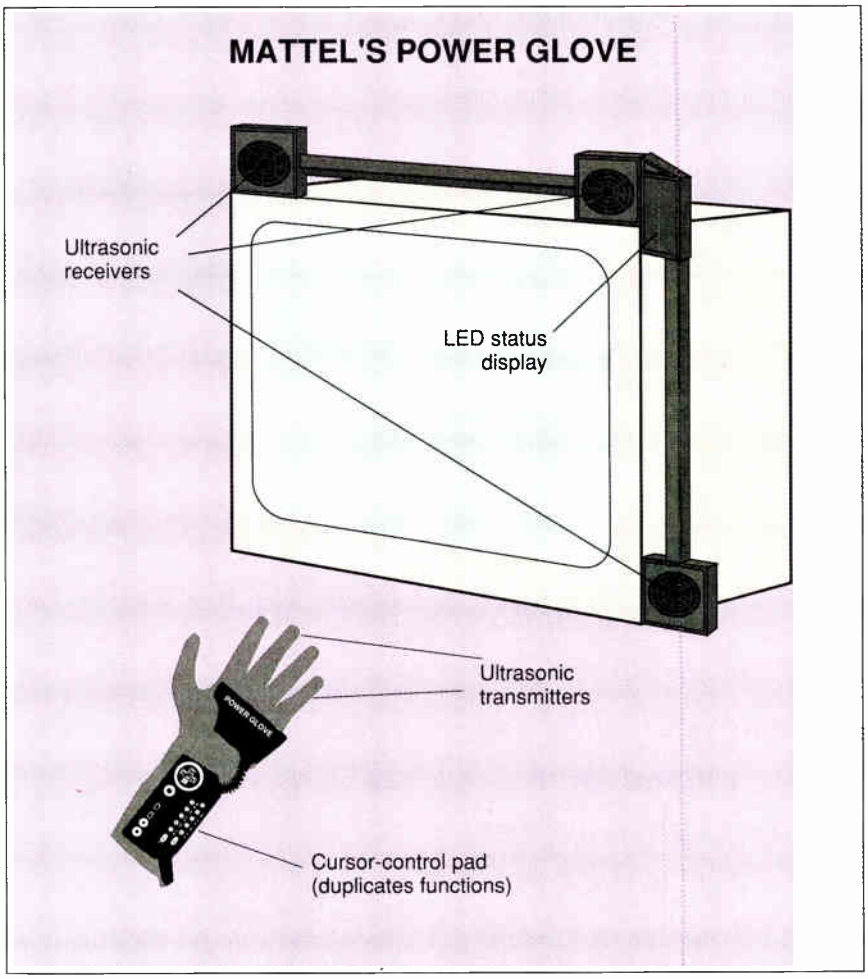


Figure 4: *The Power Glove uses two ultrasonic transmitters and three receivers to triangulate the position and orientation of the hand. The cursor keypad duplicates the sensory functions and allows for somewhat more precise input.*

register the click will determine the absolute distance to the glove as well as the relative distance.

A second transducer, which is located a few inches from the first, does the same. From there, the processor, which knows the speed of sound and the spacing between the transmitters and receivers, can use triangulation to compute the distance of the glove from the sensor array as well as the glove's roll and pitch (see figure 4).

Ultrasonics, however, suffer from one inherent disadvantage: They require an unobstructed line of sight. If the transmitters don't point directly at the receivers, the Power Glove simply can't track. Other than that, though, it's a very sound design.

OK, I'm Game

As long is you're facing the receiver array, and you are within the normal range of the ultrasonics (about 5 feet), the Power Glove can track your hand motion to within a quarter of an inch and measure the flex of your fingers to some fair degree of accuracy.

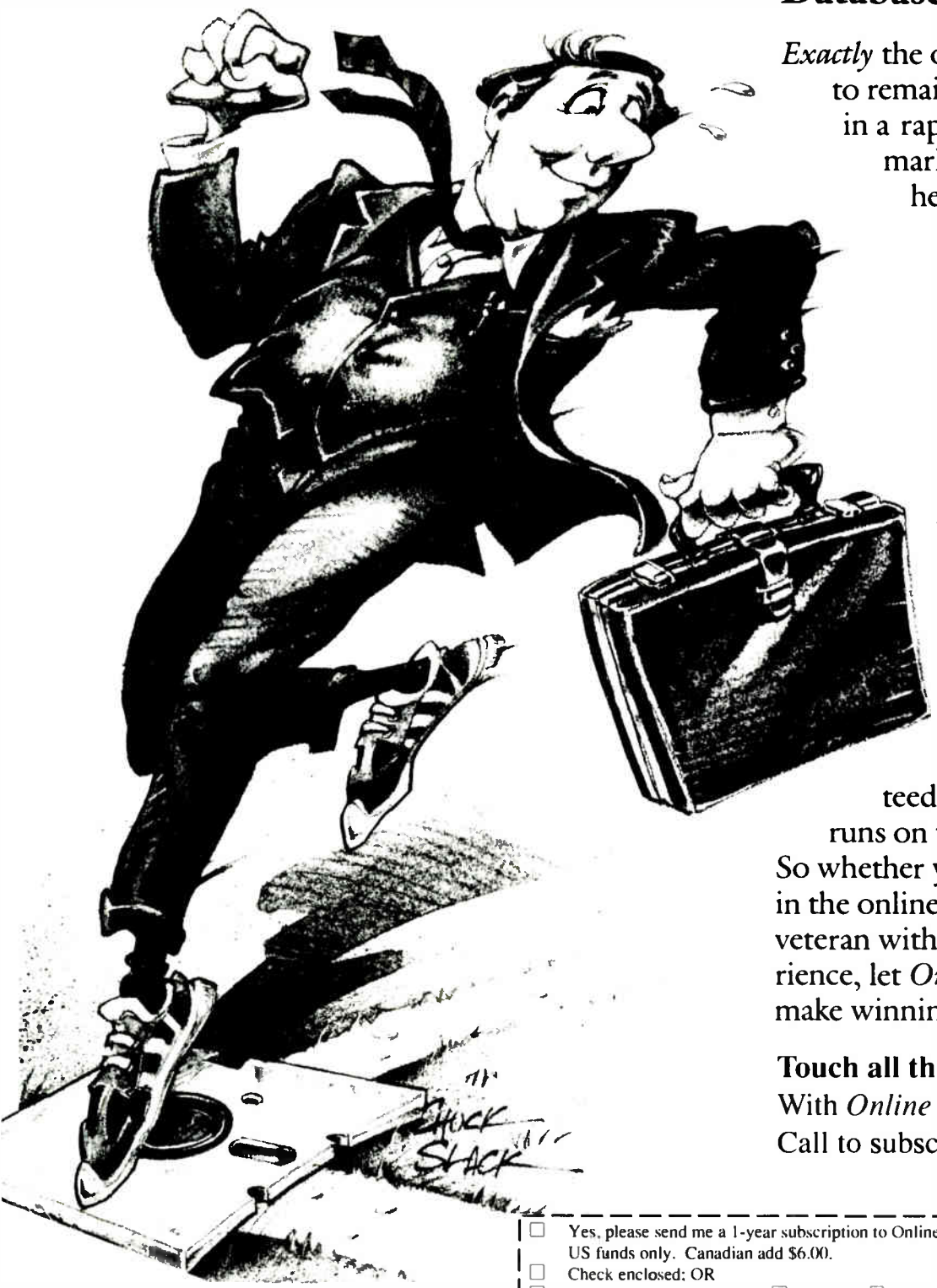
For the personal computer user, the most significant drawback of the Power Glove is that it will work only with the Nintendo system. To that end, the unit comes with a proprietary Nintendo connector that plugs directly into the game unit.

Even worse, the Power Glove takes all its detailed information and converts it into an emulation of the standard game controller pads. Although there is a special high-resolution mode, the standard mode will give you the A fire button (flexing the thumb), the B fire button (flexing the index finger), Start, Select, and the up/down/left/right motion from center. Notice that it can't tell you how

continued

World Radio History

Touch all the bases.



Databases, that is.

Exactly the ones you need to remain competitive in a rapidly changing marketplace. We're here to coach business professionals in the online skills. Because tapping into the exciting new sources of business information can be the move that keeps you one step ahead of the competition. It's a guaranteed way to put runs on the board. So whether you're a rookie in the online game or a veteran with years of experience, let *Online Access* help make winning a little easier.

Touch all the bases.
With *Online Access.*
Call to subscribe, (312) 348-5941.

☐ Yes, please send me a 1-year subscription to Online Access, four issues for $19.80. US funds only. Canadian add $6.00.
☐ Check enclosed; OR
☐ Charge my credit card: ☐ Visa ☐ Mastercard ☐ AmEx
Card # _____ Exp. date _____
Signature _____

Name _____ **Title** _____
Company _____ **Phone #** _____
Address _____
City/State/Zip _____

Send to: Online Access, 2271 N. Lincoln Ave., Chicago, IL 60614.
Or call us at 312-348-5941 to place your subscription.

World Radio History

Can We Talk?

Because the Power Glove is designed for the Nintendo Entertainment System, attaching it to your computer may take some doing. I'll describe how to connect it to a PC compatible, although the same method should work for almost any computer.

The good news is that the Power Glove runs off 5 volts and is therefore electrically compatible with the printer port of a PC compatible. The bad news is that you'll have to find a way to supply the 5 V; that's something a printer port normally doesn't do.

Connecting the Power Glove requires three data lines, a ground, and 5 V. It's probably best to connect the glove to an unused printer port; you can get 5 V from any of a number of sources.

For my prototype, I used an external regulated power supply. No external supply? The red and black wires on a spare disk drive power connector will give you 5 V, or you might tap 5 V from the keyboard connector using an extension with a tap on the keyboard's 5-V supply. Pin 5 of the five-pin DIN plug is the keyboard power, and pin 4 is ground (see figure A). With a pair of male and female five-pin DIN connectors, make a short keyboard extension cable, with all five lines. However you get power, check that the voltage is correct and fairly spike-free before you go any further.

Now for the tricky part. The glove connects to a small box that controls the ultrasonics. It's that short cable with the goofy seven-pin connector that you have to modify. Make sure you don't cut off the nine-pin connector from the glove itself!

You'll be removing the game unit connector, so you might want to find a Nintendo controller extension cable and make the modifications to that. Curtis

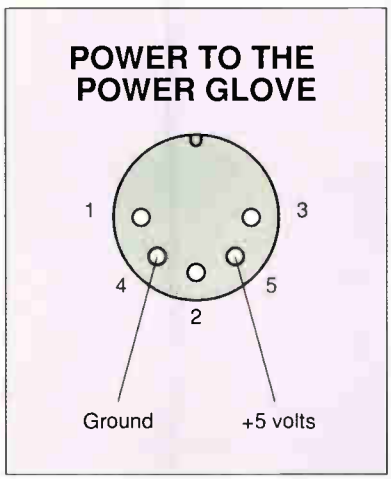
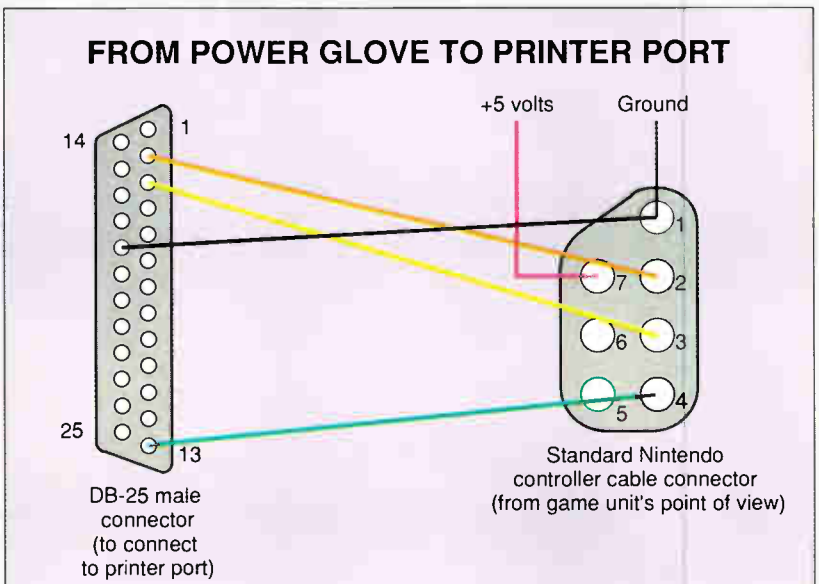


Figure A: *To connect a Power Glove to your PC compatible, you need a 5-V power source. Pins 4 and 5 of a standard five-pin keyboard connector provide 5 V to the keyboard and can also be used to power the Power Glove.*

Figure C: *Shown here are the timing pulses required to retrieve data from the Power Glove. P/S is the reset pulse to set the glove's shift register back to bit 0. CLK moves the register from bit to bit. After pulsing the P/S line, you sample bit 0, pulse CLK, and then sample and pulse seven more times for bits 1–7.*



Pin	Function	Pin	Function	Color	Curtis NC-1
2	Data clock	1	Ground	Black	Orange
3	Latch	2	Data clock (to controller)	Orange	Red
13	Data in	3	Latch (to controller)	Yellow	Brown
18	Ground	4	Data out (from controller)	Green	Black
		5	(No connection)		
		6	(No connection)		
		7	+5 volts (to controller)	Red	White

Figure B: *This diagram details the wiring necessary to connect the Power Glove to a standard PC-compatible printer port. The colors shown are for the Mattel unit. They may vary from unit to unit, so be sure to verify them. If you choose to use the Curtis NC-1 Super Extendo cable, go by the colors listed for it.*

World Radio History

Listing A: *A portion of the source for PG.COM, showing the 8088 implementation of the timing in figure C. The bit assignments on the printer port assume that the printer port is wired as shown in figure B.*

```
LPT1_addr       equ     0378h       ; LPT1
LPT2_addr       equ     0278h       ; LPT2
Mono_addr       equ     03BCh       ; LPT1 on mono cards
Clock_HI        equ     01h         ; data clock is low bit
Latch_HI        equ     02h         ; data latch is bit #1
Clock_LO        equ     0
Latch_LO        equ     0
Data_in         equ     10h         ; from port (Printer_addr+1), mask with this
                                    ; for current data bit
Printer_addr    dw      LPT1_addr
Glove_byte      db      0
delay_val       dw      1           ; empty loops to delay after an OUT
speed_constant  equ     800h        ; delay=loops/speed_constant
; Power Glove cursor emulations (bit assignments in "Glove_byte")
PG_rt           equ     01h
PG_left         equ     02h
PG_dn           equ     04h
PG_up           equ     08h
PG_start        equ     10h
PG_select       equ     20h
PG_B            equ     40h
PG_A            equ     80h
PG_fist         equ     PG_A+PG_B
;
outdx   macro
        local   delayloop
;
        out     dx,al
        push    cx
        mov     cx,delay_val
delayloop:
        loop    delayloop
        pop     cx
        endm

; This is the only Power Glove-specific part of the code, from here to HANDLE_TSR
; talks to the glove. From that point on, the code merely does the keyboard buffer
; management and any mapping of glove functions -> keyboard functions.
;
; The RESET pulse.  An L-H-L pulse, a minimum of 4 µs long.
        mov     dx,Printer_addr
        mov     al,Latch_LO+Clock_HI
        outdx
        mov     al,Latch_HI+Clock_HI
        outdx
        mov     al,Latch_LO+Clock_HI
        outdx
        mov     cx,8                ; # of bits
        mov     bl,0                ; BL will collect the data bits
bit_loop:
        shl     bl,1                ; make a place for the new bit
        mov     dx,Printer_addr
        inc     dx
        in      al,dx               ; read the LPT status
; The bit is now in bit 5 (on the select line)
        and     al,Data_in          ; isolate it
        shr     al,1                ; move it to bit 0 (low)
        shr     al,1
        shr     al,1
        shr     al,1
        add     bl,al               ; and store
; strobe in next bit - pulse the clock line from H-L-H
        mov     dx,Printer_addr
        mov     al,Latch_LO+Clock_LO
        outdx
        mov     al,Latch_LO+Clock_HI
        outdx
        loop    bit_loop            ; back, a total of 8 times
; We've got all 8 bits. Invert them.
        mov     al,bl
        xor     al,0ffh
        mov     Glove_byte,al       ; Now, 1='pressed'
```

sells the NC-1 Super Extendo set (a pair of game controller extension cords) for around $10. One end will mate perfectly with the Power Glove's connector. On the glove or extension cable, remove the end that normally plugs into the Nintendo unit, leaving a couple of inches of wire. Now, strip off some insulation from each strand and confirm the color coding. The Mattel wiring on the glove I worked with used the color scheme shown in figure B. If you use a Super Extendo cable, you may find the colors shown in the second color chart.

Connect the glove end of the wire to the 25-pin connector, as shown in figure B. The +5-V wire (formerly from pin 7) and ground (pin 1) should be connected to the 5-V supply that you chose earlier.

Serial for Breakfast

The Power Glove speaks a form of serial communications that is more like the PC keyboard than the RS-232C port. The 8 bits of data are presented one at a time on a TTL-level data line. Since there's no built-in clock rate, the computer has to provide the clock, so a second TTL line serves as the clock to advance from one bit to the next.

To keep everything synchronized, a third line serves as a master reset, to clear the glove's interface and reset it back to the first bit. Figure C shows the relative timing of the reset line, the data line, and the clock line. In the figure, the glove is completely at rest: No directions or "fire" buttons are in effect.

Pulses should be kept between 3 and 8 microseconds, and the bit sampling should be packed as tightly as possible. In figure C, the reset pulse is about 4 µs, and the clock pulses are about 3 µs. Unfortunately, the printer port on the PC has a finite response time somewhat longer than that, so you need to add some delay. The exact amount depends on the speed of your machine and the makeup of your particular printer port.

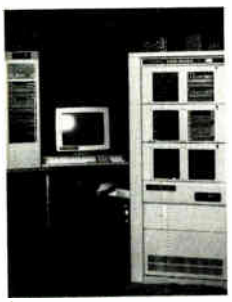
Listing A is a code snippet from the source for PG.COM, a sample TSR cursor-key driver that uses the glove output to drive the cursor keypad. If you're not working with a PC compatible, you'll need to write a piece of code that does something similar. [Editor's note: *The source code for PG.COM is available on disk and on BIX. See page 5 for details.*]

World Radio History

Circle 10 on Reader Service Card (DEALERS: 11)

TAPE AND DISKETTE DUPLICATION

CD2000 - DUPLICATOR

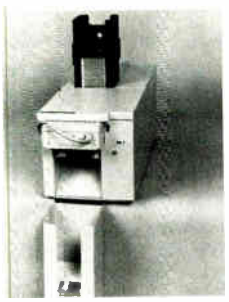


- Simultaneous Tape Duplication
- QIC, DEC, IBM, HP and 1/2"tapes
- Also Exabyte, DAT and Optical
- Versatile, Cost Efficient
- Upgrade to High Capacity Systems

LLP - LOADER, LABELER, PRINTER

- 3.5" Diskette Duplication
- Loads, Labels and Prints Custom Labels
- Easy to Operate, Unattended
- Wrap around or flat labels
- Serialized or Single Copies with Serialized Labels

RDH 3.5 LC - ROBOTIC DISK HANDLER DUPLICATOR



- Solution for 3.5" Diskettes, IBM or Macintosh
- High Volume
- Low Cost

APPLIED DATA COMMUNICATIONS

14272 Chambers Road
Tustin, CA 92680-6998
(714) 731-9000
Fax (714) 731-8907

US - 1 (800) 221-5486
In Calif. - 1 (800) 334-5486

European Inquiries: ADC GmbH
Mainhausen, West Germany
Phone 0 61 82-2010 04
Fax 0 61 82-39 22

Distributors Welcome

DEC is a trademark of Digital Equipment Corporation. HP is a trademark of Hewlett Packard. IBM is a trademark of International Business Machines. Exabyte is a trademark of Exabyte Corporation. Macintosh is a trademark of Apple Computer.

COMPANY INFORMATION

Amtec International
(Strain gauges inside the Power Glove)
3653 West 1987 South
Salt Lake City, UT 84104
(801) 977-0359
Inquiry 988.

Curtis Manufacturing, Inc.
(NC-1 Super Extendo)
30 Fitzgerald Dr.
Jaffrey, NH 03452
(603) 532-4123
Inquiry 989.

Exos, Inc.
(Dexterous Hand Master)
8 Blanchard Rd.
Burlington, MA 01803
(617) 229-2075
Inquiry 1185.

Mattel, Inc.
(Power Glove)
Consumer Affairs
5150 Rosecrans Ave.
Hawthorne, CA 90250
(213) 978-5150
Inquiry 1186.

Polhemus Navigation Sciences
(3Space Tracker)
P.O. Box 560
Colchester, VT 05446
(802) 655-3159
Inquiry 1187.

VPL Research, Inc.
(DataGlove)
656 Bair Island Rd., Suite 304
Redwood City, CA 94063
(415) 361-1710
Inquiry 1188.

far from the center you are, just that you're off-center.

The Power Glove's low price makes it a fascinating device for folks who are interested in experimenting with hand trackers. I created crude but usable gesture-recognition software using only the cursor pad emulation. The text box "Can We Talk?" on page 288 describes the communications protocol and the cabling that are required to connect the glove to an unused printer port on your PC compatible.

Give Your Computer a Hand?

After getting my hands on these three products, it's evident that none in its present form could ever replace the mouse. The Dexterous Hand Master measures the anatomical motions of the hand with more precision than today's applications could exploit. The DataGlove would be more practical for mainstream applications, but the fibers mounted on it seem too delicate to withstand the rigors of everyday use. And the price tags of these two products clearly put them out of reach as a replacement for your computer's mouse.

What about the Power Glove? Maybe. Mattel implemented it beautifully for the home video market. It's priced right and has more-than-adequate resolution for its intended purpose. The appearance is less than professional, but then, it wasn't designed to be used in the boardroom. The Power Glove is one rugged puppy, built for hard use by kids playing Nintendo games.

Being so new, no one really knows how long the Power Glove will hold up under actual use. The unit I worked with was connected to a PC compatible for several weeks. It looked haggard after being crunched under piles of books and papers, but it never failed to work. Still, the Power Glove will probably never become a popular accessory for Macs or PCs. We need something else.

All three vendors agree that some yet-undeveloped product would fill that need nicely. A product with the Hand Master's precision, the DataGlove's ease of use, and the Power Glove's affordability and rugged construction would be just the ticket. In the meantime, don't sell these products short. Many applications—most obviously, CAD—are just crying out for a good three-dimensional input device.

The Dexterous Hand Master and the DataGlove are here today, and they are priced within the budgets of those who really need them. If you're just curious, you might want to try experimenting with a Power Glove. I've navigated Lotus 1-2-3 spreadsheets, logged onto BIX, and scrolled through hours of Prodigy screens without ever touching my keyboard. The Power Glove is just downright fun, and it's a good way to get your hand on (or in) a piece of the future. ■

Howard Eglowstein is a BYTE Lab testing editor. He can be reached on BIX as "heglowstein."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

World Radio History

The backup system that makes *other* backup systems *obsolete.*

COREtape *Light* will back up a server from a workstation as well as a workstation's own local hard disk. *Now that's flexibility!*

Based on our award-winning CORE*fast.*

PC MAGAZINE EDITORS' CHOICE

Twice winner of the coveted PC Magazine *Editors' Choice Award* CORE*fast* was enhanced especially for COREtape *Light.*

"With an unbeatable price, flexible and easy to use software...this newcomer has a good shot at making 40MB tape obsolete."

—ROBERT KENDALL
PC MAGAZINE 12-26-89

COREtape *Light.* The industry's most reliable 3.5" tape backup. Stores 40 to 300+ megabytes — only $545 list!

What it is.

Available in *external* as well as internal models, COREtape *Light* uses standard 40 to 120 MB DC2000 series 3.5" tape cartridges. Typically, 300 MB or more can be backed up with compression onto one 120 MB tape.

In compressed mode, effective speed increases to about 4 megabytes per minute. Random Access Restore locates any file in less than a minute.

Using your system's (286 or above) (AT-bus or PS/2) existing floppy controller, COREtape *Light* makes installation quick and easy, and keeps a valuable expansion slot free.

Surface-mount technology, a heavy-duty metal frame, and a ferrite head all add up to an *impressive* **25,000-hour MTBF** that's *twice as high* as the competition's.

So, we gave COREtape *Light* an **18–month, full-replacement warranty**.

Net Gain.

Installed in network servers, *multiple* COREtape *Light* units are a very cost-effective alternative to DAT or helical scan. You can back up automatically and unattended at pre-scheduled intervals.

You decide — then see your dealer today!

	COREtape *Light*	CMS JUMBO	Mountain 8000 Plus	Irwin 2080	Maynard Cartridge
Interface	**QIC-80**	QIC-40	QIC-80	IRWIN	QIC-02
Capacity w/ Standard Long Length Tape	**120 MB**	60 MB	120 MB	120 MB	250 MB
Typical Capacity w/ Data Compression	**300 MB**	120 MB	150 MB*	not available	not available
List Price	**$545**	$399	$795	$849	$1,895
Price per Megabyte NORMAL	**$4.54**	$6.55	$6.62	$7.07	$7.58
Price per Megabyte COMPRESSED	**$1.82**	$3.33	$6.62	N/A	N/A
Random Access Restore	**YES**	YES	NO	YES	NO
Ferrite Head	**YES**	NO	NO	NO	NO
Metal Frame	**YES**	NO	YES	NO	YES
Warranty	**18 mos.**	12 mos.	12 mos.	12 mos.	12 mos.

*Mountain unit requires $200 add-in card.

CORE INTERNATIONAL

Distributed by...

Graydon Sherman	**1-800-472-9366**
Ingram/Micro D	**1-800-456-8000**
Softsel/MicroAmerica	**1-800-645-7779**
Markham (Canada)	**1-416-475-8955**

7171 North Federal Highway • Boca Raton, Florida 33487 • 407/997-6055 • 407//997-6009 Fax

Copyright 1990 CORE International. All rights reserved. PS/2 is a registered trademark of IBM Corp. CORE, CORE International, COREtape, COREtape *Light*, and CORE*fast* are registered trademarks of CORE International, Inc.

Circle 66 on Reader Service Card (DEALERS: 67)

World Radio History

Unleash Your 386, 486 & i860!

NDP Fortran is the key to unlocking the numeric power of Intel's 32 bit CPUs, including the i860 super-computer-on-a-chip. All of the members of our NDP language family are specifically designed to let you take maximum advantage of 32 bit protected mode operation, including the 4 gigabyte address space of the processor, plus access to all available coprocessors from Intel, Weitek and Cyrix. And, speaking of speed, our new Number Smasher i860™ delivers super-computer throughput running in an ISA bus for about the price of a 486 system. If you're burning up a lot of Cray time, you ought to seriously consider the Number Smasher i860™.

Milt Capsimolis of Ithaca Software, developer of HOOPS, the highly regarded 3D, object-oriented graphics library reports: "We ported a huge C library — well over 100,000 lines — without a hitch, in less than a day! ... We liked the enormous advantage NDP C-386 offers through its support of the Weitek coprocessor."

Fred Ziegler of Aspen Tech in Cambridge, MA: "I ported 900,000 lines of source in two weeks with NDP Fortran-386 without a single problem!" Aspen Tech's Chemical Modeling System is in use on mainframes worldwide and is probably the largest application to ever run on an Intel processor.

Our compilers come with the features you need to simplify porting to the 32-bit mode of the 386, including a 99% VAX VMS compatible FORTRAN and a dual dialect C which is UNIX System V and ANSI compatible. Also included is a library of 135 character and pixel oriented graphics routines that automatically detect and support the full range of PC display adapters. Plus we carry a full line of third party libraries and utilities that were ported with our languages.
For information about numeric coprocessor performance, call for your free copy of an article by Stephen Fried, "The State of PC Numerics in 1990". **For more information, please call our Technical Support Dept. at (508) 746-7341.**

386 & 486 Compilers and Tools

Our NDP family of compilers generate globally optimized, mainframe quality code that runs on the 386 or 486 in protected mode under UNIX, XENIX, or extended DOS. The compilers address 4 gigabytes of memory while supporting the 80287, 80387, Weitek, and Cyrix coprocessors. Applications can mix code from all three compilers and assembly language. To simplify your ports, we have just released a symbolic debugger, ClearView-386, that works with the DOS versions of the NDP languages.

NDP Fortran-386™ is a full F77 with F66 and DOD extensions that is 99% VMS compatible.
NDP C-386™ runs as a full K&R C with MS extensions or as an ANSI compiler.
NDP Pascal-386™ is a full ANSI/IEEE Pascal, with extensions from C and BSD 4.2 Pascal.

DOS 386SX versions - NDP tools included $595
DOS 386 versions - NDP tools included ... $895
DOS 486 versions - NDP tools included ... $1195
UNIX/XENIX 386 versions $895
UNIX/XENIX 486 versions $1195
NDP VMM virtual memory manager $295
Eclipse or Phar Lap Tools $495
NDP Link - Incremental Linker $295

ClearView-386 Debugger™ — MicroWay's full-featured symbolic debugger works with the NDP compilers running on DOS Extenders. It requires the MicroWay tools to process the UNIX COFF symbols emitted by our languages into the 386 load module. $395
NDP C++ Version 1.2 ..... $295
NDP Windows™ Library: $125, C Source: $250
NDP HOOPS™ $795
NDP Plot™ $325
NDP/FFT™ NDP or 80x87 version ... ea. $250
NDP to HALO '88 Graphics Interface $100

NDP NAG™ — The NAG Workstation library is a subset of the NAG mainframe libraries. It contains a library of 172 routines designed to solve differential equations and eigenvalue problems, perform matrix operations, fit curves, do statistics and regression analysis, generate random numbers, etc. $895

486 Your PC!

NumberSmasher-486™ is a 25 MHz replacement motherboard for ATs and 80386s. This motherboard supports an optional Weitek 4167 numeric coprocessor and up to 16 megabytes of memory. The Number Smasher-486 with 0K is priced at $3195.

NumberSmasher-i860™

The Number Smasher-i860 is the highest performance coprocessor card to ever run in an ISA or EISA bus or as part of a transputer system. Delivers up to 80 million floating point operations per second at 40 MHz and produces over 10 double precision Linpack megaflops. The board comes standard with an ISA interface, two transputer link adapters, your choice of NDP Fortran, C or Pascal for the i860 running under MS-DOS or UNIX, plus 8 megabytes of high speed memory. ..... from $5995

Parallel Processing

MicroWay's IBM compatible Monoputer, Quadputer, Videoputer, and Linkputer boards work together using Inmos transputers to provide expandable, plug-in mainframe performance for your desktop PC.

Monoputer™ — Includes one T800 and up to 16 meg of RAM for parallel code development. The 4 MWhetstones T800 makes it the ideal FORTRAN engine for cost-effective execution of your mainframe programs. . . from $1295

Quadputer™ — This board for the AT or 386 can be purchased with 1 to 4 transputers and 1 or 4 meg of memory per transputer. Two or more Quadputers can be linked together to build networks of up to 100 or more transputers providing mainframe power ..... from $1995

Linkputer™ — Links up to 8 boards to provide dynamic transputer topologies $1500

Transputer Compilers and Utilities
These parallel languages are designed for use with the Monoputer, Quadputer and Videoputer.
Logical Systems Parallel C $595
3L Parallel C, FORTRAN, or Pascal .. $895
TBUG — debugger for 3L compilers .. $330
Parsec Parallel C/dynamic $1500
ParaSoft EXPRESS Package — Includes transputer communications libraries, parallel code development library, C source level debugger, and system performance monitor $1500
Helios PC/s $1250
occam 2 Toolset $1500
Nexis Windows File Server — Lets you run parallel applications under the Microsoft Windows environment $495
T800/NAG™ — Port of the complete NAG mainframe library. Contains 268 functions: $2750

Math Coprocessors

WEITEK

4167-25 (Now in stock) $1395
mW1167 Micro Channel-16/20 .. from $795
mW3167 Micro Channel-25/33 .. from $1495
3167-20/-25/-33 ..... $795/ $995/ $1295
mW3167/80387 Board $200
mW1167™ and **mW3167™** coprocessor boards are built at MicroWay using Weitek components. Each includes an 80387 socket.

INTEL

8087	$84	**80287-2**	$120
80287-8	$195	**80287-10**	$220
80387-16	$330	**80387-16SX**	$310
80387-20	$375	**80387-25**	$460
80C287A	$280	**80387-33**	$570

287Turbo-20™ This coprocessor board runs a specially qualified Intel CMOS 80C287 at 20 MHz regardless of the main CPU speed .. $450

CYRIX

Cyrix CX83D87 FasMath™ — Fastest 80-bit Intel compatible coprocessor.
20 MHz: $400 **25 MHz:** $510 **33 MHz:** $625

RAMpak™ Your Compaq!

RAMpak™ - one or four meg 32-bit memory expansion module for Compaq Deskpro 386 20/25 One meg .. $150, Four meg .. $500 SIMMs ..... CALL

386 Your AT!

NUMBER SMASHER-386™ — A full-sized card that replaces the 80286 microprocessor on your IBM AT or compatible motherboard with an 80386 that runs at 20 or 25 MHz. It runs numerically intensive applications up to a factor of 60 times faster, while maintaining full hardware and software compatibility when running all 386 applications. Includes sockets to optionally add up to 8 megabytes of 32-bit memory, an Intel 80387, Weitek, or Cyrix numeric coprocessor, and 64K of high speed cache memory. ..... from $895

FASTCache-SX™ — The most cost effective accelerator we have ever manufactured. Plugs into the 286 socket, speeding up all applications by a factor of 2 to 4. Runs all 386 applications. Features an 80386-SX (16 or 20 MHz), a 4-way 32K cache, expandable to 64K, and a math coprocessor socket 16MHz: $495 20 MHz: $595

MicroWay

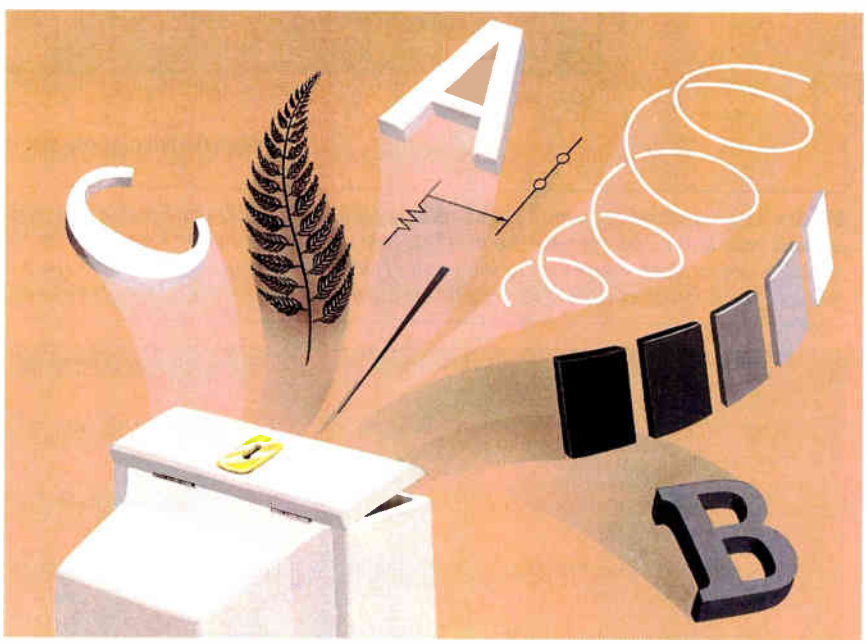
World Leader in PC Numerics

Corporate Headquarters: P.O. Box 79, Kingston, MA 02364 USA (508) 746-7341
32 High St., Kingston-Upon-Thames, U.K., 81-541-5466 USA FAX (508) 746-4678
Germany 069-75-2023 Italy 02-74.90.749 Holland 40 836455 Japan 3 222 0544

World Radio History

POSTSCRIPT INSIDER SECRETS

You can vastly improve your PostScript output with a few tricks



Put aside those PostScript graphics-generating and page-layout programs and do the work yourself for a change. Some good sense and a few secrets are all that you need to get your PostScript device to perform like you have never realized was possible. The only tool you need for good PostScript output is a text editor.

PostScript by Adobe Systems

PostScript is more than a page-description language. It is actually an incredibly powerful general-purpose computer language that can easily hold its own against any other modern contender.

Yes, PostScript does excel at putting marks on pages. The feature that makes it quite good at this is its *device independence*. You can use any editor or almost any word processor on any host computer to generate PostScript source code.

The device independence lets you use laser printers, phototypesetters, display screens, high-resolution fax substitutes, sign makers, printed circuit prototypers, plotters, CAD/CAM production systems, slide imagers, and even the three-dimensional photolithography "Santa Claus" machines, all interchangeably from the same PostScript source files.

Another big plus of PostScript lies in its ultrastrong graphical transformation capabilities. Fonts and graphics can be freely intermixed in *any* combination in *any* scale along *any* path.

The font machinery in PostScript is especially impressive; it uses single outline descriptions to create any font size or shape from a single master font dictionary. The font descriptions often include *hints* (i.e., special attributes of character shapes) and weight-versus-size adjustments. Hints can optimize your results on low-resolution output devices, as well as preserve balance in larger headline typography.

Since the font descriptions are really procedures, you can easily "postprocess" your final characters for outline, shading, three dimensions, pattern, distortion, and many other special effects.

A nearly infinite variety of PostScript fonts are available. These range from several dozen standard ones built into PostScript printers to thousands of fully professional downloadable fonts, on down through countless shareware and freeware products of lower cost and quality. You can easily create your own PostScript fonts or customize existing ones.

Another powerful PostScript feature involves its extensive use of Bézier cubic spline curve descriptions to create smooth and graceful shapes, the resolution of which improves (rather than degrades) when you increase size.

PostScript is somewhat related to Forth. It is an interpreted, stack-oriented, postfix (Reverse Polish notation) language. It makes heavy use of multiple dictionaries (i.e., collections of variables and definitions). PostScript is both reentrant and extensible, meaning that you can add or redefine any portion of the language in any manner.

PostScript is also a fun language to use, and it can become downright addictive. You can create useful output while understanding only a very few PostScript commands, but you can learn a little bit at a time and still be productive. I have seen beginning students create award-winning graphics after one class.

Usually, you do not run out and buy a copy of PostScript. Instead, the language is built into your PostScript-speaking output device, a laser printer or phototypesetter. Some laser printers that use PostScript are the NEC Silentwriter LC-890 and the Apple LaserWriter IINT and

continued

ILLUSTRATION: ROBERT TINNEY © 1990

World Radio History

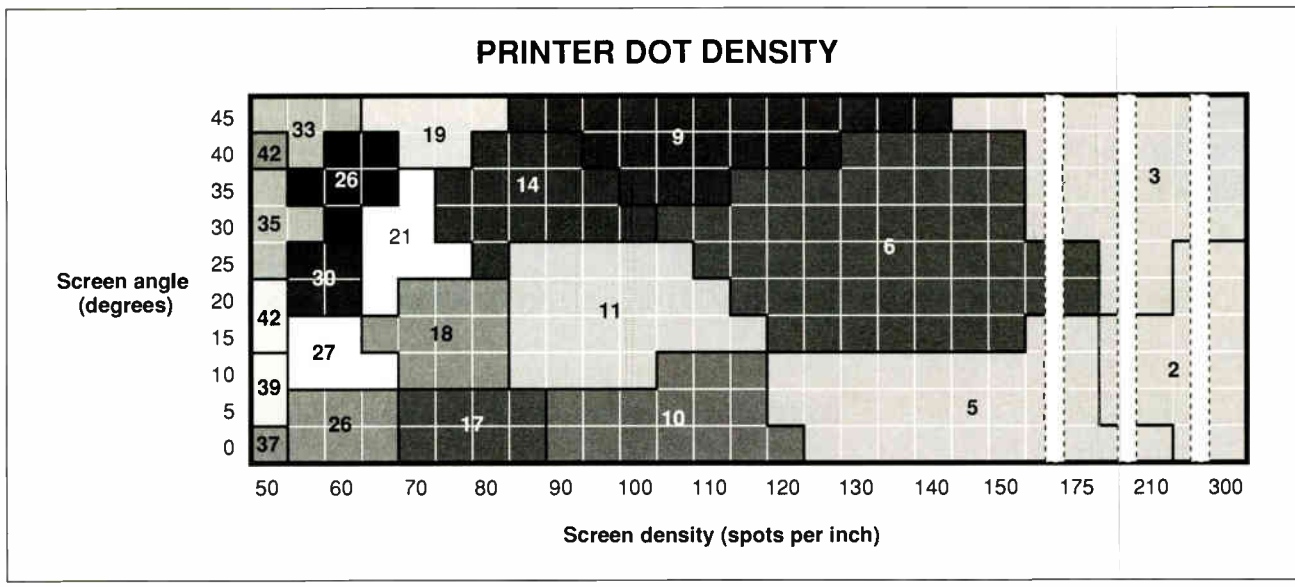


Figure 1: *This secret gray map shows many of the hidden 300-dpi PostScript grays found on the LaserWriter. The best all-around gray is the 106-spot-per-inch, 45-degree one, while a good reprogray for reduction is 85 spots and 35 degrees. The 135-spot, 25-degree screen gives india ink wash effects. The printer default is 53 spots and 45 degrees. The values on the map indicate the number of available gray levels for the region.*

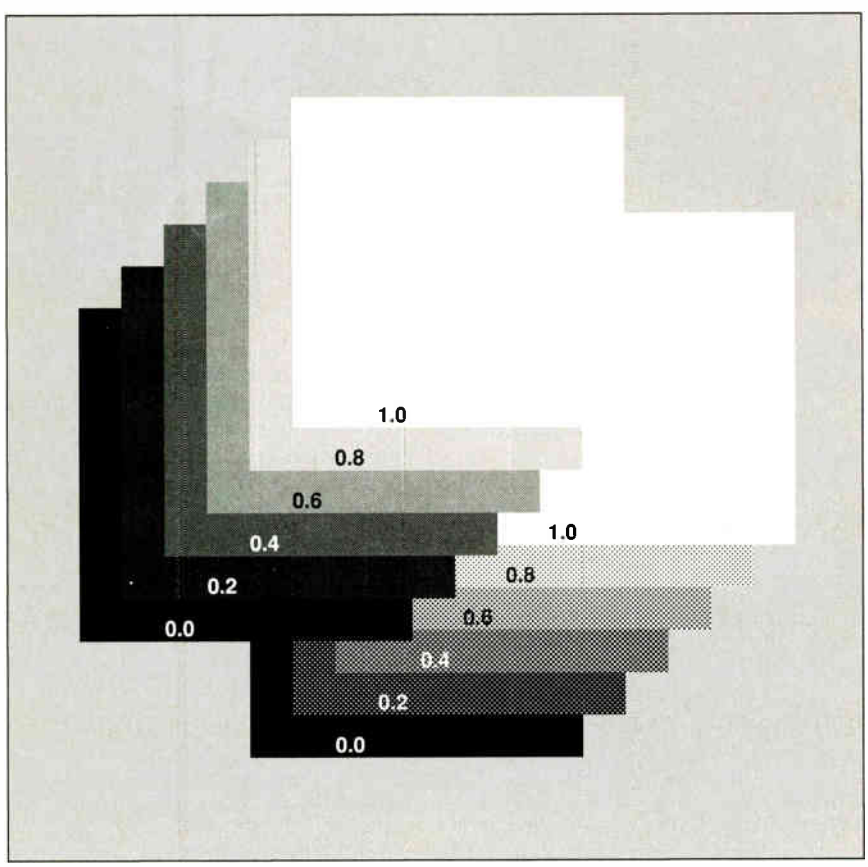


Figure 2: *PostScript lets you vary grays by specifying the spot density and the angle of spot placement. Here, the lower set of grays is the printer default of 53 spots per inch and 45 degrees. The upper set is the optimum 106 spots and 45 degrees. The numbers in the squares represent the* `grayvalue`.

IINTX. The Linotron 200-P is an example of a PostScript phototypesetter.

PostScript can be run on older dot-matrix and ink-jet printers by using inexpensive PostScript clone software emulators such as GoScript, Freedom of Press, and UltraScript.

PostScript is a loosely typed language that also gives you many data structures that you can redefine at will. PostScript is polymorphic; in other words, its wide range of operators accepts different data types as inputs. Most important, PostScript permits redefinable primitives. This lets you rearrange the scenery to suit yourself.

PostScript automatically does matrix transformations on the fly, maintaining both a user space and a device space. Its key-value dictionary structures are extremely powerful. One little-known advanced feature of these dictionaries is that you can link any two data types as a key-value pair.

What I'd like to do is introduce you to some sneaky and little-known PostScript insider secrets that will turn your PostScript machine into a super device that can leap tall buildings in a single bound. I have this column for two months, so I will be giving you two healthy portions of my brew.

Should you want more on PostScript fundamentals, check into Adobe's blue book, otherwise known as the *PostScript Language Tutorial and Cookbook*, and

continued

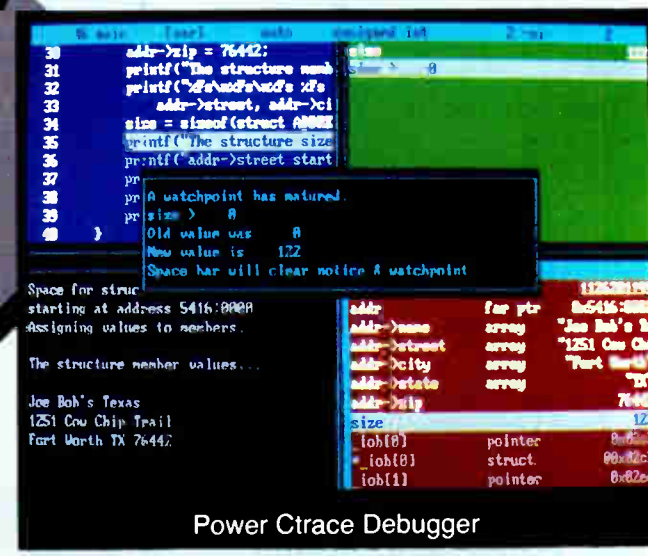
World Radio History

Power C

Incredible Value!

Computer Shopper Best Buy of 1988 — Computer Shopper Best Buy of 1989

Don't take our word for it, take theirs...



Power Ctrace Debugger

"Do you know what the underground bargain C compiler of this year is? It's the Mix Power C compiler. For under $25 with shipping, it is one heck of a good compiler."

Victor Schneider
Dr. Dobb's Journal, June 88 (Letter to the editor)

"Overall, Power C's performance is remarkable for the price. Quite compatible with the Microsoft C and Turbo C "standards", Power C is a heavyweight contender in the educational, hobbyist, and perhaps even the professional market — at a bantamweight price."

Stephen Davis
PC Magazine, September 13, 88 (Review)

"Power C is an unbelievable product for $19.95, and is very competitive with Turbo C, Microsoft C, and Microsoft's new Quick C in both features and performance. It is excellent for the beginner who wants to learn C, or for the experienced programmer who wants to develop professional applications. The manual alone is worth the price of this package, and the generous library source code and assembler offer adds to the value of it. If you have any desire to program in C, or want a more powerful C compiler, get a copy of Power C!"

Michael Cortese
Computer Shopper, August 88 (Review)

"The Ctrace debugger is where Mix really shines. It is magnificent. It's not only better than the stripped down debugger Microsoft includes with Quick C, it's better than the full debugger Microsoft provides with its high-end compiler (Codeview)."

David Weinberger
Computer Shopper, November 88 (Review)

Circle 166 on Reader Service Card

MIX software

Technical Specifications

Power C includes: Power C compiler with integrated Make, Power C Linker, Power C Libraries (450 functions), the Power C book (680 pages), and support for...

- ✓ ANSI standard
- ✓ IEEE floating point
- ✓ 8087/80287 coprocessor
- ✓ auto-sensing of 8087/80287
- ✓ automatic register variables
- ✓ unlimited program size
- ✓ mixed model (near & far pointers)
- ✓ graphics on CGA, EGA, VGA, & Hercules

Optional Products:

- ✓ Power Ctrace debugger
- ✓ Library source code
- ✓ BCD business math

Order now by calling our toll free number or mail the coupon to Mix Software, 1132 Commerce Drive, Richardson, TX 75081.

1-800-333-0330

For technical support call: 1-214-783-6001

Minimum System Requirements:
DOS 2.0 or later, 320K memory, 2 floppy drives or hard drive.
Runs on IBM PC, XT, AT, PS/2 and compatibles.

60 day money back guarantee

Name _____
Street _____
City _____
State _____ Zip _____
Telephone _____
Paying by: ☐ Money Order ☐ Check
☐ Visa ☐ MC ☐ AX ☐ Discover
Card # _____
Card Expiration Date _____
Computer Name _____ Disk Size ☐ 5¼" ☐ 3½"
Product(s) (Not Copy Protected)
☐ Power C compiler ($19.95) $_____
☐ Power Ctrace debugger ($19.95) $_____
☐ Library Source Code ($10.00) $_____
(includes assembler & library manager)
☐ BCD Business Math ($10.00) $_____
Add Shipping ($5 USA – $20 Foreign) $_____
Texas Residents add 8% Sales Tax $_____
Total amount of your order $_____

B

Power C & Power Ctrace are trademarks of Mix Software Inc. Quick C & Codeview are registered trademarks of Microsoft Corp. Turbo C is a registered trademark of Borland International.

World Radio History

the red book, also titled the *PostScript Reference Manual*. Or you might call me for more information. On to the sneaky stuff....

Those Secret Grays

For some unfathomable reason, most PostScript application packages and most users frequently end up using the seventeenth most gruesome group of grays available on their 300-dot-per-inch PostScript printers. Yet with just a few keystrokes, you can substitute absolutely outstanding grays, some of which even simulate an india ink wash.

Most 300-dpi PostScript printers are capable of putting dots only in specific locations on the page. To create a gray, the printer uses patterns of dots, which are called *spots*. For instance, a 3- by 3-dot spot could give you 10 gray levels (including black and white) with a resolution of 100 spots per inch.

Because the spots have to perfectly replicate themselves over the entire page, complex integer math is involved that decides which spot combinations are allowed. A parameter called the *screen angle* decides how the spots will orient on your page. Typically, screen angles near 45 degrees are preferred, since they will introduce fewer visual artifacts or aberrations.

Figure 1 shows the secret gray map of all the available denser grays. Because of the integer tiling, a request for a screen angle and density will automatically be converted into one of those shown on the map.

The overall "best" gray is a 106-spot, 45-degree one, while the 85, 35 option is best for camera-ready copy for later reduction. The 135, 25 option can give you india ink wash effects, but it requires careful paper and toner selection.

The default screen is clear down at 53 spots and 45 degrees, which explains the "Sunday funnies" results of most improperly done PostScript work. There is, of course, one trade-off. The denser screens permit you fewer gray levels. But one decent and dense light gray is all that you need to spruce up line art and improve your layouts. To change a halftone screen, enter the following sequence:

```
106 45 {dup mul exch
    dup mul add 1.0
    exch sub} setscreen
```

Figure 2 shows the difference between the default 53, 45 and the much finer 106, 45.

The sequence inside the braces is called the *spot function*. It determines the rule as to which pixels are turned on as the gray value goes from white to solid. You can create other spot functions for other uses. Most spot functions behave similarly when imaging their lightest gray. You can also use PostScript's `currentscreen` operator to preserve the existing spot function, while changing its density or screen angle.

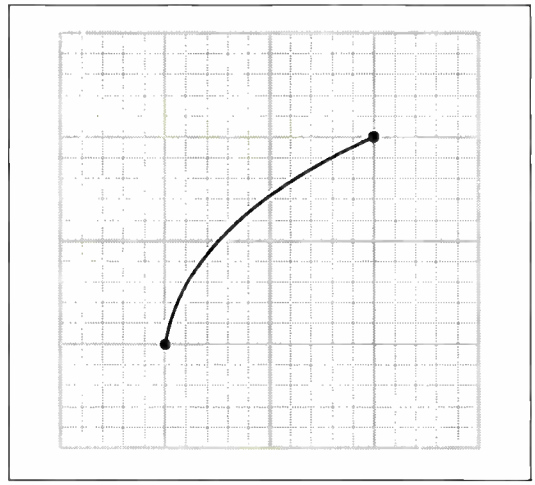


Figure 3: *Uniform and dropout-free 300-dpi gray grids can be done at a 1-to-1 scale by first locking to exact 4-pixel multiples and then using the special halftone screen function as shown here. Note that each crossing consists of a single and uniform dot. PostScript stays "locked" to the grid until the next occurrence of a* `grestore`.

Dropout-Free Gray Grids

There are other sneaky tricks you can pull once you understand your PostScript grays.

Figure 3 is the result of the PostScript code in listing 1, a fine gray *rubbergrid* that is both uniform and dropout-free (i.e., all the dots print uniformly). The tricks here involve using a special spot function and locking to exact multiples of 4 pixels. Notice that not only are the lines uniform, but also each of the crossings has precisely a single pixel dot at its center.

You can easily expand or contract a rubbergrid to fit the available space, and once you have created it, further graphics and text are locked to it until your next `restore`. You can use the grid just for layout or make it part of the final image. It is particularly attractive for engineering graphs.

But there are several minor gotchas. You can create the rubbergrid at only a 1-to-1 scale, and any scaling or repositioning gets rather involved. Because of the exact locking to 4-pixel multiples (which seems crucial for preventing 300-dpi dropouts), your final grid may not end up exactly the size you wanted or precisely in your desired location.

continued

Listing 1: *The PostScript for a fine gray rubbergrid that is both uniform and dropout-free must be very delicately tuned to the capabilities of the printer. The spot function is null so that the* `setgray` *function produces a specific dot.*

```
%  Creates uniform and ultrafine gray grids without any dropouts or rattiness.
%  The code shown is device-specific and is intended for 300-dpi printers.
%  To create a grid, use  -hpos- -vpos- -gridsize- setgrid.  Until restored, all
%  further images will be "locked" to the grid, expanding and contracting with it.
%  Note that optimum line widths and font sizes will usually be much less than 1.0
%  after locking.
%  To show a grid, use -#hlines- -#vlines- showgrid.
%  The seegrid command displays the grid when true.
%  The fat5 command emphasizes every fifth line when true.
%  The fatter10 command emphasizes every tenth line when true.
/quadpixel {transform 4 div round 4 mul itransform} def
/setgrid {save /rubbersnap exch def quadpixel /size exch def quadpixel exch quadpixel
exch translate size dup scale} def
/drawlines {72 300 div lw mul size div setlinewidth /hposs 0 def #hlines gs div 1 add
cvi {hposs 0 moveto 0 #vlines rlineto stroke /hposs hposs gs add def} repeat /vposs 0
def #vlines gs div 1 add cvi {0 vposs moveto #hlines 0 rlineto stroke /vposs vposs gs
add def} repeat} def
/showgrid{ seegrid {gsave /#vlines exch def /#hlines exch def 106 45 {pop pop 0}
setscreen 0.9 setgray /gs 1 def /lw 1 def drawlines fat5 {/gs 5 def /lw 3 def
drawlines} if fatter10 {/gs 10 def /lw 5 def drawlines} if grestore}if} def
/fat5 true def /fatter10 true def /seegrid true def
%  use examples: -xpos- -ypos- -gridsize- setgrid -#hlines- -#vlines- showgrid
%  {anything you want locked to the grid} rubbersnap restore
%  /// demo - remove before use ////
100 200 10 setgrid 20 20 showgrid showpage quit
```


World Radio History

Up to date.
Down to earth.

Changing the world. UNIX is changing the world of computers, the world of business—quite simply, changing the world. It's revolutionizing office automation. It's required for U.S. government computer contracts. It's the backbone of information strategies worldwide.

The information you need. That's why you need *UNIXWORLD*—the magazine that keeps you up to date on the rapidly changing world of open systems computing. Each issue brings you the latest product trends and technical advances that can affect your business. The inside story on some of the world's biggest high-tech companies. Easy-to-understand programming tips and tutorials that can help you and your company use UNIX to its fullest. And unbiased hardware and software reviews to help you invest wisely when you buy.

The whole UNIX-verse. *UNIXWORLD's* in-depth features go beyond dry technical facts, to show how the pieces fit together—to tell you what's important about the advances and the strategies that are changing your world. And *UNIXWORLD* consistently offers the freshest, most down-to-earth writing you'll find in any computer publication.

Subscribe and Save. Subscribe today, and receive the next 12 issues of *UNIXWORLD* for just half the regular newsstand price. Save even more by ordering for two or three years. You can't lose—every subscription to *UNIXWORLD* comes with a no-risk guarantee.*

1 year $18.00 (save 50%)
2 years $32.00 (save 55%)
3 years $42.00 (save 60%)

Subscribe now! Call toll-free:

1-800-341-1522

UNIXWORLD

If you're into UNIX, you need *UNIXWORLD MAGAZINE.*

UNIX® is a registered trademark of AT&T. UNIX WORLD is not affiliated with AT&T.
*UNIXWORLD's no-risk guarantee: If not satisfied, cancel and receive a full refund for the balance of your subscription.
A McGraw-Hill publication

World Radio History

If you just want a rubbergrid and do not care how it looks, defeat the `quadpixel` function with `/quadpixel {} def` to prevent the locking. Without the locking, you get the exact size and position you want, but you may end up with dropouts and variations in line weight.

Notice that the grid extends infinitely in both directions but is clipped to values passed to `showgrid`. You can prevent showing any of the grid by commenting out (i.e., `%`) the call to `showgrid`.

Opaque Icons

Many PostScript images use blobs sitting on strings. An obvious example is a component in an electronic schematic (see figure 4). Other examples are found in flowcharts, printed circuit boards, piping diagrams, organizational charts, and schedules.

A nearly unknown concept called an *opaque icon* can help here. There are rules: All the symbol icons are stored in dictionaries, all the icons are opaque and thus obscure anything they are sitting on, and each icon has an obvious *action point* that determines where it sits. You erase the underlining wire or string (by writing white over it) before creating the rest of the icon.

The advantage of using opaque icons is that, even after you position them, you can still slide all your continuous wires underneath. To do this, you simply describe your continuous wires *earlier* in your file. This lets you reposition the icons at any time. You never have to worry about making and breaking any of the actual connections.

A similar scheme is the *fat white, thin black* ploy. The line breaks for drawing unconnected crossing wires are created by drawing a thick white line, followed by a thin black one. You can use the same method for piping and braiding, unusual borders, isometric depth illusions, and fonts that automatically break an underline.

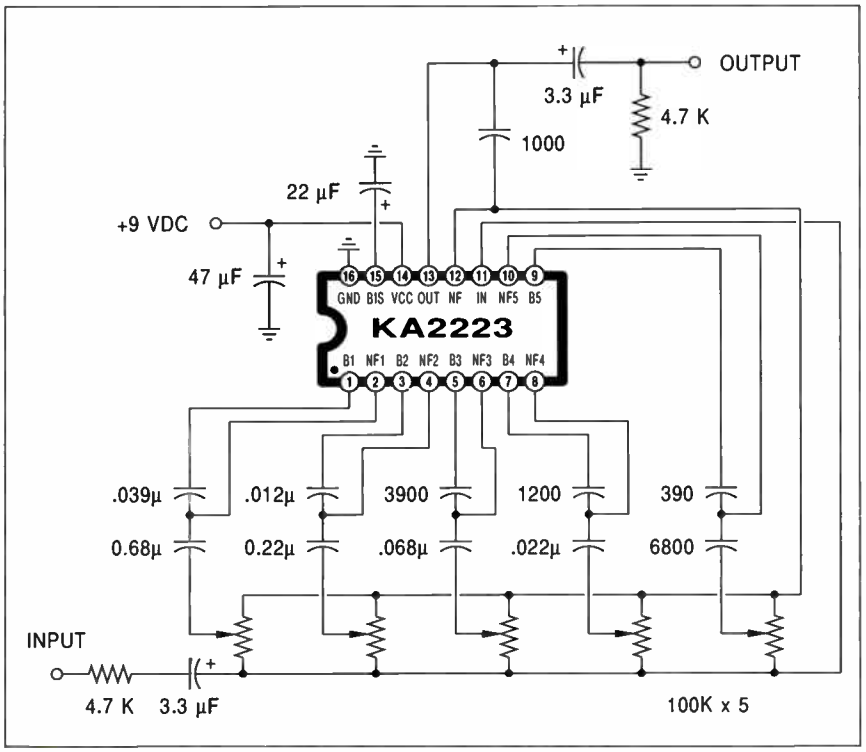


Figure 4: *Opaque icons greatly simplify drawing PostScript electronic schematics, flowcharts, and other "blobs on strings" illustrations. All the background wires are continuous, and you slide them under the icons simply by placing them earlier in the text file. Line breaks are first printed as an opaque fat white line and then as a thin black line.*

An Enigmatic Operation

PostScript has a very enigmatic operation, `eexec`, that is of major interest on my PostScript help line (see my biography). The `eexec` was a failed early attempt at making PostScript code files unreadable, but with the penalties of longer files and slower execution times.

Actually, you can easily read any `eexec` file by installing a stack-dumping error trapper and selectively inserting extra characters into your data stream or truncating your file with a Control-D end of file. You can easily reconstruct the plaintext source file from the error messages that result. The tools that you need appear in Adobe's documentation.

Listing 2 shows a faster and easier way to employ `eexec` to encrypt your own PostScript code. Listing 3 shows you how to convert your previously `eexec`-encrypted file back into plaintext.

So how does `eexec` work? The key is a 16-bit pseudorandom sequence. To encrypt, the upper 8 bits of the current pseudorandom mask get exclusive-ORed with your original ASCII value, creating a new character that will get saved as a 2-byte pair. Since an XOR operation is reversible, if you do it again with the same

continued

Listing 2: *A faster and easier way to encrypt your own PostScript code than the* `eexec` *that Adobe uses.*

```
/mask 16#D971 def /mult1 16#6000 def /mult2 16#6E6D def /adder 16#58BF def
/strrx (X) def /trunc 16#FFFF def /char 32 def /hexvalues (0123456789ABCDEF) def
/printashex {cvi /vall exch def vall 16 div cvi hexvalues exch 1 getinterval print
vall 15 and hexvalues exch 1 getinterval print flush 20 {37 sin pop} repeat
formatcount 1 add 32 eq {(\ n) print flush 100 {37 sin pop} repeat} if /formatcount
formatcount 1 add cvi 31 and def} def
/makeeexecfile {/formatcount 0 def 4 {char mask -8 bitshift or char mask -8 bitshift
and not and /echar exch def echar printashex flush 15 {37 sin pop} repeat mask echar
add dup mult1 mul trunc and exch mult2 mul trunc and add trunc and adder add trunc
and /mask exch def} repeat {currentfile strrx readstring {0 get /char exch def char
mask -8 bitshift or char mask -8 bitshift and not and /echar exch def echar
printashex flush 15 {37 sin pop} repeat mask echar add dup mult1 mul trunc and exch
mult2 mul trunc and add trunc and adder add trunc and /mask exch def} {pop exit}
ifelse} loop} def
% //// demo - remove before use. ////
1500 {37 sin pop} repeat
%  Here is the expected host-returned blackflashing result ...
%  F983EF00C334F148421509DC30FA053D6DD4273E416E6A2EA64F917B5D20E111
%  9F220AF8FC50D545AB51A0D18B6DD7543D27A21CD55887C1C7D51608F6A316EE
%  8891D92A6E0D09D1D039159DA3A0781E1380B1228C
makeeexecfile
0 0 moveto 1000 0 rlineto 0 1000 rlineto -1000 0 rlineto closepath fill showpage quit
```


World Radio History

SURVIVAL MANUALS FOR NETWORK PROS.

Data Communications magazine presents the essential reference tools for the 1990's.

NETWORK MANAGEMENT & MAINTENANCE, VOL. 4.
The latest installment in the highly respected series providing essential insights into fundamental network-management techniques that will serve as benchmarks for the '90s and beyond.
Price: $34.95. 337 pages. Item #70.

INTEGRATING VOICE AND DATA, VOL. 3.
Collected articles on such diverse topics as T1 basics, a detailed assessment of state-of-the-art fiber optics technology, and an in-depth look at the Integrated Services Digital Network (ISDN).
Price: $34.95. 319 pages. Item #66.

CONNECTIVITY AND STANDARDS, VOL. 3.
The essential handbook for information managers charged with piloting their networks through the '90s and into the 21st century. In-depth case histories and reports on evolving protocols and standards augment an invaluable collection of articles.
Price: $39.95. 730 pages. Item #63.

INSIDE X.25: A MANAGER'S GUIDE.
A hands-on guide for engineers seeking to lift the X.25 standard off the bookshelf and into the real world of network problem solving. Provides a historical perspective and introduces the basics of packet switching, open systems interconnection and the X.25 standard. Plus detailed assessments of packet technologies, equipment, and networks.
Price: $39.95. 300 pages. Item #65.

DATA NETWORK DESIGN STRATEGIES, VOL. 4.
A unique collection of articles presenting the best thinking of the late 1980's on the wide range of network design alternatives that will come into play during the 1990's.
Price: $39.95. 694 pages. Item #64.

OMNICOM INDEX OF STANDARDS, 1990 EDITION.
Edited by Harold C. Folts
A totally new edition of the classic reference for instant access to standards of leading U.S. and international organizations, including CCITT, ANSI, ISO, and IEEE. Cross referenced and indexed for quick, easy access.
Price: $127.00. 955 pages. Item #71.

THE LOCAL AREA NETWORK HANDBOOK, VOL. 3.
The authoritative chronicle of the LAN market of the late '80s. Features insightful articles by LAN pioneers and other experts.
Price: $39.95. 509 pages. Item #67.

BASIC GUIDE TO DATA COMMUNICATIONS, ED. 2
This updated supplement to the first edition is essential reading for a comprehensive understanding of data communications and a clear, insightful look at emerging trends.
Price: $34.95. 350 pages. Item #62.

Special Bonus Discount: Deduct 10% on all orders over $50.00. **Sales Tax:** Add applicable tax for your locality. **Shipping & Handling:** Add $2.50 per book. **Delivery:** Allow 4 weeks for U.S. orders; international orders allow extra time. **To order by phone:** Call (718) 834-0170. **To order by mail:** Send check and order to: Data Communications, Box 059077, Brooklyn, NY 11205.

McGraw Hill

World Radio History

straight lines in the same path. You can create cusps or inflection points by repeating a data point pair with different entry and exit angles. You can generate variable curve widths by curve-tracing up one side and down the other.

To draw a pictorial wire, you first curve-trace the wire path. Next, set a `1 setlinecap` for rounded ends. Then stroke fat white to break anything the wire is running over. Stroke black to set the wire outline. Finally, stroke gray to color the wire.

Fractal Art

If the dire predictions in the *PostScript Reference Manual* are taken seriously, any attempt whatsoever at doing fractal art with PostScript will result in the immediate vaporization of all small furry animals within an eight-block radius of your PostScript printer. In reality, PostScript is ideal for many kinds of fractals.

To prove this, see figure 5. I've taken the fern routine that first appeared in "A Better Way to Compress Images" (January 1988 BYTE). I was struck by how ungainly all the translate-rotate-scale transformations were done in both the BASIC and C code examples. In contrast, matrix image transformations between device space and user space are inherent to the very core of PostScript.

The code works by first creating a table of 128 different transformations based on the required probabilities (see listing 4). The routine uses this table to build up the final fern. As in the example cited, the first 20 dots are thrown out to give the strange attractor time to start strange attracting. It takes a mere 28 data values to *completely* define this fractal image.

What utterly amazes me about this fern fractal image is that you do not really draw it. Instead, you simply let it out, and it leaps at you with a vengeance. Very much like learning PostScript. ■

Editor's note: *The complete text of the code in this article is available in a variety of formats. See page 5 for details.*

Microcomputer pioneer and PostScript authority Don Lancaster is the author of 26 books and countless articles. He maintains a no-charge PostScript help line at (602) 428-4073. The best time to call is from 8 to 5 (MT) on weekdays. You can also contact him on BIX c/o "editors."

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Mixing REAL TIME With REAL UNIX® Is Not Magic...

It Is Technology.

VenturCom's real time UNIX product family has the only real time kernel for standard hardware platforms which is AT&T's UNIX System V. Not a simple UNIX clone. Not just UNIX on top of a real time executive.

Real UNIX provides designers with SVID and POSIX standards, RFS and NFS, X-windows, Streams, complete development tools, multiple DOS under UNIX tasks. And early access to future technologies.

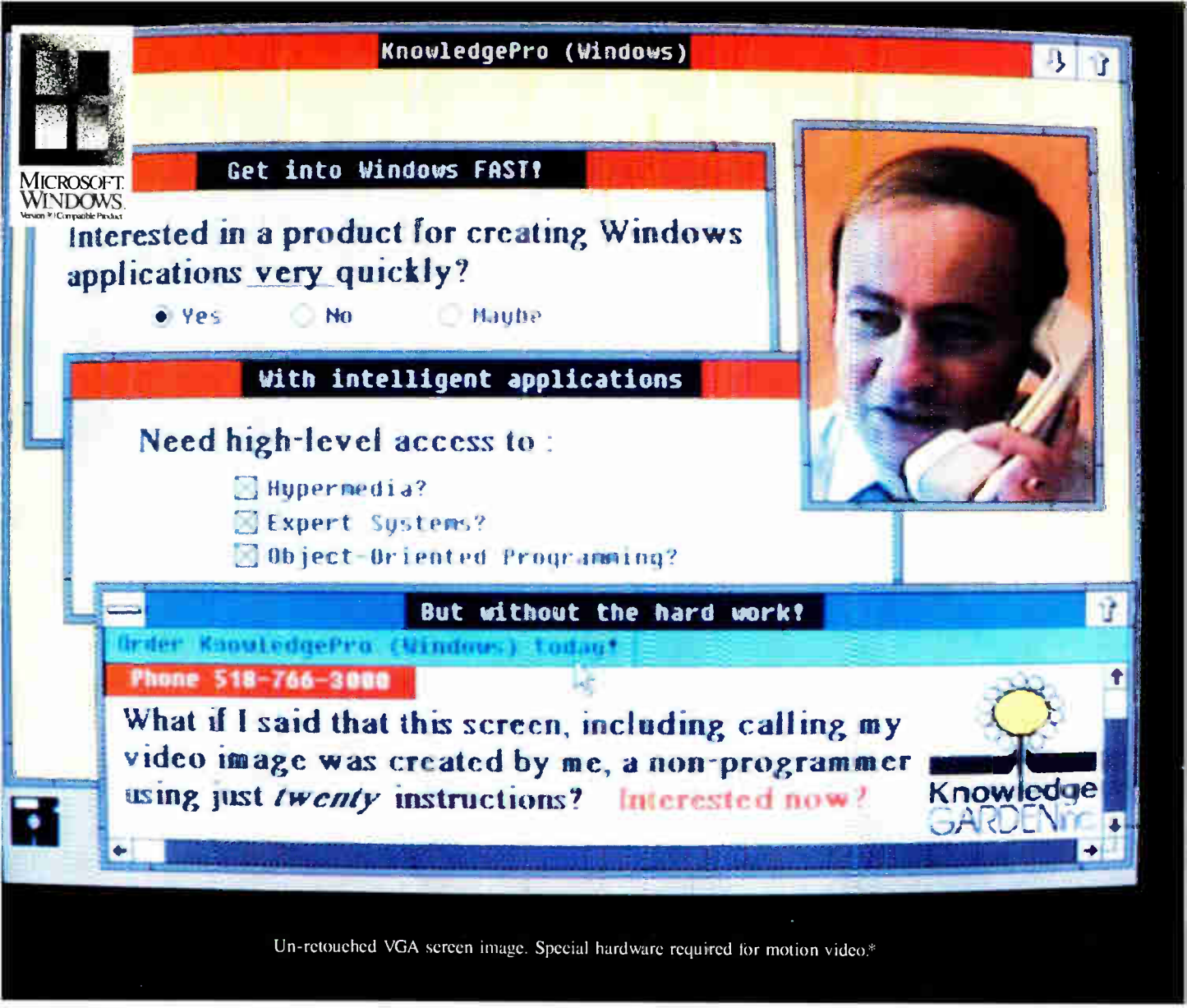
Real time adds performance and functionality to UNIX with preemptive and biased scheduling, contiguous file system, average interrupt latency of 50 μs, bounded context switches, memory locking, asynchronous I/O, and much more.

Ask us about VENIX™ for 80286/80386 PCs and Single Board Computers; RTX™ for other UNIX versions, such as Interactive System's 386/ix,™ and small, diskless, and ROMable UNIX kernels. Find out why Foxboro, Toshiba, GE, and many others are using VenturCom's real time UNIX products.

VenturCom
Real Time/Real Unix
215 First Street
Cambridge, MA 02142
(617) 661-1230
Nippon VenturCom, Inc.
Tokyo 102 Japan 03-234-9381

UNIX is a registered trademark of AT&T
386/ix is a trademark of Interactive Systems Corp.
VENIX, RTX are trademarks of VenturCom, Inc.

Circle 330 on Reader Service Card (DEALERS: 331)
World Radio History



Un-retouched VGA screen image. Special hardware required for motion video.*

Introducing the door into Windows!

Easy access to Windows

KnowledgePro (Windows) contains high-level commands for manipulating screen objects, lists, text, fonts, rules, external files and bitmap images. DLL and DDE support lets you integrate your own C routines with KnowledgePro and link your application directly to Excel and other Windows programs.

At a price you can afford

KnowledgePro (Windows) costs $695 with no runtime fees for applications. KnowledgePro for DOS costs $495. The systems run on IBM PC, XT, AT and PS/2 compatible machines with 640k of memory and a hard disk. KnowledgePro (Windows) requires Microsoft Windows 286 or 386 version 2.x or greater.

Call 518-766-3000 (FAX 518-766-3003) for more information or write to: Knowledge Garden Inc., 473A Malden Bridge Rd., Nassau, NY 12123 USA. Amex, Visa or M/C accepted.

Another intelligent tool from

Knowledge GARDEN inc.

KnowledgePro is a registered trademark of Knowledge Garden. Excel is a trademark of Microsoft Corp. IBM, XT, AT and PS/2 are trademarks of International Business Machines Corp. *VideoWindows digital video overlay board by New Media Graphics.

Circle 136 on Reader Service Card

World Radio History

Feed this to your PC and it'll think it's an HP BASIC workstation.

Finally, there's a way for serious technical computer users to get the power and features of HP BASIC on a PC. The answer is HTBasic, a real engineering BASIC that turns your PC into an HP 9000 series 200/300 BASIC workstation—at a fraction of the cost.

Like HP's Rocky Mountain BASIC, HTBasic from TransEra is a state-of-the-art BASIC that gives you all the capabilities you need for complex engineering applications. Plus you get important advanced features you won't find with any other PC BASIC. Like the complete set of HP graphic commands. Integrated HPIB (GPIB) syntax for intelligent instrument control. The advanced I/O Path System. And built-in matrix math.

In fact, all the optional HP binaries are built in. There's nothing else to load. You even get the full screen program editing and debugging environment.

Discover the new solution for cost-effective technical workstations. HTBasic from TransEra.

DISCOVER HTBASIC FOR YOURSELF

For more information, write TransEra Corporation or call today

(801) 224-6550.

HTBasic
High Tech Basic

TransEra 3707 North Canyon Road, Provo, Utah 84604 • TEL: 801-224-6550 • FAX: 801-224-0355

Circle 293 on Reader Service Card (DEALERS: 294)

World Radio History

THE BYTE VIP AWARDS

The ballots are in for BYTE readers' Very Important Product awards

BYTE's biggest assets are its readers. The tools you use are important to us. Knowing what you use and how you use it helps us to know what information to bring you each month.

We recently asked several thousand of you, selected at random, to tell us which devices and programs you find the most helpful in your day-to-day business and personal computer activities. We were gratified that so many of you took the time to respond thoroughly. Here are the products you told us you prefer in each group, winners of BYTE's VIP—Very Important Product—awards.

World Radio History

HARDWARE

Readers voted the Compaq Deskpro 386 the most popular computer system, out of a field of dozens of 286s and 386s.

MICROPROCESSOR CHIP

Intel 386
It comes as no surprise that the 386 placed first in this category, since it can simultaneously run multiple operating systems and handle memory management far more efficiently and with greater flexibility than the 286 does. What was a surprise was that, although they were distant also-rans, the i486 was a little ahead of the 286 for second place.

COMPUTER SYSTEM

Deskpro 386 and Mac II
Readers nominated a total of 63 computer systems in this classification. Among the dozens of 286 and 386 clones fighting for position, the Compaq Deskpro 386 was the favorite, with the Mac II coming in first among Motorola-based systems.

PRINTER

LaserJet II
There wasn't even a close contender for honorable mention in this category, in which readers nominated 57 different machines. The Hewlett-Packard LaserJet II won with a third of all votes cast. Although the HP LaserJet IIP has been out only a few months at this writing, it came in with a respectable 12 percent of the votes.

MONITOR

MultiSync 3D
The NEC MultiSync 3D was far and away the winner in this classification, with 37 percent of the votes.

MASS STORAGE DEVICE

Seagate ST251
In the category of mass storage devices, readers nominated a variety of their favorite hard disk drives, tape backup devices, and even WORM (write once, read many times) drives. Seagate's ST251 hard disk drive was the VIP winner, but honorable mention goes to the Imprimis Wren series.

GRAPHICS BOARD

Paradise VGA Plus
Widely used in PC clones, Western Digital's Paradise board came out on top in this category, while the ATI VGA Wonder deserves an honorable mention as a close contender.

MEMORY BOARD

AboveBoard Plus
Fully half of the respondents in our survey voted the Intel AboveBoard Plus as their favorite memory board. The AboveBoard Plus garnered close to four times as many votes as the next runner-up in this category.

LAN HARDWARE

(no winner)
Readers nominated several products in this category, but no product received enough votes for us to accord it a VIP award. Honorable mentions, for those who led the pack, go to 3Com's EtherLink, Western Digital's Ethernet, and Novell's Ethernet cards.

MODEM

Smartmodem 2400
Modem users nominated 41 devices as outstanding, although many of the units received only a few votes. The Hayes Smartmodem 2400 took the spotlight in this category, receiving 18 percent of the votes cast—twice as many votes as the next most popular modem, the Hayes 9600.

INPUT/POINTING DEVICE

Microsoft Mouse
The Microsoft Mouse got the nod from our readers for the most popular input/pointing device, with 44 percent of the votes. Honorable mention goes to the Logitech Mouse, which received 29 percent of the votes. Votes for other devices fell way short of the top two.

continued

World Radio History

BYTE Celebrates Its 15th Anniversary With A Special September Issue!

BYTE's upcoming September 1990 Issue offers readers an extraordinary retrospective of the past 15 years of computing and a view of the future by industry trailblazers!

The History of Computing Comes Alive through the unique perspective only BYTE editors can offer in their retrospective of watershed events within this dynamic industry.

Industry Trailblazers Share Their Vision of the Future. As we hurl towards the 21st century, BYTE helps you prepare for the future through editorial penned by some of the most prominent leaders in the industry such as:

- Mitch Kapor, founder, Lotus Development Corporation
- Gary Kildall, Chairman, Digital Research
- John Warnock, President & CEO, Adobe Systems
- H. John Caulfield, computer science expert, optical technology
- Ted Codd, developer of the relational database management concept
- Donald Knuth, professor of Computer Science, Stanford University, author of several classic computer science books
- Niklaus Wirth, developer of Pascal, Modula-2, and Oberon languages

And, several well-known industry commentators, including:

- Stewart Alsop, editor and publisher of *P.C. Letter*
- Esther Dyson, leading forecaster in the industry, publisher and editor of *Release 1.0* and sponsor of the Annual Personal Computing Forum
- Brit Hume, anchor, ABC Weekend and *Washington Post* syndicated columnist

Look for this Landmark Issue on Newsstands in Major Cities, Airports, Train Stations and Bookstores Across the Nation!

Advertisers!
The September issue will be one of the most compelling and best read issues BYTE has ever published! Call your local sales representative for more information.

Space Order Closing: July 12 Material Due: July 18

World Radio History

OVER $2 MILLION DOLLARS WORTH
OF INVENTORY DROPPED IN OUR LAP
TO SELL TO YOU AT WHOLESALE PRICES

VISA MasterCard

SUPREME

2014 McCULLOCH BOULEVARD, SUITE A
LAKE HAVASU CITY, ARIZONA 86403
(602) 453-9555 • 1-800-752-6016 • Fax (602) 453-9379

FIVE YEAR WARRANTY ON ALL SPREE SYSTEMS

SPREE COMPUTERS

PLEASE CALL ON SPECIAL CONFIGURATION

286-12 MHZ

80286 12 MHZ AT
1 MEG MEMORY
1.2 or 1.44 FLOPPY DRIVE
40 MEG HARD DISK
101 KEYBOARD w/TRACKBALL
VGA MONITOR & CARD w/256K
TWO SERIAL PORTS
ONE PARALLEL
$1499

386-20 MHZ

80386 20 MHZ AT
1 MEG MEMORY
1.2 or 1.44 FLOPPY DRIVE
40 MEG HARD DISK
101 KEYBOARD w/TRACKBALL
VGA MONITOR & CARD w/256K
TWO SERIAL PORTS
ONE PARALLEL PORT
25 MHZ AVAILABLE CALL **$1899**

- All Seagates Available - CALL FOR PRICING

Seagate

MFM DRIVES	DRIVE		Drive Only	XT Kit
ST225	65MS	21MEG	$199.	$239.
ST125	28MS	21MEG	$229.	$279.
ST138	28MS	32MEG	$279.	$329.
ST251-1	28MS	42MEG	$329.	$389.
ST151	24MS	42MEG	$379.	$439.
ST4096	28MS	80MEG	$559.	$609.
RLL DRIVES				
ST225R	70MS	21MEG	$189.	$239.
ST238R	65MS	32MEG	$219.	$269.
ST138R	28MS	32MEG	$259.	$309.
ST250R	70MS	42MEG	$279.	$339.
ST157R	28MS	49MEG	$369.	$419.
ST277R	28MS	64MEG	$379.	$439.
SCSI DRIVES				
ST138N	28MS	32MEG	$349.	$399.
ST157N	28MS	48MEG	$439.	$489.
ST177N	24MS	60MEG	$559.	$609.
ST1096N	24MS	83MEG	$799.	$849.

BLOW-OUT SPECIALS

DTK
BAREBONE AT (10 MHZ)
CASE • MB • P.S
$299

(Unbelievable)
DELTAGOLD XT
(10 MHZ)
512K • 1 DRIVE • I/O CARD
MONOCHROME MONITOR & CARD
KEYBOARD • MS DOS • BASIC
$449

Panasonic Office Automation
PANASONIC 1124
$289

EMERSON MONOCHROME
CARD & MONITOR
$109

EMERSON
VGA
MONITOR & CARD
$399

REPLACEMENT POWER SUPPLY
150 WATT $39
200 WATT $49

MODEM BLOW-OUT

HAYES COMPATIBLE
1200 INTERNAL $39
2400 INTERNAL $79

LAPTOP COMPUTER ACCESSORIES

TOSHIBA

T 1000	$ 599
T 1000 SE	$1100
T 1200 FB	$1319
T 1200 HB	$1799
T 1600 20 MEG	$2999
T 1600 40 MEG	$3359
T 3100 E 40 MEG	$2819
T 3100 SX	$3550
T 3200 1.44 20 MEG	$3299
T 3200 SX	$3779
T 5100	$3899
T 5100 100 MEG	$4499
T 5200 40 MEG	$4619
T 5200 100 MEG	$4979

ACCESSORIES

T-1000	
AC ADAPTER T-100/1100+	42.00
2400 B MODEMS	199.00
CARRY CASE FABRIC	39.99
UNIV. 9 VOLT ADAPTER	CALL
T-1200 F/H	
2400 B MODEM	199.00
BATTERY PACK	79.00
BATTERY RECHARGER	279.00
CARRY CASE	79.00
T-1000 SE	
BATTERY PACK	CALL
2400 B MODEM	CALL
UPGRADES 132 MEG	CALL
T-1600	
BATTERY CHARGER	279.00
LOW CAP BATTERY PACK	69.00
FABRIC CARRY CASE	89.00
2400 B MODEM	199.00
2 MB INT. MEM. BRD.	699.00
T-3200	
CARRY CASE	99.00
3MB MEM. BRD.	1079.00
T-5100	
LEATHER CARRY CASE	299.00
FABRIC CARRY CASE	99.00
2MG MEM. BRD.	699.00
T-5200	
16 BIT LAN CARD	49.00
2400B EXP SLOT	179.00
2 MB MEM. BRD.	539.00
FABRIC CASE	99.00
LEATHER CARRY CASE	299.00
UNIVERSAL LAPTOP PARTS:	
M.S. DOS 3.3	99.00
LAPLINK & ALL LAPTOPS	99.00
M.S. DOS 4.01	CALL

- All prices subject to change -

PRINTERS

HP DESK JET PLUS	$ 699
HP II P (HEWLETT PACKARD)	$ 979
HP II (HEWLETT PACKARD)	$1565
HP II D (HEWLETT PACKARD)	$2750
HP III (HEWLETT PACKARD)	$1775

MEMORY & ACC.

HP II & II D

1 MB	$249
2MB	$359
4 MB	$599
TONER	$ 79

HP II P

1 MB	$250
2 MB	$359
TONER	$ 59

PACIFIC DATA

FONTS	
POSTSCRIPTS	$479
SPREADSHEET	$110
25 IN ONE	$265
PLOTTER	$249
HEADLINE	$749

Circle 273 on Reader Service Card

World Radio History

BYTE

PRODUCT SHOWCASE

- BUYER'S MART
- BYTE BITS
- PRODUCT SPOTS
- MICRO PRODUCT CENTER

ILLUSTRATION: JULIE E. MURPHREE © 1989

World Radio History

THE BUYER'S MART

COMMUNICATIONS

PC SDLC SUPPORT

Use Sangoma hardware and software to provide a cost effective, robust and easy to use SDLC link from MS-DOS, XENIX, AIX, PICK, PC-MOS, etc.

All real time communication functions performed by intelligent co-processor card.

X.25 support also available.

Sangoma Technologies Inc.
(416) 474-1990
7170 Warden Avenue #2, Markham, Ontario, Canada L3R 8B2

Inquiry 601.

COMPUTER INSURANCE

INSURES YOUR COMPUTER

SAFEWARE provides full replacement of hardware, media and purchased software. As little as $49 a year provides comprehensive coverage. Blanket coverage; no list of equipment needed. One call does it all. Call 8 am–10 pm ET. (Sat. 9 to 5)

TOLL FREE 1-800-848-3469
(Local 614-262-0559)
SAFEWARE, The Insurance Agency Inc.

Inquiry 602.

COMPUTER UPGRADE

THE **COMPLETE** XT UPGRADE

The K-311 Upgrade Kit converts your XT to full 32-bit, 20MHz 80386 CPU and high speed disk performance. The K-311 Kit includes 20MHz 80386 w/1Mb RAM, 16-bit Adaptec 1:1 controller, 63Mb 28Ms Mitsubishi disk drive, choice of 1.2 or 1.4Mb diskette drive, Key Tronic 101 Plus keyboard, 200 W PS, new drive cables. Matches or exceeds the performance of a new system but at far less cost. Top quality, easy installation, 1 year warranty. $1,795

5G Corporation
4131 Spicewood Springs Road A-4, Austin TX 78759
800-333-4131 **512-345-9843** **Fax 512-345-9575**

Inquiry 603.

$799 FOR 386-20
$599 FOR 386SX $399 FOR 286-12

Upgrade your computer at a fraction of the cost. Send your computer in, we will do the work. Order now, we will send you a box for mailing your computer. Your old parts will be exchanged for labor charge. We will put in new parts & charge wholesale prices for any parts which do not fit the new system. Prices shown are for motherboard and 1MB RAM. New system available at low prices.

ABTECH Inc.
1431 Potrero Ave., S. El Monte, CA 91733
(800) 992-1978 **In Calif. (818) 575-0007**

Inquiry 604.

CROSS ASSEMBLERS

CROSS ASSEMBLERS
Universal Linker, Librarian
Targets for 36 Microprocessors
Hosts: PC/MS-DOS, micro VAX, VAX 8000
ENERTEC, INC.
BOX 1312, 811 W. Fifth St.
Lansdale, PA 19446
Tel: 215-362-0966 **Fax: 215-362-2404**

Inquiry 605.

CROSS ASSEMBLERS/SIMULATORS

New unique full-function simulators for the 8096 and 80C196 controllers, featuring ALL MODES of interrupts, plus the HSI, HSO, and A/D functions.

We also support the 8048/49, 8080/85, 8051/52, and Z80 controllers with excellent, reasonably priced Cross Assemblers and Simulators.

Lear Com Company
2440 Kipling St., Ste. 206, Lakewood, CO 80215
(303) 232-2226 **FAX: (303) 232-8721**

Inquiry 606.

CROSS ASSEMBLERS

MACINTOSH CROSS ASSEMBLERS

μASM™—New Version 3.0! Integrated text editor, assembler, and terminal package. S or Hex output downloads to most EPROM programmers. Macros, cond'l ass'y, local & auto labels, symbol table cross-ref. $149.95 each plus S/H. MC/VIAE. Tech. bulletin avail. Most 8-bit MPUs.
30 day money back guarantee.

MICRO DIALECTS, INC., Dept B
P.O. Box 30014, Cincinnati, OH 45230
(513) 271-9100

Inquiry 607.

CROSS ASSEMBLERS

Relocatable
Macros
PC Compatible
GUARANTEED, SUPPORTED

DEBUG SIMULATORS • DISASSEMBLERS
EPROM PROGRAMMERS

MICRO COMPUTER TOOLS CO.
Phone Toll Free (800) 443-0779
In CA (415) 825-4200
912 Hastings Dr., Concord, CA 94518

Inquiry 608.

6800-Family Development Software

Our C Compilers for the 6800, 6801, 6809, & 68HC11 feature a complete implementation (excluding bit fields) of C as described by K&R and yield 30–70% less code than other compilers. Our Assemblers feature macros and conditional assembly. Linker & Terminal Emulator included.

Wintek Corporation
1801 South St., Lafayette, IN 47904
(800) 742-6809 or (317) 742-8428

Inquiry 609.

CROSS DISASSEMBLERS

PROFESSIONAL PC SOFTWARE

- **CROSS-DISASSEMBLERS**
  Analytic, Automatic Label Generation
- **CROSS-ASSEMBLERS**
  Relocatable, Macro, Universal Linker + Librarian
- **C CROSS COMPILERS**
- **SOURCE TRANSLATION UTILITIES**
  Support for Intel, Motorola, Zilog, TI, RCA

Order Today: **(408) 773-8465**

LOGISOFT PO Box 61929, Sunnyvale, CA 94086
FAX: (408) 773-8466

Inquiry 610.

DATA ACQUISITIONS

TLX01A Inserts a telex in your PC

Telex interface with double or simple current (V11, V24/28)
Processor Z180
Battery backup RAM memory
2 auxiliary serial ports
PC-AT-XT, PS/2 30 or compatibles
Complete with communication software
Manufacturing license available

EXOR R&D
P.O. BOX 548, West Chester, OH 45069, USA
Fax: 513-777-4817 Phone: 513-777-0570

Inquiry 611.

DATA CONVERSION

FORMAT CONVERSION TOOL

Multi-format file conversion on PCs: reads in DXF, HPGL, DMPL, GERBER, EXCELLON and writes out HPGL, HPGL II, HPS (Quick Plot), PostScript, APPLE LaserWriter, DMPL, GERBER, EXCELLON. Check your files on plotters & view them on screen & print them on laser printers.

VPLOT II format conversion tool: $350
VPLOT II+ view & print on laser printers: $495

ALS DESIGN CORPORATION
One Kendall Square, #2200, Cambridge, MA 02139
(617) 621-7101 **FAX: (617) 577-1209**

Inquiry 612.

DATA CONVERSION

MEDIA CONVERSION/DATA TRANSLATION
More than just a straight dump or ASCII transfer!

Word Processing, DBMS, and Spreadsheet data on **Disks** or **Tapes** transferred directly into applications running on **Mainframes, Minis, Micros, Dedicated Word Processors, Typesetters,** and **Electronic Publishing** systems.

IBM PS/2 & Macintosh supported
#1 in the translation industry!

CompuData Translators, Inc.
3325 Wilshire Blvd., Suite 1202, Los Angeles, CA 90010
(213) 387-4477 **1-800-825-8251**

Inquiry 613.

DBMS/COPY
CONVERTS YOUR DATA INTO INFORMATION

Now your favorite stat package can access any database. DBMS/COPY can directly convert any database or spreadsheet file (ORACLE, PARADOX, dBASE, LOTUS etc.) into any stat package file (SAS, SPSS, SYSTAT, etc.) and vice versa. The PLUS version allows sorts, selections, and recalculations. $195. 30-day guarantee. VISA/MC/AMEX/PO/COD. Call for free limited version.

CONCEPTUAL SOFTWARE INC.
P.O. Box 56627, Houston, TX 77256
(713) 667-4222 **FAX: (713) 667-3FAX**
1-800-STATWOW

Inquiry 614.

WE'LL DO IT BETTER . . .
FOR LESS!
Conversion, Duplication, Any Format
FREE TEST • SATISFACTION GUARANTEED
Plus, the Personal Touch: Ask Questions and we'll explain it to you in simple English!!!

DATACOPY SERVICE
PO Box 820214, Dallas, TX 75382
1-800-969-DATA **214-272-7751**

Inquiry 615.

DATA/DISK CONVERSION

DISK CONVERSIONS

Media transfer to or from: IBM, Xerox, DEC, Wang, Lanier, CPT, Micom, NBI, CT, Exxon, WRDPLEX also WP, WS, MS/WRD, DW4, MM, Samna, DEC DX, MAS 11, Xerox-Writer, ASCII.

FREE TEST CONVERSION

CONVERSION SPECIALISTS
531 Main St., Ste. 835, El Segundo, CA 90245
(213) 545-6551 **(213) 322-6319**

Inquiry 616.

FROM MACs TO MAINFRAMES. . .
Our 12 conversion systems support over 1000 formats

DISK INTERCHANGE SERVICE COMPANY
2 Park Drive • Westford, MA 01886
(508) 692-0050

Inquiry 617.

BUY YOUR OWN CONVERSION SYSTEM!

With nearly a decade of experience in data conversion, you can work with the industry leader in 9-track tape, cartridge tape and diskette conversion systems. Enjoy the convenience of your own conversion system. Call today to discuss your application!

Flagstaff Engineering
1120 Kaibab Lane, Flagstaff, AZ 86001
(602) 779-3341
MasterCard – Visa – American Express Accepted

Inquiry 618.

World Radio History

THE BUYER'S MART

DATA/DISK CONVERSION

THE #1 CHOICE
In disk & tape conversion
for many leading corporations, government agencies, law firms, and companies in every industry—world-wide.
Free test • Satisfaction guaranteed
Graphics Unlimited Inc.
3000 Second St. North, Minneapolis, MN 55411
(612) 588-7571 or (612) 520-2345
FAX: (612) 588-8783

Inquiry 619.

QUALITY CONVERSIONS
to or from virtually
ANY TAPE OR DISK FORMAT!
Horan Data Services converts over 2000 formats incl. 9-track tape, **3480 Cartridge** and 8", 5¼" or 3½" diskettes. All densities & most operating systems supported. Formats include EBCDIC, ASCII, databases, spreadsheets, and dedicated or PC word processors.
Call 1-800-677-8885
Hours 8:00 AM to 5:30 PM Eastern Time
817 Main Street, Third Floor, Cincinnati OH 45202

Inquiry 620.

***** We RENT conversion systems or DO the conversion for you!*****
Conversion Capabilities: 9 Track Tape, 8" Disk, ¼" Cartridge, Word Processors, Optical Disk, 2.3 Gigabyte Backup, Fax Workstations
WE WILL SOLVE YOUR DATA CONVERSION PROBLEMS!
LIONSGATE DATA SERVICES
CALL: (818) 704-5867 OR FAX: (818) 716-5647

Inquiry 621.

IBM PC ⬅ TO ➡ HP FILE COPY
FASTER **EASIER TO USE**
Update version uses windows: Call for free demo! IBM PC <to> HP File Copy allows IBM PCs, PS/2, compatibles to interchange files with Hewlett-Packard Series 70, 80, 200, 300, 1000, 9000s.
Oswego Software
Box 310 **708/554-3567**
Oswego, IL 60543 **FAX 708/554-3573**

Inquiry 622.

CONVERSION SERVICES
Convert any 9-track magnetic tape to or from over 2000 formats including 3½", 5¼", 8" disk formats & word processors. Disk-to-disk conversions also available. Call for more info. Introducing OCR Scanning Services.
Pivar Computing Services, Inc.
165 Arlington Hgts. Rd., Dept. #B
Buffalo Grove, IL 60089 **(800) Convert**

DATABASE MGMT SYSTEMS

dBASE file access from C
Code Base 4 is a library of C routines which gives complete dBASE or Clipper functionality and file compatibility. Use DOS, Unix, OS/2 or MS Windows.
$295 with Source! **FREE DEMO**
Sequiter Software Inc.
Call (403) 448-0313 Fax (403) 448-0315
See our ad on page 211.

Inquiry 623.

DEMOS/TUTORIALS

INSTANT REPLAY III
Build Demos, Tutorials, Prototypes, Presentations, Music. Timed Keyboard Macros, and Menu Systems. Includes Screen Maker, Keystroke/Time Editor, Program Memorizer, and Animator. Rec'd *Great* Reviews! Simply the BEST. Not copy protected. No royalties. 60-day satisfaction money-back guar. IBM and Compatb. $199.00 U.S.Chk/Cr. Crd. Demo Diskette $5.00.
NOSTRADAMUS, INC.
P.O. Box 9252
Salt Lake City, Utah 84109 **(801) 272-0671**

Inquiry 624.

DISASSEMBLERS

μ PROCESSOR/CONTROLLER
805x/804x/680x/Z80 versions available
- Reads HEX or binary file
- Writes 'assembler-ready' source
- Multiple cross-reference listings
- Line-by-line comment field hex dump
- TAG file allows you to control disassembly

Powerful, easy-to-use, PC/MS DOS based Cross-disassembler. Adapt output file format for your assembler.
only $179.95
DLS Development, One Gale Rd.—Brick, NJ 08723
(201) 920-6807

80x86 .EXE/.COM to .ASM
- Accurately reconstruct, study & modify [64K+] programs with a *minimum* of input or editing of output.
- Assembly language output is MASM 5.x-compatible.
- Exhaustive flow-trace distinguishes code from data.
- Best formats for each. Commented BIOS calls/DOS functions. SEGMENT/PROC/other vital pseudo-ops.

PC-DISnDATa (5¼" disk & manual) $165
PRO/AM SOFTWARE
220 Cardigan Road, Centerville, OH 45459
(513) 435-4480 (9 A.M.–5 P.M. EST M–F)

Inquiry 625.

SOFT-X-PLORE
See "BYTE's May '88 issue pg. 78." Disassemble 500 kb (*) program at 10,000/min. (*) in any file, ROM/RAM memory up to 80386 instruction set (*). **SOFT-X-plore:**
* is for MS/DOS 2.0+ systems
* uses 20 algorithms and seven passes (*)
* only *$99.95* plus S&H w/30-day guarantee.

To order call **(800) 446-4656** or info **(203) 953-0236**
Or write: **RJSWANTEK INC.**
178 Brookside Rd., Newington, CT 06111
* best on the market MC/VISA accepted

Inquiry 626.

DISK DRIVES

PS/2 DRIVES FOR PCs ATs
CompatiKit/PC **$279**
CompatiKit/AT **$219**
Built-in floppy controllers—no problem. Supports multiple drives and formats. Lets your computer use IBM PS/2 1.4M diskettes *plus more!* Call for further information or to place an order.
VISA/MC/COD/CHECK.
Micro Solutions Computer Products
132 W. Lincoln Hwy., DeKalb, IL 60115 **815/756-3411**
See our ad on page 106.

Inquiry 627.

DISK DUPLICATION

SOFTWARE PRODUCTION
- Disk duplication
- All formats
- EVERLOCK copy protection
- Label/sleeve printing
- Full packaging services
- Warehousing
- Drop shipping
- Fulfillment
- 48-hour delivery
- Consultation & guidance

Star-Byte, Inc.
2880 Bergey Rd., Hatfield, PA 19440
215-997-2470 **800-243-1515**

Inquiry 628.

EDUCATION

B.Sc. & M.S. In COMPUTER SCIENCE
The American Institute for Computer Sciences offers an in-depth correspondence program to earn your Bachelor of Science and Master of Science degrees in Computer Science at home. BSC. subjects covered are: MS/DOS, BASIC, PASCAL, C, Data File Processing, Data Structures & Operating systems. MS program includes subjects in Software Engineering and Artificial Intelligence.
AMERICAN INST. for COMPUTER SCIENCES
1704-BY 11th Ave. So., Birmingham, AL 35205
205-933-0339

Inquiry 629.

ENTERTAINMENT

.3 8 6 S P Y S
.386 SPYS, the energy, excitement and superior graphics you've been looking for in an animated arcade game. Written specifically for PC's with a 386/386SX processor, Hi Res EGA graphics, 1 meg of memory and a hard disk. You will find incredible detail and action throughout. Try a demo disk now for $6.95 or the full game for $49.95. Include $3 S&H.
GENKI SOFTWARE CORPORATION
"Imagination powered by the .386"
(800) 673-9038 Mastercard or Visa (301) 997-6333
P.O. Box 2563, Columbia, MD 21045

Inquiry 630.

NEMESIS™ Go Master®
Go, a game of strategic elegance, has been a way of life in the Orient for over four thousand years. Many consider Go to be the secret of the Japanese businessman's success. *"While chess is a game of war, Go is a game of market share"* [President of Nikko Hotels].
"If you are interested in Go, buy this program."
Game of the Month J. Pournelle BYTE 7/87
Toyogo, Inc. *The Leader in Computer Go.*
PO Box F, Dept. Y, Kaneohe, HI 96744
(808) 254-1166 or 1-800-TOYOGO-9

Inquiry 631.

FAX COMMUNICATIONS

V I F O
Voice In Fax Out
VIFO answers your telephone. It greets the caller in your own voice and leads him to information that he is requesting. Information can be password protected, if you desire. After all the requests are made they are faxed to the caller right then, online, while he waits (and at his expense). VIFO requires no attendant and is available around the clock.
Call (513) 223-0712 to order.
Call (513) 228-3068 for a demo.
Digital Development Corporation
322 South Patterson Blvd., Dayton, OH 45402

Inquiry 632.

FLOW CHARTS

Flow Charting II+
For IBM and compatibles. It will amaze you with its speed, power and simplicity. 26 standard shapes with over 120 sizes — 10 text fonts — 4 line styles. Place text, lines and shapes anywhere on your chart. For only $229 you'll never draw another chart by hand.
Patton & Patton
485 Cochrane Circle, Morgan Hill, CA 95037
1-800-525-0082 Ext. 42 (Within U.S.)
408-778-6557 Ext. 42 (Int'l) B1370

Inquiry 633.

WINDOWS FLOWCHARTER
RFFlow is a professional drawing tool for flowcharts & org charts (requires Microsoft® Windows). 75 shapes automatically adjust in size. Move, copy, delete groups of objects. 7 levels of zoom. Move flowcharts to other applications via the Clipboard. Supports Windows printers, plotters, and cartridge or soft fonts. Call for free trial disk.
RFF ELECTRONICS
1053 Banyan Court, Loveland, CO 80538
Phone: (303) 663-5767 **FAX: (303) 669-4889**

Inquiry 634.

World Radio History

THE BUYER'S MART

GRAPHICS

YOU CAN BE IN PICTURES
- Send us a VHS tape with the counter location of the picture(s) you want.
- We'll convert the pictures to files & return them to you on a 5¼" floppy disk(s) in the format you request, with a file viewing utility for an IBM VGA or compatible video card with an analog monitor.
- Price: $9.99 + $.99 per Picture + $7.50 S&H

IEV, 3030 S. Main, Dept. 16, Salt Lake City, UT 84115
Phone 801-466-9841 Ext. 16 FAX: 801-466-5921

Inquiry 635.

IMAGE CAPTURE BOARD
Capture images from any VCR or Cam-Corder. Resolution: up to 512 x 480 pixels: 256 Colors or 256 shades of grey. Images may be saved in GIF, PCX, TIFF formats and more. VGA Required. Available for PC/XT/AT and PS/2: **$749.00**
JLaser5. Increase laser printer resolution to 4800 x 300 dpi w/256 grey scale. PS/2: **$599.00**
PC/XT/AT: **$399.00**

PEGASYSTEMS (614) 885-1007
P.O. Box 713, Westerville, OH 43081

Inquiry 636.

HARD DRIVE REPAIR

HARD DRIVE REPAIR
WE WILL REPAIR YOUR HARD DRIVE AT A FRACTION OF THE COST OF REPLACING IT. FAST TURNAROUND!!! CALL FOR DETAILS.

H & W micro, Inc.
528-C FOREST PARKWAY
FOREST PARK, GA 30050
(404) 366-1600

Inquiry 637.

DISK DRIVE REPAIR
DATA RECOVERY
SALES of new, remanufactured and removable disk drives
FULL TECHNICAL SUPPORT
ROTATING MEMORY SERVICE
1506 Dell Avenue, Campbell, CA 95008
(408) 370-3113
We buy used drives good or bad

Inquiry 638.

HARDWARE

CHIP CHECKER
- 74/54 TTL + CMOS
- 14/4000 CMOS
- 14-24 Pin Chips
- 8000 Nat. + Signetics
- 9000 TTL
- .3" + .6" IC widths

Tests/Identifies over 650 digital chips with ANY type of output in seconds. Also tests popular RAM chips. IBM-compatible version $259. C128 + C64 version $159.

DUNE SYSTEMS
2603 Willa Dr., St. Joseph, MI 49085
(616) 983-2352

Inquiry 639.

INDUSTRIAL STRENGTH SINGLE BOARD COMPUTER
Has optimum features for monitor + control applications: 16 Chan A/D • 4 RS232/422 Ports • 48 Prog I/O Lines • 8 Opto INs • 8 HiDrive OUTs • 4 Timers • Watchdog • 104K Memory • 5.25 x 8.0 Options: Resident FORTH OS with Target Compiler, Editor, Assembler, + Auto Load/Start; 5 MHz 8085 • 4 Chan D/A • Battery Backed Clock/RAM • Networking • PC Support.
E-PAC 1000 + $249.00 E-PAC 2000 + $449.00

EMAC INC.
P.O. Box 2042, Carbondale IL 62902 (618) 529-4525

Inquiry 640.

HARDWARE

FREE INTERFACE CATALOG
Interfaces for IBM compatibles. Digital I/O (8255) and Analog input 8 bit resolution (0–255). Control relays, motors, lights, measure temperature, voltage. Sample interconnect circuits, BASIC programs, and I/O map are included.

John Bell Engineering, Inc.
400 Oxford Way, Belmont, CA 94002
(415) 592-8411 9am to 4pm Pacific Time

Inquiry 641.

LATEST AWARD BIOS
User definable hard drives, 101/102 keyboard and 3.5" 1.44Mb floppy support are now available in Award BIOS Ver. 3.1 for the IBM AT, 286 and 386 compatibles.

KOMPUTERWERK, INC.
851 Parkview Blvd., Pittsburgh, PA 15215
Orders: 800-423-3400
Tech: (412) 782-0384

Inquiry 642.

WE BUY • WE SELL
APPLE II & MACINTOSH
SYSTEMS, PARTS & EXCHANGE REPAIRS
SAVE UP TO 55% ON MAC II CPU
CALL FOR A CATALOG
800-274-5343 / 617-891-6851
Pre-Owned Electronics, Inc.
30 Clematis Ave • Waltham, MA 02154

Inquiry 643.

HARDWARE/ADD-ONS

Call Today
for DRAMATIC Low Pricing
on New Slimms™ Memory Modules
1, 2, 4 and 8 Megabyte 72-pin modules available

TermoTrol Corp.
1888 Century Park East, Suite 1900, L.A., CA 90067
213-284-3242 800-365-0045

Inquiry 644.

HARDWARE/COMPUTERS

EMBEDDED SYSTEMS COMPUTERS
SC/FOX™PCS (Parallel Coprocessor System) and PCS32 are PC/XT/AT plug-in boards, 16 and 32 bit. 15 MIPS average, 50 MIPS burst. PCS uses the Harris RTX 2000™ 16-bit real-time CPU with 1-cycle multiplier, 14 prioritized interrupts, 3 timer/counters, 8-channel I/O bus. PCS32 uses the new SC32 32-bit Forth CPU.
SC/FOX SBC (Single Board Computer) is an 18 MIPS average, 60 MIPS burst, Eurocard-size RTX 2000 stand-alone computer.
SC/FOX SCSI I/O Plug-on board for PCS or SBC with SCSI, floppy, 56K-baud serial, 16-bit parallel ports, and software drivers.
Forth s/w included. C also available. Ideal for embedded real-time control, data acquisition, robotics, and signal processing.

SILICON COMPOSERS INC. (415) 322-8763
208 California Avenue, Palo Alto, CA 94306

Inquiry 645.

HARDWARE/CONTROLLERS

8031 SINGLE BOARD COMPUTER
- 8031 CPU, 8K EPROM/8K SRAM sockets
- 14 bits of parallel I/O + RS232 option
- 4.5 x 3.5 inches, 5 volt operation
- All IC's socketed, solder masked PCB
- Bus access for easy expansion

Base System—$64.95/ with RS232—$71.90
All Orders Add $3.00 S&H

Cottage Resources Corporation
Suite 3-672, 1405 Stevenson Drive, Springfield, IL 62703
(217) 529-7679

Inquiry 646.

HARDWARE/COPROCESSOR

DIGITAL SIGNAL PROCESSOR
DSP products for the IBM PC/XT/AT based on the TI TMS32010 and TMS320C25 up to 12 MIPS operation. Designed for applications in communications, instrumentation, speech, and numeric processing. Offered with 12 bit 110 KHz A/D and D/A and continuous-to-disk data acquisition & playback option. From $650.

DALANCO SPRY
89 Westland Ave., Rochester, NY 14618
(716) 473-3610

Inquiry 647.

DSP32C PC/AT COPROCESSOR BOARD
25 MFLOP 32 bit Floating point DSP:
- High speed NUMERICS and GRAPHICS
- 640K DUAL PORTED on board memory
- 32 bit parallel and serial IO headers
- 15 ms 1024 point FFT from high level C
- Assembler, monitor, and math libraries

Base board and ALL software $950, 640K $300

SYMMETRIC RESEARCH
15 Central Way #9, Kirkland, WA 98033
(206) 828-6560

Inquiry 648.

INVENTORY MANAGEMENT

STOCK-MASTER 4.0
Commercial grade Inventory management software at micro prices.
- Supports all 12 transaction types
- Trend Analysis
- Quality Control
- Multiple Locations
- Purchase Order Tracking
- Open Order Reporting
- Serial/Lot # Tracking
- Stock Status Reporting
- Activity History Analysis
- Bill of Materials
- Purchase Order Writing
- Order Entry
- Material Requirements
- On Line Inquiry

Applied Micro Business Systems, Inc.
177-F Riverside Ave., Newport Beach, CA 92663 714-759-0582

Inquiry 649.

dFELLER Inventory
Business inventory programs written in modifiable dBASE source code
dFELLER Inventory $150.00
Requires dBASE II or III, PC-DOS/CPM
dFELLER Plus $200.00
with History and Purchase Orders
Requires dBASE III or dBASE III Plus (For Stockrooms)

Feller Associates
550 CR PPA, Route 3, Ishpeming, MI 49849
(906) 486-6024

Inquiry 650.

LANS

The $25 Network
Try the 1st truly low-cost LAN
- Connect 2 or 3 PCs, XTs, ATs
- Uses serial ports and 5-wire cable
- Runs at 115K baud
- Runs in background, totally transparent
- Share any device, any file, any time
- Needs only 14K of RAM

Skeptical? We make believers!
Information Modes
P.O. Drawer F, Denton, TX 76202
817-387-3339 Orders 800-628-7992

Inquiry 651.

LAPTOP COMPUTERS

Laptop Savings
Laptops: Toshiba • Zenith • NEC • Sharp • Epson • Mitsubishi • Compaq
Also Laptop Accessories: Modems, Fax Modems, External Drives, Portable Printers, Memory, Key Pads, Hard Drives, Batteries, and Auto Adapters.

Computer Options Unlimited
12 Maiden Lane, Bound Brook, NJ 08805
Phone: 201-469-7678 (Fax: 201-469-7544)
Hours: 9am/10pm 7 days Worldwide sales

Inquiry 652.

World Radio History

THE BUYER'S MART

LAPTOP COMPUTERS

LAPTOP BLOWOUT SALE!!!
MITSUBISHI • SHARP • PANASONIC • TOSHIBA
Laptops are now at their lowest prices ever. We buy direct from the factory, unlike our competition. We guarantee the lowest net prices in the entire country and stock every item specific to laptops. We ship in 24 hours. We also stock over $1 million in laptops alone! Always buy from a factory-direct dealer. For your protection we check for stolen credit cards & ship only to your billing address. No COD's Please.
TOTE-A-LAP
1501 El Camino Real, Belmont CA 94002
(415) 591-1663 ext. 603

Inquiry 653.

New Laptop Products for:
Palmtops: Atari Portfolio, Poquet
Notebooks: Compaq LTE, NEC-UL, Tandy 100/102, Tandy 1100, TI-M12, Toshiba SE/XE, Zenith-MS
PC-Laptops: All major brands and models
Accessories: Auto Adapters, Batteries, Carry Cases, Keypads
Peripherals: Portable Printers, Hard Disks, 360K/1.2M Drives, Keyboard Covers, Modems, Barcode Wands, Laptop Software, etc
For a free newsletter & catalogue, please call or write:
ULTRASOFT INNOVATIONS INC.
1 Transborder Drive, PO Box 247, Champlain, NY 12919
Tel: (514) 487-9293 Fax: (514) 487-9295 9-6 EST
Canadian Orders & Dealer Inquiries are Welcome

Inquiry 654.

LAPTOP PERIPHERALS

LAPTOP BACKLIGHTS
Factory Installed • 90-Day Warranty
Toshiba, Amstrad, Sanyo, DG, Kaypro, IBM, HP, etc. **$295**
The Portable Peripherals People
Axonix Corporation
(801) 466-9797

Inquiry 655.

8051 SUPERMARKET
Complete family of 12 single board computers fully accommodates any 8051 variant. Power management, plenty of I/O, full memory map. Optional floating point. PC-compatible RS 232. PC versions reside on PC bus. Peewee's measure 3x5". 8051-optimized DIN52 bus allows stacking or backplane mounting. Interprocessor communication. Boards run 8052AH BASIC. Starting at $99. Quick custom modifications.
MODULAR MICRO CONTROLS
109 S. Water St., Northfield, MN 55057
call or fax (507) 645-8315

Inquiry 656.

TOSHIBA LAPTOP ENHANCEMENTS
FAX/MODEMS: 9600/2400 bps, software, acoustic port
MODEMS, INTERNAL: 2400 bps, acoustic or serial port
MODEM, DEDICATED: 2400 bps (T1200, T1600, T3200SX)
SERIAL IO CARDS: RS232, RS422, SCSI, HPIL, Barcode
BATTERY PACKS: 12V external battery + vehicle adapter
Contact us for more information:
PRODUCT R&D Corporation (Calif).
B05/546-9713, Fax: B05/546-9716

Inquiry 657

MAILING LIST PROGRAMS

ELIMINATE DUPLICATES
Duplicates on your mailing list cost more than embarrassment. You're paying for all that extra postage and for the materials mailed. Invest $149.00 in Dupe Eliminator and say goodbye to your dupes. Dupe Eliminator is easy to use—and it works with your dBase, ASCII, ArcList and other compatible files.
1-800-368-5806
Group 1 Software, Inc.
6404 Ivy Lane, Dept. BIT-7, Greenbelt, MD 20770-1400

Inquiry 658.

MAILING LIST PROGRAMS

YOURS FREE!
"How to Manage Your Mailing List" ArcList® & AccuMail™ are two powerful programs for your IBM or compatible PC:
- Duplicate Recognition
- Postal Discount Presorts
- Label Design & Printing
- Carrier Route and Zip+4 Insertion
- Address Correction
- dBase® Compatible

Call **800-368-5806** for a FREE GUIDE
Group 1 Software, Inc.
6404 Ivy Lane, Dept. BIT-7, Greenbelt, MD 20770-1400

Inquiry 659.

ONLY A NICKEL A NAME
Now small business owners can reach their direct mail prospects easily *and* economically—with the PC Yellow Page listings: • On-line 900 database with millions of U.S. companies available for down loading. • Updated monthly with no minimum order. • Costs only $1/minute—a nickel a name (charged to your phone bill). For a limited time only, get our start-up kit, the PC Prospector, designed to make your direct mail marketing the most results-oriented possible. It's yours for just the $6 phone charge for ordering the software. Order the PC Yellow Pages or the PC Prospector today by simply calling with either your modem or touch tone phone.
1-900-860-9210
For information call 404-455-8763

Inquiry 660.

MEMORY BOARDS

S.S.T. MEMORY UPGRADES
IBM PS/2

2MB module—Model 50,70	$279
2-8MB expan. bds—Model 55, 70	$643

COMPAQ

4MB module—DESKPRO 386/20E, 25, S	$565
4MB expan. brd—DESKPRO 386/20E, 25, S	$622
8MB single slot module—SYSTEMPRO	$2900

H P LASER JET

2MB upgrades	$279

1-800-688-8993 **5 YR. WARRANTY**

Inquiry 661.

YOUR SALES MESSAGE
about the special computer product or service that you provide belongs in print.
THE BUYER'S MART
can help you reach computer professionals and produce valuable inquiries for your company!
Call Brian Higgins for more information
603-924-3754
or
Fax: 603-924-2683

Inquiry 662.

MOUSE DRIVES

MOUSE DRIVERS
We have developed great new inexpensive Menuing and Mouse Drivers for Lotus 1-2-3 2.01 & 2.2; WordPerfect 5.0 & 4.2; dBASE III+ & IV; WordStar 5.0, 5.5, & 6.0; Turbo C & Pascal; PlanPerfect 5.0 and MultiMate Advan. II. Others to follow shortly. All are simple-to-use and make traversing your application a snap! Each driver is $40.00. Call or send your order to:
Mostly Mice Software, Inc.
125 Gates Ave., Montclair, NJ 07042
1-800-926-6873 (1-800-92 MOUSE)

Inquiry 663.

NETWORK/WORKGROUP

CoordiNet
An unbelievably easy-to-use workgroup package for Novell local area networks. Features include: public and private calendars, electronic mail, telephone messages, project management, document management, Btrieve™ database manager, report generator, link to the Sharp Wizard™, and much more. Can be used either as a 6K TSR or as a standalone program. Installs in 10 minutes and reads Netware bindery to create user lists. Simple mouse (or keyboard) driven "point-and-click" user interface with full context-sensitive help. Manual included but not needed. Only $249 per server! Demo disk $25.
Software Artistry, Inc.
3500 DePauw Blvd., Suite 1100, Indianapolis, IN 46268
Phone: (317) 876-3042 Fax: (317) 876-3258

Inquiry 664.

NEURAL NETWORKS

BrainMaker:
"The most fascinating computer software I've ever seen. . .learn about this stuff." *John Dvorak, PC Mag.* Predicts stocks, bonds, sales, inventories. Comprehensive documentation. Menus. Only $195!
Certified by Intel and Micro Devices
Free Brochure: 916/477-7481
California Scientific Software

Inquiry 665.

OPTICAL DISK

ERASABLE OPTICAL DISK DRIVE
SONY 5.25" 600 MB per disk, SONY 4mm 1.3GB per tape. Mac II, SE. SUN workstation, and other SCSI DEC Q-Bus, UNIBUS, and SCSI. 10 to 25 years warranty on Optical media. Highest quality in the industry. Will supply complete Kit to build or Finished product. International and Domestic order or Inquiry within.
BENO SYSTEMS INC
718-921-1200
FAX: 718-748-1676

Inquiry 666.

OPTICAL DRIVES

MASS-STORE COPY™
Don't spend thouand on a second optical drive to make backup copies of optical disks. **MASS-STORE COPY™** copies any size file and any size optical disk using one optical drive. Also copies any removable DOS disk:
WORM • ERASABLE • BERNOULLI BOX™ • REMOVABLE HARD DRIVES • FLOPPY
For IBM PC/XT/AT $195+$3 S&H CHK/MO/COD/PO 30-day guarantee
Informative Technologies Corp.
1718 M St. NW, Suite 292, Washington, DC 20036
Tel: (202) 675-4528 FAX: (202) 675-4529

Inquiry 667.

PROGRAMMERS TOOLS

HYPERINTERFACE™ II
Menu Creator™ — An interactive WYSIWYG editor to generate a menu-driven user interface for your software. **Screen Creator™** — An interactive WYSIWYG editor for quick and easy screen design and a screen database manager for your software. **Advanced Library** — Extended capability for data entry for your programs. FORTRAN, Pascal, C, BASIC supported.
Avanpro Corp.
P.O. Box 969, Pacific Palisades, CA 90272
(213) 454-3866

Inquiry 668.

FINITE STATE COMPILERS
Our CASE finite state compilers quickly develop table driven programs in a step-by-step process. A few keystrokes can replace hundreds of Instructions in: Ada, BASIC, C, FORTRAN, Pascal. IBM 350K RAM.
Price $200/300 per. lang.
Free Demo
AYECO INCORPORATED 5025 Nassau Circle, Orlando FL 32808 **(407) 295-0930**

Inquiry 669.

TLIB™ 5.0 Version Control
"TLIB™ is a great system" — *PC Tech Journal* 3/88. Full-featured configuration mgmt for software professionals. All versions of your code instantly available. Very compact, only changes are stored. Check-in/out locks, revision merge, branching, more. Mainframe deltas for **Pansophic, ADR, IBM, Unisys.** DOS $139 (OS/2 $195). 5-station LAN $419 (OS/2 $595)
BURTON SYSTEMS SOFTWARE
P.O. Box 4156, Cary, NC 27519 **(919) 233-8128**

Inquiry 670.

World Radio History

THE BUYER'S MART

PROGRAMMERS TOOLS

Bsupport for Btrieve®
The "Norton Utilities" for Btrieve users.
Bedit: DISPLAY, UPDATE, COPY, and DELETE.
EXPORT SDF to dBASE & LOTUS. RECOVER damaged files.
Edit/Insert using Data Dictionary.
Bbug: TSR Btrieve debugger. Displays info in pop-up window.
Brun: BUTIL replacement with Run-Time and C source.
Bedit/Bbug: $120. Brun: $150. VISA/MC/COD/PO
800/359-2721 FAX: 517/887-2366
Information Architects, Inc.
P.O. Box 4184, East Lansing, MI 48826-4184

Inquiry 671.

MULTI-TASKING TOOLKIT FOR DOS
MultiTask is a library of routines for Pascal or "C" programmers. It allows you to run many procedures concurrently within a program. There is NO RESIDENT driver to load, the multi-tasking environment is linked in your application.
• Keyboard, Serial I/O and printer support. • Many mechanisms for inter-task communication. • DOS non-reentrancy handled internally • Easy to use and well documented. • Distributed in source code form.
Only $99 Visa/MC accepted
ITI Logiciel
1705 St-Joseph E. Suite 4, Montreal, Can H2J 1N1
(514) 861-5988

Inquiry 672.

For QuickBasic programmers
SMART*menu*™ Cuts your development time by more than 60% by giving you an integrated user interface that easily configures to your applications. Dialogue boxes, pop-up & pull-down menus, as well as "fill the form" type entries. For QB 4.0 or later. Library, tools & manual are $69 + S&H.
KALTEK
P.O. Box 2166, Martinez, CA 94553 **(415) 370-1920**

Inquiry 673.

TURBO PLUS $199.00
Programming tools for use with Turbo Pascal 5.0 & 5.5. Screen Painter, Code Generator, I/O Fields, Dynamic Menus, Programming Unit Libraries, OOP Support, and Sample Programs included. All routines work in both text and graphics modes! 60-day money-back guarantee! Demo Disk avail. For IBM and compatibles.
NOSTRADAMUS, INC.
P.O. Box 9252, Salt Lake City, UT 84109-0252
(801) 272-0671

Inquiry 674.

FREE BUYER'S GUIDE
Programmer's Connection is an independent dealer representing more than 440 manufacturers with over 1200 software products for IBM and Macintosh personal computers. We have serviced the professional programmer since 1984 by offering sound advice and low prices. Call or write today to receive your FREE comprehensive Buyer's Guide.
Programmer's Connection **US 800-336-1166**
7249 Whipple Ave. NW — Canada 800-225-1166
North Canton, OH 44720 — International 216-494-3781

Inquiry 675.

• ***MULTITASK Real Time***
• ***SERIAL COMMUNICATION by interrupt***
MTASK® Professional was designed for the specific requirements of *Scientific Laboratories* and *Robotics Departments*. Gratis: demonstration diskette. Available for the present, for Turbo Pascal, Turbo C, Quick Pascal, Turbo Basic. Evaluation software for only $95. Price $495 + Shipping $20. Taxes not included.
RAMSI® International
53 rue Bernard Iske, F-92350 Plessis Robinson, FRANCE
International FAX: 33 (1) 46.32.48.37

Inquiry 676.

PROGRAMMERS TOOLS

Universal Report Generator
Generate reports from ANY file or database! The Universal Report Generator is a programming library that allows you to generate a report from any file or database from within your C or Pascal programs. Features include output to screen, printer, or text files; totals and subtotals; calculated fields; free-form report layout; automatic sorts and query selection; and much more. Also includes a "point-and-shoot" mouse-driven report painter that can be used to easily define reports. Microsoft C, Turbo C, and Turbo Pascal $349. UNIX version $499. Source code available. Demo disk $25.
Software Artistry, Inc.
3500 DePauw Blvd., Suite 1100, Indianapolis, IN 46268
Phone: (317) 876-3042 **Fax: (317) 876-3258**

Inquiry 677.

C and C++ DOCUMENTATION TOOLS
- **C-CALL ($59)** Graphic-trees of caller/called hierarchy.
- **C-CMT ($59)** Create, insert, update comment-blocks for each function, listing functions and identifiers used.
- **C-LIST ($39)** List, action-diagram, reformat programs.
- **C-REF ($49)** Local/global/parameter cross-reference.
- **SPECIAL ($149)** All 4, plus integrated C-DOC program.

SOFTWARE BLACKSMITHS INC.
6064 St. Ives Way, Mississauga, ONT Canada L5N-4M1
(416) 858-4466

Inquiry 678.

Auto Function Tester
* statement & branch test case coverage
* self-documenting / regression testing
* integrated testing environment
Structure and Standardize the testing cycle
Save time producing/verifying test cases
The more you Test the Easier it gets
requires MSC v5+ / TurboC v2+ $199
Plus $5 s/h (CA. resident add Tax of $12.44)
Talls Computer Service Inc.
P.O. Box 1539, Nevada City, CA 95959
(916) 265-5777

Inquiry 679.

TECH SPECIALIST
Tech Specialist gives you sophisticated information about programming applications on PCs. In-depth articles cover:
- MS-DOS internals
- hardware manipulation
- databases
- OS/2
- GUIs
- coding style

Pascal, C, assembly, BASIC —Tech Specialist covers them all—comprehensively! Call **913-841-1631** today for your copy.
Tech Specialist
2601 Iowa Street, Lawrence, KS 66046

Inquiry 680.

PROTOTYPING

Frustrated with Demo II?
You'll Love
PROTOSCREENS
Powerful Rapid Prototyping Software
Easy to Learn and Use - No Programming
Simulate mainframe, mini, and PC systems
Training available on rapid prototyping
BAILEY & BAILEY Software Corporation
859 East 2850 North Ogden UT 84414
(801) 782-2345 • Credit Cards • Overnight Del.

Inquiry 681.

PROTOTYPES FROM CAD
Without the Wait
BoardMaker™ Systems produces single/double sided, "ready-to-stuff" circuit boards up to 22" x 22" in-house. No chemicals or photographic techniques. Line/channel width down to 4/8 mils. Accepts standard Gerber, HPGL, Quest, Emma formats. Pays for itself after 12 to 20 boards.
Instant Board Circuits Corp.
20A Pamaron Way, Novato, CA 94949
Tel: (415) 883-1717 **Fax: (415) 883-2626**

Inquiry 682.

PUBLIC DOMAIN

SHAREWARE
FOR IBM™ AND COMPATIBLES
FREE 112 PAGE CATALOG
OVER 3000 PROGRAMS
CALL 1-800-245-BYTE (2983)
BEST BITS & BYTES
P.O. Box 8225-B, Van Nuys, CA 91409
FOREIGN COUNTRIES SEND $4.00 FOR SHIPPING

Inquiry 683.

FREE CATALOG 1500+ disks
Public Domain - Shareware
Software for IBM compatibles
$1.44 per disk
Canadian Software Distributors
Box 199, Munster, Ontario, K0A 3P0 CANADA

Inquiry 684.

FREE CATALOG
IBM SHAREWARE/PUBLIC DOMAIN
LOW AS $1.25/DISK
1-800-321-4270
CRANSTON SOFTWARE
PO Box 2679, Minneapolis, MN 55402-0679

Inquiry 685.

FREE SOFTWARE FOR IBM® PC's
TRY US! Get 15 disks full of our best selling software—FREE! Great graphics, programmers utilities, desktop publishing, finance, games, education, plus our 1600 disk catalog. Pay only $5.00 for shipping/handling — VISA/MC/AMEX
INTERNATIONAL SOFTWARE LIBRARY
511-104 Encinitas Blvd. • Encinitas CA 92024
CALL TODAY (619) 942-9998

Inquiry 686.

FREE CATALOG
$1 IBM SOFTWARE
For your free 32-page Master Edition catalog featuring the best of IBM Shareware from just $1 each, call or write today!
1-800-338-2118
SOFSOURCE
Box 828, East Lansing, MI 48826

Inquiry 687.

AAA RATED PD AND SHAREWARE
FREE 1990 MASTER CATALOG DISK
FREE PRINTER SETUP UTILITY
LOWEST PRICES — LATEST VERSIONS
OVER 10,000 PROGRAMS AVAILABLE
COMPLETELY 100% VIRUS FREE
CALL OR WRITE TODAY!!!
SOFTHOUSE INTERNATIONAL
3515 PECAN, IRVINE, CA 92714
1-(714)-551-6144

Inquiry 688.

World Radio History

THE BUYER'S MART

PUBLIC DOMAIN

SOFTSHOPPE, INC.
Selected Programs, Latest Versions, As Low as $1.50, Same Day Shipping, and No Minimum Order. For FREE CATALOG for IBM PD/Shareware, CALL 800-829-BEST (2378) or FAX 313-761-7639.

SOFTSHOPPE, INC.
P.O. BOX 3678, Ann Arbor, MI 48106-3678

Inquiry 689.

SECURITY

BIT-LOCK® SECURITY
Piracy SURVIVAL 5 YEARS proves effectiveness of powerful multilayered security. Rapid decryption algorithms. Reliable/small port-transparent security device. PARALLEL or SERIAL port. Complemented by economical KEY-LOK™ and multifeatured COMPU-LOCK™ including countdown, timeout, data encryption, and multiproduct protection. (Dos/Unix/Mac)

MICROCOMPUTER APPLICATIONS
3167 E. Otero Circle, Littleton, CO 80122
(303) 770-1917

Inquiry 695.

SOFTWARE/ACCOUNTING

dBASE BUSINESS TOOLS

- GENERAL LEDGER
- ORDER ENTRY
- JOB COSTING
- BILL OF MATLS
- PAYROLL
- PURCH ORD/INVNTORY
- ACCOUNTS RECVABLE
- JOB ESTIMATING
- SALES ANALYSIS
- ACCOUNTS PAYABLE

$99 ea. + S&H

dATAMAR SYSTEMS Cred. Card-Check-COD
4876-B Santa Monica Ave.
San Diego, CA 92107 **(619) 223-3344**

Inquiry 701.

SDK85 (8 bit) and SDK86 (16 bit)
NOW AVAILABLE ONLY FROM URDA, INC. which has an exclusive, world-wide, manufacturing and marketing license from Intel, Inc. The URDA SDK85 and SDK86 educational trainers and microprocessor development systems are now furnished fully assembled and boxed with manuals. Call URDA, Inc. for new low prices and delivery schedules. Other 8, 16 and 32 bit systems are available.

Phone URDA, Inc.
1-800-338-0517 or 412-683-8732

Inquiry 690.

1st Defense
ANTI-VIRAL
software
Protect your investment by removing that virus before it strikes.
$59.95
1st Defense Anti-Viral Systems

ModaLogic Incorporated
10474 Broadview Rd., Broadview Hts, OH 44147
(216) 838-5238
MS-DOS 2.11+ • Ohio Residents Add $4.20
Specify either 3½" or 5¼" disk

Inquiry 696.

SOFTWARE/BASIC

BASIC 7.0 TOOLS!
FINALLY! Library and FINALLY! XGRAF (graphics) are now fully compatible with near/far strings and the QBX environment. Call or write for latest information.

KOMPUTERWERK, INC.
851 Parkview Blvd., Pittsburgh, PA 15215
(412) 782-0384

Inquiry 702.

SECURITY

FIGHT PIRACY!
Since 1986, companies worldwide have been choosing Az-Tech security products. If you demand the strongest protection available, why not choose one of these "proven leaders":

- EVERLOCK Copy Protection
- EVERTRAK Software Security
- EVERKEY Hardware "Key" Software Security

For IBM and Compatibles. 30 day money back guarantee. Free info and demo disk available.

Az-Tech Software, Inc.
305 East Franklin, Richmond, MO 64085
(800) 227-0644 (816) 776-2700 Fax: (816) 776-8398

Inquiry 691.

COPY PROTECTION
The world's leading software manufacturers depend on Softguard copy protection systems. Your FREE DISKETTE introduces you to SuperLock™—invisible copy protection for IBM-PC (and compatibles) and Macintosh.

- Hard disk support
- No source code changes
- Customized versions
- LAN support
- New upgrades available

(408) 773-9680
SOFTGUARD SYSTEMS, INC.
710 Lakeway, Suite 200, Sunnyvale, CA 94086
FAX (408) 773-1405

Inquiry 697.

SOFTWARE/BUSINESS

DATA ENTRY SOFTWARE
Full-featured, heads-down data entry with two-pass verification, edit language, operator stats, much more! Designed for the PS/2®, PC, XT, AT or compatibles. Standalone $395. LAN version available.

FREE 30-day trial

Computer Keyes Tel: 206/776-6443
21929 Makah Rd. Fax: 206/776-7210
Woodway, WA 98020 USA: 800/356-0203

THE ULTIMATE COPY PROTECTION

- Completely Menu Driven
- Defeats all Hardware/Software Copiers
- No Source Code Changes
- Multiple Layering
- No Damaged Media
- Full Hard Disk Support
- Unlimited Metering
- *FREE* Demo Disk

Quite Simply The Best Ways To Protect Your Valuable Software Investment

STOPVIEW™ STOPCOPY PLUS™

BBI COMPUTER SYSTEMS® (301) 871-1094
14105 Heritage La., Silver Spring, MD 20906 FAX: (301) 460-7545

Inquiry 692.

HANDS OFF THE PROGRAM®
OPERATING SYSTEM SECURITY
Secures subdirectories, files, printers and floppies
Keyboard lock — automatic or manual
Log PC boot, program exec, file opens, login/logouts
Prevents DOS FORMAT and most viruses
Drive A: Boot Protection / Hard Disk Lock
IBM PC or 100% comp. — DOS V 3.0+ — $89.95 + $3.75 S/H

SYSTEMS CONSULTING INC.
PO BOX 111209, Pittsburgh, PA 15238
(412) 781-5280

Inquiry 698.

LP88-SPREADSHEET LP
Our best selling menu-driven linear programming system now solves problems with 1000 constraints and 5000 variables up to 30 times faster. New version reads/writes Lotus worksheets. Use 1-2-3/Symphony as a matrix generator or post processor. Many other features including interactive and batch operation, spreadsheet-style display, equation processor, problem/basis storage, file I/O, Simplex restart, report generator, sensitivity analysis. *IENews* says, "The flexibility and features of this program are a bargain at its low price." $149 with 8087 support and 100 page manual. $29 for working demo and manual.

EASTERN SOFTWARE PRODUCTS, INC.
P.O. Box 15328, Alexandria, VA 22309 (703) 360-7600

Inquiry 703.

COP's Copylock II

- Protects on standard diskettes
- Cannot be copied by any device incl. Option Board
- Fully hard disk installable
- Normal back-up of protected programs
- LAN-support
- Creates safe demo version of your software

Standard Version $975, Automatic Version $1950

DANCOTEC Computer
In US: 2835 Sierra Rd., San Jose, CA 95132 408-729-8162 or 1-800-344-2545
Int'l: 2880 Bagsvard, Denmark Phone +45-44440322 Fax +44440722

Inquiry 693.

HANDS OFF THE BOARD®
1/2 SIZE SECURITY BOARD
Stop floppy boot — Require password to boot PC
Real-time disk encrypt — prevent boot sector virus
Prevent DOS FORMAT/FDISK and low-level formats
Set hard disk READ ONLY or turn ON/OFF
Turn floppies, printers and COM ports ON/OFF
IBM XT, AT Bus — DOS V3.0+ — $149.95 + $5.00 S/H

SYSTEMS CONSULTING INC.
PO BOX 111209, Pittsburgh, PA 15238
(412) 781-5280

Inquiry 699.

ASAP!
Automated scheduler, integrates worker availability with schedule requirements. Enter hours of operation, workers' stats., ASAP! does the rest. Options include status and skill level checking, unlimited no. of depts., 65 workers per dept., flexible displays, menu-driven interface. Ideal for restaurants, retailers, etc. Will virtually pay for itself. Only $200.00! (+ $3.00 S&H). Manual included.

INflux Technologies
PO Box 3318, Carbondale, IL 62902-3318
618-549-3018

Inquiry 704.

RID YOUR SYSTEM OF VIRUSES FOR EVER
VIRUSAFE™
The most effective anti-virus system available
■ Recognizes over 70 viruses—regularly updated. ■ Protection against existing and future viruses. ■ Seeks, identifies and removes known viruses resident in memory and programs. ■ Checks integrity of specified programs for virus related changes. ■ Boot operated memory resident program constantly on guard against new virus attacks

Price $80. Visa/MC. 30-day money-back guarantee.

EllaShim Microcomputers Inc.
520 W. Hgwy 436, suite #1180-30, Altamonte Springs, FL 32714
TEL (407) 682-1587 FAX (407) 869-1409

Inquiry 694.

SOFTWARE/ACCOUNTING

PC TIME CLOCK
AutoTime is an Employee Management System that allows you to turn any PC into an Electronic Time Clock. AutoTime provides Time & Attendance, Job Costing, Payroll Interface, and Labor Distribution reporting. Network compatible. Prices start at $495. Other Business Products: Network FAX, Absence Call-In, db-EDI.

Chase Technologies
1617 Kingman Ave., San Jose, CA 95128
(408) 998-2917

Inquiry 700.

SOFTWARE/DSP

DSP HeadQuarters (DspHq)
Open architecture DSP development for IBM-PC. Use included functions, your own routines, and popular function libraries. Menu interface, command interpreter, batch command processor, file and memory management, signal processor interface, screen graphics with integrated hardcopy support. Intro price $250, FREE demo.

BittWare Research Systems
Inner Harbor Center, 8th Flr Phone: 301-879-4298
400 East Pratt Street FAX: 301-879-4465
Baltimore, MD 21202 BBS: 3-12-24/N/8/1, 301-838-3205

Inquiry 705.

World Radio History

THE BUYER'S MART

SOFTWARE/ENGINEERING

COORDINATED MULTI AXIS
MOTION CONTROL $199

- Indexer LPT™ software converts ordinary printer port into a multi axis step motor Indexer
- Easily used from any language: BASIC, C, Pascal, spreadsheet or database macros, even DOS batch files!
- Full functions for up to six axes, now includes line drawing.
- Why FIGHT with RS-232 and PAY for expensive hardware? Inquire about Indexer LPT today!!!

Ability Systems Corp.
1422 Arnold Ave., Roslyn, PA 19001 (215) 657-4338

Inquiry 706.

Affordable Engineering Software
FREE APPLICATION GUIDE & CATALOG

Circuit Analysis • Root Locus • Thermal Analysis • Plotter Drivers • Engineering Graphics • Signal Processing • Active/Passive Filter Design • Transfer Function/FFT Analysis • Logic Simulation • Microstrip Design • PC/MS-DOS • Macintosh • VISA/MC

BV Engineering Professional Software
2023 Chicago Ave., Suite B-13, Riverside, CA 92507
(714) 781-0252

Inquiry 707.

MATFOR
UNMATCHED VALUE FOR NUMERICAL COMPUTING

An interpreter with over 350 functions for Linear Algebra, Calculus, Differential Equations, Nonlinear Equations, Function Minimization, Linear/Dynamic Programming, Analysis/Design of Control Systems, Digital Signal Processing, Time Series Analysis, Advanced Statistics and more. Graphics at printers' resolution. Extendible, stand-alone package. $150 for IBM/AT/compatibles.

Computational Engineering Associates
3525 Del Mar Heights Rd., Suite 183, San Diego, CA 92130
(619) 259-8863

Inquiry 708.

The new approach to logistics
TAYLOR, THE DYNAMIC ANALYST

Taylor is the fully menu-driven factory simulation package that combines ease of use with great flexibility. Taylor offers interactive graphical modeling, numerous modelling options, animation, in depth result analysis and the Taylor Language Interface (TLI) Version 4.0 of the easiest-to-use professional simulation package on the market is available now

F&H, Logistics and Automation BV
Spoorlaan 424, 5038 CG Tilburg,
The Netherlands
Phone: +31 13 366344 Fax: +31 13 427516

Inquiry 709.

Analog Circuit Simulation

- Schematic Entry
- SPICE Simulator
- Model Libraries
- Monte Carlo Analysis
- Parameter Sweeps
- Plotting/Graphics Output

Intusoft has a complete PC-based system including everything from schematic entry through SPICE simulation using extended memory to comprehensive interactive post processing. Starting at $95 for IsSpice, the complete system sells for just $790.

Intusoft
The leader in low cost, full featured CAE software
P.O. Box 6607, San Pedro, CA 90734
(213) 833-0710 FAX (213)831-3956

Inquiry 710.

4-BAR SYNTHESIS IN A PC

Lear_links is a powerful 4-bar design package with 3 and 4 design position options and many optimization and analysis tools including full animation. It runs on any IBM PC/XT, AT, PS/2, or compatibles with 256K and graphics display.

Full package: **$475.00**, Interactive Demo: **$25.00**

Lear Com Company
2440 Kipling St., Ste. 206, Lakewood, CO 80215
(303) 232-2226 FAX (303) 232-8721

Inquiry 711.

SOFTWARE/ENGINEERING

Personal Software for
"What If" Engineering

Cedar fuses mathematics and intelligent geometric modeling and works with geometrics the same way a spreadsheet works with numbers. Now you can have the power of a smart drawing system integrated with a scientific calculator and formula solver within one easy-to-use software package. Requires Microsoft Windows. $895

MCAE Technologies Inc.
Tel: 408-748-0334 Fax: 408-748-1915

Inquiry 712.

MICROSTRESS CORP.

NEW MICROSAFE 2-D/3-D Rel. 3. Structural Analysis Program. Finite Element Analysis for IBM PCs and compatibles. Number of nodes, elements and conditions limited by disk space and model bandwidth (11000 d.o.f.) Color graphics support on various display cards (EGA, VGA, VEGA and Hercules) $250. SAFECAD (bi-directional AUTOCAD Interface) $95. GRAFPLUS $55. Plus S/H.

Accept Visa/MasterCard. Send for brochure.
P.O. Box 3194, Bellevue, WA 98009
Tel./Fax (206) 643-9941

Inquiry 713.

MIDNIGHT ENGINEERING™

A new publication for entrepreneurial hardware and software engineers that will encourage and challenge you to personally develop and market your own products.

- PRACTICAL ARTICLES
- INSIGHTFUL INTERVIEWS
- DETAILED PRODUCT REVIEWS

call or write for a FREE copy of the premiere issue of *Midnight Engineering.*

Midnight Engineering
111 E. Drake Rd., Suite 7041, Fort Collins, CO 80525
303-491-9092

Inquiry 714.

SIMULATION WITH GPSS/PC™

GPSS/PC™ is an MS-DOS compatible version of the popular mainframe simulation language GPSS. Graphics, animation and an extremely interactive environment allow a totally new view of your models. If you are contemplating the creation or modification of a complex system you need GPSS/PC to help you predict its behavior. Call now.

MINUTEMAN Software
P.O. Box 171/Y, Stow, Massachusetts, U.S.A.
(508) 897-5662 ext. 540 (800) 223-1430 ext. 540

Inquiry 715.

Circuit Analysis — SPICE
Non-linear DC & Transient; Linear AC.

- Version 3B1 with BSIM, GaAs, JFET, MOSFET, BJT, diode, etc. models, screen graphics, improved speed and convergence.
- PC Version 2G6 available at $95.

Call, write, or check inquiry # for more info.

Northern Valley Software
28327 Rothrock Dr., Rancho Palos Verdes, CA 90274
(213) 541-3677

Inquiry 716.

FREE ENGINEERING MAGAZINE

Personal Engineering is a monthly magazine sent free of charge (USA only) to scientists/engineers who use PCs for technical applications. Topics each month include **Instrumentation • Data Acq/Control • Design Automation.** To receive a free sample issue and qualification form either circle below or send request on letterhead to:

Personal Engineering Communications
Box 300, Brookline, MA 02146

Inquiry 717.

SOFTWARE/ENGINEERING

SAUNA:
3D Thermal Analysis Made Easy!

• All heat transfer modes: convection, radiation, conduction. • Interactive menu-driven • Powerful edit features • Easy to learn and use • Models: enclosures, heat sinks, circuit boards, plates • Integrated color graphics • 3D thermal analysis • Thermal parameters library • IBM PC & Macintosh II.

Tatum Labs Inc.
3917 Research Park Dr. B-1, Ann Arbor, MI 48108
313-663-8810

Inquiry 718.

SOFTWARE/FORTRAN

FORTRAN77 PROGRAMMER'S ASSISTANTS
FREE YOU FOR MORE CREATIVE WORK

ASSISTANT I - FORTRAN TOOLS assists you to manage and analyze your FORTRAN source code.

ASSISTANT II - FORTRAN77 TO C TRANSLATOR and C TOOLS make your FORTRAN to C conversion process easy and significantly reduce your conversion cost.

Please call, write, or check inquiry # for more information.

MICROTOOLS
P.O. BOX 2745, Santa Clara, CA 95055-2745, USA
(408) 243-7688

Inquiry 719.

SOFTWARE/GEOLOGICAL

GEOLOGICAL CATALOG

Geological software for log plotting, gridding/contouring, hydrology, digitizing, 3-D solid modelling, synthetic seismogram, fracture analysis, image processing, scout ticket manager, over 50 programs in catalog. Macintosh too! Please call, or write, for Free Catalog!

RockWare, Inc.
4251 Kipling St., Suite 595, Wheat Ridge, CO 80033 USA
(303) 423-5645 Fax (303) 423-6171

Inquiry 722.

SOFTWARE/GRAPHICS

S E G S 2 . 1
Scientific Engineering Graphics System

- Logarithmic, Time/Date & Linear Axes.
- Easy Curve Fitting and Data Smoothing.
- 1-2-3 Interface & Numeric Spreadsheet.
- Supports all Video & Device Standards.
- 10 Curves with up to 16,000 points each.

Advanced Micro Solutions
3817 Windover Dr. **405-340-0697**
Edmond, OK 73013 **800-284-3381**

GRAPHIC TOOLS LIBRARY

PHONTM—THE FONTMAKER: Interactively create scalable, expandable and fillable outline, stroke and bitmap fonts, figures and logos. Create hand-writing fonts. Scale a type style to various size fonts. Laser font Loader. Fast print your creation at 60 to 600 dpi. Use same font for display and print. Free hand drawing. Use fonts with PC_VDI, SCANLIB, IBM 8514/A & others. $395.

NOVA INC.
2500 W. Higgins Road, #1144 CALL **708-882-4111**
Hoffman Estates, IL 60195 FAX **708-882-4173**
See our ad on page 156.

Inquiry 720.

IMAGE TOOLS LIBRARY

SCANLIB: Image Capture. Animation. Scale image up, down. Rotate, Mirror. Manage scanned images. Includes Text functions. 149 funcs. Modes from herc. to 800X600X256. Faster and better package for PCX file handling. $195. "C", PASCAL, FORT., MS BASIC 4.0–7.0. PCXIO: Source Library avail. in "C" or Assembler for fast read/write & display of PCX files at any point on screen or memory. Color Mapping. $295.

NOVA INC.
2500 W. Higgins Road, #1144 CALL **708-882-4111**
Hoffman Estates, IL 60195 FAX **708-882-4173**
See our ad on page 156.

Inquiry 721.

World Radio History

THE BUYER'S MART

SOFTWARE/GRAPHICS

PC TECHNICAL GRAPHICS

TEKMAR is a graphics library for the **VGA, EGA** or Tecmar Graphics Master. Similar to PLOT-10, includes WINDOW, VIEWPORT, AXIS. Support for HP, HI plotters. Curve fitting, complete plotting program. Log, semi-log, multi-axis, 3-D, contours. Jerry Pournelle (Aug 86 *Byte*): "As good as any I have ever seen..." Demo disks, literature available.

Advanced Systems Consultants
21115 Devonshire St. #329, Chatsworth, CA 91311
(818) 407-1059

Inquiry 723.

CAD/CAM Developers!

You save hundreds of hours of programming and debugging time (and the thousands of dollars this time costs!) when you use the CAD/CAM math and DXF routines in the

QuickGeometry Library

All the routines you need for any type of CAD/CAM/CAE program! 250 ready-to-use routines that construct, intersect and offset lines, arcs, circles, ellipses and *even* splines!

$199 includes C source code and telephone support.

Call (617) 628-5217 today for information or to order!

Building Block Software, PO Box 1373, Somerville, MA 02144

Inquiry 724.

The Ultimate CAD/CAM Engine

TurboGeometry Library 3.0. The most complete tool box of 2D & 3D routines available today! Over 300 routines. Surfacing, Solids, Hidden line, Volumes, Areas, Transforms, Perspectives, Decomp, Clipping, Tangents & more. 30 day guar., $199.95 w/source S&H Incl. Foreign $225.00. MS/PC DOS 2.0+. Turbo Pascal, Turbo C, MSC, MIX C, Zortec C++. VISA/MC, PO, Chk, USA funds only.

Disk Software, Inc.
2116 E. Arapaho Rd., #487, Richardson, TX 75081
(214) 423-7288, (800) 635-7760, FAX (214) 423-7288

Inquiry 725.

RAINDROP™

FAST, compact PrtScrn Utility for end users AND developers. Hardcopy as fast as 10 secs. Average binary size - 6 kbyte. 12 video graphic standards. Scale, rotate, colorize and more. 'CALL' from user-written programs. Complete 9- & 24-pin dot-matrix, inkjet, and laserjet library $39.95+$3 s/h.

ECLECTIC SYSTEMS
8106 St. David Ct., Springfield, VA 22153
(703) 440-0064

Inquiry 726.

PEN PLOTTER EMULATOR

FPLOT turns your dot matrix or laser printer into an HP pen plotter. Fast hi-res output. No jagged lines. Vary line width, color. Works with Autocad, Drafix, etc. Supports NEC P5/P6, IBM Proprinter, Epson LQ/FX, Toshiba, HP Laserjet, Okidata 29x/39x, Hercules/CGA/EGA/VGA. $64 check/m.o./VISA/MC

Fplot Corporation
24-16 Steinway St., Suite 605, Astoria, NY 11103
718-545-3505

Inquiry 727.

DoDOT for *Microsoft Windows*

With DoDOT, you can:
- Capture screens, windows, dialog boxes, and pull-down menus.
- Convert between various file formats: **TIFF, Postscript, PCX, IMG, GIF, MAC, PIC, PCL, MSP, Clipboard, Bitmap, and more.**
- View and edit image with full color support.
- Print images to wide range of printers: LaserJet, Postscript, and more.

With each purchase, you receive free upgrade and support. Only $129 + $5 S/H!

Halcyon Software 10297 Cold Harbor Ave.
Cupertino, CA 95014 tel: (408) 257-0812 fax: (408) 257-2012

Inquiry 728.

SOFTWARE/GRAPHICS

POPULAR HGRAPH

SCIENTIFIC 2D & 3D graphic routines for IBM PC, VAX, SUN and Macintosh. Powerful, easy to use. Multiple fonts, device and machine independent. Uses max resolution. Links with FORTRAN, Pascal, C, Modula-2 and QuickBasic. $119.00

Custom software development.

UGraph—the graphics editor available now!

HeartLand Software, Inc.
234 S. Franklin, Ames, IA 50010
(515) 292-8216

Inquiry 729.

GRAPHICS PRINTER SUPPORT

AT LAST! Use the PrtSc key to make quality scaled B&W or color reproductions of your display on *any* dot matrix, inkjet, or laser printer (incl. Postscript) In up to 64 shades of gray or 256 colors. GRAFPLUS supports all versions of DOS with IBM (incl. EGA, VGA, Super VGA), Hercules, or compatible graphics boards. Linkable/OEM versions available. $49.95

Jewell Technologies, Inc.
4740 – 44th Ave. SW, Seattle, WA 98116
(800) 359-9000 x527 (206) 937-1081

Inquiry 730.

FORTRAN PROGRAMMER?

Now you can call 2-D and 3-D graphics routines within your FORTRAN program.

GRAFMATIC: screen routines	$135.
PLOTMATIC: plotter driver	135.
PRINTMATIC: printer driver	135.

For the IBM PC, XT, AT & compatibles. *We support a variety of compilers, graphics bds., plotters and printers.*

MICROCOMPATIBLES
301 Prelude Dr., Dept. B, Silver Spring, MD 20901 USA
(301) 593-0683

Inquiry 731.

VGA ColorWorks™ V2.2

The most advanced image creation and manipulation package available for the VGA. Import/export TIFF, PCX, TARGA images. Edit with over 250,000 colors in multiple hardware resolutions (switchable on-the-fly). Complete set of geometrics and patterns. Special effects include tint, shade, blend, mask, fountains, cut/paste, hardware zoom emulation, . . . much more (over 150 drawing controls). Incl. 44 fonts, drivers for PostScript, HP-LaserJet, HP-PaintJet, Epson LQ/FX. Producing up to 64 grey levels or 4096 colors. $59. Call for our free fully operational demo.

SPG Inc.
PO Box 171008 — Hialeah, FL 33017
(305) 362-6602

Inquiry 732.

PC SOFTWARE FOR WORK OR PLAY

$3.00 / DISK

Written by some of the best programmers in the world and delivered to you. From DOS enhancement utilities to adult only, desk top publishing, business/investment, database, word processing, games, etc., etc., etc. Our FREE CATALOG contains hundreds of the best software programs on the market. Your complete satisfaction is guaranteed when ordering from:

SILICON VALLEY FREEWARE
P.O. Box 70397, Sunnyvale, CA 94086
(415) 965-9700

Inquiry 733.

GRAPHICS LIBRARIES for C, FORTRAN, PASCAL & QuickBASIC

- Supports VIDEO, PRINTERS & PLOTTERS.
- Linear, log, polar, smith, bar & pie charts.
- Scalable fonts, line types, markers.
- Multiple plots on a page.
- Over 100 routines with full source code.
- 240 page manual. No royalties.

$295.00 (713) 491-2088

Sutrasoft
10506 Permian Dr. • Sugar Land, TX 77478

Inquiry 734.

SOFTWARE/LANGUAGES

DRUMA FORTH-83

Break the 64K barrier without speed/space penalty. Powerful, attractively priced. '83 Standard.
- 1Mb+ automated memory management
- Full OS interface, extensive utilities
- On-line documentation, ASCII/block files
- Other products: windows, modules, profiler
- IBM PC/XT/AT & all compatibles

FREE learn/utility disks offered: INQUIRE

DRUMA INC.
6448 Hwy. 290 East E103, Austin, TX 78723
Orders: 512-323-0403 BBoard: 512-323-2402

Inquiry 735.

SOFTWARE/LOTTO

PC-LOTTO 2.81 $40 US $45 CAN

LottoProcessing program for IBM compatibles. 10 LOTTO databases included with all numbers since day one. Shareware available from most outlets and PC-Clubs.

PC-LOTTOprint ver 1.1 $45 US $50 CAN
20 LOTTO BET SLIPS filled out in 10 min. (100-240 tickets!) Send $10 + 5 slips for DEMO

LOTTOWARE — 870 Gladiola Ave. Victoria B.C. CANADA V8Z 2T6 (604) 479-8536 Visa/MC 24HR

Inquiry 736.

SOFTWARE/MATHEMATICS

Leo Tames TeX

The Leo editor reads and writes TeX files. Displays, adjusts matrices, roots, symbols etc. as you edit. Fast math typing. Draft printer, font editor. For AMSTeX or LATeX. $150. Requires PC, 512K, graphics. MC/VISA, check, or PO.

ABK Software
4495 Ottawa Pl., Boulder, CO 80303
(303) 494-4872

Inquiry 737.

MATH EDITING FOR THE PC

$$x_i^2 = \sum_{k=0}^{\infty} \left[x_k^{2\pi} \binom{n}{k}\right] + \left(\frac{\int\int F\,ds}{\sqrt[3]{\alpha \pm \beta x}}\right)$$

- *MathEdit constructs math equations to be inserted into WordPerfect, Word, WordStar, and others.*
- *WYSIWYG interface—no codes need to be learned.*
- *MathEdit—$199*

K-TALK *COMMUNICATIONS*
30 West First Avenue, Suite 100
Columbus, Ohio 43201
(614) 294-3535

Inquiry 738.

MATHEMATICIANS—ENGINEERS

Have you ever seen functions of a complex variable? Would you like to really understand differential operators like div, grad and curl? How about a peek into the fourth dimension? Call or write for information on our latest PC and Macintosh software.

Lascaux Graphics
3220 Steuben Ave., Bronx, NY 10467
(212) 654-7429

Inquiry 739.

DERIVE®
A Mathematical Assistant

Makes math more inspiration and less perspiration! Combines the power of computer algebra with 2D & 3D plotting and a friendly menu-driven user interface. Does equation solving, calculus, trigonometry vector & matrix algebra, and more. Derive requires a PC compatible computer & 512K memory.

Soft Warehouse, Inc.
3615 Harding Ave., Suite 505, Honolulu, HI 96816
(808) 734-5801

Inquiry 740.

World Radio History

THE BUYER'S MART

SOFTWARE/MEDICAL

Medical Systems with ECS

PPM offers a complete line of medical software ranging from simple insurance claims processing to comprehensive A/R management.
PC **CLAIM PLUS**–claims processing with ECS to over 100 major insurance carriers–30-day money-back guarantee
THRESHOLD–complete A/R, patient billing, comprehensive practice management statistics
CLAIM NET–Nationwide electronic claims clearinghouse transmits claims to over 100 insurance carriers
Software prices start at $459.00 Dealer inquiries welcome

Physicians Practice Management
350 E. New York, Indianapolis, IN 46204
800-428-3515 **317-634-8080**

Inquiry 741.

SOFTWARE/PACKAGING

HARD TO FIND COMPUTER SUPPLIES FOR SOFTWARE DEVELOPERS & POWER USERS

Cloth binders & slipcases like IBM's. Vinyl binders, boxes, and folders in many sizes. Disk pages, envelopes, & labels. Low quantity imprinting. Bulk disks. Everything you need to bring your software to market. Disk and binder mailers. Much more! Low Prices! Fast service. Call or write for a **FREE CATALOG.**

Anthropomorphic Systems, Limited
376-B E. Saint Charles Rd., Lombard, IL 60148
1-800-DEAL-NOW **708-629-5160**

Inquiry 742.

SOFTWARE/SCANNERS

Optical Character Recognition

Stop retyping: PC-OCR™ software will convert typed or printed pages into editable text files for your word processor. Works with HP ScanJet, Panasonic and most other scanners. Supplied with 18 popular fonts. User trainable: you can teach PC-OCR™ to read virtually any typestyle, incl. foreign fonts. Proportional text, matrix printer output, Xerox copies OK. $385. Check/VISA/MC/AmExp/COD

Essex Publishing Co.
P.O. Box 391, Cedar Grove, NJ 07009
(201) 783-6940

Inquiry 743.

NEVER BALANCE YOUR CHECKBOOK AGAIN!

Amazing new software instantly reads and balances your check register with a hand-held scanner. Allows you to enter hand-printed check data into your PC WITHOUT A KEYBOARD. Supports other personal financial software.

ChekScan software with premium hand-held scanner only $289.00 (software only $96.00).

800-762-5542 or FAX: 919-828-5196

PAI, 611 Tucker Street, Raleigh, NC 27603

Inquiry 744.

SOFTWARE/SCIENTIFIC

Chaos/Nonlinear Dynamics

DYNAMICAL SOFTWARE I and II $250 / $350
Ordinary and Delay Differential Equation Solvers
• Bifurcation Diagrams • Basin Boundaries • 2- and 3-D Plotting • Poincaré Sections • Return Maps • Spectral Analysis, Fractal Dimensions, Lyapunov Exponents
CHAOS IN THE CLASSROOM Instructional Programs
Maps and Bifurcations $49.95 Fractals and Julia Sets $59.95

DYNAMICAL SYSTEMS, INC.
P.O. Box 35241, Tucson, AZ 35740, (602) 292-1962
See our ad on page 264

C Scientific Library

Create customized scientific and engineering tools with this comprehensive library of 600 functions including linear algebra, eigensystems, matrix computations, time series, smoothing and filtering, statistics, regression, linear and integer programming, nonlinear systems, optimization, differential equations, curvefitting and graphics. Superior documentation. Usable, encapsulated, modular, reliable, mature, and affordable. Several licensing and system options are available starting at $295. Request on company letterhead or send $5 (refundable on purchase) for 50-page CSL Buyer's Guide.

Eigenware Technologies
13090 La Vista Drive, Saratoga, CA 95070
(408) 867-1184 **Fax: (408) 867-6575**

Inquiry 745.

SOFTWARE/SCIENTIFIC

free catalog!
800-942-MATH
MicroMath Scientific Software

Inquiry 746.

Scientific/Engineering/Graphics Libraries
Turbo Pascal, Turbo+MS C, MS Fortran, Basic

Send for FREE catalogue of software tools for Scientists and Engineers. Includes: Scientific subroutine libraries, device independent graphics libraries (including EGA, HP plotter and Laserjet support), scientific charting libraries, 3-D plotting library, data acquisition libraries, menu-driven process control software. Versions available for a variety of popular languages.

Quinn-Curtis
1191 Chestnut St., Unit 2-5, Newton, MA 02164
(617) 965-5660

Inquiry 747.

SOFTWARE/SORT

OPT-TECH SORT/MERGE

Extremely fast Sort/Merge/Select utility. Run as an MS-DOS command or CALL as a subroutine. Supports most languages and file types including Btrieve and dBASE. Unlimited file sizes, multiple keys and much more! MS DOS **$149.** OS/2, XENIX, UNIX **$249.**

(702) 588-3737
Opt-Tech Data Processing
P.O. Box 678 — Zephyr Cove, NV 89448

Inquiry 748.

SOFTWARE/TOOLS

I.A.B., Industrial Applications Builder
Turns PC into DAC system

Powerful SW tool kit helps you build IBM PC-based data acquisition and control systems for process and machine applications. Flexible, debugged and reliable. Low cost. *Available in source code.* No royalties. Request free catalog.

EXOR R&D
P.O. BOX 548, West Chester, OH 45069, USA
Fax: 513-777-4817 **Phone: 513-777-0570**

Inquiry 749.

SOFTWARE/UTILITIES

EZ-COPY PLUS™

FLAWLESS DISKETTES FAST! on the PC you already own! THIS IS SOFTWARE ONLY! Bypasses DOS for the utmost speed. Great for publishers, developers, MIS directors, etc. 2X+ faster then DOS. Read diskette once, then, quickly & accurately mass duplicate 5.25" & 3.5" disks on your own PC/XT/AT/etc. Formats, copies, verifies, optionally SERIALIZES & PRINTS LABELS, in 1 smooth operation. Save images to HD, more ... Replaces dedicated hardware worth $1000s. **Only $129** +s/h.©

EZX Publ., Box 58177-B0790, Webster, TX 77598
Orders (V/MC/AX) & Brochures Toll Free: 1 • 800 • 359 • 9539
INFO: 713/280-9900, BBS: 280-8180; FAX: 713/280-0525

Inquiry 750.

Duplicate Disks *Fast!*

DiskDupe duplicates, formats and compares disks amazingly fast—up to 200 disks an hour! Its unique RELAY feature lets you quickly duplicate lots of master disks effortlessly. And you can protect your masters by storing disk images on your hard disk. Also supports high-density formats—plus a whole lot more! $79+S/H, Money Back Guarantee.

Micro System Designs, Inc.
1309 El Curtola Blvd., Lafayette, CA 94549
(415) 944-9994 Order today!

Inquiry 751.

SOFTWARE/VOICE

MULTI-VOICE® TOOLS

Multi-Voice Tools is a complete development Toolkit for Pascal or "C" to access all the features of the WATSON or DIALOGIC Speech Boards. It is also a high level library of procedures to build MULTI-LINE VOICE RESPONSE systems in minutes. A powerful TELEPHONE ANSWERING program is given as an example with source code.
DIALOGIC, RHETOREX, VBX $599, WATSON $99, Visa/MC

ITI Logiciel
1705 St. Joseph E, Suite 4, Montreal, PQ, Can. H2J 1N1
(514) 861-5988
We can also write your Voice Response application programs.

Inquiry 752.

SPANISH EDUCATIONAL S/W

SPANISH EDUCATIONAL SOFT

For teachers, students and parents. Developed by teachers and programmers with years of experience in educational software.
ARANDU ESCRITOR CREATIVO (2 Vol) $179.95
Develop your ideas into a meaningful composition. An efficient tool for critical thinking, paired with an easy-to-use word processor in Spanish.
ARANDU LANGUAGE COLLECTION (2 Vol) $44.95
ARANDU MATH COLLECTION (3 Vol) $64.95
ARANDU MATH & PHYSICS SIMULATION COL. (5 Vol) $219.95
30-Day Money-Back Guarantee. Please call for info/order.

ARANDU SOFT **Tel: (305) 591-3239**
7224 NW 31 St., Miami, FL 33122 **Fax: (305) 591-1940**
800-627-3764 **(305) 591-3105**

Inquiry 753.

SPEECH SYNTHESIS

SPEECH SYNTHESIS CHIP

Want the most advanced phoneme synthesis chip available? One flexible enough to generate speech, music and sound effects . . . yet low cost and remarkably easy to use? The ARTIC-263 is all of this and more . . . a versatile, high-quality, phoneme-based, speech synthesizer circuit contained in a single, monolithic, 24-pin, CMOS integrated circuit.

Artic Technologies
55 Park Street, Troy, Michigan 48083
Phone: (313) 588-7370 FAX: (313) 588-2650

Inquiry 754.

STATISTICS

JUST RELEASED STATISTIX 3.1
PC Magazine Editor's Choice!

You can rely on STATISTIX to get your work done EASILY and QUICKLY. Menu-driven. Powerful yet compact. STATISTIX offers basic and advanced statistics with an easy-to-follow manual full of examples.

"Technical support was excellent . . ."
PC Magazine.

Get the quality you want at a price you can afford. U.S. & overseas price: $199. Money-back-guarantee.

Tel: 612-631-2852 **Fax: 612-636-3070**
Analytical Software, PO Box 130204, St. Paul, MN 55113

Inquiry 755.

The BASS System™

Why use up 8 meg and 640K just to run a data step on your PC? Now you can run your data step code and statistical procs with a system that takes only 1 meg and 400K (and costs only $399)! Free information:

BASS Institute, Inc.
P.O. Box 349, Chapel Hill, NC 27514
(919) 933-7096 or BB: (919) 968-6755 (N,8,1)

Inquiry 756.

SOLO 3.0 from BMDP

Popular statistics and excellent graphics for the PC. Quick and easy to use. For business professionals, researchers, or students. From the leader in statistical software for over 25 years. Top-notch support. Satisfaction guaranteed! $199 complete with graphics. Call today, VISA or MC.

BMDP Statistical Software, Inc.
1440 Sepulveda Blvd., Suite 316, Los Angeles, CA 90025
(213) 479-7799

Inquiry 757.

World Radio History

THE BUYER'S MART

STATISTICS

Cover all the bases of design . . .
with Methodologist's Toolchest™, a comprehensive package of five programs to aid in research design and analysis. Specifically, these programs offer assistance in sampling, data collection procedures, statistical analyses, experimental design, and measurement and scaling. $499.95 + s/h. VISA, MC, AMEX, PO, Checks accepted.

The Idea Works, Inc.
100 West Briarwood, Columbia, MO 65203
1-800-537-4866 **FAX 314-445-4589**
Outside USA 314-445-4554

Inquiry 758.

Know where you're going?
You will—by using Statistical Navigator™, an expert system that helps you select the best statistic for a problem. Statistical Navigator suggests appropriate analyses and explains how each fits your needs. Version 1.1—$99.95+s/h. VISA, MC, AMEX, PO, Checks accepted.

The Idea Works, Inc.
100 West Briarwood, Columbia, MO 65203
1-800-537-4866 **FAX 314-445-4589**
Outside USA 314-445-4554

Inquiry 759.

NCSS 5.x Series — $125
Easy-to-use menus & spread sheet. Multiple regression. T-tests. ANOVA (up to 10 factors, rep. measures, covariance). Forecasting. Factor, cluster, & discriminant analysis. Nonparametrics. Cross Tabulation. Graphics: histograms, box, scatter, etc. Reads ASCII/Lotus. Many new add-on modules.

NCSS
865 East 400 North, Kaysville, UT 84037
Phone: 801-546-0445 **Fax: 801-546-3907**

Inquiry 760.

SCA STATISTICAL SYSTEM
The *only* statistical software encompassing
Forecasting & Time Series Analysis
Quality and Productivity Improvement
General Statistical Analysis
Available on DOS, OS/2 and Mac operating systems.
Call today for more information
Scientific Computing Associates
4513 Lincoln Ave., Suite 106, Lisle, IL 60532, USA
Phone: (708) 960-1698 **FAX: (708) 960-1815**

Inquiry 761.

TONER CARTRIDGES

TONERS
LASER PRINTERS $42.00 SHARP Z-50/70 $40.00
PC COPIERS $38.00 XEROX 1012 $140.00
NEW LONG LIFE EPS DURA-DRUM $87.00
YOUR CARTRIDGES TESTED, REMANUFACTURED, & FULLY GUARANTEED BY EXPERIENCED TECHS.
COLORS 24 HR. TURNAROUND MC/VISA

SOUTHERN CARTRIDGE SERVICE
33 MATHEWS DR.
HILTON HEAD ISLAND, SC 29926
800-442-6288

Inquiry 762.

UNINTERRUPTABLE POWER

HOW TO PROTECT YOUR COMPUTER
And Make It Last Longer
FREE money-saving literature. What you need to know about UPS—uninterruptible power supply. How to get complete protection from power line problems. 350VA through 15KVA models from the world's largest manufacturer of single-phase UPS.

Best Power Technology, Inc.
P.O. Box 280, Necedah, WI 54646
(608) 565-7200 ext. 3856
TOLL FREE (800) 356-5794 ext. 3856
See our Ad on page 340.

Inquiry 763.

UNIX SYSTEMS

UNIX™ X-Windows SYSTEMS
*BELL LABS
From **$2,595** Lowest Prices
Expect a MIRACLE!!!
(716) 594-1088 VISA/MC 8:30 AM–8:00 PM EST
Micro Tools Inc. Prices can change

Inquiry 764.

UTILITIES

COPY AT TO PC—BRIDGE-IT 3.5
"CPYAT2PC" RELIABLY writes 360KB floppies on 1.2 MB drives, saving a slot for a second hard disk or tape back-up. Only $79.00 + S/H
"BRIDGE-IT 3.5" is a DEVICE DRIVER supporting 3½" 720KB/1.44MB drives for PC/XT/AT without upgrading DOS/BIOS. Only $39.00 + S/H
BRIDGE-IT 3.5 BUNDLED WITH INTERNAL 1.44MB DRIVE AT $129.00 + S/H VISA/MC/COD UPS B/R
MICROBRIDGE COMPUTERS
655 Sky Way Suite 220, San Carlos, CA 94070
1-415-593-8777(CA) **1-415-593-7675 (FAX)**
1-514-845-0818 (CANADA) **1-800-523-8777**
0908-260-188 (UK)

Inquiry 765.

UNIX under DOS !!!
Get the Feel & Power of UNIX
Include awk, cb, cp, diff, ed, find, grep, ls, make, more, mv, rm, sed, sort & 17 others. All V.3 and BSD 4.3 options included. Thorough documentation.
THE BERKELEY UTILITIES $125 order now 800-542-0938
price EFFECTIVE JULY 15 $200
OPENetwork
POWER TOOLS FOR POWER USERS
215 Berkeley Pl. (B-2), Brooklyn, NY 11217

Inquiry 766.

Recover deleted files fast!
Disk Explorer now includes automatic file recovery. You type in the deleted file's name, Disk Explorer finds and restores it. Disk Explorer also shows what's really on disk; view, change or create formats, change a file's status, change data in any sector. MS-DOS **$75** U.S. Check/Credit card welcome.
QUAID SOFTWARE LIMITED
45 Charles St. E. 3rd Fl.
Toronto, Ontario, Canada M4Y 1S2
(416) 961-8243

COPYWRITE
CopyWrite
Removes
Copy Protection
No more diskettes, manuals or codewheels.
1000's of products copied.
US $75
QUAID SOFTWARE LIMITED
45 Charles St. E. 3rd Fl, Dept B.
Toronto, Ontario, Canada M4Y 1S2
(416) 961-8243 **Fax (416) 961-6448**

REMOVE HARDWARE LOCKS
Software utility allows for the removal of hardware locks. Don't wait for your lock or key device to fail or be stolen.
Guaranteed to work! The following packages are available:

PCAD	$199.00	CADKEY	$ 99.00
MICROSTATION	$99.00	PERSONAL DESIGNER	$199.00
MasterCAM	$250.00	SmartCAM	$250.00
TANGO PCB	$ 99.00	CADVANCE	$99.00

PLUS SHIPPING AND HANDLING
PHONE (204) 669-4639 FAX (204) 668-3566
VISA and MASTERCARD Welcome
SafeSoft Systems Inc.
191 Kirkstone Way, Winnipeg, MB, Canada, R2G 3B6

Inquiry 767.

UTILITIES

OS/TOOLS — THE MISSING LINK
Powerful OS/2 command line utilities:
—Quick Change Directory
—Text Search/Replace
—File Locate/Move/Update/Delete
—Directory Delete/Rename/Sort
—Change Attributes/Date & Time Stamp
—System Information
—More. . .
A must for OS/2 users. INTRODUCTORY OFFER!
OS/2 $69 MS-DOS $39 VISA/MC/Check. 30-day money back.
Frontline Software Group, Inc.
P.O. Box 257, Bolivar, MO 65613 **(417) 326-6771**

Inquiry 768.

Why You Want BATCOM!
BATCOM is a batch file compiler that transforms your .bat files to .exe files to make them faster. BATCOM extends DOS with many new commands so you can read keyboard input, use subroutines, and much more. In addition, BATCOM protects your source code. No royalties! Only $59.95. Order today!
Wenham Software Company
5 Burley St., Wenham, MA 01984
(508) 774-7036

Inquiry 769.

WORD PROCESSING

We can read 130 languages from Armenian to Zulu
Use SPOT OCR Software with an image scanner and your PC to read 130 foreign languages, typed pages, typeset material, magazines and books into standard text files. Flagstaff Engineering can provide any OCR solution. Call today to discuss your application!
Flagstaff Engineering
1120 Kaibab Lane, Flagstaff, AZ 86001
(602) 779-3341
MasterCard—Visa—American Express Accepted

Inquiry 770.

FARSI / GREEK / ARABIC / RUSSIAN
Hebrew, all European, Scandinavian, plus either Hindi, Punjabi, Bengali, Gujarati, Tamil, Thai, Korean, Viet, or IPA. Full-featured multi-language word processor supports on-screen foreign characters and NLQ printing with no hardware modifications. Includes Font Editor. $355 dot matrix; $150 add'l for laser; $19 demo. S/H in U.S. incl'd. Req. PC, 640K, graphics. 30-day Guarantee. MC/VISA/AMEX
GAMMA PRODUCTIONS, INC.
710 Wilshire Blvd., Suite 609, Santa Monica, CA 90401
213/394-8622 Tlx: 5106008273 Gamma Pro SNM

Inquiry 771.

DuangJan
Bilingual word processor for English and: Armenian Bengali, Burmese, Euro/Latin/African, Greek, Gujarati, Hindi, Khmer, Lao, Punjabi, Russian, Sinhalese, Tamil, Telugu, Thai, Ukranian, Viet, . . . Only $109+$5 s/h (foreign + $12 s/h). Font editor included. For any IBM compatibles with dot-matrix & LaserJet printer. Demo $9+$1 s/h. Visa/MC
MegaChomp Company
3438 Cottman Ave., Philadelphia, PA 19149-1606
(215) 331-2748 **FAX: (215) 331-4188**

Inquiry 772.

YOUR SALES MESSAGE
about the special computer product or service that you provide belongs in print.
THE BUYER'S MART
can help you reach computer professionals and produce valuable inquiries for your company!
Call Brian Higgins for more information
603-924-3754

Inquiry 773.

World Radio History

Only your imagination limits how you benefit from PERCON® keyless data collection.

Checking out books or checking in employees—input data quickly and accurately using bar codes or magnetic stripes. PERCON has proven bar code solutions for IBM®, DEC™, and Apple Macintosh®. Call **1-800-8-PERCON.**

PERCON

2190 W. 11th Avenue, Eugene, Oregon 97402-3503
(503)344-1189 FAX(503)344-1399

©1989 Percon Inc. PERCON, IBM, DEC and Apple Macintosh are trademarks.

A COMPLETE 386 SYSTEM
WITH VGA COLOR AND 40 MB HARD DRIVE

$1,499

- Intel 80386-16 Mhz CPU
- 1 MB RAM Expandable to 8 MB
- 40 MB Seagate Hard Drive
- VGA Color Monitor (31) and 16-bit Card
- 1.2 MB. Floppy
- 1 serial, 1 parallel, 1 game port
- 101 Keyboard
- mini Tower case with power supply
- 2 Year Warranty

Other systems with the same configuration:
286-12: $1,299 / 386-20: $1,799 / 386-25: $2,299 / 386-33: $2,999
All upgrade options are available

SPECIAL SALE

Mother Boards (Ok):

286-12	$129	2400 Internal Modem	$ 79
386-16 SX	$299	2400 External Modem	$ 99
386-20 DX	$575	9600 FAX/Modem	$289
386-25/32K cache	$950	16-Bit VGA Card 1024x768	$115
386-33/32K cache	$1,250	I/O Card (25,1P,1G)	$ 23
486	CALL	Panasonic 1180 printer	$175
		Panasonic 1124 Printer	$285
Drives:		MS-DOS 3.3 or 4.01	$ 65
ST 251-1 Hard Drive	$295	Case with power Supplies	CALL
ST 225	$195		
1.2 Floppy	$ 68		
1.44 Floppy	$ 72		

Prices Subject to changes without notice
Quantities are limited!

First Computer Systems, Inc.
3951 Pleasantdale Road, Suite 224, Atlanta, GA 30340
Tel. (404) 441-1911 Toll Free (800) 325-1911 Fax (404) 441-1856

Don't Move!
without telling
BYTE

Clip out form below
and mail to:

BYTE Magazine
Subscriber Service
P.O. Box 850
Peterborough, NH 03458-0850

At least 8 week *before* you move, please give us your new address and/or name change

(Please Print)

New address, name

Name _____

Address _____ Apt. _____

City _____

State _____ Zip _____

Print current name and address
(or affix the mailing label from your current issue of BYTE here)

Current address, name

Name _____

Address _____ Apt. _____

City _____

State _____ Zip _____

9-Track? Just call us.

Think of us as your one-stop 9-Track shop. Whatever your PC and operating system, we've got you covered, even for ***Novell*** backup. Our software is powerful and easy to use; **DEPOT 4.0** guides you through all its commands right on the screen. And to help you get the most from all our products, we offer the best customer support in the industry. So if you need complete 9-Track solutions, there's only one thing to do: call us. We'll send you a free demo disk just for calling.

1-800-PC-9TRAK *

OVERLAND DATA
San Diego, CA

*1-800-729-8725 US & Can. • 1-619-571-5555 • FAX 1-619-571-0982

World Radio History

Circle 59 on Reader Service Card

Circle 130 on Reader Service Card (DEALERS: 131)

COMPUCOM

14,400 bps SpeedModem™ $299

Cut Back on Your Contribution to Ma Bell.

SpeedModem's throughput – up to 57.6Kbps – is nearly unbelievable. Fully Hayes-compatible, MNP-5, DIS™, fax option and more.

High-Speed Isn't Our Only Specialty.

Our 2400 bps product-family includes Hayes compatibility, MNP5, and our DIS technology improves the phone line. Try send fax.

SpeedModem 300 - 14,400 bps	$299
SpeedModem + F.F.Fax!	$399
F.F.Fax! 9600 bps send/receive	$299
MNP-5 Modem 2400-4800 bps	$169
DISMNP-5 Modem 2400-4800 bps	$193
DISModemPlus send-only fax	$139
DISModem 2400bps	$119
2400 bps Modem	$ 95

FREE $69 EasyCom™ Communications Software

Find out why Byte Magazine says, "...a real deal..." (3/89 p.102).

Call 1-800-ACT-ON-IT

(1-800-228-6648)

5-Year Warranty. 30-Day Money Back Guarantee.

Setting New Standards in Modem Value and Performance

DISC DRIVE REPAIR COUPON

Formatted Cap.	Flat Rate	SPECIAL
10-19 mb	$99	89.10
20-29 mb	$125	112.50
30-39 mb	$150	135.00
40-49 mb	$175	157.50
50-85 mb	$210	189.00
86-120 mb	$275	247.50
121-150 mb	$325	325.00
151-275 mb	$425	425.00
276-380 mb	$495	495.00

TEST & EVALUATION $25

SHIPPING YOUR DRIVE FOR REPAIR

Pack your drive carefully and well protected in a sturdy shipping box. Include with the shipment a note with your **name, address, daytime telephone number** and a brief description of the problem with the drive. If prepaying, allow $9 for shipping and insurance costs.

DATA RECOVERY • CALL FOR QUOTE

FLOPPY REPAIRS

5.25" & 3.5" • $45 8" • $135

VALID THROUGH 8/31/90

COUPON MUST BE SENT WITH DRIVE

DISC DRIVES SALE – Unbeatable Prices

3.5" with 5.25" frame, new, 35ms. 1 year warranty., auto park.

			Bare Drive	8bit XT Kit	16 Bit AT Kit
PT 338	32.1 mb,	MFM	$249	$299	$349
PT 351	42.8 mb,	MFM	289	339	389
PT 357 R	49.1 mb,	RLL	299	359	399
PT 376 R	65.5 mb,	RLL	349	399	459

MACINTOSH SCSI SUBSYSTEMS

HD/SCSI - 20	$295
HD/SCSI - 30	395
HD/SCSI - 40	495
HD/SCSI - 80	895
HD/SCSI - 150	1195

HARD CARDS

	Refurb.	New*
20mb/65ms	$199	$265
30mb/65ms	235	285
40mb/65ms	295	335
48mb/36ms		365

THOUSANDS OF DISC DRIVES IN STOCK — We Feature Technical Support for Everything We Sell — We Specialize in Disc Drives — Ask for Our Brochure

jb TECHNOLOGIES, INC.

5105 Maureen Lane Moorpark, CA 93021

Phone: 805/529-0908

Fax: 805/529-7712

BIOS SOURCE CODE

The **AT BiosKit** gives you a complete Bios with source code in C you can modify for your own applications! The BiosKit includes a Bios on diskette ready for programming Eproms, and includes the utilities you need to Rom the source code. The Bios also has a Rom Monitor/Debug and Setup. At last **you have control** over the core of your system. Over 380 pages, with diskette, $199. The **XT BiosKit** is only $99. **The Intel Wildcard Supplement** for the XT BiosKit is $49. Software tools: You need MS C and MASM 5.1 for modifying the Bios.

FREE We'll include a free copy of the pocket-sized **XT-AT Handbook by Choisser and Foster** with each BiosKit if you mention this ad when you order. Of course, this $9.95 value is also available by itself. Or buy five or more for only $5.00 each.

VISA **800-462-1042** MasterCard

In California 619-271-9526

Annabooks

12145 Alta Carmel Ct., Suite 250

San Diego, CA 92128 **Money-back guarantee**

VOICE MASTER KEY® SYSTEM II

VOICE RECOGNITION & SPEECH RESPONSE FOR IBM PC/XT/AT/386, PS/2, LAPTOPS, COMPATIBLES

FOR PRODUCTIVITY, PRESENTATIONS, SOFTWARE DESIGN, ENTERTAINMENT, LANGUAGE TRAINING, EDUCATION, MORE...

SPEECH/SOUND RECORDING AND PLAYBACK. Desktop Audio sound editing allows you to create custom sound applications. Variable sample rate (to 20 KHz) and compression levels. A four-voice music synthesizer is included also!

VOICE RECOGNITION TSR utility allows you to add voice command keyboard macros to your CAD, desktop publishing, word processing, spread sheet, or entertainment programs. Up to 64 voice commands in RAM at once--more from disk.

HARDWARE SYSTEM contains built-in speaker with separate volume and tone controls, external speaker and headphone jacks. Enclosure made of sturdy vinyl-clad steel. Attaches to parallel printer port without affecting normal printer operation (U.S. Patent 4,812,847). Headset microphone, printer cable, 9 volt AC adapter (110 volt UL/CSA listed), and comprehensive user manual included.

QUALITY THROUGHOUT. MADE IN USA. ONLY $219.95

ORDER HOTLINE: (503) 342-1271 Mon-Fri, 8 AM to 5 PM PST

Visa/MasterCard, company checks, money orders, CODs (with prior approval) accepted. Personal checks subject to 3 week shipping delay. Specify computer type when ordering. Add $5 shipping charge for delivery in USA and Canada. Foreign inquiries contact Covox for C&F/CIF quotes. OEM configurations available.

30 DAY MONEY BACK GUARANTEE IF NOT COMPLETELY SATISFIED.

CALL OR WRITE FOR FREE PRODUCT CATALOG

COVOX INC.

675 Conger Street

Eugene, Oregon 97402

TEL (503) 342-1271

FAX (503) 342-1283

BBS (503) 342-4135

Circle 27 on Reader Service Card

Circle 69 on Reader Service Card (DEALERS: 70)

World Radio History

SR. SOFTWARE DEVELOPERS & SYSTEMS ARCHITECTS

Let's Get Right To The Point

Central Point Software has become the world leader in PC Utility Software by providing our talented staff with a stimulating environment that has enabled them to produce such highly acclaimed products as PC Tools™. Our aggressive expansion plans have created a substantial number of immediate openings for skilled professionals to develop our next generation of software based on the new GUI interface for Windows and Presentation manager.

We are seeking professionals capable of taking conceptual ideas and implementing them into products. You'll be challenged to develop superior MS-DOS and/or WINDOW software in a professional C, Assembler and/or C++ environment. Requires a BS or MSCS, EE or equivalent development experience, and significant expertise in a product development environment.

Located just minutes from downtown Portland, in the beautiful and affordable Pacific Northwest, we offer exceptional opportunities for professional and personal growth. Mail or Fax your resume to **Central Point Software, 15220 N.W. Greenbrier Pkwy., #200, Beaverton, OR 97006. (503)690-2221 FAX.** For questions, call Bob Clay COLLECT at (503)690-2217. Equal Opportunity Employer.

Central Point Software INC.™

SUBSCRIPTION PROBLEMS?

We want to help!

If you have a problem with your BYTE subscription, write us with the details. We'll do our best to set it right. But we must have the name, address, and zip of the subscription (new and old address, if it's a change of address). If the problem involves a payment, be sure to include copies of the credit card statement, or front and back of cancelled checks. Include a "business hours" phone number if possible.

BYTE MAGAZINE
Subscriber Service
P.O. Box 850
Peterborough, NH 03458-0850

TOSHIBA LAPTOPS

Call for low lease prices

TOSHIBA T1000	$599
T1000 SE	$CALL
T1000 XE	$CALL
T1200 XE	$CALL
T 1600 286 20MB	$2749
T 1600 286 40MB	$2999
T3100 E 286 40MB	$2595
T3100 SX 40MB	$3595
T3200 SX 40MB	$3749
T5100 386 100MB	$4299
T5200 386 40MB	$4549
T5200 386 100MB	$4945

LOWEST $$$

LEADING EDGE 386SX 20MB	$2095
LEADING EDGE 386SX 40MB	$2195
Goldstar 500 286 20MB	$1495
Altima 286 with 40MB	$1995
Altima Notebook 386SX	$Call

800-383-3199
orders only
714-898-8626
customer service/foreign orders
FAX: 714-891-1202

SHARP MZ100 $899

- 8088-10Mhz
- 640K RAM, 2 720K floppies
- CGA backlit screen
- Serial, parallel, battery

$37/mo

SHARP 4602 $1265

- Same as MZ100 and more

SHARP 4641 $1595

- 8088-10Mhz
- 40MB hard drive
- 3.5" 720K floppy drive
- 640x400 res backlit screen

$64/mo

FINANCING AVAILABLE

SHARP LAPTOPS

NOTEBOOK $CALL

- PC 6220: 286 with 20 MB & VGA
- 8.5"x11"x1.4" - 4lb

First VGA Color Sharp $CALL

- PC 8081 386 with 80MB

SHARP 5541 $2395

- 286-40MB
- Back lit VGA screen
- 3.5" 1.44MB floppy

$99/mo

LAPTOPS

ZENITH LAPTOPS

Minisport 2MB RAM	$Call
Supersport 184	$1199
Supersport 184-2	$1695
Supersport 286 20MB	$2499
Supersport 286 40MB	$2699
386SX 40MB	$3899

NEC LAPTOPS

Ultralite 2MB	$1695
Prospeed 286 20MB	$2469
Prospeed 286 40MB	$2699
Prospeed 386 40MB	$3589
PACKARD BELL 286-20 AD 700-BT	$1765

MITSUBISHI

FREE 2400 MODEM/CARRYING CASE

MP 286-210 2 FD	$1399
MP 286-220 1 FD, 20MB	$1695
MP 286-240 1 FD, 40MB	$2195

COMPAQ LAPTOPS

LTE 286 20MB	$2999
LTE 286 40MB	$3250
COMPAQ SLT 20MB	$Call
COMPAQ SLT 40MB	$LOW

EPSON LAPTOPS

Epson 286E with 20MB	$2495
Epson 286E with 40MB	$2695
Epson 386SX	$3999
INTEL COPROCESSORS	$CALL
MEMORY ADD ON	$CALL

HYUNDAI

Super LT3 286 with 20MB	$1695
Super 386S	$Call

TEXAS INSTR.

Notebook 12 286 20MB	$2395
Model 25 286 20MB	$2395
Model 45 286 40MB	$2495

MORE LAPTOPS

Samsung 5200	$1495
Peqot	$Call
Atari portfolio list	$399 $Call
PSION	$Call
Bondwell B200 2 floppys	$795
Bondwell 310: 286 40MB	$1695
Videotech 386SX 40MB	$LOW
LAPTOP ACCESSORIES	$CALL

T.P.C. TELEPHONE PRODUCT CENTER

FAX $299

EPSON FAX (lowest$)

w/cutter F1000	$599
F2000/F3000	$645/865

CANON FAX

CANON Fax 8	$499
CANON Fax 20	$699
CANON Fax 25	$935
CANON Fax 270	$1525
CANON Fax 350	$1795

PANASONIC

KXP 80 Portable Fax	$549
KXF 120	$759
KXF 220	$1045
PD120E	$499
PANAFAX UF 140	$599
PANAFAX UF 250	$1159
PANAFAX UF 260	$1299

MURATA

Murata 1400	$645
Murata 900	$499
Murata 1850	$849
Guis 110/220v	$499
Samsung 1010	$399

TOSHIBA

TOSHIBA 3200	$599
T3600	$745
T3750	$855

T.P.C. 12603 Hoover St., Garden Grove, CA 92641

SANYO

SF2U/SF5U	$555/$959
SF 515	$1145

RICOH

RICOH RF810	$439
RICOH RF850	$579
RICOH RF900	$625
RICOH RF920	$875
RICOH Fax 15	$799
RICOH Fax 25	$1065
RICOH Fax 35	$1125
RICOH Fax 65	$1175

SHARP

SHARP FO 230	$639
SHARP FO 215	$669
SHARP FO 333	$779
SHARP FO 510	$949
SHARP FO 550	$1299
SHARP UX 110	$499

FAX CARDS

Quadram JT 9600	$399
Zoltrix 9600 FAX + 2400 Modem card	$299
Complete PC 9600 Fax card	$399 $199

SCANNERS

Complete PC Full Page	$499
Mitsubishi SP MU216AF	$595
Chinon with OCR	$795
Panasonic RS307U	$998

Terms: These are pre-payment prices. Discover, VISA MC COD + 2.9%. Restocking 20%. We accept Cashiers Checks. we check for stolen credit cards. Prices subject to change. all sales are final. Defective items repaired in warranty. NO RETURNS.

World Radio History

Compu$ave International

National Orders (800) 544-8302 Int'l Orders (602) 437-8208 FAX (602) 437-8988

DRIVES

Alloy	Call
Archive VP-60E	830
Archive VP-150E	1150
Imprimis 182 Mb	1340
Imprimis 350 Mb	1645
Imprimis 702 Mb	2295
Miniscribe 3180	1099
Mitsubishi Worm	Call
Moutain 4440	555
Panasonic Worm	Call
Plus HardCard 20	510
Plus HardCard 40	576
Quantum Pro150I	840
Praim, Iomega, Rodime, Storage Dimensions, Others	Call

BOARDS

Artist XJ10/16	1914
Boca VGA 640	130
Calcomp	Save
Genoa	Call
Intel Aboveboard+	460
Intel Inboard 386 PC	375
Metheus 1128	1899
Orchid Pro Design	250
STB VGA EM 512K	220
Tecmar Classic 512	505
Video 7 V RAM 512k	465
ATI, Alloy, Artist, Number Nine, & Others	Call

COMPUTERS

Acer SX	1410
Acer 20Mhz	2220
Acer 25 Mhz	3005
Acer 25/4	3530
Acer 33Mhz	4050
ALR 286/40	1295
Altos	Save
AST	Call
Everex	Save
Hyundai Work/ST	Call
Mitsubishi	Call
Nec ProSpeed	Call
Packard Bell	Save
Racor Work/ST	Call
Sharp 4602	1540
Samsung AT	870
Samsung 386	2200
TI LT286/12	Call
TI LT286/45	Call
Toshiba Laptops	Call
Wyse 2108	665
Wyse 3216-01	Call
Other Models	Call

CD-ROMS

Hitachi CDR360	565
Hitachi CDR1503S	605
NEC PORT35	420
NEC CDR-77	560
NEC CDR-80	490
Toshiba Ext	805

PLOTTERS

Calcomp 1023	3665
Calcomp 1025E	4785
Calcomp 1043 DM	5790
Calcomp 1044GT	8615
Enter SP600	605
Houston DMP 52	Call
Houston DMP 62	Call
HP 7475 A	1380
HP 7550	2895
HP 7570	2895
HP 7595	6470
HP 7596	8370
HP DraftPro	Call
Ioline 3500	Call
Ioline 3700-1	Call
Ioline 3700-8	Call
Ioline 4000-1	Call
Ioline 4000-8	Call
Roland 885	715
Roland CAMM 1	3155
Roland CAMM-2	2110
Roland DPX 2000	2110
Roland DPX 2200	Call
Roland DPX 3300	2802
Roland DXY 1100	910
Roland DXY 1200	1330
Roland DXY 1300	1755
Roland GRX - 300	D2805
Roland GRX - 400	E3505
Roland LTX-120	2315

PRINTERS

Canon BJ 130E	705
Canon LBP-4	955
C.Itoh C5000	1610
Data Products 870p	1195
Diconix 150 Plus/P	345
Fujitsu DL3400	520
Genicom	Save
HP Paintjet	1025
Mitsubishi Color	Call
NEC LC 890 Laser	3240
NEC P2200XE	335
NEC P5200	520
NEC P5300	705
Okidata ML 321	475
Okidata ML 390	475
OTC 850XL	1645
Panasonic All	Call
QMS	Call
Qume Crystal Print	2725
Qume Script Ten	3145
Seiko Smart Label	195
Texas Instruments	Save
Toshiba 321SL	Save

SOFTWARE

We carry every major publisher and title! Call now and get our lowest current price!

MODEMS

ATI 2400 Etc/E	205
Corporate Voice	99
Everex	Save
Hayes Smart 2400	345
Hayes Smart 2400B	250
Megahertz Laptops	Call
Multitech 9600	475
Multitech v.32	675
Telebit T1000 9600	590
Telebit T2000	1050
Touchbase Systems	Call
USR HST 9600	605
USR HST V.32	Call
USR HST Dual Std	995
Ven-Tel Mac 2400E	Save

TERMINALS

Altos	Call
IBM 3151-110	350
Kimtron KT-70 PC	345
Link MC-5	315
Qume 203	335
Televideo 955	379
Televideo 965	395
Texas Instruments	Save
Unisys	Call
Wyse 30	295
Wyse 50	365
Wyse 60	399
Wyse 99 GT	475
Wyse 150	380

MONITORS

Amdek 732 VGA	425
Amdek 738	570
AST Turbovision	1645
Goldstar 1420	335
Goldstar 1430	345
Hitachi All	Call
Imtek Multiscan	425
Magnovox 14" VGA	395
Mitsubishi 1381A	505
Mitsubishi 1429	410
Mitsubishi HL 6605	1205
Mitsubishi HL 6905	2025
Nanao 9070S	995
NEC Multisync II	610
NEC Multisync 2A	485
NEC Multisync 3D	650
NEC Multisync 4D	1205
NEC Multisync 5D	2420
NEC Multisync XL	1915
PGS Ultra 16	885
PGS UltraSynch	500
Phillips	Call
Samsung 14" EGA	375
Seiko 1440	590
Seiko 2050	2095
Sigma Laser All	Call
Sony 1304	680
Sony 1320	505
Taxan 1000 Ultra	2445
Zenith 1492	645

DIGITIZERS

Calcomp 12x12	375
Calcomp 36x48	Call
GTCO 12x12	325
Hitachi	Call
HP	Call
Kurta 12x12	380
Kurta IS 12 x 17	616
Numonics	Save
Scriptel	Call
Sieko 3503	285
Summa Sketch II	345
Summa 12 x 18	625

Other sizes are available. Call for current pricing!

SCANNERS

Calera TrueScan S 2015	
Calera Scan IX-12	185
Datacopy 730	1099
Datacopy 730GS	819
Datacopy 830	1695
DFI Handy Scanner	250
Logitec	Call
Mitsubishi MS200	725
Panasonic RS307U	1050
Panasonic RS505U	795
Panasonic RS506U	1055

SPECIALS

Computone	Call
Zenith 1490 Stands	$5
Mirus	Call

Address: Compu$ave International - 4209 S. 37th Street - Dept B7 - Phoenix, AZ 85040 •Order lines open: Mon.- Fri. 7 am - 5 pm.

Prices reflect U.S. currency cash discounts and are subject to change without notice. We do not guarantee compatibility nor do we recommend. Please call or FAX before ordering. Major credit cards are accepted. All products carry manufacturer's warranty only. We do not honor rebates, extended guarantees or promotional programs. International Orders add 5%.

- COMPAQ- AST- HEWLETT-PACKARD - ZENITH - **MEMORY UPGRADES** - IBM- EVEREX -TOSHIBA - APPLE - DELL -

FIRST SOURCE INTERNATIONAL, INC.

WE ACCEPT INTERNATIONAL ORDERS

4000 Barranca Parkway, Suite 250

Irvine, California 92714

PH: (714) 262-3226 FAX: (714) 262-9145

OUTSIDE CA 1-800-535-5892

We will beat any advertised price!

VISA MasterCard AMERICAN EXPRESS

IBM PS/2

Models 30-286,50,50Z,60		
512K Kit	30F5348	$67.50
2MB Kit	30F5360	$210.00
Models 70-E61/121,55SX,65SX		
1MB	6450603	$125.00
Models 70-E61/121,50Z,55SX		
2MB	*6450604*	*$240.00*
Model 70-A21		
2MB	6450608	$240.00
Model 55SX,65SX		
4MB	*34F2933*	*$865.00*
Model 80-041		
1MB	6450375	$222.00
Models 80-111/121/311/321		
2MB	6450379	$409.00
All Models 70 and 80		
2-8MB	6450605	$725.00
Models 50,50Z,55SX & 60		
2-8MB	1497259	$725.00

LASER PRINTERS

Hewlett-Packard LaserJet II & IID		
1MB	33443B	$169.00
2MB	33444B	$279.00
4MB	33445B	$459.00
Hewlett-Packard LaserJet IIP & III		
1MB	33474A	$169.00
2MB	33475A	$279.00
4MB	33477A	$459.00
IBM Laser 4019		
1MB	1039136	$309.00
2MB	1039137	$449.00

FSI has 1M & 4M memory upgrades for the Apple Laserwriter II/NTX !

COMPAQ

Deskpro 286		
512K Kit	113012-001	$70.00
Deskpro 286-E,386-20/20E,25,Portable 3		
1MB	113131-001	$179.00
4MB	*113132-001*	*$439.00*
Portable 386		
1MB Kit	107651-001	$299.00
Deskpro 386-16		
1MB Kit	108071-001	$299.00
4MB Kit	108072-001	$869.00
Deskpro 386S		
1MB	113646-001	$179.00
4MB	112534-001	$439.00
Deskpro 386-33		
2MB	115144-001	$320.00

ALL Compaq boards also available!

AST

Bravo-286,Workstation		
512K Kit	500510-010	$63.00
2MB Kit	500510-002	$180.00
Premium 386-16/20C		
1MB Kit	500510-007	$95.00
4MB Kit	500510-008	$356.00
Premium 386-20		
1MB Kit	500510-003	$156.00
4MB Kit	500510-004	$356.00
Bravo 386-SX		
2MB Kit	500510-002	$180.00
4MB Kit	500510-008	$356.00
Premium 386-SX/25		
1MB	500718-001	$146.00
Premium 386-33,486-25		
1MB	500718-002	$155.00

LAPTOP MODELS

TOSHIBA

Models T8500,T5200		
2MB	PC10-PA8304V	$399.00
Model T5100		
2MB	PC7-PA8301V	$399.00
Model T3200SX		
2MB	PC12-PA8307V	$399.00
Model T3200		
3MB	PC6-PA7137V	$699.00
Model T3100		
2MB	PC3-PA7135E	$439.00
Model 3100E		
2MB	PC9-PA8341V	$399.00
Model T1600		
2MB	PC8-PA8302V	$399.00

ZENITH

Super Sport 286		
1MB	ZA180-66	$199.00
4MB	ZA180-67	$899.00

COMPAQ

Portable LTE 286		
1MB	117081-001	$295.00
2MB	117081-002	$485.00
SLT-286		
1MB	110235-001	$325.00

ZENITH

Models Z386-20/25		
1MB	ZA3600ME	$149.00
Model Z386-20		
2MB	ZA3600MG	$275.00
Model Z386-33		
1MB	ZA3800ME	$149.00

SIMMS

Also available in static column

IBM TYPE

ADD $10.00 FOR SIPPS

4Mx9-80	*$469.00*
1Mx9-12	$83.00
1Mx9-10	$84.00
1Mx9-80	$88.00
1Mx9-70	$91.00
256x9-12	$25.00
256x9-10	$27.00
256x9-80	$29.00
256x9-60	$49.00

APPLE TYPE

ADD $10.00 FOR SIPPS

1Mx8-12	$73.00
1Mx8-10	$75.00
1Mx8-80	$78.00
256x8-12	$24.00
256x8-10	$26.00
256x8-80	$28.00

New IIfx in stock!

DRAM

DIP,ZIP,OR SOJ

1MG X 1	
1Mx1-10	$8.75
1Mx1-80	$8.95
1Mx1-70	$9.00
1Mx1-60	$CALL
256K X 4	
256x4-10	$10.50
256x4-80	$11.00
256K X 1	
256x1-12	$2.40
256x1-10	$2.80
256x1-80	$3.20
256x1-70	$3.45
64K X 4	
64Kx4-10	$4.00
64Kx4-80	$4.50
64K X 1	
64Kx1-12	$1.49
64Kx1-10	$1.59

WE ACCEPT PURCHASE ORDERS FROM UNIVERSITIES, QUALIFIED FIRMS AND GOV'T AGENCIES

TERMS AND CONDITIONS

- ✔ We accept Mastercard, Visa, American Express (Add 4%). C.O.D. Cash or Cashier check
- ✔ 1 Year warranty on all products.
- ✔ 20% Restocking fee on non-defective returns & refused orders. RMA# required, returns without RMA# will be refused. Shipping charges non refundable. Credit only after 15 days.
- ✔ PRICES AND AVAILABILITY SUBJECT TO CHANGE WITHOUT NOTICE!

World Radio History

Circle 257 on Reader Service Card

Scottsdale Systems — Since 1980 — 1-800-777-2369

COMPUTERS
SCOTTSDALE SYSTEMS

386-SX w/K B Monitor, 1 Meg of RAM ... $1655
386-33 MHz w/K B Monitor 4 Meg of RAM ... $3925

Choice of Full Size Desktop Case or Full Size Tower Case
Each Scottsdale Machine Has a 1 Year Warranty on Parts & Labor via Overnight Service on Warranteed Products

Altos W/Xenix ... SAVE

WYSE 386 25 MHz
1 Year Warranty ... $3920
WYSE 386 16 MHz ... 2214
MATH CO-PROCESSORS ... CALL

WYSE 286
Model 2112 ... $1284
Model 2116 ... 1351

TERMINALS/MONITORS

WYSE TERMINALS
WY 30 G/A w/Keyboard ... $290
WY 50 G/A-w/Keyboard ... 377
WY 60 G/W/A w/Keyboard ... 405
WY 99 GTA w/Keyboard ... 468
WY 150 G/W/A-w/Keyboard ... 367
WY-212 G/W-w/Keyboard ... 1489
WY Height Adjustable Arm ... 95

MONITORS
NEC 2A/3D ... $499/649
NEC 40/5D ... 1160/2385
Mitsubishi Diamond Scan ... 528
Seiko 1440 ... 615
Sony 1303/1302 ... 577/649
Hitachi Super Scan ... 1999
Philips 20"Hi Res ... 2059

QUME
QVT 101 Plus G/A/W ... $316
QVT 119 Plus G/A/W ... 395
QVT 203 Plus G/A/W ... 443
QVT PCT G/A/W ... 365

WYSE MONITORS
WY 530 G/A ... $169
WY 550 AW ... 179
WY 650 ... 459
WY 700 ... 695

IBM TERMINALS
IBM 3 Year Warranty ... CALL
Link MC 5 ... 405
Altos 7 ... 457

IMTEC
ImTec 1270/1470 ... $90/121
ImTec 1430/1441V ... 348/293
ImTec 1432M ... 425

KIMTRON
KT 70PC ... $349

ACER
14" Multiscan ... 438
14" VGA 640x480 ... 349
14" Amber nonglare ... 129

Authorized Service for WYSE
LEASING AVAILABLE

INTERNATIONAL ORDERS WELCOME

PLOTTERS

IDLINE
A&D/LP 3500 ... $2339
A&D/LP 3700 ... 2889
LP 3700-8 ... 3129
LP 4000-1 ... 3579
LP 4000-8 ... 3935
Vinyl Cutting Machines ... CALL
Blades & Hot Tips ... CALL

HOUSTON INSTRUMENTS
Img Mkr ... $982
DMP 52/52 ... 2425/2866
DMP 61/62 ... 2941/3895
DMP 61 DL ... 3743
DMP 62 DL ... 4737

ENTER
SP600 ... $599

CALCOMP
1023/1025 ... $3715/4519
1043DM/1044 ... 5869/8739
5902/5902A ... 3819/4275
DM 52224 ... 11,919

HEWLETT PACKARD ... CALL
OPTICAL SCANNER & SOFTWARE
Data Copy ... CALL
Panasonic RS 505/506 $1037/1315
Microtek ... CALL
AMT
AMT ACCEL 500 Intelli Plot $1699

Roland DESKTOP PLOTTERS
1 Year Warranty
DXY 1100 ... $895
DXY 1200 Electrostatic
Paper Hold ... 1295
DXY 1300 Electrostatic
Paper Hold ... 1625

Roland DRAFTING PLOTTERS
1 Year Warranty
GRX 300 AR ... $3229
GRX 400 AR ... 3559

Roland FLATBED PLOTTERS
1 Year Warranty
OPX 2500 Pen or Pencil w/Stand ... $4275
OPX 3500 Pen or Pencil w/Stand ... 4628

Roland THERMAL PLOTTERS
LTX 420 ... $9259
LTX 320 ... 7125
LTX-120 ... 2135

Roland CAMM MACHINES
Software & Accessories ... CALL
Authorized Service for
Roland Plotters and CAMM Machines
UNITED INNOVATIONS
Model 7000A-C (1 year warranty) ... $1899
Model 8000A-D ... 2059
Model 9000A-E ... 2829

DIGITIZERS

KURTA
Lifetime Warranty On Kurta IS-1
IS-1 12x12 Cordless 4-button cursor, pen stylus and interface kit ... $439
IS 1 12x17 Cordless 4-button cursor, pen stylus and interface kit ... 629

CALCOMP
Cal Comp 23120 12x12 ... $365
Cal Comp 9100 Series ... CALL
Cal Comp 9500 Series ... CALL
Cal Comp Wiz ... 165

SUMMAGRAPHICS
Lifetime Limited Warranty
12x12 Summasketch II ... $355
12x18 Professional ... 620

HITACHI ... CALL

GENIUS TABLET
12x12 w/Cursor, Stylus & Software
3 Year Warranty on Tablet ... $299

Call For Pricing On Larger Digitizers

PRINTERS

ALPS Allegro ... $345
ALPS 324E ... 735
AMT ACCEL ... 1299
Canon BJ 130E ... 725
Panasonic 1191 ... 237
Panasonic 1180 ... 185
Okidata all models ... CALL
OTC all models ... CALL
Genicom all models ... CALL
Toshiba all models ... CALL
Citizen all models ... CALL
Diconix 150P/300P ... CALL
NEC P-2200 ... $315
NEC P-5200 ... 505
NEC P-5300 ... 659
NEC LC-890 ... 3159

Authorized Service for TriMatrix

BOARDS

Genoa Intel ... CALL
Vericom All Models ... CALL
BOCA ... CALL
VMI/Cobra All Models ... CALL
Paradise VGA Plus ... $289
Paradise Prof ... 495
Control Systems/NEC ... CALL
Number Nine/Laicomp ... CALL

MODEM

U S Robotics all models ... SAVE

MULTITECH SYSTEMS

All Models ... SAVE

NOVELL

ARCNET
Coax Startopology ... $112
16 Bit Coax ... $360

TIARA ETHERNET
Lancard/E PC 8-Bit ... 215

TIARA ARCNET
Lancard/A PC ... 91

SYNOPTICS
2500/2510 Workgroup ... CALL

LASER PRINTERS

QUME Apple & IBM ... $3199
H P Laser III ... 1799
Panasonic 3440 ... 1199
Panasonic 4450 ... 1395
LPB 8111 ... 1795
LPB 4 ... 959

LAPTOPS

Samsung 286 ... $2199
Texas Instruments ... CALL

IDMEGA

Bernoulli Box
B-120-1.21-4 MB Internal ... $895
144-1.44 MB Internal ... 1095
Prices do not include interface

ALLOY
Alloy IMP 2 & IMP 8 Cards ... SAVE
Multiware 386 & 286 Versions ... SAVE
Retriever 60 or 200 ... SAVE

POWER PROTECTION
Datashield ... SAVE
Safe Power Systems ... SAVE
TrippLite ... SAVE

TAPE BACKUPS
Emerald Systems all models ... SAVE
Genoa all models ... SAVE
Irwin all models ... SAVE

HARD DRIVES
CDC IMPRIMIS
1 Year Warranty
72 MB thru 600 MB ... CALL
Maxtor ... CALL

SOFTWARE
CAD SOFTWARE
DESIGN CAD ... $220
EZ CAD ... 139
TURBO CAD ... 69

MULTI USER
SCO Xenix 386 ... 510
Concurrent DOS 386 10 User ... 310

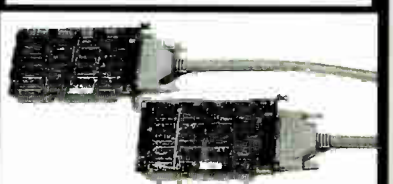
All software sales are final
CALL SERVICE FOR REPAIRS ON PRINTERS, TERMINALS, MONITORS, COMPUTERS.
Monitors, Computers

1555 W. University Dr. #101, Tempe, AZ 85281

Prices listed are for cash. Discovery, MasterCard and Visa add 1.67%. AZ residents add 6-1/2% tax, add 3% for C.O.D. add 5% for P.O. International orders welcome. All items are new with manufacturer's warranty. Returned products subject to 20% restocking fee and in new condition in original packaging, with all warranty cards, manuals and cables. No credit issued after 30 days from date of shipment. We do not guarantee compatability. Personal and company checks take up to 5 days to clear. Prices and specifications subject to change. Product subject to availability. all applicable trademarks recognized and on file.

602-966-8609 SERVICES (Mon.-Fri.) 602-731-4742 FAX 602-966-8634

PC-LabCard



PC Bus Extension Kit for XTs & ATs

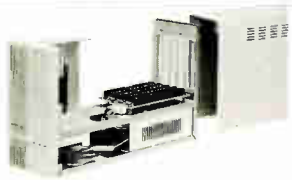
PCX-795
- Excellent solution for PC running out of slots
- Bus extender between host PC and expansion unit
- All signals buffered on extended slots
- Supports DMA and wait-state insertion
- Cable assembly for one meter extension

Advantech

USA & Canada: San Jose,CA
Tel: 408-293-6786 Fax: 408-293-4697
International: Taipei, Taiwan
Tel: 886-2-9184567 Fax: 886-2-9184566

Circle 24 on Reader Service Card

PC-LabCard



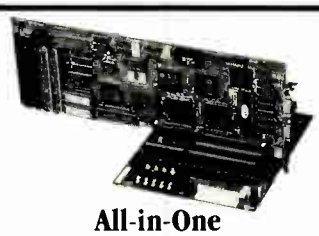
Compact & Rugged Chassis for PC-Bus Node Computer

PCXU-205
- Passive backplane with 5 AT slots
- Built-in 65 watt power supply
- Supports one 3.5" or 5.25" flnppy drive
- Supports one 3.5" hard disk
- Built-in 8 ohm speaker and cooling fan
- Dimensions 4.76" × 15.85" × 9.7"
- Low cost and easy-to-use

For Your Catalog Call
408-293-6786

Circle 24 on Reader Service Card

PC-LabCard



All-in-One 80286-12MHz CPU Card

PCA-6125
- 12MHz 80286 microprocessor
- Socketed for 80287 math coprocessor
- Popular AMI BIOS assures compatibility
- Up to 4 Mb flexible memory configuration
- Built-in HD/FD interface
- Supports 2 serial/1 parallel ports
- VLSI CMOS for low power consumption

For Your Catalog Call
408-293-6786

Circle 24 on Reader Service Card

World Radio History

FAX ANGEL®
PHONE & FAX on 1 Line!

- Auto. switch
- Voice-guided
- Compatible w/ all phones, FAXes, PC FAXes & answering machines

$145 Limited time

(800) 292-7771
VISA, M/C

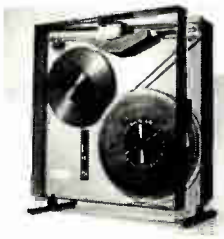
For demonstration call or FAX (714) 859-2110

ADD ON AMERICA
Division of ROHM Corporation
15 Whatney, Irvine, CA 92718

Circle 12 on Reader Service Card

MULTI-SPEED !!!
9 TRACK TAPE SUBSYSTEM
for IBM PC/AT/386

1 YEAR WARRANTY



- **IBM/ANSI** compatible at 800*/1600/3200 bpi
- Controller, cables and software included
- Interfaces for PS/2*, Xenix* and DEC*
- SCSI*, AT or MCA* Bus I/O at 25/50/100 ips

*OPTIONAL SHOWN W/OPTIONAL DUST COVER

AKSystems Inc.
20741 Marilla St. Chatsworth CA 91311
TEL:818/709-8100 FAX: 818/407-5889

Circle 15 on Reader Service Card

DATA ACQUISITION

MEASURMENT TO GO

ALL needs ! ANY computer !
- PC Software Included
- Serial, Modem, & Bus
- Stand Alone Ability
- Laptop & Handheld
- PC & MAC Cards
- Inexpensive
- OEM & VAR
- RTU's

Call for FREE DEMO DISK !

Specialists in portable and battery backed up as well as PC compatible modular systems.

Call for applications info: **(201) 299-1615**
P.O. Box 246; Morris Plains, NJ 07950

ELEXOR

Circle 93 on Reader Service Card

BLAST YOUR MESSAGE THRU!

VOICE MAIL • TELEMARKETING
CALL PROCESSING

Let Powerline transform your PC/XT/AT/386 into a multi-line voice processing command center. Have your computer intelligently process your sales, inquiries and messages. Complete package.

Single Line (BigmOuth) . . **$295.00**
Multi-Line **$895.00**
(Developer/OEM packages available)
VISA - MC - AMEX - COD

Call: (415) 652-9600
FAX: (415) 652-5311

TALKING TECHNOLOGY, INC.
4383 PIEDMONT AVE., OAKLAND, CA 94611

1990 TALKING TECHNOLOGIES INC

Circle 274 on Reader Service Card

UNIVERSAL/GANG PROGRAMMER
made in U.S.A.

$695.00 includes One Year Update and Warranty

HUSKY programs EE/EPROMS, CMOS PLDS, and Micros. It's your best bet when low cost and quality are both important.

From the people who make CUPL and ALLPRO.

LOGICAL DEVICES, INC.
1201 N.W. 65th Place
Ft. Lauderdale, FL 33309
FAX: (305) 974 8531
1-800-331-7766

Circle 145 on Reader Service Card (DEALERS: 146)

PAL™/PLD SOFTWARE
Sets The Standard

Not Protected

CUPL™ PLD complier, the most powerful language for the state machine logic design, now allows front end design entry with popular schematic capture packages such as OrCAD, P-CAD, Schema, Hi-Wire, PADs or RACAL. CUPL supports all PLDs and carries the most extensive update program. Available on MS-DOS™, Apollo™, SUN™, VAX™ and most UNIX™ based platforms.

LOGICAL DEVICES, INC.
1201 N.W. 65th Place
Ft. Lauderdale FL 33309
Fax: (305) 974-8531
1-800-331-7766

Circle 147 on Reader Service Card (DEALERS: 148)

Circle 83 on Reader Service Card (DEALERS: 84)

3M

DS-DD	Export Quantity Discounts	DS-HD
5.39 PER BOX	5.25" 3M Brand Diskettes	10.39 PER BOX
8.69 PER BOX	3.50" 3M Brand Diskettes	16.49 PER BOX

3M DATA CARTRIDGES

DC-2000	14.29	DC-600A	19.95
DC-300XLP	17.99	DC-6150XTD	20.95

3M COMPUTER TAPES

777-½"-2400'-C55	11.95	700-½"-2400'-C55	12.95
777-½"-1200'-C55	8.95	700-½"-2400'-C143	13.45
DEC-TK-50	25.95	DEC-TK-52	39.95

BASF

DS-DD	Quantity Discounts Available	DS-HD
4.79 PER BOX	5.25" BASF Brand Diskettes	7.99 PER BOX
7.39 PER BOX	3.50" BASF Brand Diskettes	14.95 PER BOX

.32 BASF 5.25" DS-DD No-Logo Bulk with sleeves, labels & W/P tabs

2400' w/tape seal	10.95	600' w/tape seal	6.95
1200' w/tape seal	7.95	300' w/tape seal	5.45

Verbatim DataLifePlus
Teflon/Preformatted

DS-DD	Quantity Discounts Available	DS-HD
5.79 PER BOX	5.25" DataLife Plus Diskettes	10.49 PER BOX
8.69 PER BOX	3.50" DataLife Diskettes	16.95 PER BOX

KAO Premium Quality Color Diskettes

5.25" DS-DD		5.25" DS-HD
.39	Color-Bulk	.69
5.95 PER BOX	Colorpack In Plastic Box	9.95 PER BOX
3.50" DS-DD		**3.50" DS-HD**
.69	Color-Bulk	1.39
9.99 PER BOX Colorpack In Plastic Box		3.50" DS/HD 2 MB 15.95 PER BOX

3M HIGHLAND DISKETTES
GREAT QUALITY AT ECONOMY PRICES!!

5.25" DS-DD		5.25" DS-HD
3.79 PER BOX	3M Highland	6.89 PER BOX
7.29 PER BOX	3.50" BRAND NAME	14.39 PER BOX

BULK DISKETTES

5.25" DS/DD	5.25" DS/HD	3.50" DS/DD	3.50" DS/HD
.25*	.49*	.49	1.29

*WITH SLEEVES, LABELS AND W/P TABS

CALL FOR BEST PRICES ON MAXELL, DYSAN, NASHUA & SONY DISKETTES!!

TERMS: No surcharge on VISA, Mastercard or AMEX. Order packaging and processing = $2.95 per order. COD orders add $3.95. PO's accepted from recognized institutions on Net 30 days. L/C, T/T and Bank Draft acceptable. Price quoted for case (100 disks or 10 cartridges). For quantities less than 1 case add 10%. **SHIPPING:** UPS surface $1.95/5 cartridges; $0.95/50 diskettes. (Prices subject to change without notice. Errors and omissions not accepted. All warranties are from manufacturers.)

Toll Free Order Line: **1-800-523-9681** TLX-9102404712
Information Line: **1-801-255-0080** FAX-801-572-3327

DISKCOTECH
213 Cottage Avenue
P.O. Box 1339 Sandy, Utah 84091

World Radio History

Mail Order Electronics · Worldwide
Jameco ELECTRONICS®

24 Hour Order Hotline (415) 592-8097

QUALITY PRODUCTS • COMPETITIVE PRICING • PROMPT DELIVERY

Intel Math Coprocessors

8088 or 8086 Systems

8087	5MHz	$89.95
8087-2	8MHz	$129.95
8087-1	10MHz	$169.95

80286 Systems

80287	6MHz	$139.95
80287-8	8MHz	$209.95
80287-10	10MHz	$239.95

80386 Systems

80387-16	16MHz	$349.95
80387-20	20MHz	$399.95
80387-25	25MHz	$499.95
80387-33	33MHz	$649.95

SIP Modules

41256A9A-80	80ns, 256Kx9	$54.95
41256A9A-10	100ns, 256Kx9	$44.95
421000A9A-70	70ns, 1Mx9	$169.95
421000A9A-80	80ns, 1Mx9	$124.95
421000A9A-10	100ns, 1Mx9	$116.95
94000L-80	80ns, 4Mx9	$499.95
94000L-10	100ns, 4Mx9	$499.95

SIMM Modules

41256A9B-80	80ns, 256Kx9	$49.95
41256A9B-10	100ns, 256Kx9	$39.95
421000A8B-10	100ns, 1Mx8	$109.95
421000A9B-70	70ns, 1Mx9	$139.95
421000A9B-80	80ns, 1Mx9	$119.95
421000A9B-10	100ns, 1Mx9	$113.95
94000S-80	80ns, 4Mx9	$499.95
94000S-10	100ns, 4Mx9	$499.95

NEC V20 & V30 Chips

UPD70108-5	5MHz, V20 Chip	$5.25
UPD70108-8	8MHz, V20 Chip	$6.95
UPD70108-10	10MHz, V20 Chip	$10.95
UPD70116-8	8MHz, V30 Chip	$7.95
UPD70116-10	10MHz, V30 Chip	$13.49

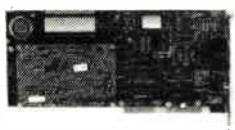
Dynamic RAMs

TMS4416-12	120ns, 16Kx4	$2.25
TMS4416-15	150ns, 16Kx4	$2.00
4116-12	120ns, 16Kx1	$1.49
4116-15	150ns, 16Kx1	$1.09
4116-20	200ns, 16Kx1	$.89
4164-100	100ns, 64Kx1	$2.75
4164-120	120ns, 64Kx1	$2.39
4164-150	150ns, 64Kx1	$2.15
4164-200	200ns, 64Kx1	$1.75
41256-60	60ns, 256Kx1	$5.25
41256-80	80ns, 256Kx1	$3.75
41256-100	100ns, 256Kx1	$3.15
41256-120	120ns, 256Kx1	$2.95
41256-150	150ns, 256Kx1	$2.59
41464-80	80ns, 64Kx4	$5.95
41464-10	100ns, 64Kx4	$4.95
41464-12	120ns, 64Kx4	$3.95
41464-15	150ns, 64Kx4	$3.59
511000P-70	70ns, 1Mx1	$13.95
511000P-80	80ns, 1Mx1	$12.95
511000P-10	100ns, 1Mx1	$12.35
514256P-80	80ns, 256Kx4	$13.45
514256P-10	100ns, 256Kx4	$12.95

Static RAMs

6116P-3	150ns, 16Kx 1(CMOS)	$2.79
6264LP-10	100ns, 64Kx1 (CMOS)	$6.95
6264LP-15	150ns, 64Kx1 (CMOS)	$4.95
43256-10L	100ns, 256Kx1	$10.95
43256-15L	150ns, 256Kx1	$9.95
62256LP-15	150ns, 256Kx1 (CMOS)	$10.95

Niche Tek 9600 Baud FAX Board



- 9600 Baud Communication Rate
- Unit will turn the computer on, send or receive FAX, then turn off
- Features: Multiple Telephone Directory, Scheduling System and Transaction Log

FAX96.....$299.95

Jameco 8MB EMS RAM Expansion Card

• IBM AT/286 and compatible computers • Capable of operating at a bus speed of 12MHz • Expandable up to 8MB using 1MB SIMM modules in increments of 2MB (zero-MB on-board) • Selectable configuration

JE1084.....$199.95

Sony 3.5" 720KB Disk Drive

- IBM PC/XT/AT Compatible
- Double-sided, double-density
- Documentation included

MPF11 Disk Drive $69.95

SMK 5.25" Installation Kit for MPF11 ....$14.95

A.R.T. EPROM Programmer

• Programs all current EPROMs in the 2716 to 27512 range plus the X2864 EEPROM • RS232 port for connection to computer (required) • PC Software included

EPP.....$179.95

Metex Digital Multimeters

General Specs:
- Handheld, high accuracy • AC/DC voltage, AC/DC current, resistance, diodes, continuity, transistor hFE
- Manual ranging w/ overload protection

M3650, 3650B & M4650 only:
- Also measure frequency and capacitance

M4650 only: • Data hold switch • 4.5 digit

M3610	3.5 Digit Multimeter	$49.95
M3650	3.5 Digit Multimeter w/Frequency & Capacitance	$69.95
M3650B	Same as M3650 w/Bargraph	$74.95
M4650	4.5 Digit w/Frequency, Capacitance and Data Hold Switch	$99.95

Jameco 12MHz 80286 Desktop Computer Kit

- Fully IBM AT Compatible
- Free! DR DOS (Disk Operating System) Software Included
- Free! QAPLUS Diagnostic Software Included!
- Free! WORDSTAR EASY Word Processing Software Included!
- 512KB RAM Included, Expandable to 4MB on board
- 8/12MHz Keyboard Switchable Operation
- AMI BIOS ROMs Included
- Fliptop Case w/200 Watt Power Supply
- Teac 5.25" 1.2MB DSHD Disk Drive
- Parallel Printer Port, Serial (RS232) Port, Game Port
- Fujitsu 101-Key (Enhanced) Keyboard

Shown with EGA Option (not included)
JE1059 EGA Monitor and EGA Card....$509.90
(See Right)

JE3008 12MHz 80286 Compatible Kit.....$599.95

Seikosha Printers

SEIKOSHA
A SEIKO GROUP COMPANY

9-Pin IBM Compatible Printer
SP2000 ..... $199.95

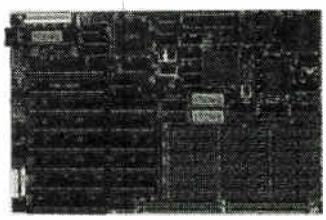
24-Pin High-Quality IBM Compatible Printer
SL90 ..... $329.95

24-Pin Multi-Font Wide Carriage IBM Compatible Printer
SL230 ..... $499.95

9-Pin High Speed Wide Carriage Black & White / Color IBM Compatible Printer
SK3005 ..... $469.95
SCK2 Optional Kit allows Color Printing on the SK3005 ..... $149.95

SL90

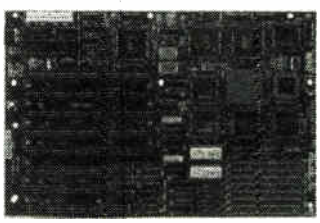
Jameco 16MHz 80286 Motherboard



- Baby size motherboard
- Expandable to 1MB RAM using 256KB DRAM chips or 4MB using 1MB DRAM chips
- Additional 1MB with 256KB DRAM SIPs or 4MB with 1MB DRAM SIPs for a total of 8MB
- Uses 100ns DRAMs
- 8/16MHz hardware or keyboard selectable operation
- AMI BIOS ROMs included
- 16MHz CMOS Harris CPU
- Supports all NEAT® CHIPSet™ functions including shadow RAM, LIM EMS 4.0, RAM re-mapping, selectable wait states, memory interleaving, etc...
- Battery-backed clock/calendar
- Five 16-bit and three 8-bit expansion bus slots
- Size: 13" x 8.5"

JE3010.....$299.95

Jameco 20MHz 80386 Motherboard



- Baby size motherboard
- Expandable to 2MB RAM using 256KB SIPs, 8MB using 1MB SIPs or 16MB using the optional JE3530 memory card (Please note the minimum RAM expansion is 4 SIP Modules at a time)
- Uses 100ns SIPs
- Includes battery pack
- 8/20MHz keyboard selectable operation
- AMI BIOS ROMs included
- Shadow RAM for fast BIOS and video performance
- Adjustable bus speeds and wait states
- 8 expansion slots - one 32-bit (for optional memory card), five 16-bit, and two 8-bit
- Size: 13" x 8.5"

JE3520 20MHz 386 Baby Motherboard.....$629.95

JE3530 8MB 32-bit Plug-in Memory Card for JE3520 (Zero MB RAM) $129.95

Partial Listing • Over 4000 Components and Accessories in Stock! • Call for Quantity Discounts

Circle 129 on Reader Service Card

World Radio History

Mail Order Electronics · Worldwide

Jameco ELECTRONICS

Request Jameco's 1990 Catalog for a Complete Listing of Components, Test/Measurement Equipment and Computer Products

Jameco 20MHz 80386 Desktop Computer Kit

- Fully IBM Compatible
- Free! Concurrent 386 (Disk Operating System) Software Included
- 4MB RAM Included, Expandable to 8MB on board, 16MB with optional expansion board
- 8/16/20MHz Keyboard Switchable Operation
- AMI BIOS ROMs Included
- Fliptop Case w/200 Watt Power Supply
- Conner High-Performance IDE 3.5" 40MB Hard Disk Drive
- Teac 1.2MB Floppy DSHD Disk Drive
- Multi I/O Card with Universal Floppy Controller
- Fujitsu 101-Key (Enhanced) Keyboard

Shown with VGA Option (not included) JE2059 Multiscan Monitor and VGA Card....$669.90 (See Below)

JE3551 20MHz 80386 Compatible Kit.....**$1949.95**

Jameco IBM PC/XT/AT Compatible Cards

JE1057

JE1043	360KB/720KB/1.2MB/1.44MB Floppy Disk Controller Card (PC/XT/AT)..	**$49.95**
JE1050	Monochrome Graphics Card w/Parallel Printer Port (PC/XT/AT)	**$49.95**
JE1052	Color Graphics Card w/ Parallel Printer Port (PC/XT/AT)	**$49.95**
JE1055	EGA Card w/ 256KB Video RAM (PC/XT/AT).....	**$139.95**
JE1057	8/16-Bit VGA Card w/ 256KB Video RAM (PC/XT/AT).....	**$199.95**
JE1060	I/O Card w/ Serial, Game, Printer Port & Real Time Clock (PC/XT) ...	**$59.95**
JE1062	RS232 Serial Half Card (PC/XT/AT)	**$29.95**
JE1065	I/O Card w/ Serial, Game and Parallel Printer Port (AT).....	**$59.95**
JE1077	Multi I/O Card w/ 360KB/720KB/1.2MB/1.44MB Floppy Controller (AT) ..	**$99.95**

EGA, VGA & Multiscan Monitor Packages

Relisys 14" EGA monitor and EGA card package (640 x 350 max. resolution)

JE1059 EGA Monitor & EGA Card.....**$509.90**

Relisys 14" Multiscan monitor and 16-bit VGA card package (640 x 480 max. resolution)

JE2059 Multiscan Monitor & VGA Card.....**$669.90**

Relisys 14" VGA monitor and 16-bit VGA card package (640 x 480 max. resolution)

JE2061 VGA Monitor & VGA Card.....**$629.90**

JE2061

IBM PC/XT/AT Compatible Keyboards

FKB4700

JE2015 84-Key Standard AT Style Layout **$59.95**

FKB4700 101-Key Enhanced Layout with 12 Function Keys **$69.95**

MEI 100-Key Microtype Keyboard

- IBM PC/XT/AT/386 Compatible
- Saves an amazing 60% of the desk space used by equivalent standard keyboards

MIRU.....**$129.95**

Jameco Digitizer Tablet

- AutoCAD 10 template and four-button puck • Resolution: up to 1016 lines per inch • Accuracy: ±.025" • Emulates three of the worlds most popular formats: Summagraphics MM, Summagraphics Bit Pad One, Calcomp 2000 • EEPROM allows custom configuration

JCAD Digitizer Tablet **$199.95**

Stylus Two Button Stylus **$39.95**

Logitech ScanMan Plus Scanner

- IBM PC/XT/AT Compatible
- 4" Scanning Window
- 400 dpi

SCANP.....**$219.95**

Logitech Mice

MSER Serial Mouse & MouseWare Software **$89.95**

MBUS Mouse w/Bus Board & MouseWare Software **$99.95**

MPS2 PS/2 Mouse & MouseWare Software **$79.95**

Modems

9600E Pictured

External Modems

1200C	Datatronics 1200 Baud	**$89.95**
2400C	Datatronics 2400 Baud	**$149.95**
9600E	Prometheus 9600 Baud	**$699.95**

Internal Modems

1200B	Jameco 1200 Baud	**$49.95**
2400B	Jameco 2400 Baud	**$99.95**

Modems listed above Include ProComm Software

IBM Compatible Cases and Power Supplies

JE1030

JE2012

JE1010	Flip-Top Standard PC/XT Case.....	**$39.95**
JE1011	Slide Standard PC/XT Case	**$39.95**
JE1030	150 watt PC/XT Power Supply.....	**$59.95**
JE1032	200 watt Baby AT Power Supply	**$89.95**
JE1035	300 watt AT Power Supply	**$139.95**
JE2011	Vertical Case w/300W Pwr. Supply	**$269.95**
JE2012	Mini-Vertical Case w/200W Pwr. Supply	**$169.95**
JE2019	Flip-Top Baby AT Case.....	**$69.95**

Floppy Disk Drives

MF353B

Mitsubishi

MF353B 3.5" 720KB Internal Drive **$99.95**

Toshiba

356KU 3.5" 1.44MB Internal Drive .. **$109.95**

Teac

FD55B 5.25" 360KB Internal Drive ... **$89.95**

FD55G 5.25" 1.2MB Internal Drive.... **$99.95**

MiniScribe Hard Drives

MFM

M8425	20MB (68ms) 3.5"HH	**$229.95**
M8425XT	20MB (68ms) 3.5"HH (Kit)	**$289.95**
M8425AT	20MB (68ms) 3.5"HH (Kit)	**$339.95**

RLL

M8438	30MB (68ms) 3.5"HH	**$249.95**
M8438XT	30MB (68ms) 3.5"HH (Kit)	**$299.95**
M8438AT	30MB (68ms) 3.5"HH (Kit)	**$389.95**
M8450	40MB (46ms) 3.5"HH	**$329.95**
M8450XT	40MB (46ms) 3.5"HH (Kit)	**$369.95**
M8450AT	40MB (46ms) 3.5"HH (Kit)	**$429.95**

(Kit) includes Hard Disk Drive, Controller & Cables

Colorado Memory Systems 40MB Tape Back-Up

- IBM PC/XT/AT/386 Compatible • Back-up 40MB in 40 minutes • Back-up 60 to 120MB with extended tapes and data compression software • Includes 40MB tape cartridge

DJ10	40MB Tape Back-Up.....	**$329.95**
KE10	External Enclosure Kit	**$149.95**
TB40	40MB Tape Cartridge	**$24.95**
TB60	60MB Tape Cartridge	**$32.95**

Mail Order Electronics · Worldwide

Jameco ELECTRONICS

1355 Shoreway Road, Belmont, CA 94002

24 Hour Order Hotline

(415) 592-8097

$50.00 Minimum Order

FAX's (415) 592-2503 or (415) 595-2664
Telex 176043 - Ans. Back: Jameco Blmt
Data Sheets - 50¢ each
For a FREE 48-Page Flier send $2.00 to cover First Class Postage and Handling
© 1990 Jameco Electronics 7/90
CA Residents Add
6.25%, 6.75% or 7.25% Sales Tax
Shipping - Add 5% plus $1.50 Insurance
(May vary according to weight and shipping method)
Terms: Prices subject to change without notice.
Items subject to availability and prior sale.
Complete list of terms/warranties is available upon request.
IBM is a registered trademark of International Business Machines

VISA MMC MasterCard

Please refer to **Mail Key 1** when ordering

Customer Service •Technical Assistance • Credit Department • All Other Inquiries • (415) 592-8097 • 7AM - 4PM P.S.T.

Circle 129 on Reader Service Card

World Radio History

SUMMER SPECIALS ON HEWLETT-PACKARD & COMPAQ PRODUCTS

Unitex, Inc
MAIL ORDER DIVISION

ESTABLISHED 1976

We Accept International Orders.
We Accept Purchase Orders from Qualified Firms, Universities and Government Agencies

FROM ANY WHERE IN THE U.S. & CANADA **1-(800)-533-0055**

INTERNATIONAL ORDERS: (714) 251-UNTX
(714) 251-8 6 8 9

SIMM/SIPP MODULES

4MG x 9 & 1MG x 9

MG x 9 - 80ns	$549
MG x 9 - 120ns	$70
MG x 9 - 100ns	$80
MG x 9 - 80ns	$85
MG x 9 - 70ns	$100

ALSO IN STATIC COL

256 x 9 FOR IBM TYPES

56 x 9 - 120ns	$21
56 x 9 - 100ns	$26
56 x 9 - 80ns	$30
56 x 9 - 60ns	$45

APPLE SIMM MODULES

MG x 8 - 120ns	$79
MG x 8 - 100ns	$80
MG x 8 - 80ns	$89
56 x 8 - 120ns	$24
56 x 8 - 100ns	$39

GATEWAY 386 MODULES

86/25/33 (1MG)	$120
(2MG)	$369
uper (1MG)	$359
port 286 (4MG)	$1179

AST 386 MODULES

PART NO.	1MG	4MG
86/25/33 SX	$120	--
86/16	$95	$375
86C	$95	$375
PART NO.	1MG	2MG
Workstation 286	--	$249
Workstation 386	--	$249
Campage 286	$95	$190

PS-2 PRODUCT

MODEL 70 & 80 SIMM

NEW!

30F2933 - 4MG Memory Module $949

6450372 - 2MG Module for 6450367 $449

6450608 For 70A21 2MG x9 80ns $249

6450603 For 70e61 70 121 50Z & 50SX 1MG x 9 - 80ns $118

6450375 1MG For 80-041 $199

6450379 2MG for 80-111&311 $359

6450604 $249
For 70E61 121,50Z & 55SX *10 or more units $239

256 x 9 (FOR PS/2)

256 x 9 - 120ns	$36
30F5348 (Kit 2ea)	$72

MODEL 30-286

1MG x 9 100ns	$110
30F5360 (Kit 2ea)	$220

VIDEO RAM

64 x 4 - 150ns	$3
64 x 4 - 120ns	$5
64 x 4 - 100ns	$7

D-RAM

1 MG x 1

1MG x 1 - 120ns	$7.25
1MG x 1 - 100ns	$7.50
1MG x 1 - 80ns	$7.75
1MG x 1 - 70ns	$9.00

256 x 1

256 x 1 - 150ns	$2.25
256 x 1 - 120ns	$2.65
256 x 1 - 100ns	$2.75
256 x 1 - 80ns	$3.25
256 x 1 - 70ns	$3.95
256 x 1 - 60ns	$4.50

256 x 4

256 x 4 - 120ns	$ 7.50
256 x 4 - 100ns	$ 8.50
256 x 4 - 80ns	$9.00

54 x 1

64 x 1 - 150ns	$1.40
64 x 1 - 120ns	$1.99
64 x 1 - 100ns	$2.49

64 x 4

64 x 4 - 150ns	$2.25
64 x 4 - 120ns	$2.50
64 x 4 - 100ns	$2.75
64 x 4 - 80ns	$3.50

256 x 4 STATIC COL

514258 100ns	$15

256 x 1 STATIC COL

51258 - 100ns	$3.50
51258 - 80ns	$4.00
51258 - 70ns	$5.50

IIT ADVANCED MATH CO-PRO

- Up to 200% Faster than Intel™ Math-Co's
- 5 year Warranty

FOR 286 MACHINES

2C87-8	$185
2C87-10	$219
2C87-12.5	$280
2C87-20	$324

FOR 386 MACHINES

3C87-16	$305
3C87-20	$350
3C87-25	$450
3C87-33	$549

INTEL MATH CO-PRO

8087-3(5MHz)	$88
8087-2(8MHz)	$115
8087-1	$165
80287-6	$120
80287-8	$183
80287-10	$208
80C287-12	$280
80387-16	$305
80387-20	$350
80387-25	$450
80387 33	$549
80387 SX	$320

CPU CHIPS

8088	$5.00
80386-16	$180
80386-20	$240
80386 25	$330
V 20 (8MHz)	$7.50
V-20 (10MHz)	$12.00

MONTHLY SPECIALS

6450604
Module for 70E61/121 50Z & 55SX 2MG x 9 - 80ns

1-9 UNITS **$235**
10 or more units **$225**

1 MG X 1 - 80ns D-RAM (DIP)
$7.50 ea.
(min qty 20 pcs)
Call for quantity pricing

IDEA Max/MC
For PS/2 MOD 50,60, & 80. Up to 12 MG of extended memory, up to 8MG of expanded. Supports EMS 4.0 Easy installation. Software included. Uses 256K or 1MG SIMMs.
IDI003MB **$219**

NO SLOT CLOCK
Clock for PC and XT computers Plugs into empty ROM socket on motherboard - Accurate to 1/100 sec.
Only **$25.00**

AST PRODUCT

RAMPAGE PLUS 286
Up to 8MG Expanded Memory - Uses 256 x 9 or 1MG x 9 SIMM. Supports LIM4.0 and OS/2 - Up to 12.5MHz bus - for AT (16 bit bus)

with 0K ... **$319**
with 2MG **$529**

ADVANTAGE
Provides up to 1.5 MG of Extended Memory and does Backfill to 640K - For AT (16 bit bus) Has one serial port , one parallel port, an optional 2nd serial port and an optional game port.

Comes standard with 128K **$109**
with 640K ... **$175**
with 1.5 MG **$259**

MEMORY EXPANSION BOARDS

COMPAQ MEMORY

ADD-ON MODULES

MODEL	1MG	4MG
386/20E/25E DESK PRO 386E,386S	$169	$469

MODEL	2MG	8MG
386/33, 486/25 & SYSTEM PRO	$320	$2495

MEMORY EXPANSION BOARDS

MODEL	512K	1MG	2MG	4MG	8MG
386/16		$425	$675	$1375	$2495
386/20E/25E 386-S		$250		$725	
Portable386				$1250	
Portable LTE	$219	$325		$495	
SLT/286		$325			

MEMORY UPGRADE KITS

MODEL	512K	2MG	4MG
Portable III	$70	$178	
DESKPRO 386/16		$250	$795

5 YEAR WARRANTY

ORCHID

RAMQUEST EXTRA The only Multifunction card that provides up to 8MG and two serial ports on one board for the IBM PS/2 Models 50, 60 & 80. Guaranteed EMS 4.0 and OS/2 compatible. Easy to install with only 4 keystrokes. Uses 256 and or 1MG SIMM's ... **$229**

RAMQUEST EXTRA 16/32 The only 0-8MG, 0 wait state card for PS/2 mod 50, 60, & 80 which fully supports both 16 and 32 bit memory access. Includes 1 SER and 1 PAR port plus a free serial cable. EMS 4.0 and OS/2 compatible. Uses 256k and/or 1MG SIMMS ... **$299**

ACCELERATORS

TINY TURBO 286 Low cost, high-speed, half slot PC/XT Accelerates your PC/XT with an 8MHz 80286 microprocessor 80287 math chip socket ... **$229**

TINY TURBO XT High-speed, half slot accelerator for PC/XT - Accelerates your PC/XT up to 4 times faster with a 12MHz 80286 microprocessor 80287 math chip socket ... **$259**

D-RAM TESTERS

UNI-001 RT ... **$119.00**
Tests all parameters except speed
64 x 1 - 256 x 1 - 1M x 1
64 x 4 - 256 x 4 - 4M x 1

UNI-002 RT ... **$149.95**
Tests speed plus parameters
64 x 1 - 256 x 1 - 1M x 1

UNI-003 RT ... **$199.95**
Tests standard SIMM Modules
256 X 9, 256 X 9 - 1MG X 9 - 4MG X8

1 YEAR WARRANTY

PRICES REDUCED

NEWER TECHNOLOGY

MEMOBYZATION Fits all popular Micro Channel computers including IBM PS/2 Models 50, 50z, 55, and 60. Can provide up to 16MG of extended memory (using 2 boards). LIM/EMS Ver 4.0 expanded memory - all or a portion with the latest LIM 4.0 software applications. Supports DOS, OS/2, XENIX and UNIX. Simple to install, no switches to set. SOFTWARE included. Uses 256K x 9 or 1MG x 9 SIMMs ... **$269**

MEMORYZATION Fits all popular Micro Channel computers including IBM PS/2 Models 70 and 80. Can provide up to 16MG of extended memory (using 2 boards). LIM/EMS Ver 4.0 expanded memory - all or a portion with the latest LIM 4.0 software applications. Supports DOS, OS/2, XENIX and UNIX. Simple to install, no switches to set. SOFTWARE included. Uses 256K x 9 or 1MG x 9 SIMMs ... **$309**

CONCENTRATION Fits all popular 286/386 computers including slim-line systems like the IBM XT286. Four modes of operation are available. Up to 15MG of AT-extended memory. Up to 3.5MG under the new LIM/EMS 4.0. 0-640K conventional memory, or up to 128MG high speed ram disk (using four boards). Supports DOS, OS/2, XENIX, UNIX-386, WINDOWS/386 and other multi-user environments. Totally switchless installation. SOFTWARE included. Uses 256K x 9 and/or 1MG x 9 SIMMs **$389**

BOCA RESEARCH

TOPHAT Does backfill conventional memory from 512 to 640K on AT with 0K **$69**

TOPHAT II Same as TophAT with 128K **$85**

BOCARAM/XT Provides up to 2MG of expanded memory for 8 bit bus. Operates up to 12MHz. Uses 256K D RAM with 0K **$120**
with 512K **$179**

BOCARAM/AT Provides up to 2MG LIM EMS 4.0 and/or 4MG of extended, expanded or backfill memory. For 16 bit bus. Operates up to 16MHz. Uses 256K D RAM with 0K **$140**
with 512K **$199**

BOCARAM/AT PLUS Provides up to 8MG of extended expanded or backfill memory. Operates up to 33MHz and is set thru software. Uses 1MG D-RAM with 0K **$140**
with 2MG **$349**

BOCARAM/AT I/O PLUS Provides up to 4MB of extended expanded or backfill memory. For 16 bit bus. Operates up to 33 MHz and is set thru software. Has serial and parallel port. Uses 1MG D-RAM with 0K **$165**
with 2MG **$379**

BOCARAM 30 Provides up to 2MG of expanded memory for IBM PS/2 model 25, 30 and 8 bit bus PC that utilize 3.5 inch floppy disks. Uses 256K D-RAM with 0K **$149**
with 2 MG **$329**

BOCARAM 50Z Provides up to 2MG, 0 wait state expanded or extended memory for IBM PS/2 Models 50 50Z 60. Uses 1MG D RAM with 0K **$160**
with 2MG **$379**

BOCARAM 50/60 Provides up to 4MG expanded, extended or backfill memory for PS/2 models 50 50 Uses 1MG D RAM with 0K **$160**
with 2MG **$379**

I/O XT 0241 For 8 bit bus. Has clock, parallel port, serial port, and optional 2nd serial port **$49**

I/O AT For 16 bit bus. Has parallel port, serial port and optional 2nd serial port **$69**

I/O SER 2 Add 2nd serial port to I/O AT or PC/XT **$15.95**

BOCA MCA PARALLEL CARD Adds 1 parallel port to PS-2 System **$89**

BOCA MCA SERIAL/PARALLEL CARD Adds 2 serial and 1 parallel port to PS/2 System **$139**

EVEREX

RAM 3000 DELUXE Up to 3MG. Selectable memory addresses. Expanded Memory Specifications (EMS) 4.0. OS/2 Can be used to backfill base memory up to 640K and the rest as expanded and/or extended memory. Uses 256K D RAM **$99**
With 512K **$139**

RAM 8000 Up to 8MG capacity support to base, extended or expanded memory in any combination. Fully compatible with Lotus, Intel, Microsoft, EMS 4.0, EEMS. Supports Multi Tasking and DMA Multi Tasking in hardware. Software configurable (no dip switches to set). Full 16MG window for future expans on. Zero wait state, uses 1MGD-RAM ... **$279**

RAM 10000 Up to 10MG capacity support to base, extended or expanded memory in any combination. Compatible with Lotus, Intel, Microsoft, EMS 4.0. Operates with no additional wait states. Uses 1MG D-RAM ... **$179**

UNITEX

3 BUTTON MOUSE Microsoft Compatible w/software included ... **$49**

384 Multifunction Card - for PC/XT ... **$89**
Expands to 384K SER/PAR CLK Game port. Uses 64K DRAM

LAPTOP MEMORY

TOSHIBA

512K for Toshiba T3100E	$169
2MG for Toshiba T1600	$399
2MG for Toshiba T3100E	$399
2MG for Toshiba T3100SX	$399
2MG for Toshiba T3200SX	$399
2MG for Toshiba T5100	$399
2MG for Toshiba T5200	$399
3MG for Toshiba T3200	$595

SHARP

1MG for Sharp 5541	$509
3MG for Sharp 5541	$759

ZENITH

1MG for ZenithSS/286	$199

HEWLETT-PACKARD LASERJET MODULES

2 & 2D

2 & 2D (0K)	$ 89
2 & 2D(1 MG)	$159
2 & 2D(2 MG)	$249
2 & 2D(4 MG)	$429

NEW!

2P & 3

2P & 3 (0K)	$ 109
2P & 3(1 MG)	$179
2P & 3(2 MG)	$269
2P & 3 (4 MG)	$449

5 YEAR WARRANTY

WARRANTY - 2 YEARS ON PARTS

IBM LASER PRINTER

MEMORY UPGRADE

MODEL	1MG	2MG	3.5MG
4019 / 4019E	$299	$399	$529

EPSON LASER PRINTER

MEMORY UPGRADE

MODEL	1MG	2MG	4MG
LP6000	$299	$399	$529

Upgrades for Canon, Facit, Fujitsu and Toshiba are available - CALL
5 YEAR WARRANTY

VIDEO ADAPTERS

ATI TECHNOLOGIES

VGA WONDER 512™ (512K video memory) High performance VGA graphics. 100% register-level compatibility in VGA, EGA, CGA, MDA and Hercules. Displays Super VGA 800x600 in 256 colors and 1024x768 in 16 colors. Switchless installation. Includes Microsoft compatible mouse ... **$369**

VGA WONDER 256™ (256K video memory, user upgradable) Same as VGA wonder 512™, except with 800x600 in 16 colors and 1024x768 in 4 colors. Includes Microsoft compatible mouse ... **$299**

BOCA RESEARCH

1024 VGA 1024 X 768 in 16 simultaneous colors 640x480 in 256 colors. 132 col X 50, 43,25 1024 X 768 + 800/600 drivers. 132 col ... **$269**

SUPER VGA 800 X 600 Resolution/ 256K RAM. 8 or 16 bit. 132 col X 50,43,25. LIM Drivers. 800 X 600 drivers for Windows, Auto CAD ... **$169**

VGA 640 X 480 Resolution/ 256K RAM, 8 or 16 bit ... **$139**

Multi EGA 640 X 480 Resolution on multiple frequency monitors. 640 X 480 + 752 X 410. 256K RAM. Drivers for Auto CAD, Windows and Lotus ... **$119**

EGA 640 X 350 Resolution. 256K RAM ... **$129**

UNITEX

MONOCHROME GRAPHICS CARD with PAR port - MGA/Hercules ... **$39**

COLOR GRAPHICS CARD - RGB color with PAR port - MGA/CGA/Hercules ... **$39**

CGA CARD - 640 x 480, 16 color, EGA-MGA/CGA/Hercules ... **$119**

EGA CARD - 1024 x 768, 16 color, VGA/EGA/MGA/CGA ... **$149**

MODEMS

EVEREX AND HAYES COMPATIBLE MODEMS

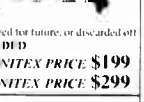
EVEREX Evercom 12 Internal 1200 BAUD	$69
EVEREX Evercom 24 Internal 2400 BAUD	$129
EVEREX External 2400	$175
UNITEX 1200I Internal 1200 BAUD	$59
UNITEX 1200E External 1200 BAUD	$99
UNITEX 2400I Internal 2400BAUD	$109
UNITEX 2400E External 2400 BAUD	$129

SUPER SPECIAL

Calculus EZ-FAX
The most Highly functional, fully loaded, Cost effective FAX board manufactured.
CCITT Group III
Provides fully concurrent background operation. Allows user to transmit, receive and view documents on screen. Once in memory, the transmissions may be edited for retransmission, printed, stored for future, or discarded off your hard drive. SOFTWARE INCLUDED
CAL 001FX (4800 baud) *UNITEX PRICE* $199
CAL 002FX (9600 baud) *UNITEX PRICE* $299

SCAN MAN
is completely compatible with the Calculus EZ-FAX. Scan man is a 1-400 Multi-Resolution Scanner. Real time screen image generation while scanning. Using this hand scanner makes faxing your scanned images a simple wave of the hand.
CAL 002SH.
$389 INCLUDES CALCULUS EZ-FAX

PRINCETON LS300
300dpi High resolution text/graphics scanner. Automatic sheet feeder permits up to 5 sheets, provides up to 32 shades of gray.
CAL 003SH.
$589 INCLUDES CALCULUS EZ-FAX



TERMS AND CONDITIONS

No surcharge for MC or VISA
Terms: MC • VISA • COD • CASH • AMEX add 4%
Purchase Orders from qualified firms
20% restocking fee on non defective returns
Prices subject to change

SEND ALL MAIL ORDERS TO
P.O. Box 19772
Irvine, CA 92713

Retail Office
4025 S. Industrial Blvd.
Las Vegas, NV 89103
Phone: (702) 732-8689
FAX: (702) 732-0390
Mon - Fri 8am - 5pm
Sat 9am - 1pm

Corporate Headquarters
17222 Armstrong Ave. • Irvine, CA 92714
Phone: (714) 251-UNTX(251-8 6 8 9)
Fax: (714) 251-8943
Mon - Fri 7am - 5pm
Sat 8am - 2pm

World Radio History

ESTABLISHED 1976

Unitex, Inc
MAIL ORDER DIVISION

We Accept International Orders.
We Accept Purchase Orders from Qualified Firms, Universities and Government Agencies

FROM ANY WHERE IN THE U.S. & CANADA **1-(800)-533-0055**

INTERNATIONAL ORDERS: (714) 251-UNTX
(714) 251-8 6 8 9

NEW

Unitex HAS NOW BEEN APPOINTED AUTHORIZED DISTRIBUTOR FOR THE **KAYPRO** COMPUTER LINE

THE AFFORDABLE MC-10

In the office, at home or for school, the MC-10 means power and economy that can't be beat !

MC-10

- 8088-**10mhz**
- 512K RAM
- 1 360K floppy disk drive
- 1 parallel port
- 1 serial port
- 1 game port
- clock/ calendar with battery back-up
- 84 keyboard
- 150 watt UL approved power supply
- FCC class B approved
- Dow Jones 48 hour depot service

OUR PRICE **$429**

1 YEAR WARRANTY

16-BIT MC-20 SERIES

Additional speed and power for business or advanced personal use. The MC-20 microcomputer is the cost-effective solution for today's businesses !

MC-20

- 80286-**12mhz** (zero wait state)
- 640K RAM
- Add $25 for 1MB RAM
- 2:1 HD/FD controller
- Add $10 for 1:1 HD/FD controller
- 1 1.2MB floppy disk drive
- 1 parallel I port
- 1 serial port
- 1 game port
- 101 keyboard
- 200 watt UL approved power supply
- FCC class B approved
- Dow Jones 48 hour depot service

OUR PRICE **$649**

1 YEAR WARRANTY

HIGH-PERFORMANCE MC-30 SERIES

Incorporates advanced 32-bit processing with speeds of over 25MHz. Kaypro also features a line of 32-bit microcomputers with cache memory and speeds of up to 33MHz. Tomorrow's technology today !

MC-30SX

- 80386-**16mhz SX**
- 1 MB RAM
- 2:1 HD/FD controller
- Add $10 for 1:1 HD/FD controller
- 1 1.2MB floppy disk drive
- 1 parallell port
- 1 serial port
- 1 game port
- 101 keyboard
- 200 watt UL approved power supply
- FCC class B approved
- Dow Jones 48 hour depot service

OUR PRICE **$999**

1 YEAR WARRANTY

MC-30/20

- 80386-**20mhz**
- 1 MB RAM
- 2:1 HD/FD controller
- Add $10 for 1:1 HD/FD controller
- 1 1.2MB floppy disk drive
- 1 parallell port
- 1 serial port
- 1 game port
- 101 keyboard
- 200 watt UL approved power supply
- FCC class B approved
- Dow Jones 48 hour depot service

OUR PRICE **$1299**

1 YEAR WARRANTY

MC-30/25

- 80386-**25mhz**
- 1 MB RAM
- 2:1 HD/FD controller
- Add $10 for 1:1 HD/FD controller
- 1 1.2MB floppy disk drive
- 1 parallell port
- 1 serial port
- 1 game port
- 101 keyboard
- 200 watt UL approved power supply
- FCC class B approved
- Dow Jones 48 hour depot service

OUR PRICE **$1399**

For 32K Cache Memory Add $250

1 YEAR WARRANTY

CALL for other configurations

All Kaypro computers come equipped with DR DOS, the most advanced MS-DOS compatible operating system available. It's extremely easy to learn and use, yet provides power and versatility that other operating systems just can't deliver.In addition to a full one year limited warranty, Dow Jones features award-winning telephone support and fast 48-hour turnaround on parts and service.

KAYPRO

DOW JONES SERVICE

Ranked No. 1 in quality of products and service in Fortune magazine's annual survey of corporate reputations.
On-Site Maintenance Service · 48 hr. Express Depot Service
Service on time, as promised!

CALL for pricing on FLOPPY DISK DRIVES HARD DISK DRIVES AND MONITORS

Retail Office
4025 S. Industrial Blvd.
Las Vegas, NV 89103
Phone: (702) 732-8689
FAX: (702) 732-0390
Mon - Fri 8am - 5pm
Sat 9am - 1pm

TERMS AND CONDITIONS
No surcharge on MC or VISA
Terms MC • VISA • COD • CASH • AMEX add 4%
Purchase Orders from qualified firms
20% restocking fee on non-defective returns
Prices subject to change

SEND ALL MAIL ORDERS TO
P.O. Box 19772
Irvine, CA 92713

Corporate Headquarters
17222 Armstrong Ave. • Irvine, CA 92714
Phone: (714) 251-UNTX(251-8 6 8 9)
Fax: (714) 251-8943
Mon - Fri 7am - 5pm
Sat 8am - 2pm

Circle 299 on Reader Service Card (DEALERS: 300)

World Radio History

Circle 86 on Reader Service Card

Diskette Emporium

Box 402, 110 E. Hotchkiss Ave.,
Hotchkiss, CO 81419

Orders Only:
1-800-322-5254 (24 Hrs., 7 days)
1-303-872-8955 (24 Hrs., 7 days)

Inquiries: 1-303-753-3306

Diskettes

Bulk diskettes are sold in lots (multiples) of 50 for 5.25 disks and lots of 25 for 3.5 disks. These diskettes are sold without sleeves or labels. The minimum is 1 lot. White Box is sold with 10 disks to a box plus sleeves and labels. The minimum is 5 boxes.

		CREDIT CARDS	COD	PRE-PAYMENT
Bulk	5.25 DSDD	$ .19	$ .18	$ .17
Bulk	3.5 DSDD	.55	.53	.41
Bulk	5.25 DSHD	.38	.36	.32
Bulk	3.5 DSHD	1.10	.89	.85
White Box	5.25 DSDD	.26	.25	.24
White Box	3.5 DSDD	.60	.58	.55
White Box	5.25 DSHD	.49	.47	.43
White Box	3.5 DSHD	1.20	1.15	1.12

Sleeves and Labels

Sleeves and Labels are sold in lots (multiples) of 100. The minimum is 1 lot.

		CREDIT CARDS	COD	PRE-PAYMENT
5.25 Paper Sleeves	(100 pack)	$3.00	$2.88	$2.79
5.25 Labels	(100 pack)	3.00	2.88	2.79
3.5 Labels	(100 pack)	3.00	2.88	2.79

Ribbons

Diskette Emporium carries over 150 printer and many typewriter ribbons. Please write us or call us at 1-303-753-3306 (the 800 tel. number Order Dept. will NOT have this information).

Take the industry by storm!!!
Storm Systems—The computer that's lightning FAST!

Storm XT-10	Storm AT-12
8088-1 Processor	80286-12 Processor
640K RAM Installed	1 Meg RAM Installed
1 Floppy Drive (360K)	1 Floppy Drive (1.2) Meg)
Floppy Controller	Floppy Controller
20MB Hard Drive and Controller	Mono Monitor
Mono Monitor	Mono Video Card
Mono Video Card	101 keyboard
101 keyboard	1 Parallel/1 Serial/ 1 Game Port
1 Parallel/1 Serial/ 1 Game Port	8 Expansion Slots
8 Expansion Slots	Software
Software	**15 Mo. Warranty**
15 Mo. Warranty	Fully Assembled and Tested
Fully Assembled and Tested	**Mfgr. in the U.S.A.**
Mfgr. in the U.S.A.	Complete System
Complete System	
Cr. Card $1024	Cr. Card $880
Prepayment $953	Prepayment $818

Due to the fact that we burn-in and test all of our systems for 72 hours, please allow additional time for shipping.

Terms & Conditions

Prices are subject to change. **Minimum Credit Card order is $20. Shipping Charges:** Add $.015 for each 5.25 Bulk Diskette; $.25 for each 5.25 White Box; $.025 for each 3.5 Bulk Diskette; $.45 for each 3.5 White Box; $.15 for each pack of 100 sleeves; $.15 for each pack of 100 labels; $.25 for each small ribbon; $.45 for each large ribbon (indicated by an "*"); $25 for each computer. The shipping charges refer to UPS Ground shipped in the continental USA. For Parcel Post, please double the shipping charges. The minimum shipping charge is $1. **Handling Charge:** add $1.50 per order regardless of the order size. **Sales Taxes:** New York residents, add 8.25%; Colorado residents, add 5%. **Payment Methods:** We accept Visa, MasterCard and American Express; COD is Cash or Certified Check only (add $3.30 to order for COD fee); for Prepayments, Personal and Company check orders are held for 14 days.

BLACKJACK COMPUTER

The ultimate card-counting weapon, operated under complete concealment within the casinos. CPU, "magic" shoes, I/O switches, sensors, power supplies, extensive training and support provided. Win consistently with the latest generation of the technology every casino fears the most.

Contact
(714) 865-1191

Circle 41 on Reader Service Card

Cross-Assemblers as low as $50.00
Simulators as low as $100.00
Cross-Disassemblers as low as $100.00
Developer Packages
as low as $200.00(a $50.00 Savings)

A New Project
Our line of macro Cross-assemblers are easy to use and full featured, including conditional assembly and unlimited include files.

Get It To Market--FAST
Don't wait until the hardware is finished to debug your software. Our Simulators can test your program logic before the hardware is built.

No Source!
A minor glitch has shown up in the firmware, and you can't find the original source program. Our line of disassemblers can help you re-create the original assembly language source.

Set To Go
Buy our developer package and the next time your boss says "Get to work.", you'll be ready for anything.

Quality Solutions
PseudoCorp has been providing quality solutions for microprocessor problems since 1985.

BROAD RANGE OF SUPPORT

- Currently we support the following microprocessor families (with more in development):

Intel 8048	RCA 1802,05	Intel 8051	Intel 8096
Motorola 6800	Motorola 6801	Motorola 68HC11	Motorola 6805
Hitachi 6301	Motorola 6809	MOS Tech 6502	WDC 65C02
Rockwell 65C02	Intel 8080,85	Zilog Z80	NSC 800
Hitachi HD64180	Motorola 68000,8	Motorola 68010	Intel 80C196

- All products require an IBM PC or compatible.

So What Are You Waiting For? Call us:
PseudoCorp
Professional Development Products Group
716 Thimble Shoals Blvd, Suite E
Newport News, VA 23606
(804) 873-1947 **FAX: (804)873-2154**

Circle 223 on Reader Service Card

UNIVERSAL PROGRAMMER

$475

PAL EPROM
GAL 8748/49
PROM 87C51...
EEPROM EXOTIC's

5ns PALs
2 Meg EPROMs
Parts added at your request.

FREE software updates on BBS.
Powerful menu driven software.

Call - (201) 994-6669
Link Computer Graphics, Inc.
4 Sparrow Dr., Livingston, NJ 07039
FAX:(201)994-0730

Circle 143 on Reader Service Card

Advertise your computer products through
BYTE BITS
(2″ x 3″ ads)

For more information call Mark Stone at 603-924-6830

BYTE

One Phoenix Mill Lane
Peterborough, NH 03458

Circle 48 on Reader Service Card

9-Track Tape Subsystem for the IBM PC/XT/AT

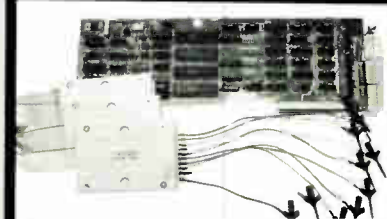
Now you can exchange data files between your IBM PC and any mainframe or minicomputer using IBM compatible 1600 or 6250 BPI 9-Track tape. System can also be used for disk backup. Transfer rate is up to 4 megabytes per minute on PCs and compatibles. Subsystems include 7" or 10½" streaming tape drive, tape coupler card and DOS compatible software. For more information, call us today!

QUALSTAR®

9621 Irondale Ave., Chatsworth, CA 91311
Telephone: (818) 882-5822

Circle 237 on Reader Service Card

200 MHz LOGIC ANALYZER



- 200 or 100 MHz max samp. rate (6 channel)
- 24 Channels (50 MHz), Timing and State
- Optional expansion to 72 channels
- 16 Levels of triggering
- 16K samples/channel (6 channel mode)
- Variable, TTL, or ECL threshold levels
- 3 External Clocks and 11 Qualify lines
- FREE software updates on 24 Hour BBS

$1299 - LA27100 (100 MHz) Price includes
$1899 - LA27200 (200 MHz) Pods and Software

Call - (201) 994-6669
Link Computer Graphics, Inc.
4 Sparrow Dr., Livingston, NJ 07039
FAX:(201)994-0730

Circle 144 on Reader Service Card

World Radio History

Canon Full Page Scanner $398

List Price $1895

Includes Free Photo Graphic Scanning and Editing Software

Deluxe OCR Software... $198

- 300 Dots Per Inch
- Automatic Sheet Feeder
- Includes PC/AT Interface Card
- Software Selectable 300/200/150/75 DPI
- Fast...7 Seconds Per Page
- Up to 32 Gray Scales
- One Year Canon Warranty

JADE COMPUTER Turbo-88 $498

—A PROVEN BEST SELLER—

Monitor Optional

- 8088 microprocessor running at 10 MHz or 4.77
- 640KB
- 5.25" 360KB Drive
- Dual diskette drive controller
- 102 Key enhanced keyboard
- Parallel printer port
- Eight expansion slots
- Serial RS-232C port
- Game Port
- Clock/Calendar
- 150 watt power supply
- 8087 socket
- Front panel display

Monitor & Hard Drive Options

Floppy Only	20 Megabyte	30 Megabyte
Complete Monographics System		
$598	$798	$848

For Complete Color System add $100

Complete VGA System

$898	$1098	$1148

JADE COMPUTER PRO-286 12 MHz $698

Monitor Optional

JADE COMPUTER Best Buy PRODUCTS

—286 POWERHOUSE—

- 80286 processor running at 12 MHz or 20 MHz *
- Zero wait state
- 1 Megabyte of RAM
- 1.2 MB or 1.44 MB drive
- Hard/floppy controller
- Six 16-Bit & Two 8 Bit expansion slots
- 102 key enhanced keyboard
- 200 watt power supply
- 80287 socket
- Clock/Calendar
- Norton S.I. 13.7/20.3 *
- Landmark 16/25.9 *
- One Year Warranty

Monitor & Hard Drive Options (12 MHz)

Floppy Only	40 Megabyte	80 Megabyte
Complete Monographics System		
$798	$1098	$1398
Complete VGA System		
$1098	$1398	$1698

*For 20 MHz System Add $298

JADE COMPUTER Super-386 16 MHz (SX) $898

Monitor Optional

20 MHz	25 MHz
$1398	$1498
25 MHz Cache	33 MHz Cache
$1898	$2398

—FIRE BREATHING 386—

- 80386 processor running at 16 MHz (SX), 20 MHz, 25 MHz or 33 MHz
- 1 MB RAM expands to 4 MB
- 384K Shadow RAM
- 1.2 MB or 1.44 MB Drive
- 1:1 Interleave Hard Disk/Floppy Disk Controller
- 80387 Socket
- Full size case
- One 32-Bit, Five 16-Bit Two 8-Bit slots
- 102 Key enhanced Keyboard
- 200 watt power supply
- Clock/Calendar
- Norton S.I. 18/23*/31.6/31.6
- Landmark 21/25.5/32.6/43.5

Monitor & Hard Drive Options (16 MHz SX)

Floppy Only	40 Megabyte	80 Megabyte
Complete Monographics System		
$998	$1398	$1598
Complete VGA System		
$1358	$1698	$1898

For 20 MHz add $498 — For 25 MHz Cache add $998

For 25 MHz add $598 — For 33 MHz Cache add $1798

EPSON

LX-810	$178
FX-850	Call
FX-1050	Call
LQ-510	$289
LQ-850	Call
LQ-950	Call
LQ-1010	Call
LQ-1050	Call
LQ-2550	Call

EPL-6000 Laser Printer....Call

Panasonic

KX-1180	$169
KX-1191	$238
KX-1124	$289
KX-1624	$428

intel®

8087	$88	80287-12	$278
8087-2	$118	80387-SX	$318
8087-1	$158	80387-16	$348
80287	$128	80387-20	$388
80287-8	$198	80387-25	$488
80287-10	$228	80387-33	$598

ITT Co-Processors

2C87-8	$198	2C87-12	$268
2C87-10	$228	2C87-20	$328

Microsoft DOS

3.3	$78
4.01	$88

Modem 2400 Internal w/Software $74

1200 Internal w/software	$44
1200 baud external	$88
2400 baud external	$128
2400 PS/2 internal	$198

VGA Package

Card $148

Monitor $298

640 x 480 Hi Res Card

HEWLETT PACKARD

New LaserJet IIP	$1098
H.P. LaserJet III	$1698
H.P. DeskJet Plus	$698
H.P. DeskWriter/For Mac	$848
Extra Toner	$98
Extra Ink Cartridge	$19

Tripplite Battery Back-up

450 Watt UPS	$398
750 Watt UPS	$498
1200 Watt UPS	$698

3½" Disk Drives

720K internal/external	$78/178
1.44 MB internal/external	$88/$188

Tripplite Line Stabilizer

600 Watt Line Conditioner	$98
1200 Watt Line Conditioner	$158
1800 Watt Line Conditioner	$188

Accessories for Your HEWLETT PACKARD

Pacific Page PostScript LJ IIP/III	$398
Pacific Page PostScript LJ II	$498
PDP 25 in 1 (172 Fonts) LJ II/IIP	$278
PDP 25 in 1 (172 Fonts) LJ III	$398
PDP Plotter in a Cartridge IIP/III/IIIi	$248

4 MB Memory Card for LJ II/IIO

Without RAM	98	2 MB	298
1 MB	198	4 MB	498

New! Memory Card for LJ IIP/III

Without RAM	148	2 MB	298
1 MB	198	4 MB	548

Roland Plotters

DXY-1100 ..... $798

All Roland Models Available

Hard Disk Sale	Drive Only	Kit w/ Controller
20 MB 60ms	$198	$248
20 MB 35ms	$248	$298
30 MB 60ms	$218	$268
30 MB 35ms	$288	$338
40 MB 40ms	$298	$348
40 MB 28ms	$348	$398
60 MB 40ms	$388	$448
80 MB 28ms	$538	$598
120 MB 28ms	$698	$768
150 MB 23ms	$998	$1098
40 MB Tape Back-up		$268
150/250 MB Tape		$628/$728

Trackballs

Logitech Trackman Serial	$98
Logitech Trackman BUS	$108
MicroSpeed PC-Trac Serial	$88
MicroSpeed PC-Trac BUS	$98
MicroSpeed FastTrap Serial	$108
MicroSpeed FastTrap BUS	$118

Panasonic VGA $468

PanaSync Monitor 1024 x 768 14" .28 Dot Pitch

Logitech

LogiMouse Hi-Rez. Bus	$88
LogiMouse Hi-Rez Serial	$98

Microsoft BUS Mouse $48

200 DPI w/ Drivers Software

Scanner

Diamond Flower HS-3000 Plus	$198
OCR Software for HS-3000	$88

Keyboard

102 enhanced click	$68
Keyboard Drawer	$34

No Surcharge for Credit Cards!

VISA AMERICAN EXPRESS MasterCard

JADE COMPUTER

4901 W. Rosecrans Ave. Box 5046, Hawthorne, California 90251-5046 213-973-7707

Continental U.S.A. 1-800-421-5500 Inside California 1-800-262-1710

10 Day Money Back Guarantee

We accept checks, credit cards (or purchase orders from qualified firms and institutions.) No surcharge on credit card orders. CA., TX., GA. & AZ. residents add sales tax. Prices and availability subject to change without notice. $4.00 minimum shipping and handling charge.

California
Torrance, Costa Mesa, Woodland Hills
Kearny Mesa, Sunnyvale

Texas: Addison, Houston
Georgia: Smyrna
Arizona: Phoenix

Not all items in stock at our nine retail locations.

MMC MICROCOMPUTER MARKETING COUNCIL

World Radio History

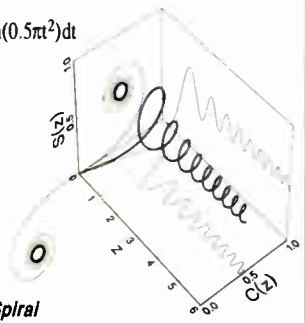
GraphiC™

"gives you all the C language routines you need to write an impressive scientific graphing program of your own. Highly recommended."*
– PC Magazine

Fresnel Integrals

$C(z) = \int_0^z \cos(0.5\pi t^2)dt$

$S(z) = \int_0^z \sin(0.5\pi t^2)dt$



Cornu's Spiral

IBM® PC (with source code) $395
Circle 254 on Reader Service Card
Macintosh® (no source code) $295
Circle 255 on Reader Service Card
Licensed for *personal* use only

VTEK 4.3™

DEC® VT100/102/52 & Tektronix® 4010/4014/4105 Terminal Emulator for IBM® PCs

"its ease of use, high resolution graphics, emulation, and price make it a more attractive purchase than the other products."*
– MINI-MICRO Systems
$195

Circle 256 on Reader Service Card

**Full reprints on request*

Scientific Endeavors
508 North Kentucky Street
Kingston, TN 37763 USA
(615) 376-4146 FAX:(615) 376-1571

Data Acquisition Processor™

Onboard Intelligence For IBM PC/XT/AT/386

- 16 MHz 80C186 for general processing
- 20 MHz DSP56001 for digital signal processing
- Sustained digital signal processing of 10 MIPS
- FFT and FIR filtering without programming
- Acquires analog and digital inputs to 235K s/s
- Buffers and processes input data as required
- Updates analog or digital outputs to 250K s/s
- Over 100 commands without programming
- Custom commands may be written in C

Call for FREE Demo Diskette

MICROSTAR LABORATORIES
(206) 881-4286
2863 152 Ave. N.E.
Redmond, WA 98052
FAX (206) 881-5494

Circle 162 on Reader Service Card

Intelligent Disassembler

snOOp II is an intelligent, interactive disassembler that automatically comments each line of code and labels jump targets.

snOOp's tutorial disassembles a specially commented file to explain its workings to you. As you move through the file you learn how to identify data areas snOOp couldn't catch and how to interpret what you see.

snOOp correctly interprets all instructions for the 8086-80386, 8087-80387 processors.

Cat. #SNOO, $49. 30 day money back guarantee. Add $5.50 S&H, CA & NY res. add tax. Visa, MC, Amex, Discover. Order today!!

Order Now **1•800•456•4123**

CENTRAL COMPUTER PRODUCTS
Serving Computer Users Since 1982
330 Central Avenue
Fillmore, CA 93015
FAX (805) 524-4026

Circle 53 on Reader Service Card

DYNAMIC RAMS

SIMM	80/100	$CALL
1MBIT	100ns	$ 7.15
514256	100ns	$ 7.50
41464	120ns	$ 2.75
41256	100ns	$ 2.50
✓ 41256	120ns	$ 2.35
51258	80ns	$ 3.75
✓ 4164	120ns	$ 1.90

* For high-speed, Zip, Ptcc, Simm Please Call !

MATH COPROCESSORS

80387-33	33mHz	$540.00
80387-25	25mHz	$440.00
80387-20	20mHz	$350.00
80387-16	16mHz	$295.00
80387SX	16mHz	$280.00
80C287A	12mHz	$260.00
2C87-12	12mHz	$250.00
2C87-10	10mHz	$196.00
80287-10	10mHz	$202.00
8087-1	10mHz	$155.00

E PROMS

27C101	250ns	$ 17.00
27C512	200ns	$ 9.75
27512	250ns	$ 7.75
27C256	250ns	$ 5.25
27256	250ns	$ 4.25
27128A	250ns	$ 4.00
27C64A	200ns	$ 4.25
2764	250ns	$ 3.50

CPU

V-30	8mHz	$ 12.75
V-20	8/10mHz	$ 8.5/15

I.C. EXPRESS

15140 Valley Blvd City of Industry,CA 91744
Customer service (818) 333-8880 FAX (818) 369-1236
ORDER: (800) 877-8188 (Mon.-Fri. 8-5 PST)
CALL FOR CURRENT PRICES & VOLUME DISCOUNTS
Price Shown for cash MasterCard/Visa add 3% Prices are subject to change
Minimum order $10.00 Shipping & Handling UPS Ground $5.00, Air $7.00 (1 lb.)
ALL MERCHANDISE IS 100% GUARANTEED WITH PROMPT DELIVERY

Circle 120 on Reader Service Card

25 MHz Single Board Computer

- Intel 80386 25 MHz processor
- Optional 25 MHz co-processor
- Up to 8 MB page mode memory
- 8 MHz I/O speed
- Phoenix/AMI/Award BIOS
- 256K EPROM
- Shadow RAM BIOS by software
- Optional high-speed cache
- Passive back plane with seven expansion slots

PROFESSIONAL COMPUTER SYSTEMS (408) 263-0222
550 Valley Way, Milpitas, CA 95035

Circle 208 on Reader Service Card

Terminal Emulation

TEK 4105/4010

- *Tektronix 4105*
- *Tektronix 4010/4014*
- *VT320, VT220, VT102*
- *Picture files*
- *VGA and EGA support*
- *High resolution hardcopy*

VT320

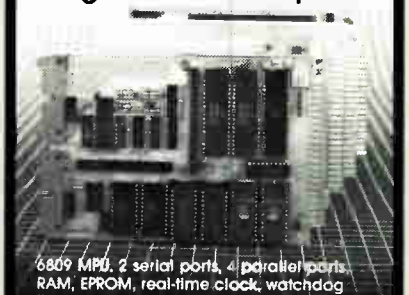
- *VT320, VT220, VT102 emulation*
- *File transfer*
- *132 column modes*
- *Color support*
- *Hot key*
- *Extensive network support*

Diversified Computer Systems, Inc.
3775 Iris Avenue, Suite 1B
Boulder, CO 80301 (303) 447-9251
FAX 303-447-1406

Trademarks: VT102, VT220 — DEC; Tektronix — Tektronics Inc.

Circle 89 on Reader Service Card

6809 Single Board Computer



6809 MPU, 2 serial ports, 4 parallel ports, RAM, EPROM, real-time clock, watchdog timer, 44-pin 4.5" × 6.5" PCB
EXPANSION MODULES: RAM, EPROM, CMOS RAM/battery, analog I/O, serial I/O, parallel I/O, counter/timer, IEEE-488, EPROM programmer, floppy disks, cassette, breadboard, keyboard/display.

WINTEK
Wintek Corp.
1801 South Street
Lafayette, IN 47904
317-742-8428

Circle 309 on Reader Service Card

World Radio History

LOW PRICE LEADER

SINCE 1983

IBM

PS/2 model 30/286	1895
PS/2 model 50/30 meg	2395
PS/2 model 70/60 meg	3695
PS/2 model 80/40 meg	4395
PS/2 model 70/120 meg	5595
PS/2 model 80/115 meg	Call

Call for other models

COMPAQ

386 S 40 meg	Call Call
386 20E - 40 meg	4015
286E 40 meg	2150
386 110 meg/25 MHz	7295
386 60 meg/25 MHz	5895
Portable III 40 meg/12 MHz	3995

CARD & MONITOR EXTRA

Call for other models

Macintosh

Mac IICX/80 Meg, 40 Meg RAM	5095
Mac-II/40 Meg	4095
Mac-SE 30/40 Meg	3595
Call for 60 and 100 Meg	
Lazer NT	3495
Lazer NTX	4795

LAP-TOP

Compaq SLT 286-20/40		3795/Call
Toshiba T1000		659
T1000SE	Toshiba	Call
T1200HB	Sale!	Call
T1600-40 Meg		Call
T1000 XE/10 MB		Call
T3200-40 Meg/SX40		Call
T5100-40/100		Call
T5200-40/100		Call
T3100SX		Call
T1200 XE/20 MB		Call
Zenith 286-20/40 Meg		Call
Mitsubishi 286-20/40		1795/2195

DISKS

DYSAN 5¼ HD / 3½ HD	13/26
MAXELL 5¼ HD / 3½ HD	12/25

Min. 10 Boxes Order

EVEREX

Everex

Step 286 - 12 & 16 MHz & 20 MHz
1 Meg RAM
Set up utility in ROM
S/P, C/C
Enhanced keyboard
1.2 MB floppy
DOS/BASIC

Call! for your configuration

Everex

Step 386-20 MHz & 16 MHz & 25 MHz & 33 MHz
Up to 256K cache of very high speed RAM
2 Meg RAM, expandable to 16 Meg
S/P, C/C
Enhanced keyboard
1.2 MB floppy
DOS/BASIC

Call!

Everex 386-33 Special of the Month

AST

AST 486	Call
AST 286 model 70	1190
AST 386 model 300c	2695
AST 386 40 Meg	3095
AST 386SX	Call

CARD & MONITOR EXTRA
CALL FOR OTHER MODELS

WE STOCK

CITIZEN, OKIDATA, EVEREX, GOLD STAR, TOSHIBA, NEC, WYSE, HITACHI, PRINCETON GRAPHICS, SONY, ACER, HOUSTON INSTRUMENTS, AMDEK, HAYES, SAMSUNG, CALCOMP, PC MOUSE, MICROSOFT MICE, LOGITECH, MITSUBISHI, IRWIN & ARCHIVE TAPE BACK, TAXAN, MAGNOVOX

BOARDS

Paradise VGA+	219
Vega VRAM	409
ATI VGA Wonder	259
Everex EGA	149
Tatung 16 bit	239

SOFTWARE SPECIALS

dBase IV	455
Wordperfect 5.1	260
Aldus Pagemaker	495
Ventura Publisher	525
Clipper	435
WordStar 5.5	150
EasyExtra	40

NOVELL Authorized Dealer

PRINTERS

EPSON

LX-810/LQ-510	199/339
LQ-850/1050	545/749
FX-850/1050	359/479

OKIDATA

320/321	359/490
390/391	490/649

TOSHIBA

321-SL/341-SL	399/595
T311	365

PANASONIC

1524/1624	Call
1124	319

Call for others

LASER PRINTERS

HP Laser IID	2750
HP Laser 2P	995
HP Laser III	1695
Panasonic 4450	1395
Brother HL-8-E	1895
Nec LC 890	3195
Toshiba Laser 6	1095

MODEMS

Everex 1200 Int	79
Everex 2400 Int	149
Hayes 2400 B	299
More in Stock	Call

MONITORS

Nec Multisync IIA	499
Nec Multisync 3D	599
Magnavox EGA	339
Nec Multisync 5D	2350
Samsung EGA	359
Sony 1302	619

PACIFIC DATA PRODUCTS

P. Page II	459
P. Page IIP	365
P. 1-2-4 Mem II	159
P. One Meg IIP	180
P. 25 in One III	325
P. Headlines	245

Intel Coprocessors

8087-3	105
8087-2	145
80287-8	225
80287-10	249
80387-16	395
80387-20	425
80387-25	495
80387-33	599

ALL QUOTED PRICES ARE CASH PRICES ONLY.
Visa and MasterCard 3% higher, American Express 5% higher

EXPORTS Available

COMPUTERLANE

HOURS:
M-F 9-6
S 10-6

CORPORATE ACCOUNTS WELCOME
CALL FOR VOLUME DISCOUNTS
CONSULTANTS CALL FOR PRICING

1-800-526-3482 (Outside CA)
(818) 884-8644 (In CA)
(818) 884-8253 (FAX)

Prices subject to change without notice
* Quantities are limited

22107 ROSCOE BLVD.
CANOGA PARK
½ BLOCK W. OF TOPANGA
CA 91304

Compaq is a Registered Trademark of Compaq
IBM is a Registered Trademark of International Business Machines

Circle 62 on Reader Service Card

World Radio History

Intelligent multiport, supports RS-422

SmartLynx AT™ intelligent 4-port serial adapter for PC-AT and compatibles supports RS-422 and most multi-user operating systems. On-board processor takes burden off CPU.

For order info, call:
1-800-553-1170

QUATECH
666 Wolf Ledges Parkway
Akron, OH 44311

PC-AT is a trademark of IBM Corporation.

Circle 228 on Reader Service Card

Eight Serial Ports One Board

Quatech's ES-100 provides eight RS/232 serial ports in a single AT slot. RJ-11 modular connectors. 16450 UARTS are standard. Optional buffered 16550 UARTS. PC-AT, ISA, or EISA compatible. Priced below $500! Quantity Pricing Available!

Call for our PC Interface Handbook:
1-800-553-1170

QUATECH
666 Wolf Ledges Parkway
Akron, OH 44311

PC-AT is a trademark or registered trademark of IBM Corp.

Circle 229 on Reader Service Card

RS-422/RS-485 Boards for AT, Micro Channel

RS-422/RS-485 asynchronous serial communication boards from Quatech available in 1 to 4 ports for PC-AT and compatibles and 1 to 4 ports for PS/2 Micro Channel.

Call for our free PC Interface Handbook:
1-800-553-1170

QUATECH
666 Wolf Ledges Parkway
Akron, OH 44311

PC-AT, Micro Channel, and PS/2 are trademarks or registered trademarks of IBM Corp.

Circle 230 on Reader Service Card

Synchronous Communication Boards for AT

Quatech synchronous/asynchronous serial boards for PC-AT and compatibles support RS-232, RS-422, and RS-485 communication.

Call for our free PC Interface Handbook:
1-800-553-1170

QUATECH
666 Wolf Ledges Parkway
Akron, OH 44311

PC-AT and PC are registered trademarks of IBM Corp.

Circle 231 on Reader Service Card

Joystick Adapter for PS/2

Quatech GPA-1000 works with IBM Micro Channel for PS/2 Models 50, 60, 70, and 80. Connect two joysticks or four paddles. Also compatible with IBM Game Control Adapter for PC-XT and AT.

Call our toll free order line:
1-800-553-1170

QUATECH
666 Wolf Ledges Parkway
Akron, OH 44311

IBM, Micro Channel, PS/2, PC-XT, AT, and Game Control Adapter are trademarks or registered trademarks of IBM Corp.

Circle 232 on Reader Service Card

Digital I/O Board

Single-slot Quatech PXB-721 for PC-AT has 72 digital I/O lines. Connect three choices of data acquisition modules. Supports Labtech Notebook™

Call for our free PC Interface Handbook:
1-800-553-1170

QUATECH
666 Wolf Ledges Parkway
Akron, OH 44311

LabTech Notebook is a trademark of Laboratories Technologies Corp.

Circle 233 on Reader Service Card

5218 Printer Interface for PS/2 and AT

Quatech interface cards connect IBM 5218 DisplayWriter printer to PS/2 and AT.* Available now. Hundreds installed.

For order info, call:
1-800-553-1170

QUATECH
666 Wolf Ledges Parkway
Akron, OH 44311

IBM, DisplayWriter, PS/2, and AT are trademarks of IBM Corp.

Circle 234 on Reader Service Card

2 parallel, 2 serial, 1 board

Quatech DSDP-402 for PC-AT has two parallel ports, and two serial ports for any combination of RS-232, 422, and 485 communication. DSDP-100, two parallel and two RS-232 ports, available at lower cost.

For order info, call:
1-800-553-1170

QUATECH
666 Wolf Ledges Parkway
Akron, OH 44311

Circle 235 on Reader Service Card

Wave Form 20MHz-32K $1290

The WSB-100 Wave Form Synthesizer Board from Quatech has the best set of numbers in the market. With speed to 20MHz and a 32K memory at $1290, it's making waves in more ways than one. The WSB-100 is also a star performer as a digital pulse/word generator with the optional digital module.

Call for our free PC Interface Handbook
1-800-553-1170

QUATECH
666 Wolf Ledges Parkway
Akron, OH 44311

Circle 236 on Reader Service Card

World Radio History

8031 In-Circuit Emulation $199

Our emulator provides most of the features of an 8031 In-Circuit-Emulator at a significantly lower price. It assists in integration, debug, and test phases of development. Commands include: disassembly, trace, breakpoint, alter register/memory, and load Intel Hex file.

HTE
HiTech Equipment Corp
9400 Activity Road
San Diego, CA 92126
(619) 566-1892

Circle 116 on Reader Service Card

IEEE 488

Easiest to use, GUARANTEED!

- IBM PC, PS/2, Macintosh, HP, Sun, DEC
- IEEE device drivers for DOS, UNIX, Lotus 1-2-3, VMS, XENIX & Macintosh
- Menu or icon-driven acquisition software
- IEEE analyzers, expanders, extenders, buffers
- Analog I/O, digital I/O, RS-232, RS-422, SCSI, modem & Centronics converters to IEEE 488

Free Catalog & Demo Disks
(216) 439-4091

IOtech
25971 Cannon Rd. • Cleveland, OH 44146

Circle 124 on Reader Service Card

QUARTERHORSE

High Capacity Tape Subsystems

for Disk Backup, Data Acquisition, and Archiving
on IBM PC/XT/AT & PS/2

Everything you need in a single high quality package: Drive, SCSI Host Adapter, Enclosure, and DSI's Backup Software.

- 150 Mb 1/4" CT.....$1,395.
- 320 Mb 1/4" CT.....$1,495.
- 1.2 Gb 4mm DAT.....$3,195.
- 2.3 Gb 8mm HS.....$3,695.

Optional Application Interface Library (in 'C') available. Full Support.

DATA STRATEGIES INTERNATIONAL, INC.
9020 Capital of Tx. Hwy. Suite 570
Austin, Tx. 78759
(512) 338-4745 FAX (512) 345-1328

Circle 74 on Reader Service Card

$120 to repair a hard disk failure!

That same $120 could have paid for breakdown insurance on a basic computer system for an entire year. Insurance against hard disk failures and any other losses. Now SAFEWARE FIX:IT provides insurance for mechanical breakdown, (wear and tear) as well as external losses (theft, fire, power surges, natural disasters and more). All in a single policy, for as little as $100. per year. Call free for full information.

1-800-822-2345
Local 1-614-262-0708 Fax 614-262-1714

SAFEWARE, The Insurance Agency Inc.
2929 N. High Street
P.O. Box 02211
Columbus, OH 43202

SAFEWARE
Not Available in All States

Circle 245 on Reader Service Card

PC Communications Coprocessors

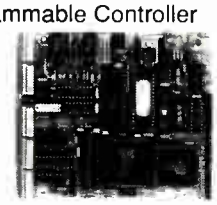
Our communications coprocessors offload serial and parallel communications tasks from PC's used in dedicated applications. RS232 and RS485 style communications. Easily programmed using C. A memory mapped interface to the host PC allows high speed data transfer and simple buffer schemes. From 64k to 512k of memory local to the coprocessor but accessible from the host PC. Used in many industrial and business systems to dramatically improve performance compared to standard PC serial port implementations.

Z-World Engineering
1340 Covell Blvd., Davis, CA 95616
(916) 753-3722
Fax: (916) 753-5142

Circle 314 on Reader Service Card

Little Giant™

C Programmable Controller



This shirt pocket sized computer interfaces directly to the outside world. Use it to control anything. Instantly C programmable with your PC and our Dynamic C. ROM and battery backed RAM to 1024k bytes. 8 Channel, 10/12 bit, A/D with conditioning. High voltage/current drivers. Battery backed time/date clock. Watchdog/power fail. 4 serial channels. 24 parallel ports. Timers. Integral power supply. Terminations for field wiring. Expansion connector. Plastic/metal packaging available. OEM versions from $199.00.

Z-World Engineering
1340 Covell Blvd., Davis, CA 95616
(916) 753-3722
Fax: (916) 753-5141

Circle 315 on Reader Service Card

Nashua

3½" DS 6.95 per box	3½" HD 15.95 per box
5¼" DS 3.95 per box	5¼" HD 6.50 per box

3M

Authorized Distributor Magnetic Media Division

5¼" DD 5.95 PER BOX	5¼" HD 10.95 PER BOX
3½" DS 8.95 PER BOX	3½" HD 17.95 PER BOX

Canon LBP-4

LASER BEAM PRINTER

OUR PRICE IS SO LOW THAT THE MANUFACTURER WOULD BE VERY UPSET IF WE WERE TO PUBLISH IT. SO WE CAN ONLY SAY "THE PRICE IS LOW & INCLUDES ONE TONER CARTRIDGE & UPS TWO DAY AIR DELIVERY"

CALL FOR PRICE

Diskette Connection™

NORTHEAST & CANADA
1-800-451-1849
PO BOX 10247, WILMINGTON, DE. 19850

SOUTHEAST
1-800-940-4600
PO BOX 4183, DEERFIELD BEACH, FL. 33442

MIDWEST
1-800-654-4058
PO BOX 1674, BETHANY, OK. 73008

WEST - HAWAII & ALASKA
1-800-621-6221
PO BOX 12396, LAS VEGAS, NV. 89112

Minimum Order $20.00 NO SURCHARGE on VISA / MC
COD orders add $3.50 Shipping charges determined by items and delivery method required by customer.
(Prices are subject to change without notice)
FAX (405) 495-4598 VISA

World Radio History

Circle 298 on Reader Service Card

UNICORN
YOUR I.C. SOURCE

COLLIMATOR PEN
(INFRA-RED)

A low power collimator pen containing a MOVPE grown gain guided GaAlAs laser. This collimator pen delivers a maximum CW output power of 2.5 mW at 25°.

These collimated laser sources are designed for industrial applications such as data retrieval, telemetry, alignment, etc.

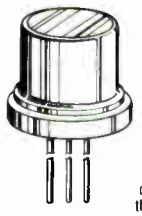
The non-hermetic stainless steel encapsulation of the pen is specifically designed for easy alignment in an optical read or write system, and consists of a lens and a laser device. The lens system collimates the diverging laser light. The wavefront quality is diffraction limited.

The housing is circular and precision manufactured with a diameter of 11.0 mm and an accuracy between + and - 11μm.

~~LIST PRICE: $180.00~~ OUR PRICE: **$39.99**

• QUALITY COMPONENTS...LOW PRICES SINCE 1983 •

LASER DIODE
(INFRA-RED)



Designed for general industrial low power applications such as reading optical discs, optical memories, barcode scanners, security systems, alignment, etc.

The gain guided laser is constructed on an n-type gallium arsenide substrate with a Metal Organic Vapor Phase Epitaxial process (MOVPE).

The device is mounted in a hermetic SOT148D encapsulation. (diameter 9.0 mm)

The SB1053 is standard equipped with a monitor diode, isolated from the case and optically coupled to the rear-emitting fascet of the laser. This fast-responding monitor diode can be used as a sensor to control the laser optical output level.

~~LIST PRICE: $38.00~~ OUR PRICE: **$9.99**

• WE CARRY A FULL LINE OF COMPONENTS! •

EPROMS

STOCK#	PINS	DESCRIPTION		1-24	25-99	100+
1702	24	256 x 4	1us	3.99	3.79	3.41
2708	24	1024 x 8	450ns	6.49	6.17	5.55
2758	24	1024 x 8	450ns	3.99	3.79	3.41
2716	24	2048 x 8	450ns (25v)	3.29	3.13	2.82
2716-1	24	2048 x 8	350ns (25v)	3.79	3.60	3.24
TMS2716	24	2048 x 8	450ns	6.29	5.98	5.38
27C16	24	2048 x 8	450ns (25v-CMOS)	3.99	3.79	3.41
2732	24	4096 x 8	450ns (25v)	3.79	3.60	3.24
2732A-2	24	4096 x 8	200ns (21v)	3.79	3.60	3.24
2732A	24	4096 x 8	250ns (21v)	3.69	3.51	3.16
2732A-4	24	4096 x 8	450ns (21v)	3.19	3.03	2.73
TMS2532	24	4096 x 8	450ns (25v)	5.79	5.50	4.95
TMS2532	24	4096 x 8	450ns (25v)	1.99	1.89	1.70
27C32	24	4096 x 8	450ns (25v-CMOS)	4.19	3.98	3.58
2764-20	28	8192 x 8	200ns (21v)	3.99	3.79	3.41
2764	28	8192 x 8	250ns (21v)	3.79	3.60	3.24
2764A-20	28	8192 x 8	200ns (12.5v)	3.99	3.79	3.41
2764A	28	8192 x 8	250ns (12.5v)	3.29	3.13	2.82
TMS2564	28	8192 x 8	250ns (25v)	6.79	6.45	5.81
27C64	28	8192 x 8	250ns (21v-CMOS)	4.19	3.98	3.58
27128-20	28	16,384 x 8	200ns (21v)	5.79	5.50	4.95
27128	28	16,384 x 8	250ns (21v)	5.09	4.84	4.35
27128A	28	16,384 x 8	250ns (12.5v)	5.79	5.50	4.95
27C128	28	16,384 x 8	250ns (21v)	5.79	5.50	4.95
27256-20	28	32,768 x 8	200ns (12.5v)	5.29	5.03	4.53
27256	28	32,768 x 8	250ns (12.5v)	4.79	4.55	4.09
27C256	28	32,768 x 8	250ns (12.5v-CMOS)	5.29	5.03	4.53
27512-20	28	65,536 x 8	200ns (12.5v)	7.49	7.12	6.41
27512	28	65,536 x 8	250ns (12.5v)	6.99	6.64	5.98
27C512	28	65,536 x 8	250ns (12.5v-CMOS)	6.99	6.64	5.98
27C1024	32	131,072 x 8	200ns (12.5v-CMOS)	17.99	17.09	15.38
68764	24	8192 x 8	450ns	13.99	13.29	11.96
68766	24	8192 x 8	450ns	14.99	14.24	12.82

VISA • CALL FOR A FREE CATALOG! • MasterCard

UNICORN ELECTRONICS

10010 Canoga Ave., Unit B-8 • Chatsworth, CA 91311

ORDER BY PHONE!
OUTSIDE CALIFORNIA: (800) 824-3432
IN CALIFORNIA: ..... (818) 341-8833
ORDER BY FAX: ..... (818) 998-7975

8051 68HC11

For info call:

Australia	(02) 654 1873
Austria	(0222) 38 76 38
Benelux	+31 1858-16133
Canada	(514) 689-5889
Denmark	(42) 65 81 11
Finland	90-452 1255
France	(01) 69 412 801
Great Britain	0962-73 3140
Israel	(03) 484832
Italy	(011) 7710010
Korea	(02) 784 7841
New Zealand	(09) 392464
Portugal	(01) 83 56 70
Scandinavia	+46 40922425
Singapore	(065) 284-6077
Spain	(93) 217 2340
Switzerland	(01) 740 41 05
Taiwan	(02) 7640215
Thailand	(02) 281-9596
West Germany	08131-1687

NOHAU CORPORATION
51 E. Campbell Ave. • Campbell, CA 95008
(408) 866-1820 FAX (408) 378-7869

Circle 183 on Reader Service Card

How to Protect Your Computer

And Make It Last Longer

FREE money-making literature. What you need to know about UPS — uninterruptible power systems. How to get complete protection from power line problems. 500 VA to 18 KVA models from the world's largest manufacturer of single-phase UPS.

Best Power Technology, Inc.
P.O. Box 280, Necedah, WI 54646
Toll-Free (800) 356-5794, ext. 3867
(608) 565-7200, ext. 3867

Circle 40 on Reader Service Card

LOW COST 15-BIT A/D CONVERTER

for IBM® PC/XT/AT COMPUTERS

UNUSUAL SPECIFICATIONS:

Years since introduction:	6
Total returns for non-performance:	0
Failures in field (including outright abuse):	4
Total service charges parts and labor:	$0.00
Price:	still $265.00

LAWSON LABS, INC.
5700 RAIBE ROAD
COLUMBIA FALLS, MT 59912
800-321-5355 or 406-387-5355

Circle 142 on Reader Service Card

ICs PROMPT DELIVERY!!!

SAME DAY SHIPPING (USUALLY)
QUANTITY ONE PRICES SHOWN for MAY 27, 1990

OUTSIDE OKLAHOMA: NO SALES TAX

		DYNAMIC RAM			
	1MB	COMP DeskPro 386/20		$295.00	
IIT 2C87-10 $250.00	SIMM	AST Prem386/33Mhz		225.00	
	SIMM	1Mx9	80 ns	88.00	80387-25
	SIMM	256Kx9	100 ns	30.00	80387-33
	1Mbit	1Mx1	80 ns	8.25	
	41256	256Kx1	60 ns	4.15	
IIT 2C87-12.5 $275.00	41256	256Kx1	80 ns	3.10	80387-16
	41256	256Kx1	100 ns	2.50	80387-20
	41256	256Kx1	120 ns	2.25	
	4464	64Kx4	100 ns	3.00	
IIT 2C87-20 $315.00	41264*	64Kx4	100 ns	5.95	80287-8 $210.00
		EPROM			
	27C1000	128Kx8	200 ns	$18.00	
	27512	64Kx8	200 ns	7.80	
	27256	32Kx8	150 ns	6.50	
	27128	16Kx8	250 ns	3.75	8087-2 $110.00
* 2-PORT VIDEO RAM		**STATIC RAM**			
	62256P-10	32Kx8	100 ns	$8.25	
	6264P-12	8Kx8	120 ns	4.50	
	6116AP-12	2Kx8	120 ns	4.25	

OPEN 6 DAYS, 7:30 AM-10 PM; SHIP VIA FED-EX ON SAT.

SAT DELIVERY INCLUDED ON FED-EX ORDERS RECEIVED BY:
Th: $2 $8.25 4 lb
Fr: P1 $16.50 1 lb

MasterCard VISA or UPS CASH COD
MICROPROCESSORS UNLIMITED, INC.
24,000 S. Peoria Ave.
BEGGS, OK 74421
(918) 267-4961
No minimum order. Please note prices subject to change
Shipping insurance rates up to $1.00 for packing materials

Circle 161 on Reader Service Card

SONY 720K-BULK 100% ERROR FREE

SONY® 59¢ EACH IN LOTS OF 50

(CHOOSE FROM—Blue, Orange, Green, Red, Yellow, Gray, White, Black & Biege, DS/DD)

SONY Boxes of 10 - 3.5" DD & HD
DD 1MB .... $ 8.95/Box HD 2MB .... $ 16.96/Box

3M Boxes of 10 - 5.25" DD & HD
DD 360K.....$ 6.50/Box HD 1.2MB....$ 11.50/Box

3M DATA CARTRIDGES (Min. 2 each)
- DC-2000...$ 15.95
- DC-2120...$ 24.95
- DC-2080 ... 20.95
- DC-600A ... 20.95
- DC-6150 ... 22.95
- DC-6250 ... 28.95

— CALL FOR LARGE QUANTITY DISCOUNTS —

ZOOM 2400 Bd Int. Modem w/ProComm s/w $ 99.
External ..... $ 109. (w/Cable: XT or AT or Mac)

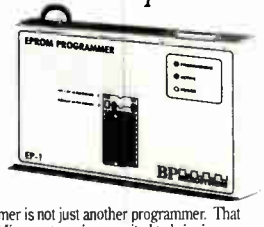
AMERICAL GROUP
800-288-8025
12132 Sherman Way, N. Hollywood CA 91605
CALL OR MAIL C.O.D. VISA

Circle 23 on Reader Service Card

There is a Difference.

Lifetime Free Updates

EP-1 $349



A programmer is not just another programmer. That is why BP Microsystems is commited to bringing our customers the highest quality programmers at an affordable price. A good example of this commitment is the EP-1 EPROM Programmer. The EP-1 supports virtually every 24- or 28-pin E/EPROM. And, all of our programmers include lifetime free software updates and an unconditional money back guarantee.

BP MICROSYSTEMS
1-800-225-2102
(713) 461-9430

Circle 45 on Reader Service Card

World Radio History

Catch the A·Bus™

Low Cost Data Acquisition and Control Products

Popular Products

Relay Card: Control 8 relays individually. 3A at 120VAC, SPST. **RE-140: $142**

High-Speed 12-bit A/D converter: Eight extremely fast (10μs) analog inputs. 0-5V, on board amp. **FA-154: $179**

8 bit A/D: 8 analog inputs. 0-5.1V. 20mV steps. 7500 readings/sec. **AD-142: $142**

12 Bit A/D: ±4V range. On-board amp. 130ms conversion. 1 input; use RE-156 or MX-155 to expand. **AN-146: $153**

Temperature Sensor: 0-200°F. 10mV/°F. Read each 2° with AD-142. **TS-111: $12**

Digital Input: 8 isolated inputs. Read voltage presence or switch status. **IN-141: $65**

Latched Digital Input: 8 isolated inputs. Each is latched to catch switch closures and alarm loops. **LI-157: $85**

Smart Quad Stepper Controller: On board computer controls 4 motors simultaneously. Simple English commands like "MOVE ARM 10.2 LEFT". Set position, ramping, speed, units... Many inputs for limit switches etc. Stepper motors available. **SC-149: $299**

Odin Software: PC compatible. Control relays from analog inputs or time schedules. Logging. Background mode. **OS-189: $129**

Reed Relay Card: 8 reed relays (20mA at 60VDC, SPST). **RE-156: $109**

Digital Output Driver: 8 outputs: 250mA at 12V. For relays, solenoids, stepper motors, lamps... **ST-143: $78**

D/A converter: 4 Channel 8 Bit D/A converter with output amplifiers. **DA-147: $149**

24 line TTL I/O: Connect 24 signals. TTL 0/5V levels or switches. (8255A) **DG-148: $72**

32 Channel Multiplexer: Switches up to 32 channels to a single common. **MX-155: $83**

Clock with Alarm: Powerful clock/calendar. Battery backup. **CL-144: $98**

Touch Tone Decoder: Converts tones to unique values. **PH-145: $87**

A·Bus Prototyping card: **PR-152: $16**

Counter Timer: 3 16-bit counters. Count pulses, time intervals. **CT-150: $132**

Cobra Robot Arm: 5 axis robot. Connects to PC printer port. Excellent resolution and repeatability. **SK-190: $549**

Motherboard: Holds up to 5 A·Bus cards. **MB-120: $108**

Metal A·BUS MB-120 cover: **MC-108: $45**

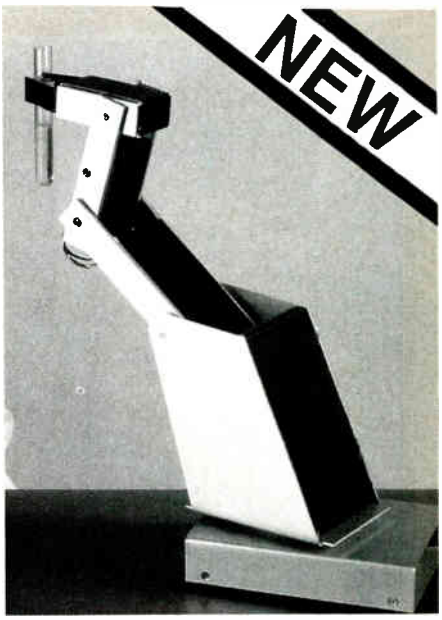
Acrylic A·BUS cover **AC-109: $49**

A·Bus Adapters:
IBM PCs & compatibles. **AR-133: $69**
MicroChannel Adapter: **AR-170: $93**
Parallel Adapters also available for Apple II, Commodore 64,128, TRS-80
Serial Adapter: Connect A·Bus systems to any RS-232 port. **SA-129: $149**
Serial Processor: Built in BASIC for off-line monitoring, logging, decision making. **SP-127: $189**

Circle 19 on Reader Service Card

NEW! Cobra Robot Arm

Alpha Products proudly announces this 5-axis arm. It connects to the IBM PC and compatible computers using the standard printer port. Pulse width modulated, high-torque servomotors for efficiency and power. Arm extends 13 inches. Four articulations plus gripper. Use for automating long and repetitive lab experiments and robotics instructions. With software. Only $549



Call for new catalog! (800) 221-0916

What is the A·Bus?

The A·Bus is a system for connecting devices to your computer. All A·Bus devices are compatible: no matter what type of computer they may be connected to. With the A·Bus boards, you can perform a myriad of functions.
Sensing. Detecting or reading a switch or voltage.
Measuring. Determining a force, frequency, temperature, weight, or any other quantity. Each of these conditions is converted to a voltage which is then measured by A·Bus cards.
Switching. Open or close a circuit. Switch any type of electrical device.
Governing. Control the level or position of a device. Move objects, drive motors.
In simple terms: the A·Bus is a set of building blocks which can be assembled into any system.

Why is the A·Bus so wonderful?

It's affordable. From the $65 Digital Input Card to the $299 Smart Stepper Controller, you get much more than your money's worth.
It's simple. Easy connection to your computer and simple wiring with screw terminals. Designed to be easy to use in software.
It's reliable. Built to commercial standards using prime components.
It's versatile. You mix and match low cost boards to fit your project.
It's well supported. Proudly designed and built in America.
It's proven. Thousands of applications installed around the world, on sea and on land.
A customer's comment: *"I've reviewed the field for a year. There is nothing like your A·Bus. Its low cost, power and versatility have no match."*

ALPHA Products

242-B West Avenue, Darien, CT 06820 USA Call (203) 656-1806 or Fax 203 656 0756

UK: Pinna Electronics, Scotland..... Tel: (0294) 605296 Fax: (0294) 68286
Asia: Batam Development Agency, Singapore..... Tel: 473-4518 Fax: 479-6496
Scandinavia: A/S Con-Trade, Norway ..... Tel: (04) 41 83 51 Fax: (04) 41 94 72

World Radio History

GO AHEAD.ASK US ANYTHING!

800-87 EXCEL

88-12s from $399 to $1,278

286-XTs from $499 to $1,378

286-12s from $699 to $3,325

286-16s from $799 to $3,425

286-20s from $899 to $3,525

386SXs from $969 to $3,595

386-20s from $1,299 to $4,215

386-25s from $1,399 to $4,315

386-25s from $1,769 to $4,665
(64K Cache)

386-33s from $1,949 to $4,845
(64K Cache)

EXCELLENCE!

We guarantee it! Excellent performance, Excellent Price, Excellent selection, and EXCELLENT before and after the sale (toll free) Support and Service. 30 DAY MONEY BACK GUARANTEE and ONE FULL YEAR Parts and Labor Warranty. All EXCEL computers carry a 10 Year Limited Warranty. Do Not Settle For Anything Less.

EXCELERATE!

386-25
25 MHz
0-WAIT
Norton SI-44
Speed-117 Mhz
Exp. to 16 MB
AWARD BIOS
DIP
EMS 4.0

MODEL/DESCRIPTION	BASE	MONO	CGA	EGA	MONO VGA	COLOR VGA	VGA SUPER
1.2MB and 1.4MB Floppy Drive	$4,379	$4,479	$4,599	$4,837	$4,592	$4,906	$4,975
30 / 38MILS,MFM,1-1,ST125	$4,639	$4,739	$4,859	$5,097	$4,852	$5,166	$5,235
30 / 38MILS,MFM,1-1,ST138	$4,659	$4,759	$4,879	$5,117	$4,872	$5,186	$5,255
40 / 38MILS,RLL,1-1,MS8450	$4,679	$4,779	$4,899	$5,137	$4,892	$5,206	$5,275
40 / 19MILS,IDE,1-1,QUANTUM	$4,729	$4,829	$4,949	$5,187	$4,942	$5,256	$5,325
65 / 38MILS,RLL,1-1,PTI	$4,739	$4,839	$4,959	$5,197	$4,952	$5,266	$5,335
80 / 19MILS,IDE,1-1,QUANTUM	$4,969	$5,069	$5,189	$5,427	$5,182	$5,496	$5,565
120 / 20MILS,IDE,1-1,CONNER	$5,039	$5,139	$5,259	$5,497	$5,252	$5,566	$5,635
200 / 16MILS,IDE,1-1,CONNER	$5,379	$5,479	$5,599	$5,837	$5,592	$5,906	$5,975
320 / 16MILS,ESDI,1-1,CDC	$6,079	$6,179	$6,299	$6,537	$6,292	$6,606	$6,675
700 / 16MILS,ESDI,1-1,HITACHI	$6,679	$6,779	$6,899	$7,137	$6,892	$7,206	$7,275

For prices and details on HUNDREDS of more items including BAREBONES, CO-PROCESSORS, DRIVES, CONTROLLERS, MONITORS, MODEM/FAX BOARDS and much more call:

800-87 EXCEL

Networking

ARCNET LAN CARD Twisted Pair NT2050, Coax Star NT2051,Coax Bus NT2052. **$77**

ARCNET PASSIVE HUB, 4 Port Hub,NT2055. **$18**

ETHERNET LAN CARD, 8bit XT/AT, NE1000 COMPATIBLE. NT2030. **$147**

ETHERNET LAN CARD, 16 BIT AT, NE2000 COMPATIBLE. NT2036. **$169**

UNIX/XENIX 4-port MULTI-TERMINAL, 16 AND 32 port Versions available. NT2018. **$109**

NETWORK OS by CRIS Inc. IBM LAN, MS-NET,NOVELL Compatible,Price per node. NT2022-NT2028 **$119**

Motherboards & Barebones

12Mhz XT Motherboard, 0K, 4.77/12Mhz, 640K/1MB, SI-4.9, XT2123. **$69**

10Mhz 286XT Motherboard, 640K/1MB, SHADOW RAM, DISKCACHE, 0K. XT2861. **$99**

286-12Mhz AT Baby Motherboard, Upto 4MB, 0-Wait State. AT2071. **$195**

80386-25Mhz FLASHCOM Motherboard, Full Size, Exp. to 8MB, 0K. MADE IN USA. AT2061. **$1199**

80486-25Mhz Motherboard, 0K, Exp. to 8MB, Landmark 117Mhz, Full Size, 6 Layer. AT2486. **$3,395**

EXCEL 386-25 25Mhz BAREBONE AT Case, 200W PS, Exp. 8MB, 0K. SS2009. **$775**

Drives & Controllers

AT HARD/FLOPPY CONTROLLER, MADE IN USA, MFM, Controls 4 Floppy Drives, 1:1 Interleave, 2 Yr Warranty. AT2112. **$89**

AT HARD/FLOPPY CONTROLLER, Made in USA, RLL, Controls 4 Floppy Drives, 1:1 Interleave, 2 Yr Warranty. AT2022. **$109**

360K Floppy Disk Drive 5-1/4". DR2001. 720K Floppy Disk Drive 3-1/2". DR2005. **$69**

1.2 MB Floppy Disk Drive 5-1/4". DR2003. 1.4 MB Floppy Disk Drive 3-1/2". DR2006. **$89**

700MB Hard Disk Drive, Hitachi, DK515-78, 3 Yr Warranty, ESDI, 16ms. DR2700. **$1,999**

600MB Optical Disk, SLSI, 60ms, Rewriteable. DR2600. **$2,025**

1.3 Gbytes WangDAT Cassette Tape Drive, SCSI. DR2130. **$2,250**

Boards

MONOGRAPHICS W/PRINTER MGA. Hercules Compatible. VI2002. **$29**

ENHANCED VGA GRAPHICS CARD 8 or 16 bit. 512K, 1024x768, 800x600 @ 256 Colors,2 Year Warranty, MADE IN USA. VI2083. **$179**

AT I/O Card Serial, Parallel, Game Ports. AT2004. **$35**

RAM 3000, Upto 3MB, 4.0 EMS RAM Card. LIM 4.0, 0K, 16 bit AT. VI2E13. **$99**

2400 BAUD INTERNAL 5Yr Warranty, 2400/1200 Baud. CO2012. **$79**

9600/2400 Baud FAX/MODEM Internal, 1 Year Warranty. CO2019. **$299**

SALES - 800-873-9235

ORDER 24 HOURS 7 DAYS A WEEK

NETWORK PC

Division Of WAA Incorporated. 5020 N W 39th Street, Lincoln Nebraska 68524
HOME OFFICE (402)470-3446 - FAX NUMBER (402)470-3179
NETWORK PC FACTORY OUTLET LOCATED AT 48TH & O STREET, LINCOLN NEBRASKA 68510

SERVICE - 800-666-3440

VISA, MC Money orders and cashiers checks welcome. Company or personal checks, please allow two weeks. Corporate and Institutional PO's are welcome. Dealers or VAR'S please call. All Shipping, Handling and Insurance costs are excluded. All Products carry a 1 Yr limited warranty, parts and labor ex-factory. All Sales are Final. Defective items will be replaced at our discretion. Returns are not excepted without a RMA number. All items returned must be in orignal packaging. Prices, terms and information in this advertisement are subject to change without notice.

Circle 181 on Reader Service Card

World Radio History

Rom Based AT Systems

Single Board Solutions

- 5 Serial Ports
- DOS & Applications on Rom
- Cards $299, Systems $399

CPU Cards: V50 CPU, 8086 Code Compatible
1MB Ram, 256kB Eprom
5 Serial Ports
CMOS (2 watt), 4.5" x 7"

Expansion: Backplanes for PC/AT cards
Piggyback card with:
Floppy, Scsi, Printer, Keyboard

Software: We provide tools to burn exe files and DOS on to Rom. Programs will run as on an AT. BIOS, Utilities, Debug Monitor, and Source code available.

Kila Systems

(303) 444-7737 Fax (303) 786 9983
655 Hawthorn Ave., Boulder, CO 80304

Circle 135 on Reader Service Card

GENUINE Dysan® DISKS

100% error free!

5.25" DSDD	62¢	ea.
5.25" DSHD	$1.09	ea.
3.5" DSDD	88¢	ea.
3.5 DSHD	$1.93	ea.

Dysan

HEWLETT PACKARD

Genuine HP Toner Cartridges
SERIES I Order #92285A
SERIES II Order #92295A

1-2 ea.	3-5 ea.
$79.95	$78.55

1-800-258-0028

S&H:FOB Grand Rapids, MI. MI residents + 4% tax.
Prices subject to change. COD + $5.50.

Precision Data Products™
P.O. Box 8367 • Grand Rapids, MI 49518
616-698-2242 • FAX: 616-698-9047

Circle 207 on Reader Service Card

TERABYTE INTL

MOTHER BOARD

386-33/32K CACHE	1MB $1350	2MB $1450	4MB $1615
386-25	1MB $ 850	2MB $1020	4MB $1105
386SX-16	1MB $ 455	2MB $ 550	4MB $ 750

MODEM	2400 BSP INTERNAL $ 69.00
VGA	16 BIT 1024X768 $165.00

EVEREX MFM 1:1 INTERLEAVE HD/FD CONTROLLER $ CALL

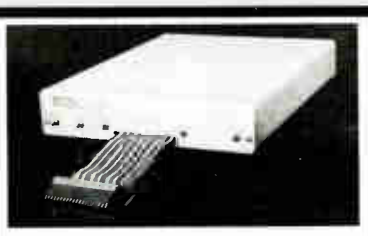
D-RAMS			MATH COPROCESSORS		
256Kx4	-08	$CALL	80387	33	$550
1MEG	-08	$CALL	80387	-25	$450
64X4	-10	$ 3.50	80387	-20	$355
41256	-08	$CALL	80387	-16	$315
41256	-10	$ 2.50	80387SX		$CALL
41256	-12	$ 2.00	80287	-10	$210
SIMMS & SIPPS			**CACHE MEMORY**		
1 MEGX9	-80	$CALL	8KX8	-20	$CALL
256X9	-80	$CALL	8KX8	-25	$CALL

CALL FOR CURRENT PRICE & VOLUME DISC.

IN USA 800-688-BYTE ASK FOR TERI
CANADA 604-263-0988 ASK FOR LCH

TERABYTE INTL INC.
17777 CRENSHAW BLVD #103 TORRANCE CA 90504
TEL 213-323-8778 FAX 213-323-8896
PRICE SUBJECT TO CHANGE WITHOUT NOTICE

Circle 281 on Reader Service Card



68HC05 AND 68HC11 IN CIRCUIT EMULATORS

The TECICE-HC05 and TECICE-HC11 are low cost real time in circuit emulators for the Motorola 68HC05 and 68HC11 families of single chip microcomputers. Any host computer with a serial port and terminal emulation software can be used with these emulators. Complete development system software is included for MS-DOS based computers. The base prices are $1,195 for the HC05 and $995 for the HC11.

TECI THE ENGINEERS COLLABORATIVE, INC.

RR#3, BOX 8C Barton, Vermont 05822
Phone (802) 525-3458 FAX (802) 525-3451

Circle 94 on Reader Service Card

486 $2495

11.1 MIPS

Made in U.S.A.

JC GOLD CARD

The JCS 486, the New Performance Leader in Personal 486 Systemboards

- Intel 80486/25(B6) CPU
- 8KB Cache integrated in CPU
- Math Coprocessor integrated in CPU
- Shadow RAM for Video & System BIOS
- Second Level Cache Memory expandadable to 512KB
- Weitek 4167 numeric coprocessor socket
- 30 DAY MONEY BACK GUARANTEE

486 Complete System.....$3985
Include 4MB Memory, 150MB ESDI HDD, ESDI Cache Controller, 1.2 or 1.44MB FDD, MS DOS, AT I/O, 101 Keyboard

80386/20 CPU Bd, C&T chipset	$ 590
80386/25 CPU Bd, C&T chipset	$ 695
80386/25 Cache Bd, C&T chipset	$1095

Dealer inquiries welcome

Jemini Electronics TEL (408)727-9986
3400 De La Cruz Blvd, Unit T FAX (408)727-7687
Santa Clara Ca, 95054

Circle 132 on Reader Service Card

FREE CATALOG

RS-232C INTERFACE & MONITORING EQUIPMENT CATALOG

WRITE or CALL for YOUR *FREE* COMPREHENSIVE B & B ELECTRONICS CATALOG TODAY!
Pages and pages of photographs and illustrated, descriptive text for B&B's complete line of RS-232 converters, RS-422 converters, current loop converters, adapters, break-out boxes, data switches, data splitters, short haul modems, surge protectors, and much, much more. Most products meet FCC Part 15J. Your RS-232 needs for quality, service and competitive prices will be more than met by B&B ELECTRONICS. **Manufacturer to *you*, no middleman!** Money-back guarantee! Same-day shipment! One-year warranty on products! Technical support is available.

Order direct from manufacturer TODAY & SAVE!

Write For Your FREE Catalog Today!

B&B electronics MANUFACTURING COMPANY
4002G Baker Road P.O. Box 1040 • Ottawa, IL 61350
Phone: 815-434-0846

Circle 325 on Reader Service Card

Circle 35 on Reader Service Card

PC BASED UNIVERSAL DEVICE PROGRAMMER $695/895

- Programs EE/EPROMs, MICROs, BIPOLARs,PALs, GALs, EPLDs, PEELs (current libraries support over 900 devices by over 35 manufacturers)
- **Software driven pin drivers**. D/A generated programming voltages (8 bit DACs used to generate voltages from 5-25V with 0.1V resolution for all pins)
- Fast device programming / verify / read via dedicated parallel interface.
- **Upgradeable for virtually any future programmable devices up to 40 pins.**
- Self-subsistent operation. No additional modules or plug-in adapters required
- Includes user friendly **MEMORY BUFFER FULL SCREEN EDITOR**. Commands include: Fill, Move, Insert, Delete, Search. Data entry can be done in ASCII or HEX form. **FUSEMAP EDITOR** for Logic devices.
- Friendly **Menu-Driven interface**. Device selection by **PIN** and **Manufacturer**
- Supports **8/16/32 bit data word formats.**
- Programming algorithms: **Normal, Intelligent I & II, Quick Pulse Programming.** Automatic selection of fastest algorithm for any given part
- Verify operation performed at normal & worst case operating voltage
- **Functional test:** JEDEC standard functional testing for logic devices. TTL Logic functional test for 74xx/54xx series devices and memory devices. Test library can be updated by the user. User definable test pattern generation
- File formats accepted: **JEDEC (full), JEDEC(kernal), Binary, MOS Technology, Motorola Hex, Intel Hex, Tektronix Hex.**
- **Base price ($695)** includes Interface card, cable, Memory + Micro + Bipolar library, TTL/CMOS/MEMORY device test capability, one year free updates
- **Complete price ($895)** includes all of the above plus **Logic Device Library.**
- Library updates can be received via floppy or B&C Customer Support BBS
- **Full 1 year warranty.** Customer support via voice line, Fax & dedicated BBS

UNIVERSAL RS-232 PROGRAMMER $345/495

- **Programs EE/EProms, ZPRams,Intel Micros,Flash EProms,Memory Cards.**
- **Stand-Alone Mode** for EE/EProm and Memory Card Duplication / Verify.
- All 24/28/32 pin EE/EProms to 4 MBits (upgradeable to **32 megabits**).
- **Micros8741/A,-2/A,-4,-8,-9,-51,-C51,-C51/A/B,-52,-53,-55,-C521,-C541,9761.**
- **Model UP100 ($345). Model UP200 ($495)** accepts dedicated modules.
- **Memory Cards** Programming Module (Seiko/Epson,Fujitsu.) - **$145.**
- **GANG** Programming Module (4 sockets) - **$145.**
- **Optional built-in Eraser/Timer** module - **$50.** **Conductive foam pad.**
- On-Board Programming capability; Custom interface modules available.
- **User friendly Menu-Driven** Interface Program for **IBM-PC and Macintosh.**
- Can be operated with any computer containing an **RS-232 serial port.**
- OEM open board programmer configurations available (from **$245**).
- One year free software updates and Customer Support.
- Customer support via voice line, **dedicated BBS** or fax; **Full 1 year warranty.**

INTELLIGENT ROM EMULATOR $395

- Emulates **2716 through 27512 EProms** (2k to 64k bytes) with a single unit.
- **Megabit parts** can be emulated with multiple units (Mega adapter required).
- Connects to the **standard parallel printer port.** Uses standard printer cable.
- **FAST data loading via parallel printer port (64k bytes in less than 10 seconds).**
- Intelligent "In-Circuit-Emulator" type features include: **Address Compare** (with HALT output), **Address Snapshot** (for target addr. bus monitoring), **Trigger Input** (for external events monitoring), **Programmable Reset Output.**
- **Powerful Memory buffer editor.** Selectable wordsizes (8,16,32).
- User friendly software. Command set includes: **Load, Write, Display, Run, Type, Edit, Fill, Run-Command-File, Monitor, Port, Reset, Help, Calculator.**
- **Cascadable to 8 units.** Includes target cable with **Trigger, Halt & Reset** clips.
- **CMOS model with NiCad rechargeable 9V battery backup - $495.** (Can be used in **stand-alone** mode; Built-in battery recharging circuitry.)
- File formats accepted: **Binary, Intel Hex, Motorola S.**

MC / VISA / AMEX Call today for datasheets!

B&C MICROSYSTEMS INC.
355 WEST OLIVE AVE., SUNNYVALE, CA 94086 USA
TEL: (408)730-5511 FAX: (408)730-5521 BBS:(408)730-2317

World Radio History

SUMMER CLEARANCE CALL 800-654-7762

CONDITIONS: ALL NEW WITH 6 MONTH WARRANTY—WILL NOT BE UNDERSOLD—LIMITED TO STOCK ON HAND

CANON FLATBED SCANNER IX-12F

325 Left

- 300 DPI • 16 Secs per page • 32 Level Gray Scale
- 1 year warranty • Ready to go Interface card and cable included

List 1595 **Your Price 599.00**

DPTIONS: OCR 199.00 PC Paint By Z-Soft 1.65 79.00 Sheet Feeder 299.00

WANGTEC 60MB TAPE BACKUP

142 Left

- 6.5MB per minute • Wangtec 5099EN24 drive
- Wangtec 8 bit Qic60 controller • Software • Menu driven
- DC600 cartridge • Easy installation

List 999.00 **Your Price 499.00** 40MB backup no controller 249.00

HIGH SPEED SCANNER

97 Left

Canon IX-12 **Ready to go for IBM - Type Machine**

Manufactured by Canon

List: 1095.00 **Your Price: 499.00**

STANDARD FEATURES: 300 DPI - Allows for the creation of high resolution graphics/text. **Automatic Sheet Feeder** - Efficient document handling. **Image Input** - Sheet or card (up to 5 sheets can be set with the built-in Automatic Document Feeder) **Scanning Speed** - 12 seconds/page (at 300 dot/inch) 6 seconds/page (at 150 dot/inch) **Gray Scale** - 32 shades either pattern or 2 shades.

OPTIONS: PC Paint By Z-Soft 1.65 79.00 PC-OCR Software 199.00 Super Fax by Calculus 249.00

MODEMS & VGA MONITORS

1200 BAUD 399.00

2400 BAUD INTERNAL MODEM ZOOM 12HZ

- Fully Hayes Compatible • Addressable COM 1,2,3,4 • Compatible with IBM PC, XT, AT and Compatibles
- Full Duplex Operation with Software • Auto Dial/Auto Answer **List 199.00 Your Price 89.00 Each**

2400 BAUD EXTERNAL MODEM **List 299.00 Your Price 109.00**

VGA 14" MONITOR

- .31 Dot Pitch • 3 month warranty • Samsung • Demo units **List 699.00 Your Price 279.00**

EGA Card 640 x 350 89.00 VGA 800 x 600 16 Bit Card 119.00

COMPAQ

Description	Equiv. Compaq Part #	For Model #	Your Low Price
1MB Add-on Module	113131-001	386/20/25/20e/286E	179.00
1MB Add-on Module	113646-001	Deskpro 386S	189.00
4MB Add-on Module	***113132-001***	***386/20/25/20E/286E***	***489.00***
4MB Add-on Module	112554-001	Deskpro 386S	499.00
1MB Memory Exp. Bd	113644-001	Deskpro 386/20e	299.00
1MB Memory Exp. Bd	113633-001	Deskpro 386S	309.00
4MB Memory Exp. Bd	113645-001	Deskpro 386/20e	799.00
4MB Memory Exp. Bd	113634-001	Deskpro 386S	799.00
1MB Memory Exp. Bd	117428-001	286E	469.00
4MB Memory Exp. Bd	117429-001	286E	1299.00
1MB Upgrade Bd	110235-001	SLT/286	399.00
4MB Upgrade Bd	108070-001	386/16	1299.00

HP LASER JET II, IID, IIP & III

1Meg 179.00 2Meg 269.00 *4Meg 419.00*

HP IIP 1049.00 HP LASER JET II 1499.00 HP III 1799.00

All memory boards expandable to 4 Meg.

ZENITH

386/25/33	1 Meg	149.00
	2 Meg	399.00
Super	1 Meg	389.00
Super 286	4 Meg	1199.00

MEMORIES. . .

SIPP/SIMM MODULES

Description	150NS	120NS	100NS	80NS	60NS
64 x 9 IBM	199.00	299.00	—	—	—
256 x 8 Apple	199.00	249.00	299.00	399.00	—
256 x 9 IBM	149.00	199.00	299.00	339.00	599.00
1Meg x 8 Apple	—	859.00	959.00	999.00	—
1Meg x 9 IBM	—	849.00	899.00	949.00	1099.00
4Meg x 9 IBM	—	—	—	5999.00	6999.00

INTEL COPROCESSORS

8 Bit			**32 Bit**		
8087	5MHz or less	85.00	80807-16	16MHz	309.00
8087-2	8MHz	119.00	80387-20	20MHz	359.00
8087-1	10MHz or less	149.00	80387-25	25MHz	459.00
16 Bit			80387-33	33MHz	559.00
80287	6MHz	129.00	80387-SX		299.00
80287-8	8MHz	189.00	Above Piggyback 512K exp 2 Meg #4220		149.00
80287-10	10MHz	218.00			
80C287-12	Laptop	289.00			

AST

1 Meg	149.00
2 Meg	259.00
4 Meg	399.00

Specify Machine Type

IBM PS2 (BOARDS & MODULES)

Description	Equiv. IBMPS2 Part #	For Model #	Your Low Price
512K Upgrade	30F 5348	30/286	99.00
2MB Upgrade	30F 5360	30/286	279.00
1MB Module	6450603	70-E61 & 121	139.00
2MB Module	***6450604***	***70-E61 & 121***	***249.00***
2MB Module	6450608	70-A21	259.00
1MB Mem. Board	6450375	80-041	299.00
2MB Mem. Board	6450379	80-111 & 311	499.00
2MB Exp. 8MB	6450605	70/80	1249.00

RAM CHIPS

Description		150NS	120NS	100NS	80NS	70NS
64 x 1	Thousands In Stock Call For Qty. Dis.	1.49	2.99	2.95	—	—
64 x 4		3.45	3.95	4.45	5.95	—
256 x 1		2.99	2.59	2.95	2.79	4.95
256 x 4		—	8.99	9.99	10.99	13.45
1 Meg x 1		—	5.95	6.45	6.85	7.95

TOSHIBA LAPTOP

512K	199.00
2 Meg	499.00
3 Meg	699.00

Specify Machine Type

MICROSOFT FILE 2.0

For Mac 48 Left

Data base with forms & reports List Price 195.00 **Your Price 79.00**

80MB FOR MAC

26 Left

80 MB HARD DRIVE KIT BY EVEREX

- 80 MB for MAC II & SE • EMAC 80ID • All installation manuals, cables & software included

List Price 1495.00 **Your Price 599.00**

NEC CUT SHEET FEEDER

225 Left

- Works with 2000/3500 series List 399.00 **Your Price 49.00**
- Cut sheet feed guide List 99.00 **Your Price 19.00**

INTEL PIGGYBACK BOARD

39 Left

- 512K exp 2 Meg for above board • Part no 4220

List 545.00 **Your Price 149.00**

REAL IBM MEMORY BOARDS

250 Left

The Real Thing **ORIGINAL BOARDS**

- 512K memory expansion board for IBM AT • Model 6450203 IBM

List price 395.00 **Your Price 69.00**

- 512K expandable to 2 Megs for IBM AT • Model 6450343

List price 495.00 **Your Price 89.00**

BOCA AT PLUS

39 Left

2 Meg 279.00 4 Meg 449.00 8 Meg 849.00

WORDSTAR 5.0

- Write or edit text based business reports as documents
- Advanced page preview to save time
- Organize format & merge info from other software

List 495.00 **Your Price 124.00**

TANDON TM100-2A

625 Left

- 360K full height drive • The original IBM drive

List 199.00 **Your Price 79.00**

LOTUS 1-2-3

95 Left

Buy LOTUS 1 2 3 & Get Always FREE

Version 2.01 5¼ **List 495.00** **Your Price 199.00**

Lotus Metro 1.0 **List 85.00** **Your Price 29.00 each**

MONOCHROME CARD

950 Left

- ½ card PC, XT, AT compatable • Text card only

List 69.00 **Your Price 8.00**

US ROBOTICS 2400 PS2

22 Left

- 2400 baud internal for PS2 • For models 50/60/80
- Auto dial • 2400/1200/300 baud rate • Auto answer

List 399.00 **Your Price 149.00**

ORCHID RAMQUEST II

42 Left

RAMQUEST II:

- Memory card for PS/2 models 50 & 60
- Comes with 1 Meg of Ram expandable to 2 Megs (uses 256K's)
- EMS 4.0 compatible & OS/2 • Ram disks, disk caching & print spooling software included

List price was 795.00 **Your Price 149.00**

DTK SYSTEMS

8088-10	80286-10	80386-20
256K exp. 640K	640K exp. 1Meg	1Meg exp. 8Meg
$349.00	$649.00	1299.00

All systems include 101 Keyboard, Power Supply, Case, Motherboard, Drive & Memory

BERING BERNOULLI BOX

19 Left

BERNOULLI BOX EXTERNAL

- Two 20 Meg removable drives • Uses 5¼ removable cartridges
- Use SCSI interface compatible with all MACS

List 2299.00 **Your Price 999.00**

DOS 3.1 w/GW BASIC

125 Left

- MS Dos 3.1 with GW basic
- Packaged with great documentation from AT & T

List 99.00 **Your Price 29.00 each**

LETTER QUALITY PRINTER

By C. ITOH

DAISYWHEEL PRINTER MANUFACTURED

Why pay $1149 for a C.Itoh

STARWRITER™ F-10

When our 40 cps letter quality daisywheel printer from the same manufacturer is only . . . **List Price 1249.00** **Your Price 399.00**

OPTIONS

• 6 ft. Serial Cable	$ 19.00
• Bidirectional Tractor	99.00
• Serial to Parallel Converter	99.00

COLOR/MONO CARD

157 Left

- Mono & color graphics • Parallel port • Manufactured by STB

List 99.00 **Your Price 29.00**

SEAGATE 10 MEG

125 Left

- Full HT • 60 day warranty • 10 Meg St412

Qty. 1 List Price 199 **Your Price 79.00**

Controller & Cables **Add 50.00**

ORDERS ONLY

800-654-7762

TECHNICAL / CUSTOMER SERVICE / ORDER STATUS:

702-294-0204

FAX 702-294-1168

Trademarks are Registered with their respective Co's. Prices Subject to Change

All Products 90 Day Warranty unless stated otherwise.

SE HABLA ESPANOL

- WE ACCEPT INTERNATIONAL ORDERS
- WE ALSO PURCHASE EXCESS INVENTORY—FAX OR CALL
- MEMORY PRICES ARE FLUCTUATING AGAIN — CALL FOR CURRENT PRICES
- NO SOFTWARE RETURNS

NO SURCHARGE FOR MC/VISA/AE

TERMS:

MC • VISA • COD CASH • NET

Purchase Orders from Qualified Firms

Personal Checks • COD add $5.00

20% Restocking Fee on Returns Within 15 Days

No Refunds After 30 Days

NEVADA COMPUTER CORP.

1000 Nevada Hwy. • Unit 101

Boulder City, NV 89005

Formerly Mead Computer

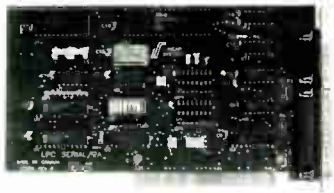
SHIPPING: (min. 6.25) UPS

Circle 182 on Reader Service Card

World Radio History

New

LPC Serial/2A HDLC/SDLC Data Communication Controller for IBM PC/AT Bus



- Dual Channel Synchronous Controller (Z85C30)
- Runs 800K BAUD
- Full Duplex DMA
- HDLC LapB software option

Computer Modules, Inc.
2348C Walsh Ave.
Santa Clara, CA 95051
Tel: (408) 496-1881
Fax: (408) 496-1886

IBM PC/AT is a trademark of IBM, Inc

Circle 328 on Reader Service Card

SAME DAY SHIPPING

R & R Electronics
6050-X, McDonough Drive, Norcross, GA 30093
(404) 368-1777 • Fax (404) 368-9659
Prices subject to change without notice

SIMMs

PS/2, AST etc.	Call	256Kx9-80	$26
1Mx9-70	$80	256Kx9-100	$24
1Mx9-80	$77	1Mx8-80	$72
1Mx9-100	$75	Other Cards	Call

D-RAMS

256K-70	$3.00	64x1-100	$2.00
256K-80	$2.75	64x4-100	$3.50
256K-100	$2.50	256x4-100	$8.00
256K-120	$2.25	1Mx1-80	$7.80
256K-150	$2.00	1Mx1-100	$7.70

INTEL or IIT

8087	$ 88	80287-12	$275
8087-2	$115	80387-SX	$300
8087-1	$165	80387-16	$315
80287-6	$135	80387-20	$355
80287-8	$185	80387-25	$450
80287-10	$215	80387-33	$550

MasterCard 800-736-3644 VISA

Circle 239 on Reader Service Card

JLaser 5 . . . $399

Laser Printer Controller

Thinking of buying a
- LaserMaster
- Intel Visual Edge™
- Kofax board

Wasting $$$

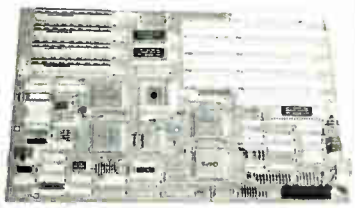
JLaser 5 gives you the functions of all three boards combined into one, *plus* EMS:
- Fast laser printing
- Halftones on a laser printer
- Group 4 file printing and display

TALL TREE SYSTEMS
2585 E. Bayshore Rd. ■ Palo Alto, CA 94303
(415) 493-1980 ■ FAX (415) 493-7639

Versions available for HP Series II/III and Canon LBP-4 laser printers
All products are trademarks of their respective companies
Artwork for this ad created with JLaser 5 and included software

Circle 275 on Reader Service Card

386/SX .... $339 All-In-One Series



FLOPPY CONTROLLER BUILT-IN
IDE HD INTERFACE BUILT-IN
MULTI I/O PORTS BUILT-IN
PHOENIX BIOS W/EMS 4.0
C&T 386/SX CHIP-SET
EXPAND TO 8MB ON-BD

HOMESMART COMPUTING
(800)627-6998/US
MC-VISA-AMX-COD

Circle 324 on Reader Service Card

EZ-ROUTE VERSION II

SCHEMATIC TO PCLAYOUT $500 INCLUDES AUTO ROUTER

EZ-ROUTE Version II from AMS for IBM PC, PS/2 and Compatibles is an integrated CAE System which supports 256 layers, trace width from 0.001 inch to 0.255 inch, flexible grid, SMD components and outputs on Perplotters as well as Photo plotters and printers

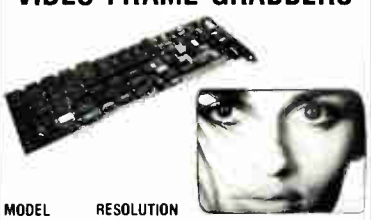
Schematic Capture $100, PCB Layout $250, Auto Router $250.

FREE EVALUATION PACKAGE
30 DAYS MONEY BACK GUARANTEE
1-800-972-3733 or (305) 975-9515

ADVANCED MICROCOMPUTER SYSTEMS, INC.
1321 N.W. 65 Place - Ft. Lauderdale, FL 33309

Circle 34 on Reader Service Card

VIDEO FRAME GRABBERS



MODEL	RESOLUTION	
HRT 256-4	256 x 256 x 4	495
HRT 256-8	256 x 256 x 8	795
HRT 512-8	512 x 512 x 8	995
HRT 512-24	512 x 512 x 24	1995

- IBM PC/XT/AT COMPATIBLE
- DIGITALIZE IN REAL TIME
- COMPOSITE VIDEO IN
- 24 BIT RGB OUT except model HRT 256-4 16 level gray scale out
- SOFTWARE LIBRARY OF IMAGE ANALYSIS ROUTINES
- FREE SOFTWARE UPGRADES TO REGISTERED OWNERS
- FULL CREDIT ON UPGRADE PURCHASE IN FIRST YEAR RETURN OLD BOARD AND JUST PAY DIFFERENCE

HRT
HIGH RES TECHNOLOGIES
P.O. BOX 76
LEWISTON, N.Y. 14092
PHONE 416-497-6493 FAX 416-497-1988

Circle 115 on Reader Service Card

Circle 36 on Reader Service Card

LOW COST INTERFACE CARDS FOR PC/XT/AT

RS-485/422 Card [PC485] $95/125

- Serial Asynchronous Communication up to 4,000ft; 2 or 4 wires; NS16450 UART.
- Can be configured as COM1-COM4; Maximum Baud Rate 56KB.
- Flexible configuration options, RTS or DTR control of transmission direction.
- Full/Half duplex operation. Supports hardware handshaking (RTS,CTS).
- Dual drivers/receivers;Handles 64 devices;Compatible with most comm. sftwr.
- High speed version available (supports baud rates up to 256KB) - $165

Dual-Port RS-485/422[PCL743] $175

- Two independent channels / UARTs; 2 or 4 wire operation. Max. Baud 56KB
- Dipswitch configurable as COM1-4 (IRQ2-7). On board terminator resistor.

IEEE-488 Card [PC488A] $145

- Includes INSTALLABLE DOS DEVICE DRIVERS and support for BASIC
- Additional Support for ASSEMBLY, C, Pascal and FORTRAN - $50.
- IRQ (1-6). DMA channel 1 or 2. Up to 4 boards per computer.
- Compatible with most IEEE-488 Software packages for IBM-PC (e.g. ASYSTANT-GPIB, Lotus Measure). Compatible with NI's GPIB-PCIIA

IEEE- 488 Card [PC488B] With Built-In Bus Analyzer $345

- Software Support for BASICA, QuickBASIC and GWBASIC
- Additional libraries for C, Pascal, FORTRAN, Assembly available - $50 (all) Full range of Talker, Listener, Controller, Serial, Parallel Poll, SRQ, etc...
- Powerful menu-driven BUS ANALYZER can be run in the background while 488 programs or commands are executed; Features Program Stepping, Break points, Real Time Bus Data Capture (4K buffer), Instant Screen Toggling.
- Complete Controller / Talker / Listener capability. Based on TI's TMS-9914.
- Memory-resident Printer Port Emulation Utility included. (LPT1-3)
- NEC-7210 based card (compatible with NI's GPIB-PCII; - $445.

DIGITAL I/O Card [PCL720] $175

- Input: 32 TTL compatible channels; Input load is 0.2 mA at 0.4V.
- Output: 32 TTL compatible channels;Sinks 24mA(0.5V); Sources 15mA(2.0V)
- Counter/Timer: DC to 2.6MHz; 3 channels; 16 bit counters; 6 counting modes.
- Breadboard area for prototyping. Dipswitch I/O port selection (200-3F8 hex).

LOW COST DATA AQUISITION & CONTROL CARDS FOR PC/XT/AT

12 BIT A/D & D/A [PCL711s] $295

- A/D converter: 8 single-ended channels; Device: AD574; Conversion time less than 25μsec; Input range: ±5V; Software Trigger Mode only.
- D/A converter: 1 channel; 12 bit resolution; 0 to +5V, 10V Output Range.
- Digital I/O: 16 Input / 16 Output channels; All I/Os TTL compatible.
- External Wiring Terminal Board with mounting accessories included.
- Utility Routines and Demo/Sample Programs for BASIC and Quick-BASIC.

12 BIT A/D & D/A [PCL812] $395

- A/D converter: 16 single ended inputs; Device : AD574; Conversion time less than 25 μsec; Built-in programmable pacer; Input ranges: ± 10V, ± 5V, ± 1V.
- D/A converter: 2 channels ; 12 bit resolution.; Output Range 0-5V ;
- Digital I/O: 16 Input / 16 Output channels; All I/Os TTL compatible.
- Counter: 1 channel programmable interval counter/timer; Uses Intel 8254.
- DMA and interrupt capability. Utility software for Basic included.

FAST 12BIT A/D/A [PCL718] $795

- A/D converter: 16 single ended or 8 differential channels; 12 bit resolution; Programmable scan rate; Built-in Interrupt and DMA control circuitry; Conversion speed 60,000 smpls/sec (standard), 100,000 smpls/sec (optional).
- Input ranges: Bipolar ± 10V, ±5V, ± 2.5V, ± 1V, ± 0.5V; Unipolar 10,5,2.1V.
- D/A converter: 2 channels; Resolution: 12 bits res; Settling time: 5μsec; ±5V
- Digital I/O: 16 OUT, 16 IN, TTL compatible; All I/Os TTL compatible.
- Counter: 16 bit progr. interval counter/timer; Uses Intel 8254; Pacer clock;
- Software: Utility software for BASIC and QuickBASIC included. Supported by LabDAS ($195/495), ASYST, LABTECH, UnkelScope

6 Channel 12 bit D/A [PCL726] $495

- Output Ranges: 0 to +5V, 0 to +10V, ±5V, ±10V or sink 4-20mA.
- Settling time: 70μS. Linearity: ± 1/2bit. Voltage output driving capacity: ± 5mA
- Digital I/O: 16 digital inputs and 16 digital outputs; TTL compatible.

STEPPER MOTOR CARD $395

- Capable of independent and simultaneous control of up to 3 stepper motors.
- Speed: Programmable from 3.3 PPS to 3410 PPS; Built-in acceleration control.
- Output Mode: One clock (Pulse, Direction) or two clock (CW, CCW pulses)
- Step position Read-back; Opto-isolated outputs; Crystal based timing.
- Includes 8 bit digital input/output port. Order P/N [PCL-738B]

MC / VISA / AMEX — Call today for datasheets!

Circle 37 on Reader Service Card

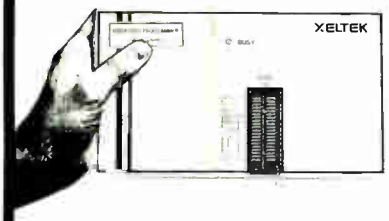
B&C MICROSYSTEMS INC.
355 WEST OLIVE AVE., SUNNYVALE, CA 94086 USA
TEL: (408)730-5511 FAX: (408)730-5521 BBS:(408)730-2317

World Radio History

Circle 311 on Reader Service Card

$585
(COD, VISA, MC, AMEX)

UNIVERSAL PROGRAMMER



PROGRAMS
- E(E)PROMs upto 4 MBits & 16Bit wide
- PALs from AMD, MMI, TI, NS, CYPRESS etc.
- 22V10 from AMD, ATMEL, TI, SAMSUNG & CYPRESS.
- EPLDs from ALTERA INTEL, TI.
- GALs from LATTICE, SGS & NS.
- FPLs from SIGNETICS.
- PEELs from ICT, HYUNDAI & GOULD.
- BIPOLAR PROMs.
- SINGLE CHIPs (8748, 8751 & 87C51 series)

SUPPORTS
- 32Bit WORDSPLIT with 4 GANG adaptor.
- PALASM2/CUPL/ABEL/TANGO/OrCAD JEDEC files.
- PAL VERIFICATION using TEST VECTOR.
- GAL electronic signature recognition.
- 87C451, 63701 X/Y/V & 63705V with adaptor (option)
- Tests ICs (TTL, CMOS) & D/S Memorys ICs with user definable test patterns.

Package includes software, programming module, high speed interface card and Cable.

OPTIONS
- Socket adaptors for PLCC, LCC, SOIC, and FLAT-PAK ICs.
- 4 Socket adaptor for E(E)PROMs.
- Socket adaptors for micro controllers.

LOGIC PROGRAMMER $395
- PROGRAMS PAL, GAL, PEEL, EPLD
- Pull-down menu driven softwere

E(E)PROM PROGRAMMER
- Programs 16K–1024K EPROM, CMOS.
- 1, 4, 8, 16, Gang programmers.
- High or low byte programming.
- from $150

EPROM ERASER

QET-140 ($295)
· Erases any EPROM just. 4 seconds.

ET-140 ($95)
· Erases upto 9 EPROMs

ET-265 ($285)
· High capacity.
· Erases upto 30EPROMs W/timer.

QET-140

1YEAR WARRANTY & 30 DAYS MONEY BACK GUARANTEE

XELTEK

Call Now 1-800-541-1975(Toll Free Order)
TEL.(408)727-6995 FAX.(408)727-6996

473 Sapena Ct., Unit 26, Santa Clara CA95054

---

25 MHz 80486 Motherboard

Faster than the Everex Step™

11.4 MIPS! $2,980 (0k) Qty 1

Features:
- i486™ Microprocessor with Built-In 8K Cache & FPU
- Burst Mode Utilization for Maximum System Throughput
- External Dual READ/WRITE Back Cache Architecture
- External Scalable 64K/256K Fast Direct-Mapped Cache
- Intelligent Refresh Optimized Scheme

	MIPS	Cache	0k	4M
486/25	11.4	256K	3380	3720
386/33	8.3	64K	1649	1989
386/25	6.2	64K	1199	1519
386/20	4.9	64K	999	1319

Technology Power Enterprise, Inc.
46560 Fremont Blvd #118, Fremont CA 94538
Tel (415) 623-9162 FAX (415) 623-9462

Circle 277 on Reader Service Card

MARYMAC®

14th year

of discounting Tandy® computers, Fax and Radio Shack® products

Radio Shack® SCO Tandy®

We will meet or beat . . .
GUARANTEED LOWEST PRICES

MARYMAC INDUSTRIES INC.
22511 Katy Fwy.
Katy (Houston), TX 77450
1-713-392-0747 FAX (713) 574-4567

Toll Free 800-231-3680

Circle 154 on Reader Service Card

New, Improved!

8051/8052 BASIC COMPILER!

Now with integer, byte and bit extensions.
Fully compatible with MCS BASIC 52
Runs on IBM-PC or compatible

$295.00

Call Now! 603-469-3232

Binary Technology, Inc.
Main Street • P.O. Box 67 • Meriden NH 03770

Circle 326 on Reader Service Card

CORTEX CORPORATION MASTER CONTROL

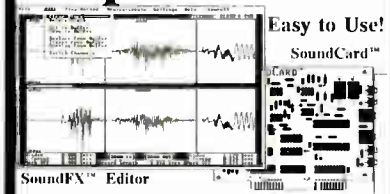
For Industrial Control and Multiple File Server Applications: Control up to 16 CPU's with a single Monitor and Keyboard!

- Units to Control from 2 to 16 CPU's
- Enclosed Keyboard Drawer and Monitor (5 inch screen)
- 16 Gauge Steel Rack – mount construction, Double-plated
- Black Anodized Aluminum Faceplate

CORTEX CORPORATION
(612) 894-3354 • Fax (612) 894-2414
12274 Nicollet Ave. S. • Burnsville, MN 55337

Circle 68 on Reader Service Card

SuperSound™



DISCOVER the POWER of SOUND in YOUR IBM-PC or PS/2 from $19.95!

***Best* Digital Audio Software/Hardware.**
30 Day Money-Back Guarantee if not Satisfied

- SuperSound - Stereo SoundFX™ Graphical Editor and SoundCard™ $339
- SuperSound - Mono version software and hardware $299
- SuperSound - Engr version special hardware/software for tech. app. $469
- SoundFX-Jr™ playback editor, waveform generator w/SoundBytes™ $49.95
- SoundJr™ playback printer port hardware module w/ SoundBytes $19.95
- For Business: Training, Point-of-Sale Shows - Works with Grasp, QBasic, C ..
- For Engineering: AM/FM Function Gen., Clear Voice Alarms, Storage Scope ..
- For Fun: Create Your Own Mac like Boot-up Sounds, Alter Your Voice ..
- Write or Call for FREE PRODUCT CATALOG of IBM-PC sound products.

OEM Developers: Send RFQs for Custom Digital Audio Software, Hardware or ICs. Analog/Digital VLSI Bipolar/CMOS Integrated Circuit Design / Production.

Tech:(408)-446-4521 by **Silicon Shack** FAX: (408)-374-4412
5120 Campbell Ave. #112, San Jose, CA 95130.

Orders only: 800-969-4411 VISA/MasterCard

™ SuperSound, SoundFX, SoundFX-Jr, SoundJr, SoundCard, SoundBytes, and TurboSound are trademarks of Silicon Shack, Ltd. Other product names are trademarks of their manufacturers.

Circle 259 on Reader Service Card

Infra-Red Remote Control

OCTACOMM®/IR

Change TV channels from your PC. Control DOS programs from a hand-held remote. Use a PC to send and receive the infra-red signals used by hand-held remote controllers like those used with TVs, VCRs and other devices. *Maintains a database of IR signals learned from your own hand-held remote controller.* Hardware attaches to the serial port of the IBM-PC. Software for DOS 2.0 and greater.

Price: $395.00

Houston Computer Services, Inc.
11331 Richmond Avenue / Suite 101 / Houston, Texas 77082

(713)493-9900

M/C - Visa - Discover - AmEx - COD

OCTACOMM is a registered trademark of Houston Computer Services, Inc.

Circle 117 on Reader Service Card

World Radio History

EDITORIAL INDEX BY COMPANY

Index of companies covered in articles, columns, or news stories in this issue
Each reference is to the first page of the article or section in which the company name appears

Company, Page #	Inquiry #
A	
Accolade, 19	
Active Book Company, 205	
Ad Lib, 65	1002
Adobe, 293	
Advanced Data Servers, 44	1152
Advanced Micro Devices, 19	
Airis, 133	990
Aldus, 116, 305	860
	981
Altima Systems, 42	1139
Amtec International, 283	988
Aox, 44	1153
Apple Computer, 19, 91, 110, 252, 305	1011
	1114
	1196
Ariel, 19	
Arity, 56	1122
Articulate Systems, 225, 252	1040
Artisoft, 52	1166
Ashton-Tate, 256	1061
Asymetrix, 116	857
Autodesk, 305	1189
B	
BDS Systems, 62	1132
Beta Research, 19	
Borland International, 19, 110, 305	983
	1010
Bradford Business Systems, 56	1121
Brier Technologies, 19	
Brother International, 138	1071
Business Solutions, 64	1135
Business Technology Center, Bradley University, 65	1000
Buzzwords International, 56	1120
C	
Capella Systems, 52	1170
Cardinal Technologies, 52	1168
Casio, 87	1101
Cherry Electrical, 225, 252	1042
CMC Research, 65	1006
Compaq Computer, 305	1190
Covox, 225, 252	1039
Curtis Manufacturing, 283	989
D	
D-Link, 52	1167
DataMerge, 58	1128
Dataproducts, 138	1072
Datastorm Technologies, 305	984
Dayna Communications, 110	1013
Delta Tao Software, 19	
Desktop Systems, 138	1073
Dragon Systems, 225, 252	1106
DTK Computer, 42	1140
Dukane, 43	1146
DuPont Imaging Systems, 19	
Dyna Micro, 160	853
E	
ECA C&C Products, 48	1155
Educorp Computer Services, 256	1054
Electronic Text, 65	995
Enable Software, 58	1126
Epson America, 138	1074
Exos, 237, 252, 283	1105
	1185
F	
Facit, 138	1075
Farallon Computing, 19	
Fortron/Source, 42	1141
Frame Technology, 110	1014
Future Soft Engineering, 116	864
G	
Geovision, 256	1065
Golden Bow Systems, 65	1008
Graphsoft, 256	1053
Gupta Technologies, 116	859
H	
Hayes Microcomputer Products, 50, 305	1160
	1193
Hercules Computer Technology, 44	1151
Hewlett-Packard, 19, 43, 87, 138, 305	1076
	1102
	1143
	1191
I	
IBM, 138, 360	1077
ICI Image Data, 19	
Image Mapping Systems, 256	1057
Inner Media, 64	1134
Intel, 305	1194
Intellectual Software Queue, 256	1184
Interplay Productions, 65	992
Intuit, 305	985
ITT PowerSystems, 44	1149
K	
King Communications, 19	
Kurzweil Applied Intelligence, 225, 252	1041
Kyocera Unison, 138	1078
L	
L. C. Technologies, 205	
Laboratory Technologies, 62	1133
Leong Jacobs, 65	1009
Logitech, 65	1005
Lotus Development, 196, 305	884
	1195
M	
Mannesmann Tally, 138	1079
MapInfo, 256	1059
Mapping Information Systems, 65	999
MapWare, 256	1058
Mattel, 283	1186
MECC, 256	1183
Micro Doc, 256	1062
MicroClean, 65	1003
Microcom, 50	1163
Micrografx, 116	862
Microlytics, 64, 87	1103
	1137
Micromaps Software, 256	1056
Microsoft, 19, 116, 305	858
	1197
MicroSpeed, 48	1157
microTrans, 64	1138
MIPS Computer Systems, 19	
Microelectronics and Computer Technology, 243, 252	1109
MIT CAD Lab, 252	1116
Modern Computer Aided Engineering, 62	1130
Modular Software Systems, 65	993
Motorola, 19	
N	
NASA Ames Research Center, 215, 252	1119
National Information Services, 19	
National Instruments, 44	1150
NCR, 138	1080
NEC, 19, 138	1081
NEC Technologies, 42, 305	1142
	1198
Network General, 50	1161
Novell, 305	1200
O	
Owl International, 64	1136
P	
Packard Bell, 138	1082
Panasonic, 43	1145
Paradise Systems, 305	982
PC Globe, 256	1063
Peripheral Land, 19	
Personal Computer Products, 138	1083
Perstor Systems, 65	1004
Peter Norton Computing, 305	1199
Polaroid, 48	1156
Polhemus Navigation Systems, 283	1187
Primavera Systems, 58	1125
Prolog Development Center, 56	1123
Public Brand Software, 256	1068
Public (Software) Library, 256	1070
Q	
Q/Cor, 19, 43	1144
Quanta Press, 256	1181
Questionnaire Service, 256	1060
R	
Reflection Technology, 48, 252	1111
	1154
Robert Lloyd, 256	1067
S	
Scandinavian PC Systems, 65	996
Scitor, 58	1127
Scott Instruments, 225, 252	1113
Scott, Foresman, 358	
Seagate Technology, 305	986
Sensor Frame, 237, 252	1112
Sharp Electronics, 19, 87, 138	1084
	1104
Shryer Publishing, 256	1182
Silicon Graphics Computer Systems, 174	856
SimGraphics Engineering, 237	
Softbridge Microsystems, 116	863
SoftKlone, 50	1162
Software Publishing, 305	1192
Solutions, 58	1129
Sota Technology, 65	1007
Spatial Systems, 237	
Spear Technology, 160	852
Speech Systems, 225, 252	1107
Spinnaker Software, 110, 256	1012
	1051
Spyglass, 62	1131
Star Micronics, 138	1085
Storage Dimensions, 167	854
Strategic Mapping, 256	1052
Strategic Studies Group, 65	1001
Sunrise Services, 52	1169
Symsoft, 97	991
T	
Texas Instruments, 138, 225, 252	1086
	1117
The Software Toolworks, 65, 256	994
	1064
The Voice Connection, 225, 252	1110
The Whitewater Group, 116	861
The World Digitized, 256	1069
Toshiba, 19, 138	1087
U	
University of Minnesota, 256	1066
V	
Verbex Voice Systems, 225, 252	1118
VideoLogic, 65	997
Vitesse Semiconductor, 19	
Voice Control Systems, 225, 252	1115
Voice Processing, 225, 252	1043
Voice Recognition Technologies, 225, 252	1037
Votan, 225, 252	1038
VPL Research, 237, 283	1188
W	
Wang Laboratories, 252	1108
WordPerfect, 19, 305	987
World Game Institute, 256	1055
X	
Xerox, 205	
Xircom, 19	
Z	
Zenith Data Systems, 167	855
Zephyr Services, 65	998
Zortech, 186	881

World Radio History

READER SERVICE

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

* Correspond directly with company.

Alphabetical Index to Advertisers

Inquiry No.		Page No.
8	ABACUS SOFTWARE,INC	93
9	ABACUS SOFTWARE,INC	93
10	ADC	290
11	ADC	290
12	ADD ON AMERICA	329
13	AHEAD SYSTEMS	70
14	AHEAD SYSTEMS	70
15	AK SYSTEMS	329
16	ALF PRODUCTS	264
17	ALL COMPUTERS,INC	245
18	ALL COMPUTERS,INC	245
19	ALPHA PRODUCTS	341
20	ALR	2,3
21	ALR	2,3
22	ALTEC TECH.CORP	265
34	A.M.S.	345
23	AMERICAL GROUP	340
24	AMERICAN ADVANTECH	328
24	AMERICAN ADVANTECH	328
24	AMERICAN ADVANTECH	328
25	AMERICAN POWER CONVERSION	171
26	AMERICAN POWER CONVERSION	171
27	ANNABOOKS	325
28	ARTISOFT	109
29	ATRON CADRE TECHNOLOGIES	29
33	AVOCET SYSTEMS,INC	79
30	AXSYS	154
31	AXSYS	154
32	AXSYS	154
325	B & B ELECTRONICS	343
35	B & C MICROSYSTEMS,INC	343
36	B & C MICROSYSTEMS,INC	345
37	B & C MICROSYSTEMS,INC	345
38	BAY TECHNICAL ASSOCIATES	249
39	BAY TECHNICAL ASSOCIATES	249
40	BEST POWER TECHNOLOGY,INC	340
326	BINARY TECHNOLOGY,INC	346
450	BIX	280,281
41	BLACK JACK COMPUTER	334
42	BLAISE COMPUTING,INC	6
43	BORLAND INTERNATIONAL	11
44	BORLAND INTERNATIONAL	11
45	BP MICROSYSTEMS	340
46	BUFFALO PRODUCTS,INC	145
47	BUREAU OF ELECTRONIC PUB	78
*	BUYERS MART	312–323
*	BYTE BACK ISSUES	276,277
48	BYTE BITS	334
*	BYTE PUBLICATIONS	307
*	BYTE SUB MESSAGE	356
*	BYTE SUB SERVICE	326
*	BYTEWEEK/NEWSLETTER	282
*	CANON USA	32A–B
50	CANON USA	33
51	CAPITAL EQUIPMENT	74
52	CAPITAL EQUIPMENT	75
53	CENTRAL COMPUTER PROD	336
54	CENTRAL POINT SOFTWARE	326
55	CENTURY SOFTWARE	80
56	CENTURY SOFTWARE	80
57	CHEETAH INT'L	224
*	CLEO COMMUNICATIONS	104D
58	CNS	272
59	COMPUCOM	325
60	COMPUSAVE INTERNATIONAL	327
320	COMPUTER ACCESSORIES	157
321	COMPUTER ACCESSORIES	157
61	COMPUTER FRIENDS	357
328	COMPUTER MODULES,INC	345
62	COMPUTERLANE	337
*	COPIA INTERNATIONAL LTD	156
66	CORE INTERNATIONAL	291
67	CORE INTERNATIONAL	291
319	COREL SYSTEMS	121
68	CORTEX	346
69	COVOX,INC	325
70	COVOX,INC	325
71	CSS LABS	242
72	CSS LABS	242
73	CURTIS,INC	124
*	DATA COMMUNICATIONS	299
74	DATA STRATEGIES INT'L	339
75	DATA TRANSLATION	77
76	DELL COMPUTER CORP	CII,1
77	DELL COMPUTER CORP	136,137
*	DELL COMPUTER CORP	136A–B
79	DIGITAL DISTRIBUTING	39
80	DIGITAL DISTRIBUTING	39
81	DIGITAL RESEARCH	71
82	DIGITALK	26,27
83	DISKCOTECH	329
84	DISKCOTECH	329
85	DISKETTE CONNECTION	339
86	DISKETTE EMPORIUM	334
87	DISTRIBUTED PROCESSING TECH	263
88	DISTRIBUTED PROCESSING TECH	263
89	DIVERSIFIED COMPUTER SYS	336
90	DROVER TECHNOLOGIES	124
91	DYNAMICAL SYSTEMS,INC	264
92	ECOSOFT	286
93	ELEXOR,INC	329
94	ENGINEERS COLLABORATIVE,THE	343
95	ERGO COMPUTING,INC	164,165
96	ERGO COMPUTING,INC	164,165
*	EVEREX SYSTEM COMPUTER	207
*	EVEREX SYSTEM COMPUTER	208
97	EVEREX SYSTEM COMPUTER	209
98	EVEREX SYSTEM COMPUTER	210
99	FAIRCOM CORPORATION	86
100	FIRST COMPUTER SYSTEMS,INC	324
101	FIRST COMPUTER SYSTEMS,INC	324
102	FIRST SOURCE INTERNATIONAL	327
103	FIRST SOURCE INTERNATIONAL	327
104	FLYTECH TECHNOLOGY,INC	59
105	FORVAL AMERICA	227
106	FORVAL AMERICA	227
107	FOX SOFTWARE,INC	25
*	GATEWAY 2000	22,23
108	GRAPHTEC	270
109	GREENVIEW	68
110	GTEK,INC	106
111	GTEK,INC	106
112	HAVEN TREE	100
323	HERCULES COMPUTER	99
113	HEWLETT-PACKARD PERIPH	129
114	HEWLETT-PACKARD PERIPH	130,131
115	HIGH RES TECHNOLOGIES	345
116	HITECH EQUIPMENT CORP	339
324	HOME SMART COMPUTING	345
117	HOUSTON COMPUTER SERVICES	346
119	IBM WORKSTATION	212,213
120	I.C. EXPRESS	336
121	INES	274
122	INTEGRAND	178
123	INTERCON ASSOCIATES	144
124	IO TECH	339
125	IO ENGINEERING	149
126	IO ENGINEERING	149
127	IVERSON COMPUTER CORP	233
*	IVERSON COMPUTER CORP	233A–B
128	JADE COMPUTER	335
129	JAMECO ELECTRONICS	330,331
130	JB TECHNOLOGIES,INC	325
131	JB TECHNOLOGIES,INC	325
6	JDR MICRODEVICES	353–355
7	JDR MICRODEVICES	353–355
132	JEMINI ELECTRONICS	343
133	KADAK PRODUCTS LTD	244
134	KEA SYSTEMS	261
135	KILA SYSTEMS	343
136	KNOWLEDGE GARDEN	303
137	LAHEY COMPUTER SYSTEMS	108
140	LATTICE,INC	134
141	LATTICE,INC	134
142	LAWSON LABS	340
143	LINK COMPUTER GRAPHICS	334
144	LINK COMPUTER GRAPHICS	334
145	LOGICAL DEVICES,INC	329
146	LOGICAL DEVICES,INC	329
147	LOGICAL DEVICES,INC	329
148	LOGICAL DEVICES,INC	329
149	LOGITECH	51
150	LOGITECH	51
*	LOTUS	72A–B
*	LOTUS	73
151	MAP INFO CORP	82
*	MARK WILLIAMS CO	83
154	MARYMAC INDUSTRIES	346
155	MATHSOFT,INC	273
158	MEGATEL	274
160	MICRO SOLUTIONS COMP.PROD	106
*	MICROLOGIC	279
161	MICROPROCESSORS UNLIMITED	340
*	MICROSOFT CORP	8,9
*	MICROSOFT CORP	21
*	MICROSOFT CORP	54,55
*	MICROSOFT CORP	57
*	MICROSOFT CORP	234,235
162	MICROSTAR LABORATORIES	336
*	MICROWAY	166
*	MICROWAY	292
159	MIS COMPUTER SYSTEMS	126
165	MITCHELL PACIFIC COMPUTER	216
166	MIX SOFTWARE	295
167	MKS	85
168	MODGRAPH	18
169	MODGRAPH	18
170	MODGRAPH	18
173	MULTISCOPE,INC	127
174	MULTISCOPE,INC	127
175	NANAO	96
176	NANTUCKET	190
177	NANTUCKET	191
178	NATIONAL INSTRUMENTS	CIII
243	NATIONAL TELEVAR	170
179	NCR CORP	172,173
180	NEC HOME ELECTRONICS	12,13
181	NETWORK PC	342
182	NEVADA COMPUTER CORP	344
183	NOHAU CORPORATION	340
184	NORTHGATE COMPUTER SYS	46,47
185	NORTHGATE COMPUTER SYS	192,193
186	NORTHGATE COMPUTER SYS	194,195
187	NORTHGATE COMPUTER SYS	254,255
188	NORTHGATE COMPUTER SYS	268,269
316	NOVA,INC	156
189	NU-MEGA TECHNOLOGIES	69
*	ONLINE ACCESS	287
*	ORACLE	123
190	OSBORNE/MCGRAW-HILL	301
191	OUTPUT TECHNOLOGY CORP	41
192	OVERLAND DATA	324
193	PACIFIC DATA PRODUCTS	147
194	PACIFIC DATA PRODUCTS	147
195	PANASONIC-1100 SERIES	155
196	PANASONIC-LASER PRINTERS	15
197	PARA SYSTEMS	101
198	PATTON & PATTON	72
199	PC BRAND	179
*	PC BRAND	180,181
*	PC BRAND	182,183
*	PC BRAND	184,185
*	PC CONNECTION	102,103
*	PC CONNECTION	104,104A
*	PC CONNECTION	104B,104C
200	PERCEPTIVE SOLUTIONS,INC	236
201	PERCEPTIVE SOLUTIONS,INC	236
202	PERCON	324
205	PHAR LAP SOFTWARE	89
206	PLUS DEVELOPMENT	119
207	PRECISION DATA PRODUCTS	343
208	PROFESSIONAL COMPUTER SYS	336
*	PROGRAMMER'S PARADISE	40,40A–C
209	PROGRAMMER'S SHOP	200
210	PROGRAMMER'S SHOP	200
211	PROGRAMMER'S SHOP	200A
212	PROGRAMMER'S SHOP	200A
213	PROGRAMMER'S SHOP	200B
*	PROGRAMMER'S SHOP	200C
221	PROTECH MARKETING,INC	115
222	PROTECH MARKETING,INC	115
223	PSEUDOCORP	334
224	QMS,INC	153
225	QMS,INC	153
226	QMS,INC	92
227	QMS,INC	92
228	QUA TECH,INC	338
229	QUA TECH,INC	338
230	QUA TECH,INC	338
231	QUA TECH,INC	338
232	QUA TECH,INC	338
233	QUA TECH,INC	338
234	QUA TECH,INC	338
235	QUA TECH,INC	338
236	QUA TECH,INC	338
237	QUALSTAR CORP	334
238	QUARTERDECK	16,17
239	R & R ELECTRONICS	345
240	RADIO SHACK	CIV
322	RAIMA CORPORATION	45
241	RAINBOW TECHNOLOGIES	197
242	RAINBOW TECHNOLOGIES	197
244	ROSE ELECTRONICS	107
245	SAFEWARE,INC	339
246	SAMNA	125
247	SAMSUNG	219
248	SAMSUNG	219
249	SANTA CRUZ OPERATION	49
250	SAS INSTITUTE,INC	95
252	SCIENCE ACCESSORIES	275
253	SCIENCE ACCESSORIES	275
254	SCIENTIFIC ENDEAVORS	336
255	SCIENTIFIC ENDEAVORS	336
256	SCIENTIFIC ENDEAVORS	336
257	SCOTTSDALE SYSTEMS	328
*	SEAGATE TECHNOLOGY	177
258	SEQUITER SOFTWARE,INC	211
318	SHARP ELECTRONICS	132
259	SILICON SHACK LTD	346
260	SILICON VALLEY SOFTWARE	84
261	SN'W COMPUTERS	64
262	SOFTWARE ADD-ONS	241
*	SOFTWARE DEVELOPMENT SYS	113
263	SOFTWARE SECURITY	253
317	SONY	222,223
265	SPECIALTY SOFTWARE DEVMNT	90
266	SPECTRUM SOFTWARE	201
267	STATSOFT	67
268	STONY BROOK SOFTWARE	98
269	STONY BROOK SOFTWARE	98
270	STORAGE DIMENSIONS	63
271	STORAGE DIMENSIONS	63
272	SUPERSOFT	262
273	SUPREME ENTERPRISE	310
274	TALKING TECHNOLOGY	329
275	TALL TREE SYSTEMS	345
276	TATUNG	214
277	TECHNOLOGY POWER ENT	346
278	TEKTRONIX	30,31
279	TEKTRONIX	30,31
280	TELEPHONE PRODUCTS CTR	326
281	TERABYTE INT'L,INC	343
282	TEXAS INSTRUMENTS	158,159
283	THE OAKLAND GROUP	187
284	THE PERISCOPE CO	217
285	THE PERISCOPE CO	217
286	THE SOFTWARE LINK	198
287	THE SOFTWARE LINK	198
288	THE SOFTWARE LINK	199
289	THE SOFTWARE LINK	199
290	TOSHIBA	60,61
291	TOSHIBA	60,61
292	TOUCHBASE SYSTEMS,INC	66
293	TRANS ERA	304
294	TRANS ERA	304
295	TRITON TECHNOLOGIES	94
296	TRITON TECHNOLOGIES	94
297	TULIN CORP	216
298	UNICORN	340
299	UNITEX	332,333
300	UNITEX	332,333
*	UNIXWORLD	296A–B
*	UNIXWORLD	297
330	VENTURCOM	302
331	VENTURCOM	302
*	VERMONT CREATIVE SOFTWARE	35
301	VICTORY ENTERPRISES	108
302	VIDEO TEXTBOOK TRAINING	272
303	VIDEO TEXTBOOK TRAINING	272
304	VOGON ENTERPRISES LTD	232
305	WARD SYSTEMS GROUP	240
306	WARD SYSTEMS GROUP	240
307	WATCOM PRODUCTS,INC	189
308	WIESEMANN & THEIS GMBH	146
400	WINTEK CORPORATION	7
309	WINTEK CORPORATION	336
310	XEC PRODUCTS	221
311	XELTEK	346
312	XIRCOM	204
313	ZENITH DATA SYSTEMS	53
*	ZORTECH,INC	37
314	Z-WORLD ENGINEERING	339
315	Z-WORLD ENGINEERING	339

INTERNATIONAL SECTION 64 IS 1–64

No North American Inquiries please.

401	3EST-USA	IS-58
402	AGC TECHNOLOGY CORP	IS-61
403	ALADDIN KNOWLEDGE SYS,LTD	IS-35
404	AMDS LTD	IS-46
405	AMERICAN RESEARCH CORP	IS-49
406	AMERICAN RESEARCH CORP	IS-49
407	ARGOSY	IS-50
408	ATICO	IS-43
409	BEHAVIOR TECH	IS-64
410	BLUE CHIP TECHNOLOGY	IS-58
*	BYTE BACK ISSUES	IS-52
*	BYTE SUB MESSAGE	IS-44
412	CLARION SOFTWARE	IS-19
413	CLARION SOFTWARE	IS-19
414	COMPUBRAS COMPUTERS	IS-42
415	COMPUCLASSICS	IS-29
416	DAEWOO TELECOM	IS-24,25
417	DIETRICH GMBH	IS-54
418	D-LINK UK	IS-57
*	ELONEX	IS-33

World Radio History

READER SERVICE

*Correspond directly with company.

Inquiry No.		Page No.
419	FAST ELECTRONIC GMBH	IS-55
420	FAST ELECTRONIC GMBH	IS-55
421	FORTRON/SOURCE	IS-9
422	GALAXY	IS-54
423	GAMMA PRODUCTIONS,INC	IS-18
424	GLOCKENSPIEL	IS-41
425	GREY MATTER	IS-63
426	GTCO	IS-21
427	GTCO	IS-21
428	I X I LIMITED	IS-56
429	IMT	IS-50
430	INTERQUAD LTD	IS-3
431	INTERQUAD LTD	IS-5
432	ITHACA STREET SOFTWARE	IS-32
433	JC INFORMATION SYS.CORP	IS-23
434	LASERMASTER CORPORATION	IS-37
435	LASERMASTER CORPORATION	IS-37
436	M3PC	IS-12,13
437	MASHOV	IS-45
438	MAYFAIR MICROS	IS-10
*	MICROWAY	IS-62
439	PERFORMANCE TECHNOLOGY	IS-28
457	PROGRAMMER'S ODYSSEY	IS-48
440	SCHNELLMANN INTERHANDELS AG	IS-31
441	SIEMENS AG	IS-17
442	SMART SOFTWARE	IS-34
*	SOFTLINE	IS-47
443	SOFTWARE CONSTRUCTION CO.LTD	IS-59
444	SOFTWARE DMI	IS-54
445	SOFTWARE DMI	IS-56
446	SURAH,INC	IS-56
447	TEAC CORPORATION	IS-14

Inquiry No.		Page No.
*	TOPS	IS-53
449	TRIANGLE DIGITAL	IS-58
451	TRIGEM COMPUTER,INC	IS-6
452	TWINHEAD	IS-51
453	UNIVERSAL DATA SYSTEMS	IS-11
454	UNIVERSAL DATA SYSTEMS	IS-11
455	USA SOFTWARE	IS-39
456	VASCO	IS-20

INT'L DIRECT RESPONSE POSTCARDS

*	COMPUTER SOLUTIONS	IS
*	GATEWAY 2000	IS
*	REASONABLE SOLUTIONS	IS

REGIONAL SECTIONS

Midwest 64 MW1-12

Inquiry No.		Page No.
476	DERBYTECH COMPUTERS,INC	MW-5
477	DERBYTECH COMPUTERS,INC	MW-5
478	EKM	MW-4
479	EKM	MW-4
480	INTERFACE GROUP	MW-7
481	OMNI COMPUTERS,INC	MW-2
482	OMNI COMPUTERS,INC	MW-2
483	PAO-KU INTERNATIONAL LTD	MW-9
484	PAO-KU INTERNATIONAL LTD	MW-9
485	REASON TECHNOLOGY	MW-11
486	TECH CITY	MW-3
487	TECH CITY	MW-3

Northeast 64 NE1-20

Inquiry No.		Page No.
500	BYTE CARD DECK	NE-8
504	COMPUTER INTEGRATION CTR	NE-19
505	COMPUTER INTEGRATION CTR	NE-19
501	DEERFIELD DATA SYSTEMS	NE-2
502	ECA C&C PRODUCTS,INC	NE-11
503	ECA C&C PRODUCTS,INC	NE-11
506	GEMS COMPUTERS,INC	NE-17
507	GROUP 1 SOFTWARE	NE-4
508	GROUP 1 SOFTWARE	NE-4
509	HARMONY COMPUTERS	NE-3
510	HARMONY COMPUTERS	NE-3
511	INFO/OPTICS	NE-7
512	INFO/OPTICS	NE-7
513	INTERFACE GROUP	NE-9
514	LPI	NE-8
515	MANCHESTER EQUIPMENT	NE-20
*	MANCHESTER EQUIPMENT	NE-20A-B
516	MICROTEST	NE-13
517	MICROTEST	NE-13
518	PAO-KU INTERNATIONAL LTD	NE-15
519	PAO-KU INTERNATIONAL LTD	NE-15
520	PROTEUS TECHNOLOGY CORP	NE-12
521	TECH CITY	NE-5
522	TECH CITY	NE-5

Pacific Coast 64 PC1-16

Inquiry No.		Page No.
351	BYTE CARD DECK	PC-10
523	CACHE COMPUTERS,INC	PC-15
524	CONVEX RESOURCES	PC-9
525	EKM	PC-10
526	EKM	PC-10
527	INFO/OPTICS	PC-5
528	INFO/OPTICS	PC-5
529	INTERFACE GROUP	PC-3
530	LPI	PC-4
531	METAWARE	PC-13
532	OMNI COMPUTERS,INC	PC-2
533	OMNI COMPUTERS,INC	PC-2
534	PAO-KU INTERNATIONAL LTD	PC-7
535	PAO-KU INTERNATIONAL LTD	PC-7
536	TECH CITY	PC-11
537	TECH CITY	PC-11
538	ZERICON	PC-16

South 64 SO1-12

Inquiry No.		Page No.
350	BYTE CARD DECK	SO-4
488	CENTCIRCUIT INTERNATIONAL	SO-7
489	CENTCIRCUIT INTERNATIONAL	SO-7
490	GEMS COMPUTERS,INC	SO-11
491	INTERFACE GROUP	SO-5
492	OMNI COMPUTERS,INC	SO-2
493	OMNI COMPUTERS,INC	SO-2
494	PAO-KU INTERNATIONAL LTD	SO-12
495	PAO-KU INTERNATIONAL LTD	SO-12
496	TECH CITY	SO-9
497	TECH CITY	SO-9
498	UNITED INNOVATIONS	SO-3

BYTE ADVERTISING SALES STAFF:

Steven M. Vito, Associate Publisher/V.P. of Marketing, One Phoenix Mill Lane, Peterborough, NH 03458, tel. (603) 924-9281
Arthur Kossack, Eastern Advertising Director, Two Prudential Plaza, 180 North Stetson Ave., Chicago, IL 60601, tel. (312) 616-3341
Jennifer L. Bartel, Western Advertising Director, 14850 Quorum Drive, Suite 380, Dallas, TX 75240, tel. (214) 701-8496
Liz Coyman, Inside Sales Director, One Phoenix Mill Lane, Peterborough, NH 03458, tel. (603) 924-2518

NEW ENGLAND
ME, NH, VT, MA, RI, CT, ONTARIO CANADA & EASTERN CANADA
Dan Savage (617) 262-1160
MaryAnn Goulding (603) 924-2664
McGraw-Hill Publications
575 Boylston Street
Boston, MA 02116
FAX: (617) 262-6430

EAST COAST
NY, NYC, NJ, DE, PA
Kim Norris (212) 512-2645
Ariane Casey (212) 512-2645
Patricia Payne (603) 924-2654
McGraw-Hill Publications
1221 Avenue of the Americas—28th Floor
New York, NY 10020
FAX: (212) 512-2075

SOUTHEAST
NC, SC, GA, FL, AL, TN, VA, MS, AR, LA, DC, MD, WV, KY
John Y. Schilin (404) 843-4782
Patricia Payne (603) 924-2654
McGraw-Hill Publications
4170 Ashford-Dunwoody Road
Suite 520
Atlanta, GA 30319
FAX: (404) 252-4056

MIDWEST
IL, MO, KS, IA, ND, SD, MN, WI, NE, IN, MI, OH
Kurt Kelley (312) 616-3328
MaryAnn Goulding (603) 924-2664
McGraw-Hill Publications
Two Prudential Plaza
180 North Stetson Ave.
Chicago, IL 60601
FAX: (312) 616-3370

SOUTHWEST, ROCKY MOUNTAIN
CO, OK, TX,
Alison Keenan (214) 701-8496
Patricia Payne (603) 924-2654
McGraw-Hill Publications
14850 Quorum Drive
Suite 380
Dallas, TX 75240
FAX: (214) 991-6208

NORTH PACIFIC: San Francisco, CA NORTHERN CA, OR, ID, MT, WY, NORTHERN NV
Roy J. Kops (415) 954-9728
Leslie Hupp (415) 362-4600
McGraw-Hill Publications
425 Battery Street
San Francisco, CA 94111
FAX: (415) 954-9786

NORTH PACIFIC: Campbell, CA SILICON VALLEY, HI, WA, AK, W. CANADA
Bill McAfee (408) 879-0371
McGraw-Hill Publications
1999 South Bascom Ave.
Suite #210
Campbell, CA 95008
FAX: (408) 879-9067

SOUTH PACIFIC: Los Angeles, CA LOS ANGELES COUNTY, AZ, NM, SOUTHERN NEVADA
Andrew B. Uphoff (714) 557-6292
Jonathan Sawyer (603) 924-2665
McGraw-Hill Publications
3333 Wilshire Boulevard #407
Los Angeles, CA 90010
FAX: (714) 557-2219

SOUTH PACIFIC: Costa Mesa, CA ORANGE COUNTY, SAN DIEGO COUNTY, UT
Ron Cordek (714) 557-6292
Jonathan Sawyer (603) 924-2665
McGraw-Hill Publications
3001 Red Hill Ave.
Building #1—Suite 222
Costa Mesa, CA 92626
FAX: (714) 557-2219

BYTE BITS (2x3)
Mark Stone (603) 924-6830
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

The Buyer's Mart (1x2)
Brian Higgins (603) 924-3754
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Regional Advertising
James Bail (603) 924-2533
Barry Echavarria (603) 924-2574
Larry Levine (603) 924-2637
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Outsert Sales Program
Scott Gagnon (603) 924-2651
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

BYTE Deck
Ed Ware (603) 924-6166
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Computing for Engineers Deck
Ellen Perham (603) 924-2598
BYTE Publications
One Phoenix Mill Lane
Peterborough, NH 03458

Peterborough, NH Office
Inside Sales FAX: 603-924-2683
Advertising FAX: 603-924-7507

International Advertising Sales Staff:

Uwe Kretzschmar, European Advertising and Marketing Manager, BYTE Publications, McGraw-Hill Publishing Co., Wimbledon Bridge House, One Hartfield Road, Wimbledon London, SW19 3RV, England, Tel: 44 81 543 1234, Fax: 44 81 540 3833

GERMANY
Uwe Kretzschmar
Tel: 44 81 543 1234

UNITED KINGDOM
Roz Weyman
McGraw-Hill Publishing Co.
Wimbledon Bridge House
One Hartfield Road
Wimbledon London SW19 3RV
England
Tel: 44 81 543 1234
FAX: 44 81 540 3833

BENELUX
Frank Tanis
Batenburg 103
3437 AB Nieuwegein
The Netherlands
Tel: 31 34 02 49496
FAX: 31 34 02 37944

FRANCE, ITALY
Zena Coupé, Amanda Blaskett
A-Z International Sales Ltd.
4 Ashmount Road, Hornsey Lane
Highgate, London N19 3BH
England
Tel: 44 71 281 4116
FAX: 44 71 281 8224

ISRAEL
Dan Ehrlich
Ehrlich Communication International
P.O. Box 11297
Tel Aviv 61112
Israel
Tel: (972) 3 449823
FAX: (972) 3 5468168

SPAIN
Maria Sarmiento
c/o Manuel Ferrero 13
28036
Madrid, Spain
Tel: 34 1 45 52 891

JAPAN
Masaki Mori
McGraw-Hill Publishing Co.
Overseas Corp.
Room 1528
Kasumigaseki Bldg.
3-2-5 Kasumigaseki,
Chiyoda-Ku
Tokyo 100, Japan
Tel: 81 3 581 9811
FAX: 81 3 581 4018

HONG KONG
Seavex Ltd.
503 Wilson House
19-27 Wyndham St.
Central, Hong Kong
Tel: 85 5 260149
Telex: 60904 SEVEX HX
FAX: 852 810 1283

SINGAPORE
Seavex Ltd.
400 Orchard Road, #10-01
Singapore 0923
Republic of Singapore
Tel: 65 734 9790
Telex: RS35539 SEAVEX
FAX: 65 732 5129

TAIWAN
Nancy Yin
The Third Wave Publishing Corp.
977 Min Shen E. Road, 1-4 Flr.
Taipei 10581, Taiwan ROC
Tel: 886 2 763 0052

BRAZIL
Ernest McCrary
Empresa Internacional de Comunicacoes Ltda.
Rua da Consolacao, 222
Conjunto 103
01302 Sao Paulo, S.P., Brasil
Tel: 55 (11) 259-3811
Telex: (100) 32122 EMBN

World Radio History

READER SERVICE

To get further information on the products advertised in BYTE, fill out the reader service card by circling the numbers on the card that correspond to the inquiry number listed with the advertiser. This index is provided as an additional service by the publisher, who assumes no liability for errors or omissions.

* Correspond directly with company.

Index to Advertisers by Product Category

HARDWARE

800 ADD INS

Inquiry No.		Page No.
13	AHEAD SYSTEMS	70
14	AHEAD SYSTEMS	70
17	ALL COMPUTERS,INC	245
18	ALL COMPUTERS,INC	245
19	ALPHA PRODUCTS	341
404	AMDS LTD	IS-46
24	AMERICAN ADVANTECH	328
407	ARGOSY	IS-50
410	BLUE CHIP TECHNOLOGY	IS-58
51	CAPITAL EQUIPMENT	74
52	CAPITAL EQUIPMENT	75
488	CENTCIRCUIT INT'L	SO-7
489	CENTCIRCUIT INT'L	SO-7
328	COMPUTER MODULES,INC	345
87	DISTRIBUTED PROCESSING TECH	263
88	DISTRIBUTED PROCESSING TECH	263
110	GTEK,INC	106
111	GTEK,INC	106
323	HERCULES COMPUTER	99
115	HIGH RES TECHNOLOGIES	345
124	IO TECH	339
433	JC INFORMATION SYSTEMS CORP	IS-23
142	LAWSON LABS	340
144	LINK COMPUTER GRAPHICS	334
162	MICROSTAR LABORATORIES	336
*	MICROWAY	292
*	MICROWAY	IS-62
183	NOHAU CORPORATION	340
200	PERCEPTIVE SOLUTIONS,INC	236
201	PERCEPTIVE SOLUTIONS,INC	236
206	PLUS DEVELOPMENT	119
228	QUA TECH,INC	338
229	QUA TECH,INC	338
230	QUA TECH,INC	338
231	QUA TECH,INC	338
232	QUA TECH,INC	338
233	QUA TECH,INC	338
234	QUA TECH,INC	338
235	QUA TECH,INC	338
236	QUA TECH,INC	338
265	SPECIALTY SOFTWARE DEVMNT	90
275	TALL TREE SYSTEMS	345
284	THE PERISCOPE CO	217
285	THE PERISCOPE CO	217
449	TRIANGLE DIGITAL	IS-58
314	Z-WORLD ENGINEERING	339

801 DRIVES

Inquiry No.		Page No.
73	CURTIS,INC	124
206	PLUS DEVELOPMENT	119
*	SEAGATE TECHNOLOGY	177
451	TRIGEM COMPUTER,INC	IS-6
297	TULIN CORP	216

802 FACSIMILE

Inquiry No.		Page No.
12	ADD ON AMERICA	329
430	INTERQUAD LTD	IS-3

803 HARDWARE PROGRAMMERS

Inquiry No.		Page No.
45	BP MICROSYSTEMS	340
110	GTEK,INC	106
111	GTEK,INC	106
143	LINK COMPUTER GRAPHICS	334
145	LOGICAL DEVICES,INC	329
148	LOGICAL DEVICES,INC	329
311	XELTEK	348

804 INSTRUMENTATION

Inquiry No.		Page No.
68	CORTEX	346
93	ELEXOR,INC	329

805 KEYBOARDS/MICE

Inquiry No.		Page No.
426	GTCO	IS-21
427	GTCO	IS-21
117	HOUSTON COMPUTER SERV	346
134	KEA SYSTEMS	261
149	LOGITECH	51
150	LOGITECH	51
185	NORTHGATE COMPUTER SYS	192,193
188	NORTHGATE COMPUTER SYS	268,269
202	PERCON	324
252	SCIENCE ACCESSORIES	275
253	SCIENCE ACCESSORIES	275

806 MASS STORAGE

Inquiry No.		Page No.
15	AK SYSTEMS	329
66	CORE INTERNATIONAL	291
67	CORE INTERNATIONAL	291
74	DATA STRATEGIES INT'L	339
180	MICRO SOLUTIONS COMP.PROD	106
192	OVERLAND DATA	324
237	QUALSTAR CORP	334
440	SCHNELLMANN INTERHANDELS AG	IS-31
317	SONY	222,223
270	STORAGE DIMENSIONS	63
271	STORAGE DIMENSIONS	63
447	TEAC CORPORATION	IS-14
304	VOGON ENTERPRISES LTD	232

807 MISCELLANEOUS

Inquiry No.		Page No.
24	AMERICAN ADVANTECH	328
41	BLACK JACK COMPUTER	334
320	COMPUTER ACCESSORIES	157
321	COMPUTER ACCESSORIES	157
69	COVOX,INC	325
70	COVOX,INC	325
417	DIETRICH GMBH	IS-54
94	ENGINEERS COLLABORATIVE,THE	343
122	INTEGRAND	178
456	VASCO	IS-20

808 MODEMS/MULTIPLEXORS

Inquiry No.		Page No.
38	BAY TECHNICAL ASSOCIATES	249
39	BAY TECHNICAL ASSOCIATES	249
59	COMPUCOM	325
105	FORVAL AMERICA	227
106	FORVAL AMERICA	227
292	TOUCHBASE SYSTEMS,INC	66
453	UNIVERSAL DATA SYSTEMS	IS-11
454	UNIVERSAL DATA SYSTEMS	IS-11

809 MONITORS

Inquiry No.		Page No.
431	INTERQUAD LTD	IS-5
434	LASERMASTER CORP	IS-37
435	LASERMASTER CORP	IS-37
175	NANAO	96
180	NEC HOME ELECTRONICS	12,13
276	TATUNG	214

810 NETWORK HARDWARE

Inquiry No.		Page No.
401	3EST-USA	IS-58
38	BAY TECHNICAL ASSOCIATES	249
39	BAY TECHNICAL ASSOCIATES	249
46	BUFFALO PRODUCTS,INC	145
*	CLEO COMMUNICATIONS	D, 104
524	CONVEX RESOURCES	PC-9
416	DAEWOO TELECOM	IS-24,25
418	D-LINK UK	IS-57
104	FLYTECH TECHNOLOGY,INC	59
121	INES	274
516	MICROTEST	NE-13
517	MICROTEST	NE-13
247	SAMSUNG	219
248	SAMSUNG	219
286	THE SOFTWARE LINK	198
287	THE SOFTWARE LINK	198
288	THE SOFTWARE LINK	199
289	THE SOFTWARE LINK	199
308	WIESEMANN & THEIS GMBH	146
312	XIRCOM	204

811 PRINTERS/PLOTTERS

Inquiry No.		Page No.
407	ARGOSY	IS-50
*	CANON USA	32A–B
50	CANON USA	33
501	DEERFIELD DATA SYSTEMS	NE-2
108	GRAPHTEC	270
113	HEWLETT-PACKARD PERIPH	129
114	HEWLETT-PACKARD PERIPH	130,131
434	LASERMASTER CORP	IS-37
435	LASERMASTER CORP	IS-37
243	NATIONAL TELEVAR	170
191	OUTPUT TECHNOLOGY CORP	41
195	PANASONIC-1100 SERIES	155
196	PANASONIC-LASER PRINTERS	15
224	QMS,INC	153
225	QMS,INC	153
240	RADIO SHACK	CIV
318	SHARP ELECTRONICS	132
446	SURAH,INC	IS-56
278	TEKTRONIX	30,31
279	TEKTRONIX	30,31
282	TEXAS INSTRUMENTS	158,159
498	UNITED INNOVATIONS	SO-3
538	ZERICON	PC-16

812 SCANNERS/IMAGE PROCESSORS

Inquiry No.		Page No.
75	DATA TRANSLATION	77
502	ECA C&C PRODUCTS,INC	NE-11
503	ECA C&C PRODUCTS,INC	NE-11
511	INFO/OPTICS	NE-7
512	INFO/OPTICS	NE-7
527	INFO/OPTICS	PC-5
528	INFO/OPTICS	PC-5
149	LOGITECH	51
150	LOGITECH	51

813 SOFTWARE SECURITY

Inquiry No.		Page No.
403	ALADDIN KNOWLEDGE SYS,LTD	IS-35
419	FAST ELECTRONIC GMBH	IS-55
420	FAST ELECTRONIC GMBH	IS-55
221	PROTECH MARKETING,INC	115
222	PROTECH MARKETING,INC	115
241	RAINBOW TECHNOLOGIES	197
242	RAINBOW TECHNOLOGIES	197
263	SOFTWARE SECURITY	253

814 SYSTEMS

Inquiry No.		Page No.
402	AGC TECHNOLOGY CORP	IS-61
20	ALR	2,3
21	ALR	2,3
22	ALTEC TECH.CORP	265
24	AMERICAN ADVANTECH	328
405	AMERICAN RESEARCH CORP	IS-49
406	AMERICAN RESEARCH CORP	IS-49
409	BEHAVIOR TECH	IS-64
523	CACHE COMPUTERS,INC	PC-15
57	CHEETAH INT'L	224
524	CONVEX RESOURCES	PC-9
71	CSS LABS	242
72	CSS LABS	242
78	DELL COMPUTER CORP	CIII,1
77	DELL COMPUTER CORP	136,137
*	DELL COMPUTER CORP	138A–B
476	DERBYTECH COMPUTERS,INC	MW-5
477	DERBYTECH COMPUTERS,INC	MW-5
79	DIGITAL DISTRIBUTING	39
80	DIGITAL DISTRIBUTING	39
478	EKM	MW-4
479	EKM	MW-4
525	EKM	PC-10
526	EKM	PC-10
*	ELONEX	IS-33
95	ERGO COMPUTING,INC	164,165
96	ERGO COMPUTING,INC	164,165
*	EVEREX SYSTEM COMPUTER	207,208
97	EVEREX SYSTEM COMPUTER	209
98	EVEREX SYSTEM COMPUTER	210
100	FIRST COMPUTER SYS,INC	324
101	FIRST COMPUTER SYS,INC	324
421	FORTRON/SOURCE	IS-9
422	GALAXY	IS-54
*	GATEWAY 2000	22,23
116	HITECH EQUIPMENT CORP	339
324	HOME SMART COMPUTING	345
119	IBM WORKSTATION	212,213
127	IVERSON COMPUTER CORP	233
*	IVERSON COMPUTER CORP	233A–B
132	JEMINI ELECTRONICS	343
135	KILA SYSTEMS	343
436	M3PC	IS-12,13
158	MEGATEL	274
*	MICROWAY	166
159	MIS COMPUTER SYSTEMS	126
168	MODGRAPH	18
169	MODGRAPH	18
170	MODGRAPH	18
179	NCR CORP	172,173
181	NETWORK PC	342
184	NORTHGATE COMPUTER SYS	46,47
186	NORTHGATE COMPUTER SYS	194,195
187	NORTHGATE COMPUTER SYS	254,255
481	OMNI COMPUTERS,INC	MW-2
482	OMNI COMPUTERS,INC	MW-2
492	OMNI COMPUTERS,INC	SO-2
493	OMNI COMPUTERS,INC	SO-2
532	OMNI COMPUTERS,INC	PC-2
533	OMNI COMPUTERS,INC	PC-2
483	PAO-KU INTERNATIONAL LTD	MW-9
484	PAO-KU INTERNATIONAL LTD	MW-9
494	PAO-KU INTERNATIONAL LTD	SO-12
495	PAO-KU INTERNATIONAL LTD	SO-12
518	PAO-KU INTERNATIONAL LTD	NE-15
519	PAO-KU INTERNATIONAL LTD	NE-15
534	PAO-KU INTERNATIONAL LTD	PC-7
535	PAO-KU INTERNATIONAL LTD	PC-7
199	PC BRAND	179
*	PC BRAND	180,181
*	PC BRAND	182,183
*	PC BRAND	184,185
208	PROFESSIONAL COMPUTER SYS	336
520	PROTEUS TECHNOLOGY CORP	NE-12
485	REASON TECHNOLOGY	MW-11
441	SIEMENS AG	IS-17
486	TECH CITY	MW-3
487	TECH CITY	MW-3
496	TECH CITY	SO-9
497	TECH CITY	SO-9
521	TECH CITY	NE-5
522	TECH CITY	NE-5
536	TECH CITY	PC-11
537	TECH CITY	PC-11
277	TECHNOLOGY POWER ENT	346
290	TOSHIBA	80,61
291	TOSHIBA	60,61
452	TWINHEAD	IS-51
301	VICTORY ENTERPRISES	108
309	WINTEK CORPORATION	336
310	XEC PRODUCTS	221
313	ZENITH DATA SYSTEMS	53
315	Z-WORLD ENGINEERING	339

815 UPS

Inquiry No.		Page No.
25	AMERICAN POWER CONVERSION	171
26	AMERICAN POWER CONVERSION	171
40	BEST POWER TECH,INC	340
197	PARA SYSTEMS	101

SOFTWARE

816 APPLE/MAC APPLICATIONS-SCIENTIFIC/TECHNICAL

Inquiry No.		Page No.
250	SAS INSTITUTE,INC	95

817 APPLE/MAC LAN

Inquiry No.		Page No.
*	TOPS	IS-53

World Radio History

READER SERVICE

*Correspond directly with company.

Inquiry No.		Page No.
818	**IBM/MSDOS APPLICATIONS BUSINESS OFFICE**	
30	AXSYS	154
31	AXSYS	154
32	AXSYS	154
107	FOX SOFTWARE,INC	25
423	GAMMA PRODUCTIONS,INC	IS-18
507	GROUP 1 SOFTWARE	NE-4
508	GROUP 1 SOFTWARE	NE-4
*	MICROLOGIC	279
*	MICROSOFT CORP	8,9
243	NATIONAL TELEVAR	170
*	ORACLE	123
198	PATTON & PATTON	72
322	RAIMA CORPORATION	45
244	ROSE ELECTRONICS	107
258	SEQUITER SOFTWARE,INC	211
819	**IBM/MSDOS APPLICATIONS SCIENTIFIC TECHNICAL**	
91	DYNAMICAL SYSTEMS,INC	264
92	ECOSOFT	286
112	HAVEN TREE	100
155	MATHSOFT,INC	273
178	NATIONAL INSTRUMENTS	CIII
254	SCIENTIFIC ENDEAVORS	336
255	SCIENTIFIC ENDEAVORS	336
256	SCIENTIFIC ENDEAVORS	336
266	SPECTRUM SOFTWARE	201
267	STATSOFT	67
820	**IBM/MSDOS APPLICATIONS WORD PROCESSING**	
246	SAMNA	125
821	**IBM/MSDOS CAD**	
34	A.M.S.	345
524	CONVEX RESOURCES	PC-9
309	WINTEK CORPORATION	336
400	WINTEK CORPORATION	7
822	**IBM/MSDOS COMMUNICATIONS**	
55	CENTURY SOFTWARE	80
56	CENTURY SOFTWARE	80
89	DIVERSIFIED COMPUTER SYS	336
457	PROGRAMMER'S ODYSSEY	IS-46
274	TALKING TECHNOLOGY	329
295	TRITON TECHNOLOGIES	94
296	TRITON TECHNOLOGIES	94
823	**IBM/MSDOS GRAPHICS**	
319	COREL SYSTEMS	121
824	**IBM/MSDOS LAN**	
28	ARTISOFT	109
127	IVERSON COMPUTER CORP	233
*	IVERSON COMPUTER CORP	233A–B
151	MAP INFO CORP	82
439	PERFORMANCE TECH	IS-26
286	THE SOFTWARE LINK	198
287	THE SOFTWARE LINK	198
*	TOPS	IS-53
825	**IBM/MSDOS LANGUAGES**	
33	AVOCET SYSTEMS,INC	79
43	BORLAND INTERNATIONAL	11
44	BORLAND INTERNATIONAL	11
58	CNS	272
82	DIGITALK	26,27
424	GLOCKENSPIEL	IS-41
140	LATTICE,INC	134
141	LATTICE,INC	134
514	LPI	NE-8
530	LPI	PC-4
531	METAWARE	PC-13
*	MICROSOFT CORP	21
*	MICROSOFT CORP	234,235
*	MICROWAY	292
166	MIX SOFTWARE	295
176	NANTUCKET	190
177	NANTUCKET	191
260	SILICON VALLEY SOFTWARE	84
268	STONY BROOK SOFTWARE	98
269	STONY BROOK SOFTWARE	98
293	TRANS ERA	304
294	TRANS ERA	304
*	VERMONT CREATIVE S/W	35
*	ZORTECH,INC	37
826	**IBM/MSDOS UTILITES**	
16	ALF PRODUCTS	264
29	ATRON CADRE TECHNOLOGIES	29
42	BLAISE COMPUTING,INC	6
53	CENTRAL COMPUTER PROD	336
412	CLARION SOFTWARE	IS-19
413	CLARION SOFTWARE	IS-19
90	DROVER TECHNOLOGIES	124
99	FAIRCOM CORPORATION	86
109	GREENVIEW	68
429	IMT	IS-50
432	ITHACA STREET SOFTWARE	IS-32
136	KNOWLEDGE GARDEN	303
140	LATTICE,INC	134
141	LATTICE,INC	134
*	LOTUS	72A–B
*	LOTUS	73
437	MASHOV	IS-45
*	MICROSOFT CORP	54,55
*	MICROSOFT CORP	57
173	MULTISCOPE,INC	127
174	MULTISCOPE,INC	127
316	NOVA,INC	156
189	NU-MEGA TECHNOLOGIES	69
238	QUARTERDECK	16,17
245	SAFEWARE,INC	339
444	SOFTWARE DMI	IS-54
445	SOFTWARE DMI	IS-56
272	SUPERSOFT	262
283	THE OAKLAND GROUP	187
307	WATCOM PRODUCTS,INC	189
827	**OTHER APPLICATIONS BUSINESS/OFFICE**	
310	XEC PRODUCTS	221
828	**OTHER APPLICATIONS Miscellaneous**	
480	INTERFACE GROUP	MW-7
491	INTERFACE GROUP	SO-5
513	INTERFACE GROUP	NE-9
529	INTERFACE GROUP	PC-3
302	VIDEO TEXTBOOK TRAINING	272
303	VIDEO TEXTBOOK TRAINING	272
305	WARD SYSTEMS GROUP	240
306	WARD SYSTEMS GROUP	240
829	**OTHER APPLICATIONS Word Processing**	
480	INTERFACE GROUP	MW-7
491	INTERFACE GROUP	SO-5
513	INTERFACE GROUP	NE-9
529	INTERFACE GROUP	PC-3
830	**OTHER — CROSS DEVELOPMENT**	
223	PSEUDOCORP	334
*	SOFTWARE DEVELOPMENT SYS	113
831	**OTHER — LANGUAGES**	
326	BINARY TECHNOLOGY,INC	346
99	FAIRCOM CORPORATION	86
480	INTERFACE GROUP	MW-7
491	INTERFACE GROUP	SO-5
513	INTERFACE GROUP	NE-9
529	INTERFACE GROUP	PC-3
832	**OTHER — UTILITES**	
109	GREENVIEW	68
302	VIDEO TEXTBOOK TRAINING	272
303	VIDEO TEXTBOOK TRAINING	272
833	**DESKTOP PUBLISHING**	
123	INTERCON ASSOCIATES	144
125	IQ ENGINEERING	149
126	IQ ENGINEERING	149
434	LASERMASTER CORP	IS-37
435	LASERMASTER CORP	IS-37
165	MITCHELL PACIFIC COMP	216
243	NATIONAL TELEVAR	170
193	PACIFIC DATA PRODUCTS	147
194	PACIFIC DATA PRODUCTS	147
226	QMS,INC	92
227	QMS,INC	92
244	ROSE ELECTRONICS	107
834	**EDUCATIONAL/ INSTRUCTIONAL**	
8	ABACUS SOFTWARE,INC	93
9	ABACUS SOFTWARE,INC	93
27	ANNABOOKS	325
325	B & B ELECTRONICS	343
*	BYTE BACK ISSUES	276,277
*	BYTE BACK ISSUES	IS-52
48	BYTE BITS	334
350	BYTE CARD DECK	SO-4
351	BYTE CARD DECK	PC-10
500	BYTE CARD DECK	NE-8
*	BYTE PUBLICATIONS	307
*	BYTE SUB MESSAGE	356
*	BYTE SUB MESSAGE	IS-44
*	BYTE SUB SERVICE	326
*	BYTEWEEK/NEWSLETTER	282
*	DATA COMMUNICATIONS	299
86	DISKETTE EMPORIUM	334
428	I X I LIMITED	IS-56
147	LOGICAL DEVICES,INC	329
148	LOGICAL DEVICES,INC	329
*	UNIXWORLD	296A–B
*	UNIXWORLD	297
835	**MAIL ORDER/ RETAIL**	
23	AMERICAL GROUP	340
408	ATICO	IS-43
35	B & C MICROSYSTEMS,INC	343
36	B & C MICROSYSTEMS,INC	345
37	B & C MICROSYSTEMS,INC	345
47	BUREAU OF ELECTRONIC PUB	78
414	COMPUBRAS COMPUTERS	IS-42
415	COMPUCLASSICS	IS-29
60	COMPUSAVE INTERNATIONAL	327
61	COMPUTER FRIENDS	357
62	COMPUTERLANE	337
476	DERBYTECH COMP,INC	MW-5
477	DERBYTECH COMP,INC	MW-5
83	DISKCOTECH	329
84	DISKCOTECH	329
85	DISKETTE CONNECTION	339
102	FIRST SOURCE INT'L	327
103	FIRST SOURCE INT'L	327
490	GEMS COMPUTERS,INC	SO-11
506	GEMS COMPUTERS,INC	NE-17
425	GREY MATTER	IS-63
509	HARMONY COMPUTERS	NE-3
510	HARMONY COMPUTERS	NE-3
120	I.C. EXPRESS	336
128	JADE COMPUTER	335
129	JAMECO ELECTRONICS	330,331
6	JDR MICRODEVICES	353–355
7	JDR MICRODEVICES	353–355
*	MANCHESTER EQUIPMNT	NE-20A–B
515	MANCHESTER EQUIPMENT	NE-20
154	MARYMAC INDUSTRIES	346
438	MAYFAIR MICROS	IS-10
161	MICROPROCESSORS UNLTD	340
181	NETWORK PC	342
182	NEVADA COMPUTER CORP	344
184	NORTHGATE COMPUTER SYS	46,47
185	NORTHGATE COMPUTER SYS	192,193
186	NORTHGATE COMPUTER SYS	194,195
187	NORTHGATE COMPUTER SYS	254,255
188	NORTHGATE COMPUTER SYS	268,269
481	OMNI COMPUTERS,INC	MW-2
482	OMNI COMPUTERS,INC	MW-2
492	OMNI COMPUTERS,INC	SO-2
493	OMNI COMPUTERS,INC	SO-2
532	OMNI COMPUTERS,INC	PC-2
533	OMNI COMPUTERS,INC	PC-2
190	OSBORNE/MCGRAW-HILL	301
483	PAO-KU INTERNATIONAL LTD	MW-9
484	PAO-KU INTERNATIONAL LTD	MW-9
494	PAO-KU INTERNATIONAL LTD	SO-12
495	PAO-KU INTERNATIONAL LTD	SO-12
518	PAO-KU INTERNATIONAL LTD	NE-15
519	PAO-KU INTERNATIONAL LTD	NE-15
534	PAO-KU INTERNATIONAL LTD	PC-7
535	PAO-KU INTERNATIONAL LTD	PC-7
199	PC BRAND	179
*	PC BRAND	180,181
*	PC BRAND	182,183
*	PC BRAND	184,185
*	PC CONNECTION	102,103
*	PC CONNECTION	104,104A
*	PC CONNECTION	104B,104C
207	PRECISION DATA PRODUCTS	343
*	PROGRAMMER'S PARADISE	40,40A–C
209	PROGRAMMER'S SHOP	200
210	PROGRAMMER'S SHOP	200
211	PROGRAMMER'S SHOP	200A
212	PROGRAMMER'S SHOP	200A
213	PROGRAMMER'S SHOP	200B
*	PROGRAMMER'S SHOP	200C
239	R & R ELECTRONICS	345
485	REASON TECHNOLOGY	MW-11
257	SCOTTSDALE SYSTEMS	328
259	SILICON SHACK LTD	346
442	SMART SOFTWARE	IS-34
261	SN'W COMPUTERS	84
*	SOFTLINE	IS-47
262	SOFTWARE ADD-ONS	241
443	SOFTWARE CONSTRUCTION CO.LTD	IS-59
273	SUPREME ENTERPRISE	310
280	TELEPHONE PRODUCTS CTR	326
281	TERABYTE INT'L,INC	343
298	UNICORN	340
299	UNITEX	332,333
300	UNITEX	332,333
455	USA SOFTWARE	IS-39
302	VIDEO TEXTBOOK TRAINING	272
303	VIDEO TEXTBOOK TRAINING	272
836	**MISCELLANEOUS**	
10	ADC	290
11	ADC	290
504	COMPUTER INTEGRATION CTR	NE-19
505	COMPUTER INTEGRATION CTR	NE-19
130	JB TECHNOLOGIES,INC	325
131	JB TECHNOLOGIES,INC	325
837	**ON-LINE SERVICES**	
450	BIX	280,281
*	COPIA INTERNATIONAL LTD	156
*	ONLINE ACCESS	287
838	**OPERATING SYSTEMS**	
81	DIGITAL RESEARCH	71
133	KADAK PRODUCTS LTD	244
*	MARK WILLIAMS CO	83
205	PHAR LAP SOFTWARE	89
249	SANTA CRUZ OPERATION	49
330	VENTURCOM	302
331	VENTURCOM	302
839	**RECRUITMENT**	
54	CENTRAL POINT SOFTWARE	326

World Radio History

REQUEST FREE INFORMATION BY FAX

Attention BYTE Readers!! Now you can fax your requests for free product and advertiser information featured in this issue.

Just fax this page to 1-413-637-4343. You'll save time because your request for information will be processed as soon as your fax is received.

1 Circle the numbers below which correspond to the numbers assigned to advertisers and products that interest you.

2 Check off the answers to questions "A" through "C".

3 Print your name, address, and fax number clearly on the form.

4 Remove this page or copy this page clearly and fax it to the number above.

Fill out this coupon carefully. PLEASE PRINT.

Name

Title

Company

Address

City

State/Province Zip

Country

(_____) (_____)
Phone Number Fax Number

A. What is your level of management responsibility?

1 ☐ Senior-level Management
2 ☐ Other Management
3 ☐ Non-Management

B. What is your primary job function/principal area of responsibility? (Check one.)

4 ☐ Administration
5 ☐ Accounting/Finance
6 ☐ MIS/DP/Information Center
7 ☐ Product Design and Development
8 ☐ Research and Development
9 ☐ Manufacturing
10 ☐ Sales/Marketing
11 ☐ Purchasing
12 ☐ Personnel
13 ☐ Education/Training
14 ☐ Other: _____

C. Please indicate your organization's primary business activity: (Check one.)

Computer-Related Businesses:

15 ☐ Manufacturer (Hardware, Software)
16 ☐ Computer Retail Stores
17 ☐ Consultants
18 ☐ Service Bureau/Planning
19 ☐ Distributor/Wholesaler
20 ☐ Systems House/Integrator/VAR
21 ☐ Other: _____

Non-Computer-Related Businesses:

22 ☐ Manufacturing
23 ☐ Finance, Insurance, Real Estate
24 ☐ Retail/Wholesale
25 ☐ Education
26 ☐ Government
27 ☐ Military
28 ☐ Professions (Law, Medicine, Engineering, Architecture)
29 ☐ Consulting
30 ☐ Other Business Services
31 ☐ Transportation, Communications, Utilities
32 ☐ Other: _____

☐ *I subscribe to BYTE.* ☐ *I do not subscribe to BYTE.*
☐ *Please send me one year of BYTE Magazine for $24.95 and bill me. Offer valid in U.S. and possessions only.*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	184	185	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	188	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
281	282	283	284	285	288	287	288	289	290	291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320
321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	338	337	338	339	340
341	342	343	344	345	348	347	348	349	350	351	352	353	354	355	358	357	358	359	360
361	362	363	364	365	366	367	366	369	370	371	372	373	374	375	376	377	378	379	380
381	382	383	384	365	366	387	388	389	390	391	392	393	394	395	396	397	398	399	400
401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	436	439	440
441	442	443	444	445	446	447	446	449	450	451	452	453	454	455	456	457	456	459	460
461	462	463	464	465	466	467	466	469	470	471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520
521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	536	539	540
541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560
561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580
581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600
601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620
621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	837	636	839	640
841	842	843	644	645	646	847	648	849	650	851	852	653	654	655	656	857	658	859	660
661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680
681	682	663	664	665	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700
701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720
721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740
741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760
761	762	763	784	785	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780
781	782	783	784	785	788	787	788	789	790	791	792	793	794	795	796	797	798	799	600
801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820
821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840
841	842	843	844	845	848	847	848	849	850	851	852	853	854	655	856	857	858	859	860
861	882	863	864	865	866	887	888	889	870	871	872	873	874	875	876	877	878	879	880
881	882	863	884	885	866	887	888	889	890	891	892	893	894	895	896	897	898	899	900
901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920
921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	936	939	940
941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	956	959	960
961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980
981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020
1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040
1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060
1061	1062	1063	1064	1065	1066	1067	1066	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080
1081	1082	1083	1084	1085	1086	1087	1086	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100
1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120
1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140
1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160
1161	1162	1183	1184	1185	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180
1181	1182	1183	1184	1185	1188	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200
1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220
1221	1222	1223	1224	1225	1226	1227	1228	1229	1230										

World Radio History

MMC MICROCOMPUTER MARKETING COUNCIL of the Direct Marketing Association, Inc

JDR Microdevices®

• 30 DAY MONEY BACK GUARANTEE • 1 YEAR WARRANTY ON ALL PRODUCTS • TOLL-FREE TECHNICAL SUPPORT

DYNAMIC RAMS

PART#	SIZE	SPEED	PINS	PRICE
4116-150	16384x1	150ns	16	1.49
4164-150	65536x1	150ns	16	2.49
4164-120	65536x1	120ns	16	2.89
4164-100	65536x1	100ns	16	3.39
TMS4464-12	65536x4	120ns	16	3.95
41256-150	262144x1	150ns	16	2.59
41256-120	262144x1	120ns	16	2.95
41256-100	262144x1	100ns	16	3.15
41256-80	262144x1	80ns	16	3.75
414256-100	262144x4	100ns	20	12.95
414256-80	262144x4	80ns	20	13.45
1 MB-120	1048576x1	120ns	18	11.95
1 MB-100	1048576x1	100ns	18	12.35
1 MB-80	1048576x1	80ns	18	13.95

SIMM/SIP MODULES

PART#	SIZE	SPEED	FOR	PRICE
41256A9B-12	256K x 9	120ns	SIMM/PC	36.95
41256A9B-80	256K x 9	80ns	SIMM/PC	49.95
421000A8B-10	1MB x 8	100ns	SIMM/MAC	109.95
421000A9B-10	1MB x 9	100ns	SIMM/PC	113.95
421000A9B-80	1MB x 9	80ns	SIMM/PC	119.95
256K9SIP-80	256K X 9	80ns	SIP/PC	54.95
256K9SIP-60	256K X 9	60ns	SIP/PC	64.95
1MBx9SIP-80	1MB x 9	80ns	SIP/PC	124.95

MATH COPROCESSORS

intel 5 YEAR WARRANTY

8-BIT COPROCESSORS

8087	5 MHz	89.95
8087-2	8 MHz	129.95
8087-1	10 MHz	169.95

16-BIT COPROCESSORS

80287	6 MHz	139.95
80287-8	8 MHz	209.95
80287-10	10 MHz	239.95
80C827	12MHZ	299.95

32-BIT COPROCESSORS

80387-16	16 MHz	359.95
80387-SX	16 MHz	319.95
80387-20	20 MHz	399.95
80387-25	25 MHz	499.95
80387-33	33MHz	649.00

INCLUDES MANUAL & SOFTWARE GUIDE

Littlefoot™ CASE $249.95

- ACCOMODATES ALL MOTHERBOARD SIZES
- INCLUDES 250 WATT POWER SUPPLY
- MOUNTS FOR 3 FLOPPY & 4 HARD DRIVES
- TURBO AND RESET SWITCHES
- SPEED DISPLAY, POWER, DISK LEDS
- MOUNTING HARDWARE, FACEPLATES AND SPEAKER INCLUDED

CASE-100

CASE-200 "SUPERFOOT"-HOLDS 11 DRIVES $499.95

CASE-120 "MINIFOOT" W/200 WATT PS $199.95

STANDARD CASES

CASE-70 FULL SIZE SLIDE CASE $89.95

CASE-50 FOR 8088 OR MINI-86 MOTHERBOARDS $59.95

CASE-FLIP FLIP-TOP XT-STYLE CASE $39.95

CASE-SLIDE SLIDE TYPE XT-STYLE CASE $39.95

CASE-JR $149.95

WITH150W POWER SUPPLY. FOR 8088 OR MINI-286 BOARDS.

CASE-JR-200 ..... $189.95

WITH 200W POWER SUPPLY. FOR 8088 OR MINI-286 BOARDS.

NOTE: CASES DO NOT INCLUDE DRIVES.

UL APPROVED POWER SUPPLIES

PS-135 135 WATT FOR 8088 ..... $59.95

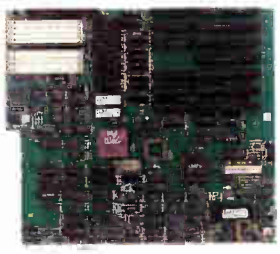
PS-155 150 WATT FOR 8088 ..... $69.95

PS-200X 200 WATT FOR 8088 ..... $89.95

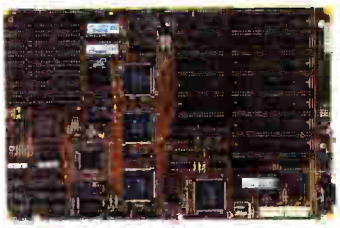
PS-200 200 WATT FOR 286/386 ..... $89.95

PS-250 250 WATT FOR 286/386 ..... $129.95

YOUR MOTHERBOARD CONNECTION!



FOR SYSTEM SAVING IDEAS CALL TO REQUEST OUR NEW CATALOG



"OUR FASTEST" 33MHZ CACHE 386 $1495

• NORTON SI 45.9 • LANDMARK AT SPEED 50.8

• 33MHZ 80386 MPU • 64K ZERO WAIT STATIC RAM CACHE • 1/2/4/8MB ON-BOARD RAM USING 80NS SIMMS (0KB INSTALLED) • 1/2MB USING 4/8 256K SIMMS OR 4/8MB USING 4/8 1MB SIMMS • CHIPS & TECHNOLOGY 82C206 DMA INTERRUPT CONTROLLER • SOCKETED FOR 80387-33 MATH CO-PROCESSOR • EIGHT EXPANSION SLOTS (ONE 32-BIT, SIX 16-BIT, ONE 8-BIT) • AMI BIOS ASSURES IBM COMPATIBILITY • 8/33MHZ KEYBOARD ADJUSTABLE SPEEDS

MCT-386MBC-33 ..... $1495.00

25MHZ 386 $999

• NORTON SI 29.7 • LANDMARK AT SPEED 32.5

• 25MHZ 80386 MPU • 10MHZ/25MHZ KEYBOARD SELECTABLE SPEEDS • 16MB ON-BOARD RAM CAPACITYUSING SIPS (0KB INSTALLED) • 1/2MB USING 36/72 256KX1 DRAMS OR 4/8 256K SIPS; 4/8MB USING 36/72 1MBX1 DRAMS OR 4/8 1MB SIPS; 16MB USING 72 1MBX1 DRAMS AND 8 1MB SIPS • SHADOW RAM FOR BIOS & VIDEO • SOCKETED FOR WEITEK 3167 COPROCESSOR • EIGHT EXPANSION SLOTS (FIVE 16-BIT, THREE 8-BIT) • AMI BIOS ADJUSTABLE BUS SPEEDS • INTERLEAVED MEMORY• NEAR 0 WAIT STATE

MCT-386MB25S

20MHZ 386 $799

MCT-386MB20S • **NORTON SI 23.0 • LANDMARK AT 25.8**

MINI 25MHZ CACHE 386

• NORTON SI 30.5 • LANDMARK AT SPEED 40.7

• 25MHZ 80386 • REQUIRES ONE OF THE RAM CARDS LISTED BELOW • SHADOW RAM FOR ROM BIOS • USES MEMORY CACHING FOR SUPERIOR PERFORMANCE • MEMORY INTERLEAVING FOR NEAR 0 WAIT STATE OPERATION (8 BANKS OF MEMORY REQUIRED) • SOCKETED FOR 80387 OR WEITEK 3167 COPROCESSORS

MCT-C386-25 ..... $1199.00

1/2/4MB USING 8/16/32 256KX4 DRAMS & 4/8/16 256KX1 DRAMS (0K INSTALLED)

MCT-C386-M4 ..... $99.95

1/2MB USING 36/72 256KX1 DRAMS OR 4/8MB USING 36/72 1MBX1 DRAMS (0K INST)

MCT-C386-M8 ..... $99.95

1/2/4MB USING 4/8/16 256K SIMMS, 4/8/16MB USING 4/8/16 1MB SIMMS OR 10 MB USING 8 1MB SIMMS AND 8 256K SIMMS (0K INSTALLED)

MCT-C386-M16 ..... $99.95

MINI 25MHZ 386 $799

• NORTON SI 26.6 • LANDMARK AT SPEED 32.5

• MEMORY INTERLEAVING FOR NEAR ZERO WAIT STATES • SOCKETED FOR 80387 COPROCESSOR • USES 80NS 256K OR 1MB SIP/DIP RAMS • 16MB RAM CAPACITY: 8MB ON BOARD, 8MB USING OPTIONAL RAM CARD (0KB INSTALLED) • ON-BOARD RAM: 1/2MB USING 4/8 256K SIPS OR 4/8MB USING 4/8 1MB SIPS • FIVE 16-BIT SLOTS, TWO 8-BIT SLOTS, ONE 32-BIT SLOT FOR PROPRIETARY RAM CARD • STANDARD XT HOLE SPACING • AMI BIOS • SIZE: 8.5" X 13"

MCT-M386-25 25MHZ VERSION $799.00

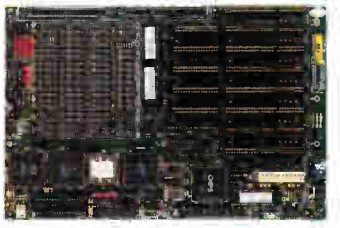
MCT-M386-20 20MHZ VERSION $629.00

16MHZ MINI 386-SX $399.95

• NORTON SI 15.3 • LANDMARK AT SPEED 20.8

• USES 16MHZ INTEL 80386SX CPU • EXPANDABLE TO 8MB ON BOARD • 512K/1MB USING 18/36 256KX1 DRAMS OR 2/4 256K SIPS OR 4/8 256KX4 AND 2/4 256KX1 DRAMS; 2/4MB USING 18/36 1MBX1 DRAMS OR 2/4 1MB SIPS; 6/8MB USING 36 1MBX1 DRAMS AND 2/4 1MB SIPS AMI BIOS • CHOOSE FAST 0 WAIT STATE OR 1 WAIT STATE FOR ECONOMICAL USE OF SLOWER RAM • FIVE 16-BIT & THREE 8-BIT EXPANSION SLOTS • CHIPS & TECHNOLOGY NEW ENHANCED ADVANCED TECHNOLOGY (NEAT) CHIPSET • SOCKET FOR 80387SX-16 COPROCESSOR • 8.5" X 13" SIZE FITS IN MINI-AT AND FULL-SIZE AT CASES

MCT-386SX $399.95



20MHZ 286 $389.95

• NORTON SI 20.3 • LANDMARK AT SPEED 26.3

• NEAT CHIPSET HAS POWER TO COMPETE WITH 386 SYSTEMS • EXPANDABLE FROM 512K TO 8MB, 512K/1MB USING 18/36 256KX1 DRAMS OR 2/4 256K SIPS; 2/4MB USING 18/36 1MBX1 DRAMS OR 2/4 1MB SIPS; 6/8MB USING 36 1MBX1 DRAMS AND 2/4 1MB SIPS • 20/10MHZ KEYBOARD SELECTABLE SPEEDS • AMI BIOS • SHADOW RAM AND PAGE INTERLEAVED MEMORY • FAST 0 WAIT STATE OR 1 WAIT STATE FOR SLOWER RAM • 8.5" X 13" FITS MOST XT, MINI-AT & FULL SIZE AT CASES • FIVE 16-BIT & THREE 8-BIT SLOTS • SOCKET FOR 80287-12 MATH CO-PROCESSOR

MCT-M286-20N

16MHZ 286 W/NEAT CHIPSET $289.95

MCT-M286-16N **NORTON SI 16.2 / LANDMARK AT 21.1**

12MHZ 286 W/NEAT CHIPSET $269.95

MCT-M286-12N **NORTON SI 12.0 / LANDMARK AT 15.5**

12.5MHZ 286 $199.95

• NORTON SI 14.3 • LANDMARK AT SPEED 16.5

• AT-COMPATIBLE • 6/12.5MHZ KEYBOARD SELECTABLE SPEEDS • EXPANDABLE TO 4MB ON BOARD; 512K/1MB USING 18/36 256KX1 DRAMS; 2/4MB USING 18/36 1MBX1 DRAMS (0KB INSTALLED) • MEMORY SPEED: 120NS FOR 1 WAIT, 100NS FOR 0 WAIT

MCT-M286-12 ..... $199.95

MCT-M286-10 6/10MHZ VERSION $189.95

10MHZ 8088 NORTON SI 2.1 $99.95

• NOW USES LOW-COST 256K X 4 1MB DRAMS • XT COMPATIBLE; OPERATES AT 4.77/10MHZ • KEYBOARD SELECTABLE CLOCK SPEEDS • SOCKET FOR 8087-1 COPROCESSOR • 8 SLOTS • MCT BIOS • 640K RAM CAPACITY (0KB INSTALLED)

MCT-TURBO-10 ..... $99.95

MCT-TURBO 8MHZ VERSION $89.95

ORDER TOLL-FREE 800-538-5000

KEY CODE 10

JDR MICRODEVICES 2233 BRANHAM LANE, SAN JOSE, CA 95124 (408) 559-1200
FAX (408) 559-0250 TELEX 171-110

COPYRIGHT 1990 JDR MICRODEVICES

CUSTOMER SERVICE 800-539-5001 TECH SUPPORT 800-538-5002
MON.-FRI. 7 A.M. TO 5 P.M., SATURDAY, 9 A.M. TO 3 P.M. (PST)

ORDER VIA BBS (408) 559-0253

VISA MasterCard

Circle 6 on Reader Service Card (DEALERS: 7)

World Radio History

JDR Microdevices®

• 30 DAY MONEY BACK GUARANTEE • 1 YEAR WARRANTY ON ALL PRODUCTS • TOLL-FREE TECHNICAL SUPPORT

MONITORS

VGA PACKAGE $499.95

VGA COLOR AND CLARITY AT AN EGA PRICE! • 8 BIT VGA CARD IS FULLY COMPATIBLE WITH IBM VGA • 720 X 540 MAXIMUM RESOLUTION, 640 X 480 IN 16 COLORS • 528 X 480 IN 256 COLORS • HIGH RESOLUTION ANALOG MONITOR • EGA/CGA/MONO AND HERCULES COMPATIBLE • DRIVERS FOR WINDOWS, GEM, 1-2-3, SYMPHONY AUTOCAD & VENTURA

VGA-PKG

MONO-VGA PAPERWHITE VGA MONITOR $139.95
NEC-MULTI-3D NEC MULTI-3D MULTISYNC $649.00
CM-1440 SEIKO DUAL FIXED FREQUENCY $599.00

RELISYS MULTISYNCH $429.95

• 14" NON-GLARE SCREEN • 800 X 560 MAX RESOLUTION • CGA/EGA/VGA COMPATIBLE • TTL/ANALOG MODE

JDR-MULTI

RELYSIS VGA MONITOR $359.95

• 14" ANALOG VGA MONITOR • GLARE RESISTANT SCREEN • 720 X 480 MAXIMUM RESOLUTION • TILT/SWIVEL BASE

VGA-MONITOR

EGA MONITOR $339.95

• 14" NON-GLARE SCREEN WITH 640 X 350 MAXIMUM RESOLUTION • DISPLAY 16 COLORS SIMULTANEOUSLY

EGA-MONITOR

TAXAN DUAL PAGE MONITOR $1499

• GLARE RESISTANT 19" MONOCHROME SCREEN • INCLUDES DISPLAY CARD • 1280 X 960 NON-INTERLACED

TAXAN-P

14" SCREEN MONO $139.95

• GLARE RESISTANT 14" SCREEN WITH AMBER DISPLAY • 720 X 350 RESOLUTION • TILT/SWIVEL BASE

GM-1489

MONO-SAMSUNG SAMSUNG 12" FLAT SCREEN $129.95
JDR-MONO 12" MONO WITH GREEN SCREEN $69.95

ENHANCED KEYBOARD WITH CALCULATOR $74.95

• NUMERIC KEYPAD DOUBLES AS A MULTI-FUNCTION BUSINESS CALCULATOR WITH MEMORY FUNCTIONS • 101 KEYS • 12 FUNCTION KEYS • XT/AT & PS/2 COMPATIBLE (PS/2 REQUIRES ADAPTOR GENDER 5-6 $4.95)

FC-3001

ENHANCED KEYBOARDS

BTC-5339 101-KEY WITH 12 FUNCTION KEYS $69.95
BTC-5339R COMPACT 101 KEY, 30% SMALLER $79.95
MAX-5339 101-KEY MAXI-SWITCH (286 ONLY) $84.95
K103-A AUDIBLE "CLICK" 101-KEY KEYBOARD $84.95

STANDARD KEYBOARDS

BTC-5060 84-KEY WITH 10 FUNCTION KEYS $59.95
MAX-5060 MAXI-SWITCH 84-KEY (286 ONLY) $64.95

GENISCAN SCANNER $199.95

• UP TO 400 DPI • 32 LEVELS OF GRAY SCALE • SPEED OVERRUN WARNING LIGHT • AUTO MERGE FOR LARGE IMAGES • INCLUDES INTERFACE CARD • INCLUDES SCANEDIT II, & DR. GENIUS SOFTWARE

GS-4500

PRODIGY-OCR OCR SOFTWARE $49.95

FASTTRAP 3-AXIS TRACKBALL $109.95

• 2 & 3 AXIS POINTING CAPABILITY • HIGH RESOLUTION 200 PULSE/INCH • HARDWARE VARIABLE RESOLUTION • STANDARD RS-232C SERIAL INTERFACE

FAST-TRAP

PC-TRAC 2-AXIS TRACKBALL $89.95

RAM CARD FOR HP LASERJET $89.95

• FOR LASERJET SERIES II PRINTERS • USER EXPANDABLE TO 1, 2 OR 4MB (0K INSTALLED) • USES 256K 150NS OR 1MB 120NS DRAMS

MCT-RAMJET

RAM CARD FOR LASERJET IIP $299.95

• ADDS 1MB TO 2MB RAM (1MB INSTALLED)

IIP-RAM

JETFONT SUPERSET -150 FONTS! $299.95

2 CARTRIDGES CONTAIN THE EQUIVALENT OF 18 SEPARATE HP CARTRIDGES WITHOUT DOWN-LOADING! • FOR HP LASERJET, LASERJET+ AND LASERJET II • DRIVERS FOR WORDPERFECT, WORD-STAR 2000, IBM DISPLAY WRITE 4, MS WORD, WINDOWS, 1-2-3, DBASE II AND MORE!

SUPERSET

LOGITECH MICE

LOGITECH • THREE-BUTTON SERIES 9 • 320 DPI RESOLUTION • SERIAL PS/2 COMPATIBLE.

LOGC9 SERIAL MOUSE $98.95
LOGC9-C SERIAL MOUSE (NOT PS/2 COMPATIBLE) $79.95
LOGC9-P SERIAL MOUSE WITH PAINTSHOW $109.95
LOGC9-PC SERIAL MOUSE WITH PAINT/CAD $154.95
LOGB9 BUS MOUSE $89.95
LOGB9-P BUS MOUSE WITH PAINTSHOW $104.95
LOGB9-PC BUS MOUSE WITH PAINT/CAD $149.95

CABLES AND GENDER CHANGERS

MOLDED; GOLD-PLATED CONTACTS; 100% SHIELDED

CBL-PRINTER	6 FT. PC PRINTER CABLE	9.95
CBL-PRNTR-25	25 FT. PC PRINTER CABLE	15.95
CBL-PRINTR-RA	RIGHT ANGLE PRINTER CABLE	15.95
CBL-DB25-MM	DB25 MALE-DB25 MALE 6 FT.	9.95
CBL-DB25-MF	DB25 MALE DB25 FEMALE 6 FT.	9.95
CBL-9-SERIAL	DB9 FEMALE-DB25 MALE 6 FT.	6.95
CBL-KBD-EXT	5 FT. KEYBOARD EXTENSION	7.95
CBL-CNT-MM	36-PIN CENTRONICS M/M	14.95
CBL-FDC-EXT	37-PIN EXT. FLOPPY CABLE	9.95
CBL-MNT-9	9 PIN MONITOR EXTENSION	6.95
CBL-MNT-15	15-PIN MONITOR EXTENSION CABLE	9.95
CBL-MODEM	MODEM -DB25 DB25-FEMALE	6.95
GENDER-VGA	DB9-DB15 ADAPTOR	4.95

DEVELOPERS' WORLD

JDR caters to the developer with a full line of prototyping and programming products. Here are just a few examples, Request our catalog for our complete line!

PROTOTYPE CARDS

JDR-PR1	8 BIT WITH +5V AND GROUND PLANE	27.95
JDR-PR2	ABOVE WITH I/O DECODING LAYOUT	29.95
JDR-PR2-PK	PARTS KIT FOR JDR-PR2 ABOVE	8.95
JDR-PR10	16-BIT WITH I/O DECODING LAYOUT	34.95
JDR-PR10-PK	PARTS KIT FOR JDR-PR10 ABOVE	15.95

EPROMS

PART#	SIZE	SPEED	Vpp	PINS	PRICE
2716-1	2048x8	350ns	25V	24	3.95
2732A	4096x8	250ns	21V	24	3.95
2764	8192x8	450ns	12.5V	28	3.49
2764-250	8192x8	250ns	12.5V	28	3.69
2764-200	8192x8	200ns	12.5V	28	4.25
27128	16384x8	250ns	12.5V	28	4.25
27128A-200	16384x8	200ns	12.5V	28	5.95
27256	32768x8	250ns	12.5V	28	4.95
27C256	32768x8	250ns	12.5V	28	5.95
27512	65536x8	250ns	12.5V	28	7.95
27C101-20	131072x8	200ns	12.5V	32	16.95

EPROM PROGRAMMER $129.95

• PROGRAMS 27XX AND 27XXX EPROMS UP TO 27512 • SPLIT OR COMBINE CONTENTS OF SEVERAL DIFFERENT SIZED EPROMS (VARIOUS FORMATS AND VOLTAGES) • READ, WRITE, COPY, BLANK CHECK AND VERIFY • HEX AND INTEL HEX FORMATS SOFTWARE

MOD-EPROM

DATARASE II EPROM ERASER $39.95

• SMALL SIZE! • ERASES ALL SIZE EPROMS UP TO 4 AT A TIME - MOST IN 3 MINUTES • WALL PLUG POWER SUPPLY

DATARASE II

MODULAR PROGRAMMING SYSTEM

EACH MODULE IN THIS SYSTEM USES A COMMON HOST ADAPTOR CARD, SO YOU CAN USE JUST ONE SLOT TO PROGRAM EPROMS, PROMS, PALS & MORE!

COMMON HOST ADAPTOR CARD $29.95

• UNIVERSAL INTERFACE FOR ALL THE PROGRAMMING MODULES! • SELECTABLE ADDRESSES PREVENTS CONFLICTS • MOLDED CABLE

MOD-MAC

UNIVERSAL MODULE $499.95

• PROGRAMS EPROMS, EEPROMS, PALS, BI-POLAR PROMS, 8748 & 8751 SERIES DEVICES; 16V8 AND 20V8 GALS (GENERIC ARRAY LOGIC) FROM LATTICE, NS, SGS • TESTS TTL, CMOS, DYNAMIC & STATIC RAMS • LOAD DISK, SAVE DISK, EDIT, BLANK CHECK, PROGRAM, AUTO, READ MASTER, VERIFY AND COMPARE • TEXTOOL SOCKET FOR .3" TO .6" WIDE C'S (8-40 PINS)

MOD-MUP

MOD-MUP-EA 4-UNIT ADAPTOR $99.95

EPROM MODULE $119.95

• PROGRAMS 24-32 PIN EPROMS, CMOS EPROMS & EEPROMS FROM 15K TO 1024K • HEX TO OBJ CONVERTER • AUTO, BLANK CHECK/PROGRAM/VERIFY • VPP 5, 12.5, 12.75, 13, 21 & 25 VOLTS • NORMAL, INTELLIGENT, INTERACTIVE & QUICK PULSE PROGRAMMING ALGORITHMS

MOD-MEP

MOD-MEP-4 4 EPROM PROGRAMMER $169.95
MOD-MEP-8 8 EPROM PROGRAMMER $259.95
MOD-MEP-16 16 EPROM PROGRAMMER $499.95

PAL MODULE $249.95

• PROGRAMS MMI, NS, TI 20 & TI 24 PIN DEVICES • BLANK CHECK, PROGRAM, AUTO, READ MASTER, VERIFY & SECURITY FUSE BLOW

MOD-MPL

OTHER MODULES

MOD-MMP MICROPROCESSOR PROGRAMMER $179.95
MOD-MIC DIGITAL IC & MEMORY TESTER $259.95
MOD-MBP BI-POLAR PROM PROGRAMMER $499.95

PAL DEVELOPMENT SOFTWARE $99.95

ENTRY-LEVEL PAL DEVELOPMENT FROM CUPL. FULL SUPPORT FOR 16L8, 16R4, 16R6, 16R8, 20L8, 20R4, 20R8 AND 20X8.

MOD-MPL-SOFT

COPYRIGHT 1990 JDR MICRODEVICES

Circle 6 on Reader Service Card (DEALERS: 7)

World Radio History

MICROPOLIS
HIGH SPEED HARD DRIVES

KITS INCLUDE: FAST FLOPPY/HARD CONTROLLER, CABLES, INSTALLATION GUIDE & NOVELL NETWARE-286 SOFTWARE

SIZE	MODEL	AVG. SPEED	INTER FACE	DRIVE PRICE	KIT PRICE
157.5MB	1355	23MS	ESDI	$949	$1049
157.5MB	1375	23MS	SCSI	$999	$1099
338.1MB	1558	18MS	ESDI	$1619	$1799
338.1MB	1578	18MS	SCSI	$1619	$1799
676.8MB	1568	16MS	ESDI	$2499	-
676.8MB	1588	16MS	SCSI	$2499	-

HARD DISKS

21.4MB $199 65.5MB $389
32.7MB $219 80.2MB $569
42.8MB $339 84.9MB $499

DRIVE KITS

21.4MB $249
32.7MB $279

Seagate

SIZE	MODEL	AVG. SPEED	FORM FACTOR	DRIVE ONLY	XT KIT	AT F/H KIT
21.4MB	ST-225	65MS	5-1/4"	$199	$249	$309
32.7MB RLL	ST-238	65MS	5-1/4"	$219	$279	$379
42.8MB	ST-251-1	28MS	5-1/4"	$339	$389	$449
43.1MB SCSI	ST-251N	40MS	5-1/4"	$419	-	-
65.5MB RLL	ST-277-1	28MS	5-1/4"	$389	$449	$549
80.2MB	ST-4096	28MS	5-1/4"	$569	-	$679
84.9MB SCSI	ST-296N	28MS	5-1/4"	$499	-	-
122.7MB RLL	ST-4144R	28MS	5-1/4"	$699	$759	$859
21.4MB	ST-125	40MS	3-1/2"	$259	$299	$373
32.1MB RLL	ST-138R	40MS	3-1/2"	$289	$339	$429

KITS INCLUDE HARD DRIVE, DRIVE CONTROLLER, CABLES AND JDR'S DETAILED INSTRUCTION MANUAL

$99.95
1.44MB 3-1/2" DRIVE

- 80 TRACKS • 135 TPI • ULTRA HIGH DENSITY
- READ/WRITE 720K DISKS, TOO
- INCLUDES ALL NECESSARY MOUNTING HARDWARE

FDD-1.44X BLACK FACEPLATE
FDD-1.44A BEIGE FACEPLATE

FDD-1.44SOFT SOFTWARE DRIVER $19.95
MF355A 3-1/2" MITSUBISHI 1.44MB, BEIGE $129.95
MF355X 3-1/2" MITSUBISHI 1.44MB, BLACK $129.95
FDD-360 5-1/4" DOUBLE-SIDED DD 360K $69.95
FD-55B 5-1/4" TEAC DOUBLE-SIDED DD 360K $99.95
FDD-1.2 5-1/4" DOUBLE-SIDED HD 1.2M $95.95
FD-55G 5-1/4" TEAC DOUBLE-SIDED HD 1.2M $129.95

"I...will highly recommend your company to anyone in the market for a computer."
—Allen P. Cutter, Prescott, AZ

PROMETHEUS

9600 BAUD V.32 MODEM $699

- 9600/4800/2400/1200 BPS • FULL DUPLEX • ASYCHRONOUS/SYNCHRONOUS • MNP 5 FOR 100% ERROR FREE TRANSMISSIONS • CCITV 32 V 22/BIS/V.22, BELL/212A COMPATIBLE • DATA COMPRESSION ALLOWS 19.2K BAUD

PRO-96E

EXTERNAL 2400 BAUD $149.95

- 2400/1200/300 BPS • REQUIRES SERIAL PORT & CABLE

PRO-24E
PRO-24I 2400 BAUD INTERNAL MODEM 1/2 CARD $99.95

MODULAR CIRCUIT TECHNOLOGY

4800/2400 BPS FAX MODEM $119.95

- 4800 BAUD GROUP III FAX TRANSMISSION ONLY • 2400 BPS DATA MODEM • MENU DRIVEN PROFAX SOFTWARE • SENDS DOS TEXT, PCX & TIFF FILES TO FAX TRANS.

MCT-FAXM
MCT-24I INTERNAL 2400 BAUD DATA MODEM $89.95
MCT-12I INTERNAL 1200 BAUD DATA MODEM $69.95

VIVA 2400 BAUD $119.95

- 2400/1200/300 BAUD OPERATION
- FULLY HAYES AT COMMAND SET COMPATIBLE • EXTENDED S-REGISTER PROGRAMMING • 8 INTERNATIONAL ICON STATUS LIGHTS • BUILT-IN SPEAKER 2ND PHONE JACK FOR VOICE • AUTO WAIT FOR DIAL TONE & AUTO REDIAL
- STANDARD RS 232C INTERFACE

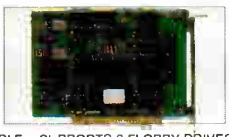
VIVA-24E
VIVA-24MNP $129.95
ERROR CORRECTING VERSION

TERMS: Minimum order $10.00. For shipping and handling include $4.00 for UPS Ground and $5.00 for Air. Orders over 1 lb. and foreign orders may require additional shipping charges - contact the sales department for the amount. CA. residents must include applicable sales tax. Prices are subject to change without notice. We are not responsible for typographical errors. We reserve the right to limit quantities & to substitute manufacturer. All merchandise subject to prior sale. A full copy of our terms is available upon request. Items shown may only be representative.

MODULAR CIRCUIT TECHNOLOGY — INTERFACE CARDS

DRIVE CONTROLLERS

1.44MB FLOPPY $49.95



- XT OR AT COMPATIBLE • SUPPORTS 2 FLOPPY DRIVES (360K, 720K, 1.2MB & 1.44MB) • USER SELECTABLE AS A PRIMARY OR SECONDARY (3RD OR 4TH) FLOPPY DRIVE

MCT-FDC-HD

HIGH DENSITY 4-FLOPPY CARD $59.95

- INTERFACES UP TO 4 FLOPPY DRIVES • CABLES FOR 4 INTERNAL DRIVES • BIOS SUPPORTS ANY COMBINATION OF DRIVES (360K/720K/1.2MB/1.44MB)

MCT-FDC-HD4

FLOPPY DISK $29.95

- INTERFACES UP TO 4 FLOPPY DRIVES TO IBM PC OR COMPATIBLE • DS/DD AND DS/QD COMPATIBLE

MCT-FDC

HARD DISK $79.95

- SUPPORTS 16 DRIVE SIZES INCLUDING 10, 20, 30 AND 40MB• CAN DIVIDE 1 LARGE DRIVE INTO 2 LOGICAL DRIVES

MCT-HDC
MCT-RLL RLL CARD SUPPORTS 2 RLL DRIVES $89.95

286/386 FLOPPY/HARD $149.95

- FLOPPY/HARD DISK CONTROL IN AN AT DESIGN • FOR UP TO 2 FLOPPIES (360K/720K/1.2MB/1.44MB) & 2 HARD DRIVES

MCT-AFH

286/386 1:1 INTERLEAVE $169.95

- CONTROLS 2 HARD & 2 FLOPPY DRIVES (360K/720K/1.2MB/1.44MB) • CONCURRENTLY USE HARD & FLOPPY DRIVES

MCT-FAFH

MULTIFUNCTION I/O CARDS

MULTI I/O CARD $59.95

- SERIAL PORT • CLOCK/CALENDAR WITH BATTERY
- PARALLEL PORT IS ADDRESSABLE AS LPT1 OR LPT2

MCT-IO

MULTI I/O FLOPPY $79.95

- SUPPORTS UP TO 2 360K FLOPPIES
- SERIAL, PARALLEL, GAME PORT AND CLOCK/CALENDAR

MCT-MIO

MONOGRAPHICS MULTI I/O $119.75

- CONTROL 2 FLOPPIES • SERIAL, PARALLEL, GAME PORT, CLOCK/CALENDAR • RUNS COLOR GRAPHICS SOFTWARE ON YOUR BLACK AND WHITE MONITOR

MCT-MGMIO

286/386 MULTI I/O CARD $59.95

- SERIAL, PARALLEL AND GAME PORTS • USES 16450 SERIAL SUPPORT CHIPS FOR HIGH SPEED OPERATION

MCT-AIO

DISPLAY CARDS

16-BIT VGA $199.95

- 640 X 480 IN 16 COLORS • 256K VIDEO RAM EXPANDABLE TO 512K • 64 LEVELS OF GRAY SCALE

MCT-VGA-16
MCT-VGA-8 8-BIT VERSION $169.95

MONO GRAPHICS $49.95

XT AND AT-COMPATIBLE • HERCULES COMPATIBLE MONOGRAPHICS • SUPPORTS LOTUS 1-2-3 • HIGH RESOLUTION 720 X 348 DISPLAY • VLSI CHIPS • CONFIGURE THE PARALLEL PRINTER PORT AS LPT1 OR 2

MCT-MGP

MEMORY CARDS

576K RAM CARD $49.95

- USER SELECTABLE CONFIGURATION TO 576K • USES 64K AND 256K DRAMS (OK INSTALLED)

MCT-RAM

286/386 EXPANDED MEMORY $129.95

- USER EXPANDABLE TO 2MB USING1MB DRAMS • CONFORMS FULLY TO LIM EMS 3.2 • RAM DISK SOFTWARE

MCT-AEMS
MCT-EMS XT COMPATIBLE EMS CARD $99.95

INTERNATIONAL ORDERS

We speak English, Espanol, Portugues or Italiano! Use Fax, Telex, Mail or phone to place your orders. We accept Mastercard, Visa, Moneyorders or checks drawn against banks with a U.S. office - U.S. dollars please.

Phone orders call (408) 559-1200 and ask for Sonia or Rubin.

Please advise our International Sales staff if your country has special import restrictions such as Certificate of Origin, Consularized Invoices etc. Just let us know what you require to clear customs in your country and we'll be happy to provide complete documentation

FAX SWITCHER $109.95

CONNECT ONE PHONE LINE TO YOUR PHONE, FAX, MODEM AND ANSWERING MACHINE --THIS DEVICE ROUTES THE CALLS! • OPERATES ON SINGLE OR MULTI-LINE SYSTEMS • AUX. PORT FOR MODEM, CORDLESS PHONE, ALARM, POS TERMINAL, ETC.

FAXM-SWITCH

JIM'S BARGAIN HUNTERS CORNER

Jim Wharton
JDR's VP Sales

$799.95

NEC 150MB ESDI HARD DRIVE

- 5-1/4" HALF-HEIGHT DRIVE
- 150MB STORAGE
- ESDI FORMAT
- 18MS AVERAGE ACCESS SPEED

5655 EXPIRES 7/30/90

DFI ETHERNET CARD $199.95

- 100% HARDWARE COMPATIBLE WITH NOVELL NE-1000 ETHERNET CARD
- FOR THICK OR THIN ETHERNET
- 15 PIN ETHERNET CONNECTOR
- BNC CONNECTOR FOR THIN ETHERNET

DFINET-300 8-BIT VERSION
DFINET-400 16-BIT VERSION $239.95

ORDER TOLL-FREE 800-538-5000 KEY CODE 10

CUSTOMER SERVICE 800-538-5001 TECH SUPPORT 800-538-5002 BBS (408) 559-0253

MON.-FRI. 7 A.M. TO 5 P.M., SATURDAY, 9 A.M. TO 3 P.M. (PST)

VISA

World Radio History

A Message To Our Subscribers

FROM TIME TO TIME we make the BYTE subscriber list available to other companies who wish to send our subscribers material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services, or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to the following address.

BYTE MAGAZINE
Subscriber Service
P.O. Box 850
Peterborough, NH 03458-0850

Chaos Manor Mail

Jerry Pournelle answers questions about his column and related computer topics

Take WordPerfect . . . Please

Dear Jerry,

I, too, have tried WordPerfect, both versions 4 and 5, and in the end I deleted them from my files. That bizarre control interface, non-mnemonic and nonintuitive, is too much. It is not so much feature-rich as it is feature-ridden.

I have witnessed this phenomenon: Some trustful rube shells out $200-plus for WordPerfect and proceeds to struggle for months. It is a contest of will, shaping the credulous innocent until he or she finally memorizes enough commands to make it all work. At this point he or she cannot go back, and becomes instead another WordPerfect booster. The free unlimited help line is a very necessary part of the package.

My first word processor was Better Working on the Commodore 64, and it was a good lesson on the limitations of that platform. Luckily, I had my introduction to PC word processing via the Leading Edge word processor. A program that borrowed the folder-and-drawer metaphor, it was very rational in its controls and allowed 30-character filenames. Alas, it was another orphan format and had a very limited subdirectory structure for hard disks. Designed as a floppy disk–based program, it was never upgraded. Later, I tried a couple of versions of Volkswriter that were OK, but, again, they had a peculiar system of keystrokes to maneuver through subdirectories. Like you, I have settled on Q&A for nearly all my writing chores.

If I had the paranoiac outlook of a Stephen King, I'd suspect a conspiracy by WordPerfect Corp. to brainwash and preprogram millions of proles for future use as slaves in some gigantic intergalactic data processing project—probably a census.

How many WordPerfect users continue to use it after trying other, more sensible systems, and how many are there who are afraid to try something new, lest they experience another agonizing period of frustration? They are suspicious of any new programs because they might be as obtuse and difficult to learn as WordPerfect.

I have a theory that our search for the perfect application is as inevitable and possibly endless as the search for the lost chord, enlightenment, or the infinite, all-knowing mind of God—something most of us don't discover until it's too late.

Bill Copenhaven
Richmond, CA

I'm sure your theory is wrong! But it would make a good science fiction plot . . .—Jerry

String Handling in C

Dear Jerry,

I am writing to you to address the issue of C's string-handling capabilities in the letter from Paul A. Elias (December 1989). It is a well-known fact that C's facilities for manipulating strings are less than convenient. Programmers have to know beforehand not only what strings they intend to use, but also how much memory each string will require at run time. This requirement makes it difficult for programmers to manipulate strings whose size and values can be determined only at run time.

What makes BASIC so appealing to some people is its built-in support for dynamic string manipulation; for example, the functions MID$, RIGHT$, and LEFT$ let the programmer dissect parts of a string at will. And in BASIC, all strings are created on demand. This is done simply by using a string variable. The C programmer could resort to dynamic memory allocations and therefore create the space needed for new strings, but this wouldn't be desirable, because the programmer would have to make sure that all memory allocated to strings that are not needed anymore is returned to the

Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future. He can be reached c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458, or on BIX as "jerryp."

World Radio History

heap. BASIC has an advantage over C in that respect because it has a garbage collector. But there is a solution: C++.

C++ is a superset of C, so it retains 99 percent of the features of the programming language as defined by ANSI. Thus, in C++, the programmer could design and implement a string class that would provide all the expressiveness and power of BASIC, but with the speed and control of C. I developed my own string package using Zortech's C++ 2.0 compiler. It allowed me to use syntax like the following:

```
string s1 = "Hello"
string s2 = "Bob";
string s3 = s1 + s2;
 // s3 is the concatenation of s1
 // and s2, "Hello Bob"
string s3 = s3.mid(1,5)
 // s3 is set to "Hello"
string s4 = s1 + " " + s2;
 // demonstrates use of standard C
 // character string in expression
```

and so on.

A programmer could easily develop a "complex" data type for performing complex arithmetic. C++ has facilities for integrating user-defined types with existing data types in the language. As a result, a programmer could develop a complex number class that could, say, be added to integral expressions. For example,

```
complex x(1,5);
 // x = 1 + 5i
int i = 5;
complex sum = x + i;
 // sum = 1 + 5i + 5 == 6 + 5i
```

This type of expressive power is *not* possible in a language like BASIC. So, for those programmers who have a legitimate gripe about C's string-manipulation support, I believe that C++ is the answer.

Bruce W. Bigby
West Somerville, MA

I'm fairly certain that if C++ had existed back when I was trying to learn C—that was a long time ago, with Leor Zolman's BDS C, which was the only thing that would run on old Ezekial the Z80—I might have learned it thoroughly and would be using it yet.

I suspect that at my age and state of activity I will not be learning C++, but you never know: There's pressure for me to learn Unix, and if I do that I'll have to know some C. For the nonce, QuickBASIC has all the string handling that I need built into the language, and I have not noticed that I need more speed and control in what I do, which isn't to say that others wouldn't.—Jerry

Pascal Placement

Dear Jerry,

In reference to your review of *Computer Science with Pascal for Advanced Placement Students* in Computing at Chaos Manor (February), I don't think the Educational Testing Service cares anymore about UCSD Pascal. The people there may still claim that they want Standard Pascal, but the fact remains that I did just fine on the AP test last year without knowing a shred of UCSD Pascal.

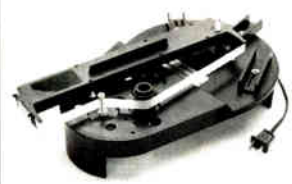
Frederick Bertsch
East Lansing, MI

Thanks; I hope you're correct, because UCSD Pascal is a bit passé, I fear.
—Jerry ■

Never buy another ribbon!

Over 135,000 sold

Shipping $5.00



Universal Cartridge unit shown with Epson cartridge **$75.00**

Universal Cartridge (includes one adapter) 75.00
Multicolor Adapter (specify printer).....40.00
Epson only MacInker mod. 271EP 45.00
Imagewriter only MacInker™ mod. 234IM.....45.00
Universal Spool MacInker 75.00
Heat Transfer Adapter 25.00
Extra Ink Bottle, black .....3.00 **pint** 18.50
Colored Ink Bottle .....4.00 **extra reservoir** 5.50

All models delivered complete with bottle of ink, ink meter , reservoir, reservoir cover.
Go color !! Single & multicolor, standard and heat transfer cartridges available: red, green, blue, brown, purple, yellow, orange, white, silver and gold. Indelible and OCR ink cartridges available.

Over 24,000 printers supported. Better than new print quality. Extended printhead life thanks to lubricated ink. Average cartridge can be re-inked 60-100 times at 5cents/re-inking. Multicolor adapters re-ink multiband cartridges. Documented customer savings of up to $30,000/year. Detailed free catalog.

MacBond II
Automatic Ribbon Welder

Shipping $9.00

New

$299.00

Make your own ribbons! MacBond II splices and bonds in seconds ribbons of any size and inked in any ink and color. First real alternative to ribbon bonding machines costing thousands of $$$. We have a complete range of bulk ribbons, color and multicolor, heat transfer etc. for your application.

LightSpeed 2400LE
2400b MNP class 5

Shipping $7.00

New

$169.00

4800 b throughput, full duplex. 9600, 4800, 2400, 1200 bps. CCIT V.22bis, V.22, Bell 212A & 103J modes • Auto speed selection • MNP cl. 5 error correction • Synch & asynchronous modes • Cable and software included (PC or MAC) • 2 year warranty

LightSpeed 9624E .....699.00 **LightSpeed 2400LE**(MNP cl 5)....169.00
LightFax 9624 faxmodem .....399.00 **Ring-On Remote Power Center**.....199.00

LightSpeed 9624E is a V.32, mnp 5, 9600 b modem. LightFax 9624 is a full featured group III, 9600 b fax & 2400 b modem combined, shipped with software & cable for PC or MAC (specify). Ring-On is a power center which senses an incoming call to turn on computer & modem.

Printer Servers
High Capacity (up to 3 Meg)

Shipping $8.00

New

$359.00

Meet the UG-501, the ultimate buffer & most economical area network element. Printer buffer, autoscanning switch, soft-code switch & universal converter, all in one. Can be configured with serial-parallel inputs & outputs in various combinations. Use it stand-alone (4 computers to 2 printers all working simultaneously) or cascade UG-501s in your network. Memory expandable up to 3 MEG. Price from $359.00, depending on memory. UG-501, just one of our complete family of buffers-switches-converters.

Computer Friends, Inc.
14250 NW Science Park Dr.
Portland OR 97229

Satisfaction or 30 day refund - Immediate shipment - Major credit cards - PO's from National Accounts

Order Toll Free 1-800-547-3303
In Oregon (503)626-2291
fax (503)643-5379 **telex 4949559 CF**

World Radio History

PRINT QUEUE

Hugh Kenner

Zen and the Art of Assembly

A valuable series for those contemplating the way of assembly

Generally I find better things to do in this space than discuss those staples of the computer book industry, its endless instruction manuals. (Every publisher needs an assembly book on its list; they are mostly the same book, rewritten.) But this month I make an exception to announce a conceptual breakthrough. I hope the industry is watching; there are implications for other sorts of books as well.

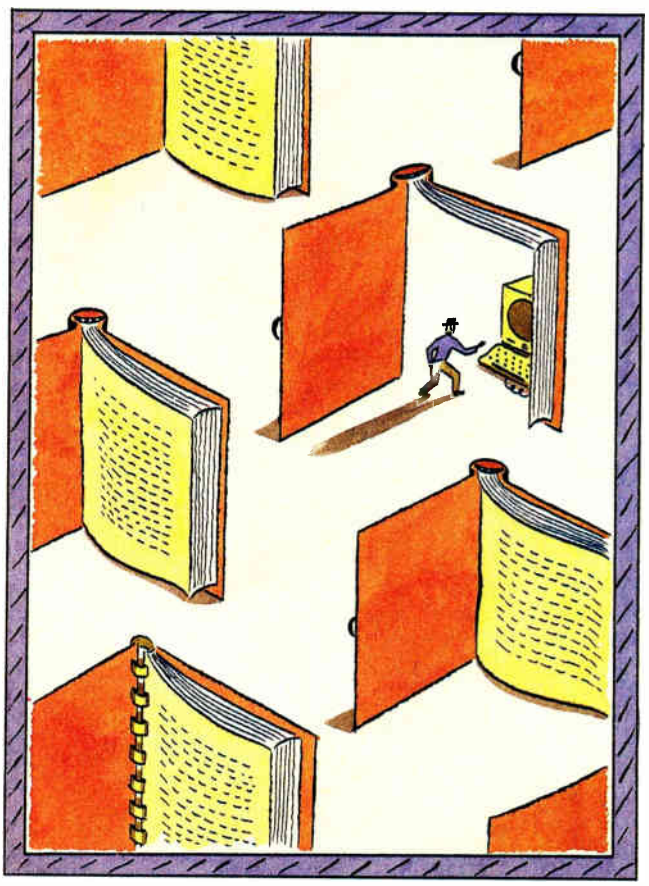
Start from an observation. Arguably the worst assembly program ever published lurks partway through Borland's *Turbo Assembler User's Guide*, a clearly written book designed to teach beginners the elements of what they covet assembly for—writing programs that are "small and blindingly fast." The program is `WCount.EXE`, a compact little package for counting words in a text file. Small, yes: 676 bytes. But "blindingly fast"? Counting through the 2000-word file that I tried it on took it—hold on!—35 seconds! The commercial word counter I'd been using zipped through the same file in 4 seconds. And a program called BWC, for BIX Word Counter (courtesy of BIXen Terje Mathisen), took under 1 second!

My howls about `WCount` drew an instructive response from someone at Borland. It's naive, he said, to expect optimal quality from something the purpose of which is only to demonstrate a structure and the use of some directives. To which I'd respond, I don't ask for optimal quality, but at the least for minimal quality.

In his foreword to the Scott, Foresman Assembly Language Programming Series, of which he is general editor, Jeff Duntemann fingers the theme `WCount` illustrates so ludicrously: "the difference between assembly language programs that work and assembly language programs that work *well*." For assembly is a lot of bother, with little point if the result is no better than C or Pascal. (And as we've just been seeing, it can even be abysmally worse.) He goes on: "I have yet to see any assembly language book make this point, much less dwell on it."

Right. And dwelling on it means getting rid of the notion that assembly is what most books make it out to be, a set of mnemonics tied to a microprocessor. Making it work *well* entails "knowledge of the machine, the individual instructions, and the relationships among instructions that transcend all three." Yes, "The subject deserves better than it has gotten at the hands of the computer book industry."

Thus, one assumption behind Duntemann's Scott, Foresman series is that good assembly code is machine-specific; they're talking about the AT and compatibles, not just the 80x86 chips. (If you're vague about things like the PC's screen I/O, you'll probably be wondering where a lot of instruction cycles went.) Another assumption is that details are "an interconnected web," so that serial discussion of any topic without "forward references" to more advanced topics is well nigh impossible. "This means that the same broad set of topics must be taught in each book, but that the level of detail be gradually increased in moving from beginner to expert." Amen. So even if you Know Nearly All about assembly, start with Volume 1.



That volume is by Duntemann himself. He leads off with *Assembly Language from Square One* ($29.95) and assumes that you know how to run your PC, but assumes *nothing* about either programming or "what happens inside the box itself." So pretend that this is the case. Pretend too that assembly is your first stab at a language. It's easier, Duntemann alleges, than learning how to play the piano. Mistakes won't make the dog howl, and "what takes *years* of agony in front of a piano can be done in a couple of months in front of your average PC." In fact, "compared to raising an average American child from birth to five years, it's a cakewalk."

ILLUSTRATION: MICHAEL KLEIN © 1990

World Radio History

Turn the page, and a Scotts Valley housewife is planning a hectic morning. Her list ends, "Drop off groceries at home. If it's time, pick up Nicky. If it's not, collapse for a few minutes, then pick up Nicky. Collapse!" (You've spotted the IF conditionals. And in assembly language, "Collapse!" might be "END Start.")

By page 145 we're being told, "Programming involves two major components of the PC: the CPU and the memory. Most books begin by choosing one or the other and describing it. My own opinion is that you can't really describe memory and memory addressing without describing the CPU and you can't really describe the CPU without going into memory and memory addressing. So let's do both at once."

What follows is not only the sole fail-safe account of segments and offsets I've seen, it's also the most useful exposition of what the CPU registers do. We're next taught to consolidate this understanding by looking at the PC's video refresh buffer via DEBUG. And without being sure how it happened, we're suddenly in command of a field of topics, instead of clinging to whichever handle the usual book chooses to offer.

By page 200, the discussion of a program that works is telling us, "The stack segment contains the program's stack. I haven't explained stacks just yet, and...I'm going to hold off just a little while longer. In short, a stack is simply an ordered place to stash things for the short term, and that will have to do until we cover the concept in depth in Section 7.2." You see what was meant earlier by "forward reference"? It's a simple device straitjacketed manuals never seem to employ. There are things we need to be aware of before knowing all about them. Why have manual writers never discovered that?

But move on we must. Volumes 2, 3, and 4 are *Assembly Language Magic*, by William Murray III and Chris H. Pappas ($29.95), and a two-volume *Zen of Assembly Language* by Michael Abrash. (Part 2 of *Zen*, "The Flexible Mind," is promised for this year, but I've seen only the first part, "Knowledge," $29.95.) Further books in the series are promised but not yet specified.

Assembly Language Magic starts with a quick summary of themes already covered by Duntemann—things like hexadecimal numbers and using a debugger—but Murray and Pappas are soon offering much more detail about assemblers and linkers. Also, their unit of attention is the complete program, whereas Duntemann's tended to be the instruction or the memory fetch. They do a lot with lookup tables: real time savers, especially if you need such brutes as logarithms but have no 80x87 chip. They're alert to 386 special cases. By chapter 15, we're getting characters, strings, and numbers in and out of programs, something most texts I've seen scamp utterly.

Zen, finally. The point of the Abrash *Zen* (yes, his name and title do bracket the alphabet) is that the PC abounds in "cycle stealers" that are so interwoven that only hunches can save you. (There's an art to hunches; you can pick it up.) He starts with an example of a horrible program: a published "Optimizing for Speed" article that used all information available, saved cycles by the bushel, and (as its author never noticed) ran more slowly than the naive version it was trying to improve. Moral? The available information was "accurate but incomplete": a general truth.

So Abrash gives us, straight off, code for a Zen timer that's right to about a microsecond and could have spared Mr. Optimizing for Speed all that egg on his face. One Abrash theme is, "Assume nothing." Clock it with the Zen timer. Not that Intel is lying when we're told that the SHR instruction takes just two clock cycles; no, but fetching those instructions each time they're used can take four cycles per fetch. Thus, `shr ax,1` repeated five times can use not a mere 10 cycles (two per SHR) but up to 40, depending on the state of the prefetch queue when we start. Yes, as Duntemann said, "an interconnected web." Zen is the art of swinging through such webs: "We fit you" versus "We give you fits."

I'll not wander into the labyrinths of Zen, but return instead to the state of instruction manuals. They derive, it seems, from a custom called "Documentation," which told an engineer how the previous engineer had left things. That assumed a fund of knowledge, inaccessible to innocents like me when we faced, years back, what was called "Documentation" for the CP/M operating system: chunks of verbiage, impenetrable in their presumption of knowledge we didn't have.

What follows is not only the sole fail-safe account of segments and offsets I've seen, it's also the most useful exposition of what the CPU registers do.

For no reason we understood, the system was broken into topics, each dealt with (exhaustively) once and then discarded. And "exhaustively," in isolation, was apt to mean "unintelligibly." "Prayer and fasting," as Doug Cooper used to intone over something akin, the International Standards Organization's version of Pascal. Item by item, you would not make hide nor hair of it.

A bad tradition has persisted, and at Borland, where they write superb assembly code—witness Turbo Pascal and Turbo C and Turbo Assembler—they still issue a thick manual to "document" the 80x86 instruction set and think they're teaching us assembly. Isolated instructions, that's all, for congealing into a clunker like `WCount`.

Although they understand quality well at Borland, it's beyond the reach of such fragmented presentation, the way of which holds their suave writers fast by the neck. Zen—which "teaches nothing," merely "points the way"—Zen in Scotts Valley is unthinkable.

That's my 1600 words for this month. `WCount` (invoked for olde tymes' sake) has just taken 27 seconds to tell me so. BWC verified that in less than a second. But BWC is inward with Zen. ■

Hugh Kenner is a professor of English at Johns Hopkins University. His reviews have appeared in publications like the New York Times *and* Harper's. *His recent books include* A Sinking Island *and* Mazes. *He can be contacted on BIX as "hkenner."*

Your questions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

World Radio History

QUEST FOR A MOUSEBALL

All I wanted was a small gray ball, quantity one

Something should have clicked in my mind when I saw my children bouncing a small gray ball as they ran to the car. Only later did I see my IBM mouse on the floor, its bottom off and its ball. . . gone to the mall!

When my children returned, I stood with one hand open to retrieve the mouseball and the other with a finger in scolding position. "All right," I said sternly, "where's my mouseball?" It isn't easy to sound stern while demanding a mouseball.

"Your what?" each child repeated blankly.

"The small gray ball you swiped from my den and bounced out the door!"

One child turned to the other: "It's your fault. You bounced it in the store, and now it's gone!"

"Gone?" I sputtered. "Where?"

"Under some racks of clothes," my wife explained patiently, wondering why a grown man would get so upset over a little rubber ball.

I didn't know it then, but I had just been drafted into the ranks of consumer crusaders like Ralph Nader. Of course, Nader is out to save the planet. I just wanted my mouseball.

I called a computer store and ordered a new mouseball. Three days later, the manager called back and told me that I'd have to call IBM directly. "I can only order parts that have a number in my order book," he said. "I have a part number for the mouse, but I can't get a number for the mouseball. But I'm sure IBM will have one for you."

The next day, I called IBM customer service. I work right next to IBM's headquarters, so I thought I could walk over and pick up a mouseball. Wrong.

"I'm sorry," the customer service rep cooed with practiced sympathy. "IBM has no part number for the mouseball, and cannot order one for you."

"Wait a minute," I replied. "This mouse says 'IBM' on it. IBM manufactures this mouse. Somewhere, IBM has barrels of mouseballs. Of course IBM is *able* to get me a mouseball. What you're telling me is that IBM *won't* get me one."

"No, sir," the customer service rep replied, an edge creeping into her voice. "What I said is that no number has been assigned, so the part cannot be ordered."

"But IBM assigns these numbers," I insisted. "And if only a mouseball with a number can be ordered, then IBM can just assign a number or make an exception to the rule."

"I'm sorry. There's nothing I can do."

"Of course there is. You can switch me to your supervisor."

This turned out to be a bad idea. The supervisor had evidently been pulled away from sticking pins in voodoo dolls, and she was in no mood to be pleasant.

"I hope you understand," she said. "The part has no number. It cannot be ordered. Why don't you just buy another mouse? It's only $100 or so."

Yes, I said to myself, I suppose that I will have to buy another mouse. But it sure won't be an IBM mouse.

That evening, still brooding, I curled up with the latest issue of BYTE and looked through the ads for clone mice. And there it was: a full-page ad with a picture of an IBM mouse, disassembled into parts scattered all over the page. "An IBM Mouse," the ad read, "has 55 moving parts. And if any of them break, you're out of luck." The ad was for an electronic mouse, with no moving parts. It was not made out of rubber, and it was not round, so it could not be bounced out the door. But it *was* pretty expensive.

Just then, I got a wicked idea. What if I wrote to the clone mouse company and offered my story in return for a mouse? That would certainly prove their point about moving parts, and I would get a mouse (and get even with IBM to boot!).

Then I got an even better idea. Why not call IBM first and announce that I was going over to the enemy camp? That would give me two chances to solve my problem.

The next day, I called the corporate offices of IBM and spoke to a man who seemed to be a mid-level executive. I told my story and ended with the theatrical threat. "I see," he said. "I'll get back to you." A few minutes later, the phone rang. It was IBM. "We'll give you a *new* mouse," the executive said somberly. "I will meet you in the lobby of your building, so that this problem may be concluded."

In the lobby, he looked at me without expression. He handed me a small gray box containing a small gray mouse, which in turn contained a small, gray, numberless mouseball.

"You must understand," he said. "We are doing this one time. We will not do this again."

I thought for a moment and said, "I cannot imagine that all this could happen ever, ever again."

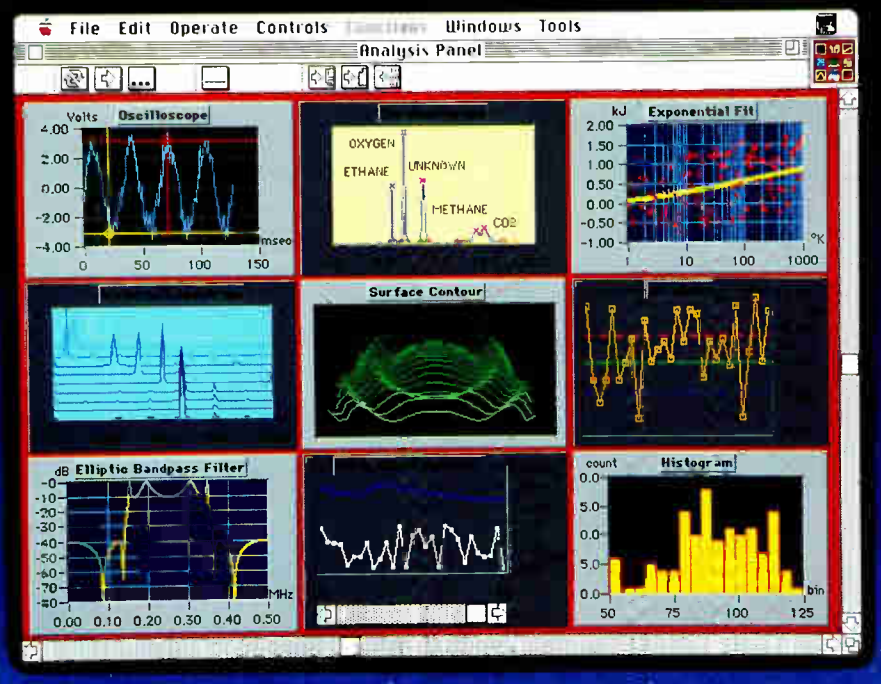
And, indeed, the bottom of my new mouse has four screws, designed to keep its mouseball from making solo trips to the mall. And though I never made it big in clone mouse advertisements, I'll be able to remember the day I looked IBM squarely in the eye. And it blinked. ■

Stop Bit is an open forum for informed opinion on topics related to personal computing. The opinions expressed are those of the author and not necessarily those of BYTE or its staff. Your contributions and comments are welcome. Write to: Editor, BYTE, One Phoenix Mill Lane, Peterborough, NH 03458.

Joel S. Moskowitz is an environmental lawyer with Gibson, Dunn & Crutcher in Los Angeles. He can be reached on BIX c/o "editors."

ILLUSTRATION: PAULETTE BOGAN © 1990

World Radio History



The Brightest Star in Real-Time Data Analysis... Just Got Brighter

New DSP Board Delivers 33.33 MFLOPS

The brilliant analysis capabilities of LabVIEW* 2 just received a power boost from our NB-DSP2300 digital signal processing and analysis accelerator board for the Macintosh II. The new board stars the Texas Instruments TMS 320C30 DSP chip. With a full complement of LabVIEW 2 modules and C development tools for writing custom routines, you can easily harness this processing power to incorporate real-time analysis in the most demanding instrumentation applications.

Extensive Analysis Library

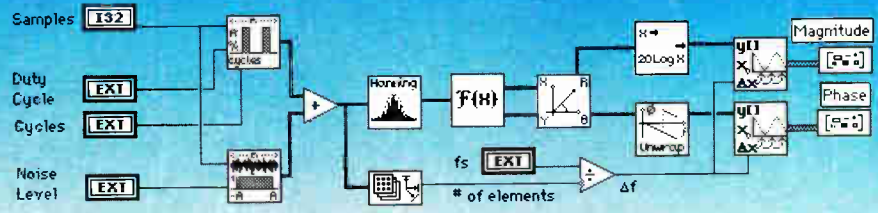
- **DSP** - FFTs, FHTs, spectral analysis, convolutions, correlations
- **Filters** - IIR filters, FIR filters, smoothing windows
- **Waveform Analysis** - integration, differentiation, pulse analysis, peak detection
- **Waveform Generation** - impulse, geometric, sinusoidal, sinc, noise
- **Statistics** - descriptive statics, histograms, regressions
- **Vector/Matrix Algebra** - inversions, products, linear system solutions
- **Numerical Analysis** - conversions, complex numbers, evaluations, curve-fitting

Complete Graphical Programming Language

LabVIEW is a stellar solution for scientists and engineers accustomed to drawing block diagrams, because they can simply connect, interchange, combine, and define new executable blocks to create software modules called virtual instruments.

Easy Development

LabVIEW's innovative, time-saving approach for building data acquisition and instrument control systems includes sophisticated routines for digital signal processing and analysis.



Compiled Language Speed

Thanks to the new graphical compiler of LabVIEW 2, block diagrams execute at blazing speeds, comparable to compiled C. Thus, LabVIEW 2 offers the productivity gains of graphical programming without sacrificing performance.

Call for *FREE* Catalog
(800) 433-3488 (U.S. and Canada)
(512) 794-0100

NATIONAL INSTRUMENTS®
The Software is the Instrument™
6504 Bridge Point Parkway
Austin, TX 78730-5039

Nihon National Instruments K.K. (Japan) (3) 788-1922
National Instruments of France (1) 4865-3370
National Instruments of Italy (2) 4830-1892
National Instruments United Kingdom (06) 355-23-545

Circle 178 on Reader Service Card

World Radio History

Draw attention to your work with the low-cost, color-ready Tandy® DMP 240 printer.

Let the Tandy DMP 240 bring your documents out of the dark ages. With *eight vibrant colors*, your work will stand out from those common shades of gray. Operating under DeskMate® software, as well as programs using the Epson® LQ Color Driver, the *24-pin* Tandy DMP 240 produces eye-catching text and graphics at your command. The *multi-function operation panel* makes the DMP 240 remarkably versatile and easy to use. A 2-line LCD display lets you set over 100 different printing combinations. Define printer settings just once, then load them with the touch of a button. *Programmable tear-off* lets you detach paper without wasting sheets. *Paper park* allows you to print single sheets without having to remove the fanfold paper, and the reversible tractor feed increases your printing options to include many different forms and papers. *Add a touch of color* to your work—anything else pales by comparison.

CREATING NEW STANDARDS

PROVEN LEADERSHIP

Over 7,000 USA locations, 39,000 employees, seven research and development centers, 31 USA and overseas manufacturing plants—NOBODY COMPARES!

GUARANTEED SATISFACTION

Over 35 million customers benefit annually from our satisfaction guarantee. Putting you first has made us #1 in PC compatibles—NOBODY COMPARES!

Radio Shack®
AMERICA'S TECHNOLOGY STORE℠

Radio Shack is a division of Tandy Corporation. Epson/Reg. TM Epson America, Inc.

Circle 240 on Reader Service Card

World Radio History