A PENTON PUBLICATION

APRIL 1990

Electronics

FIRST MAGAZINE OF GLOBAL ELECTRONICS MANAGEMENT

A NEW CAD ERA: PUTTING THE PIECES TOGETHER

CONCURRENT ENGINEERING CONCEPT SPAWNS RUSH OF PRODUCTS USING VHDL

PAGE 50

VALID UNLEASHES A FAST, POWERFUL WAY TO SIMULATE ASICs

PAGE 55

PLUS . . .

32 incredible reasons for using this 32-bit LAN CoProcessor.

Intelligent bus master:
Integrated 4-channel scatter/gather DMA for transmit/receive buffer chaining, eliminating the need for buffer copying

Automatic frame re-transmission through the FIFO

Direct interface to Intel's 32-bit processors

High bandwidth burst bus:
Transfers data up to 106 Mbyte/s, enabling minimum (below 2%) consumption of system bus

Full duplex serial operation

Integrated bus parity logic

82586 software compatible

Late collision detection logic

Independent transmit/receive FIFOs

Fully compliant with all IEEE 802.3 network protocols

Dynamic bus sizing

Dynamic CRC handling

32-bit demultiplexed address and data bus

Network analysis monitor modes

Programmable loop-back pin

Linear addressing for UNIX* and OS/2*:
4 gigabytes of linear address space

Bus lock logic

33 MHz support now

Multi-master capability:
Programmable bus throttle for controlling the 82596 bus usage

Big/little endian processor interface

Surface mount and ceramic packages

Six 32-bit statistics counters

20 Mbit/s serial data rate

Advanced diagnostics and self-test capabilities

Full cache coherency support

Automatic padding of short frames

Time domain reflectometry test

Configurable interrupt polarity

Deep FIFOs for EISA and Micro Channel* applications:
192 bytes of internal FIFO provide 100 μs of bus latency for bus mastering

Available in 3 bus interface specifications—CA, DX and SX

64-bit hash table for multi-cast or individual address filtering

Intel's 32-bit leadership:
The 82596 LAN CoProcessor is part of the world's most complete range of 32-bit silicon peripherals from Intel

Plus one.

Volume production now

If you call us now at (800)548-4725 and ask for Literature Department #YA13, we'll rush you a complete technical package on the Intel 82596 so you can start designing today.

intel®

CIRCLE 330

Electronics

EDITOR
Jonah McLeod
MANAGING EDITOR
Howard Wolff
SENIOR EDITORS
Bernard C. Cole, Lawrence Curran
EDITOR-AT-LARGE
Samuel Weber
ASSISTANT MANAGING EDITORS
Jacqueline Damian
Sherrie Van Tyle
DEPARTMENT EDITORS
Semiconductors:
(San Jose) **Bernard C. Cole**
Communications:
Jack Shandle
System Technology:
(San Jose) **Jonah McLeod**
EDITORIAL PRODUCTION MANAGER
Lisa Iarkowski
ART
(Associate Director) **Mark Montgomery**
(Technical Illustrator) **Janet Kroenke**
BUREAUS
Boston: **Lawrence Curran, Manager**
Dallas: **Jon Campbell, Editor**
Los Angeles: **Lad Kuzela**
Mid-Atlantic: **Jack Shandle, Manager**
Frankfurt: **John Gosch, Manager**
France Correspondent: **Bradford Smith**
Italy Correspondent: **Andrew Rosenbaum**
Japan: **Shin Kusunoki, Consultant, Nomura Research Institute**
UK Correspondent: **Peter Fletcher**
Electronics Index: **Mark Parr**
VICE PRESIDENT-EDITORIAL
Perry Pascarella
GROUP EDITORIAL DIRECTOR
Leland Teschler
COMPUTER SYSTEMS ADMINISTRATOR
Anne Gilio Turtoro
GROUP ART DIRECTOR
Peter Jeziorski
EDITORIAL ADMINISTRATION
Bradie S. Guerrero
Tina A. Montone

National Sales Manager: **John French**
Director of Circulation: **Gloria Adams**
Manager of Circulation: **Nancy Schlachet**
Reader Service Manager: **Paula Greenleaf**

CORPORATE PRODUCTION
Production Manager:
Robert D. Scofield
(201) 393-6253/6254
FAX: (201) 393-0410
Assistant Production Manager:
Linda Marangella
(201) 393-6258
Production Assistants:
Debbie Vidulich, Beverly Desbiens

PUBLISHER
James C. Uhl

April 1990 Volume 63, Number 4

Electronics (ISSN 0883-4989) is published monthly by Penton Publishing, Inc., 1100 Superior Ave., Cleveland, OH 44114. Second class postage paid at Cleveland, OH, and additional mailing offices.

Editorial and advertising addresses: Electronics, 611 Route #46 West, Hasbrouck Heights, NJ 07604. Telephone (201) 393-6060. Facsimile (201) 393-0204. San Jose, Calif.: Telephone (408) 441-0550. Circulation (1100 Superior Ave., Cleveland, OH 44114): (216) 696-7000.

Subscriptions free to qualified managers. All others: $60 for one year in the U.S.; $70 in Canada; $125 in all other countries. For subscriber change of address and subscription inquiries, call 216-696-7000.

POSTMASTER: Please send change of address to ELECTRONICS, Penton Publishing, Inc., 1100 Superior Ave., Cleveland, OH 44114.

The New SpectraScan® SpectraRadiometer® Brings Near Real-Time Testing To The Production Line. Now you can perform precise spectroradiometric measurements in near real-time in production test and inspection environments.

HEAD FOR THE FUTURE.

- Determine the spectral and photometric/colorimetric output of displays.
- Test automotive panels and displays for correctness and uniformity of color.
- Make accurate measurements of reflectance/transmittance, source color temperatures and flash lamp spectra.

And that's just the beginning!

The SpectraScan's new system software is easy to use, requires minimal training, and allows maximum system flexibility. The software's six basic functions make it simple to define hardware and software measurement parameters. Our optional SpectraView™ Software package includes all the capabilities of the standard software plus such added capabilities as CIE LUV/LAB calculations, reflectance/transmittance measurements, user-defined ("Hot") function keys, and more.

The SpectraScan SpectraRadiometer is truly a "Head for the future." It is fully compatible with your PC or equivalent computer, with a variety of new features including optional dual apertures, pressurized detector chamber, expanded spectral range, and a wide variety of objective lenses.

Call or write today to find out how you can head for the future with near real-time spectroradiometry.

CIRCLE 253 for salesman's call

CIRCLE 254 for literature

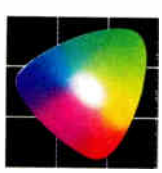


PHOTO RESEARCH®
The Light Measurement People®
Division of **KOLLMORGEN**
9330 DeSoto Avenue, P.O. Box 2192, Chatsworth, CA 91313-2192 USA
(818) 341-5151 FAX: (818) 341-7070 TLX: 69-1427 Cable: SPECTRA

International Sales Representatives: **AUSTRALIA** COHERENT SCIENTIFIC Ph: (08) 2714755 **CANADA** OPTIKON CORPORATION Ph: (519) 885-2551 **FRANCE** INSTRUMAT S.A. Ph: (1) 69-28-27-34 **HOLLAND** INTECHMIJ B.V. Ph: (20) 56-96-611 **INDIA** PHOTONICS INTERNATIONAL Ph: (91) 322350 **ISRAEL** ANKOR Ph: (03) 5713305 **ITALY** PHOTO SYSTEMS SAS Ph: 39-2-9588607 **JAPAN** KYOKKO TRADING COMPANY Ph: (03) 586-5251 **SWEDEN** SAVEN AB Ph: (8) 79-21-100 **U.K.** MICRON TECHNIQUES LTD. Ph: (02) 02-841261 **WEST GERMANY** OPTEEMA ENGINEERING GmbH Ph: (49) 212-67-352

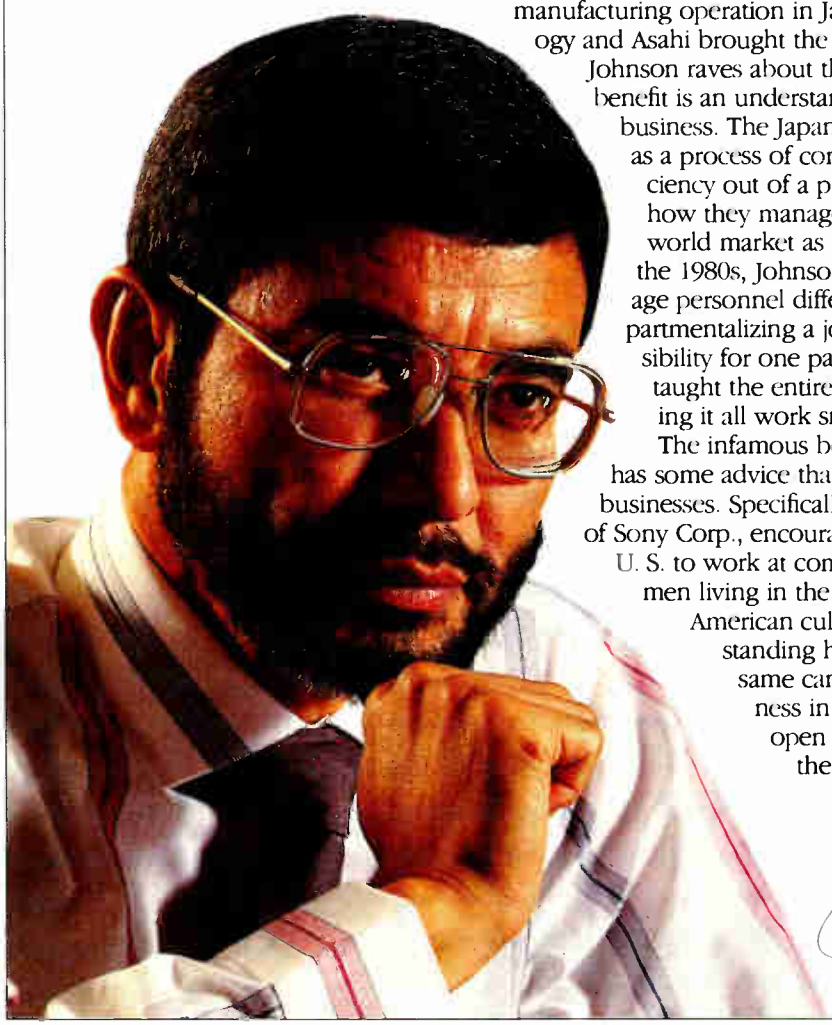
NO ONE WANTS A TRADE WAR

The talk in Congress these days is of impending economic war with Japan. The Omnibus Trade Bill of 1988 calls for sanctions against the Japanese, especially in telecommunications, if the U. S. determines this summer that progress has not been made toward improving the balance of trade. But even as the members of Congress vie to see which can bash Japan harder, they agree that no one can afford a trade war. It's simply a lose-lose situation: imagine, for example, the screams of systems manufacturers when the price of DRAMs doubles.

At the heart of all this economic warmongering is the U. S. belief that Japan has erected structural impediments to free trade with other countries. You know what structural impediments are if you're a woman trying to get into an all-male social club. You also know if you're a company like Rodime Ltd., based in Scotland, which tried to be a dominant supplier of 3.5-in. disk drives by patenting the form factor. Rodime has not been able to enforce its patent. Other examples abound.

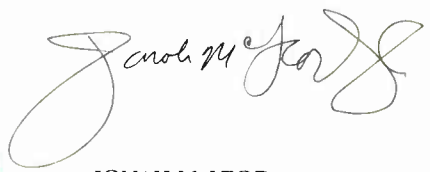
So before the rhetoric turns into a real trade war, consider how some electronics companies have gotten around the Japanese roadblocks to successfully penetrate that market. Take the recent joint venture between Texas Instruments Inc. and Kobe Steel Ltd. of Japan. Kobe gets TI's semiconductor manufacturing expertise and TI gets a $350 million manufacturing facility in the Kansai region from which to sell into the Japanese market.

Then there's one that can serve as a case study. Called Asahi Komag Ltd., it's in Yonezawa, Japan, and is a 50 : 50 partnership between Komag of Milpitas, Calif., and Japan's Asahi. It's a marriage built of complementary interests, says Steve Johnson, president and CEO of Komag. Asahi wants to learn how to produce state-of-the-art sputtered disks; Komag wants to establish a major manufacturing operation in Japan. Komag brought the technology and Asahi brought the capital and managerial talent.



Johnson raves about the results but asserts that a larger benefit is an understanding of the Japanese approach to business. The Japanese, he says, view manufacturing as a process of continually squeezing ever more efficiency out of a production facility. That explains how they managed to maintain market share in the world market as the yen rose against the dollar in the 1980s, Johnson asserts. Also, the Japanese manage personnel differently, he says. Instead of compartmentalizing a job and giving each worker responsibility for one part of the process, each individual is taught the entire process and contributes to making it all work smoothly.

The infamous book *The Japan That Can Say No* has some advice that might actually be useful to U. S. businesses. Specifically, coauthor Akio Morita, chairman of Sony Corp., encourages Japanese companies in the U. S. to work at community service, and his countrymen living in the U. S. to become involved with the American culture as a means of better understanding how Americans do business. The same can be said to Americans doing business in Japan: as a powerful lever to help open the Japanese market, understand the Japanese culture. E

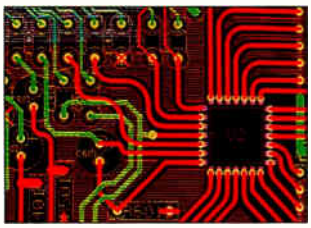


JONAH McLEOD
EDITOR

Why 8,000 of the world's leading companies design PCBs with P-CAD:

A Supercharged Product

If you're like most PCB designers and engineering managers, you want PCB CAD software that'll help



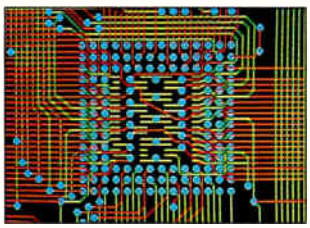
With Master Designer you have it all: full analog support, including filled polygons, curved traces, trace hugging and trace plowing.

you do your job, not dictate how you're going to do it. That's why nearly half the world's PC-based PCB design is done with P-CAD.® No other software can get your product to market faster with more reliable, more manufacturable boards. And it's incredibly flexible, too.

The P-CAD Master Designer™ lets you design huge boards of up to 2,500 components, 4,000 nets, and 800 component definitions. Zip through our library of over 6,000 parts, point and click—no need to type in part numbers. Layout information is incorporated right into the schematic, improving your design speed and accuracy. Managing ECOs is a snap, with complete forward and back annotation.

Powerful add-on modules like Digital Design Lab,™ Analog and Digital Simulators help you perfect your design before you build it.

For flexibility, nothing matches P-CAD's Master Router™ automatic routing system. It's fully re-entrant with features like unlimited net classes plus route-by-window to give you the control you need to select the best routing strategy for your design. Routing priorities can be specified up-front to ensure that critical signals are routed efficiently. Clean routing with fewer vias

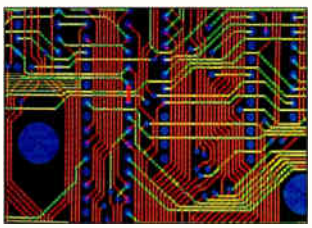


Use all the current technologies: SMT, high-speed circuits, fine-line, ultrafine-line and more.

reduces your manufacturing costs. For the really tough designs, our 100%-completion Rip-n-Route™ option lets you fine-tune routing on-the-fly and create manufacturable boards without manual clean-up.

Everything about P-CAD is fully integrated. You go from schematic capture to simulation, verification, and routing, right up to manufacture, from a single database with a single user interface. Programmable function keys and macros allow you to customize your system for the way you work best.

Virtually all popular hardware configurations are supported, including hardware pan and zoom for lightning-fast redraws. An open architecture combined with the famous P-CAD

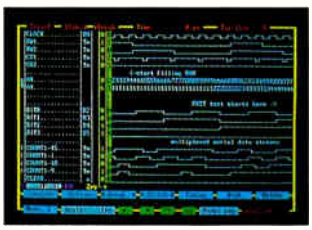


With the flexible P-CAD autorouting system, you're never locked into preset design strategies.

Database Interchange Format (PDIF) database translator makes it easy to integrate with MICRO CADAM™ mechanical design, drafting systems like AutoCAD® and documentation software like Ventura® and Interleaf,® complete with PostScript® support.

From A Dedicated Company

P-CAD Master Designer comes with a lot more than terrific software and superb documentation. P-CAD users enjoy the comfort of knowing they're never alone. They also get outstanding support from technical field representatives in over 100 locations with over 19 training centers. But that's not all. P-CAD maintains a technical support center and hot line, user groups and a 24-hour electronic bulletin board. All from the company that is the acknowledged leader in PCB design and analysis software. That's why over 14,000 P-CAD installations are slashing PCB design



Let Digital Design Lab run, test, and debug your circuit before you even build a prototype.

times and boosting profits around the world.

When you combine a powerful product with a dedicated successful company it all adds up to the highest-performance PCB design system available on any platform.

Call P-CAD today, toll-free:
800-523-5207

(in CA 800-628-8748)

Find out how to put Master Designer to work for you now!

P-CAD, 1290 Parkmoor Avenue
San Jose, California 95126 USA
(408) 971-1300 Fax (408) 279-3752

p-cad®
A CADAM COMPANY

APRIL 1990 VOLUME 63, NO. 4

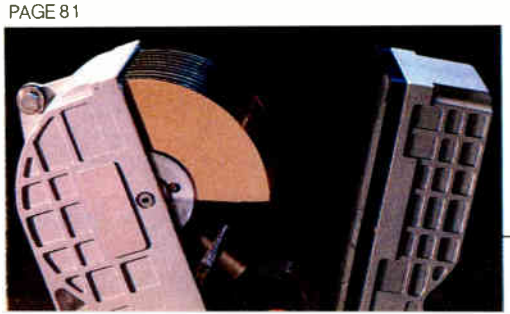
Electronics

COVER STORY PAGE 50
ILLUSTRATION: MARGARET ENDRES

FEATURES

PAGE 26

PAGE 81



PAGE 85

DEPARTMENTS

NEWS ROUNDUP

WORLDWIDE NEWS

NEWSMAKERS

SUPPLEMENT

Companies covered in this issue, indexed to the first page of the article in which each is mentioned.

*International only

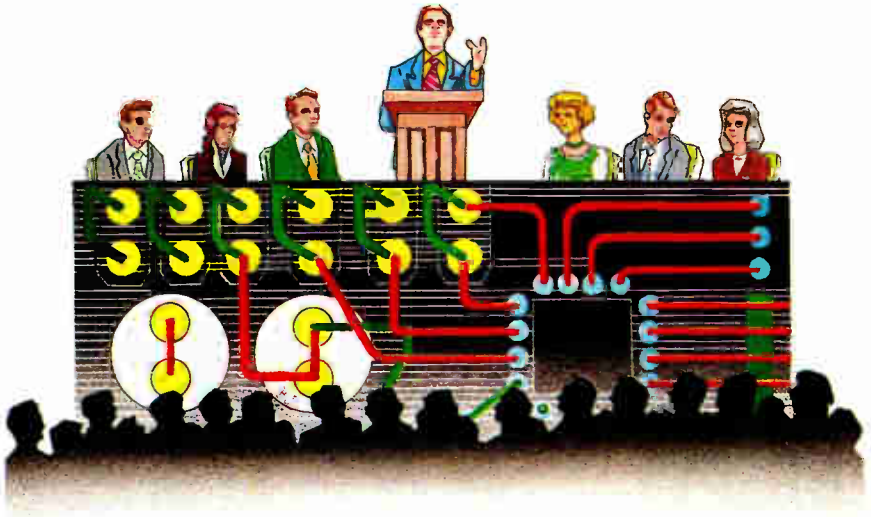
LETTER FROM

THE ISSCC

HOW A ONCE-SOBER CONFERENCE IS BECOMING A PRODUCT SHOWCASE

A TECHNICAL FORUM GOES GLITZY

BY BERNARD C. COLE



A FEW DAYS AT THE INternational Solid State Circuits Conference brings home just how important this meeting is to researchers and the companies that fund them. But oh how times have changed.

In the blink of an eye, this annual conclave, perhaps the most prestigious in the electronics industry, has radically changed character. It used to be a purely technical meeting, at which circuits still under development were described and problems frankly discussed for the benefit of all. Now it's become something of a marketing event—a showcase for companies and their soon-to-be introduced products. Companies are using the ISSCC as the first step in a promotion campaign toward the full product debut later in the year.

Typical of this trend is Matsushita Electric Industrial Co. Ltd.'s handling of a new microprocessor announcement at this year's ISSCC, held in late winter in San Francisco. The Osaka company introduced its 64-bit, very-long-instruction-word Sparc processor in the technical sessions, then held a press conference touting the fact that Solbourne Computer Inc. will use the device, the MN10501, in its next generation of desktop engineering workstations. The Longmont, Colo., company says the machines are scheduled for introduction later this year.

Another good example is Philips Signetics Corp. The Sunnyvale, Calif., company described a 32-bit-long-instruction-format engine, a device built in a very-long-instruction-word architecture that's optimized for embedded-control applications—and also announced that it will soon be introduced.

The part is a subset of a more ambitious 200-word-instruction device, the LIFE-1, scheduled to make its debut later in the year. Fabricated using a 1.5-μm CMOS process, it will feature a 50-MHz clock rate and will run 80 million instructions per second. At that speed, it will go head to head in the marketplace with such devices as MIPS Computer Systems Inc.'s R3000 and Intel Corp.'s i860 reduced-instruction-set computing processors.

It's one thing for companies giving technical sessions at the ISSCC to announce products based on those developments. It's quite another for outfits with absolutely no connection to the conference to piggyback off it in hopes of nabbing the attention of the technical press. One high profile user of that technique was Chips & Technologies Inc., which rented hotel space just down the block from ISSCC headquarters to announce a multiprocessor chip set [*Electronics*, March 1990, p. 29]. Another was IBM Corp., which unveiled its new workstation family during the ISSCC's run (see p. 32). And rather than submit a paper, IBM chose this venue to hold a press conference announcing that it has begun fabricating the next generation 16-Mbit dynamic random-access memories, using a three-dimensional trench structure.

However, all the marketing mania in the world can't alter the fact that the ISSCC is still the industry's premier technical forum, if for nothing else than its daily panel sessions. These are much less structured than the technical sessions to allow for give and take between panel members and the audience of engineers. Here is a forum where participants can discuss technological trends, problems being encountered, and possible solutions.

For veterans who recall ISSCC discussions of the early 1980s, when everyone was wondering what could be done with the thousands of transistors that LSI technology could achieve, this year's sessions were an eye-opener. At one session in particular it was accepted out of hand that at least 100 million and as many as a billion transistors could be integrated on a chip by the end of the 1990s. Most of the talk was not on how to get there but "what do we do with all of that silicon" once we finally arrive.

THE ANSWER IS SIMPLE, says Richard Stewart, head of the advanced display research device center at the David Sarnoff Research Center in Princeton, N. J. Even now, he says, there are applications in advanced displays, imagers, and video processing that cry out for this level of integration. And it's coming. The first billion-transistor monolithic device is a virtual certainty, says Jack Raffel, director of the digital integrated circuit group at the Massachusetts Institute of Technology's Lincoln Laboratory, Lexington, Mass. It will probably be a multiprocessor configuration, he says with a wafer-scale memory as a core. It will likely consist of multiple 64- and 16-Mbit modules, with several tens of processor modules

The Only 1 GS/sec Digital Oscilloscope With...

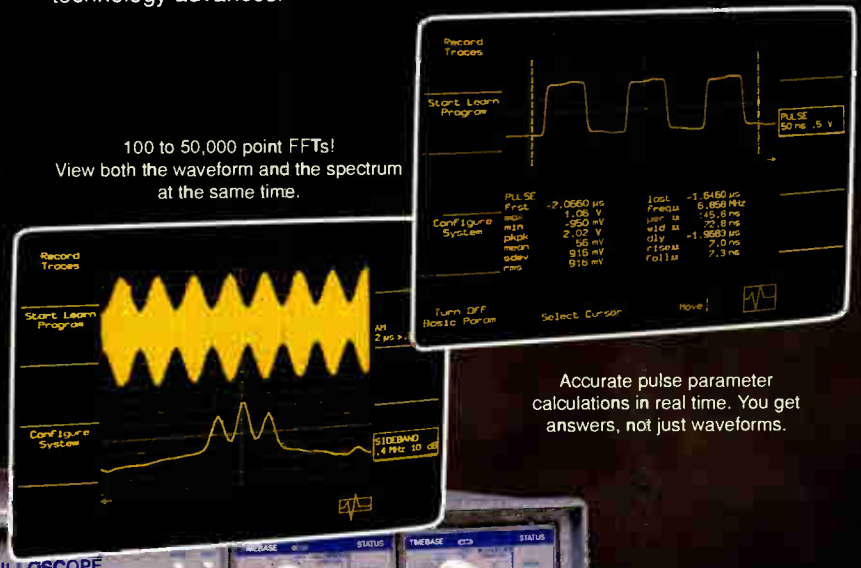
- Simultaneous 4 channel digitizing:
  - 1 GS/sec at 8 bits for transients
  - 20 GS/sec at >10 bits repetitive
  - 50k samples per channel
- Logic, glitch, interval, & TV triggering
- 2 Msample waveform storage
- FFT, math, and averaging
- > 30 pulse parameters
- Statistics
- PASS/FAIL decisions

LeCroy 7200 modularity lets you choose 2 to 4 channels with 400 MHz bandwidth. Uniquely, the 7200 never gives up sampling rate or waveform memory as you increase the number of channels.

Only LeCroy makes advanced analyses so easy! Automate voltage, time, frequency, and even PASS/FAIL measurements. Qualify these measurements with histograms and trend data. Store the waveforms and all calculated results on the built-in hard disk and floppy.

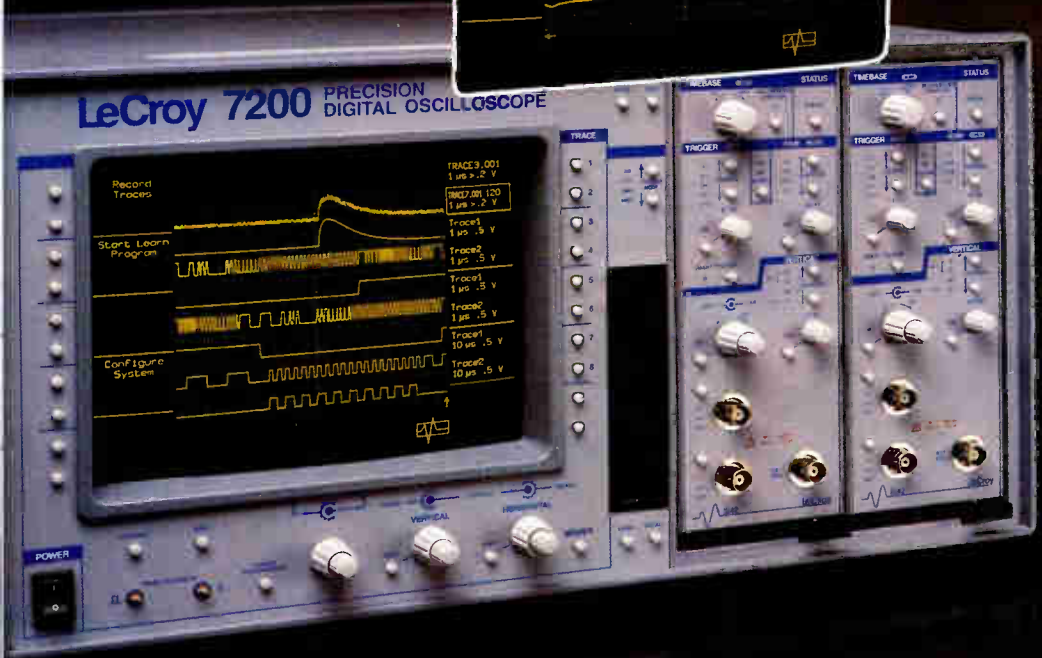
Eliminate oscilloscope obsolescence...
...with the 7200, you can add plug-ins as your needs change and as technology advances.

100 to 50,000 point FFTs!
View both the waveform and the spectrum at the same time.



Accurate pulse parameter calculations in real time. You get answers, not just waveforms.

Display up to 8 live, stored, or analyzed signals simultaneously.



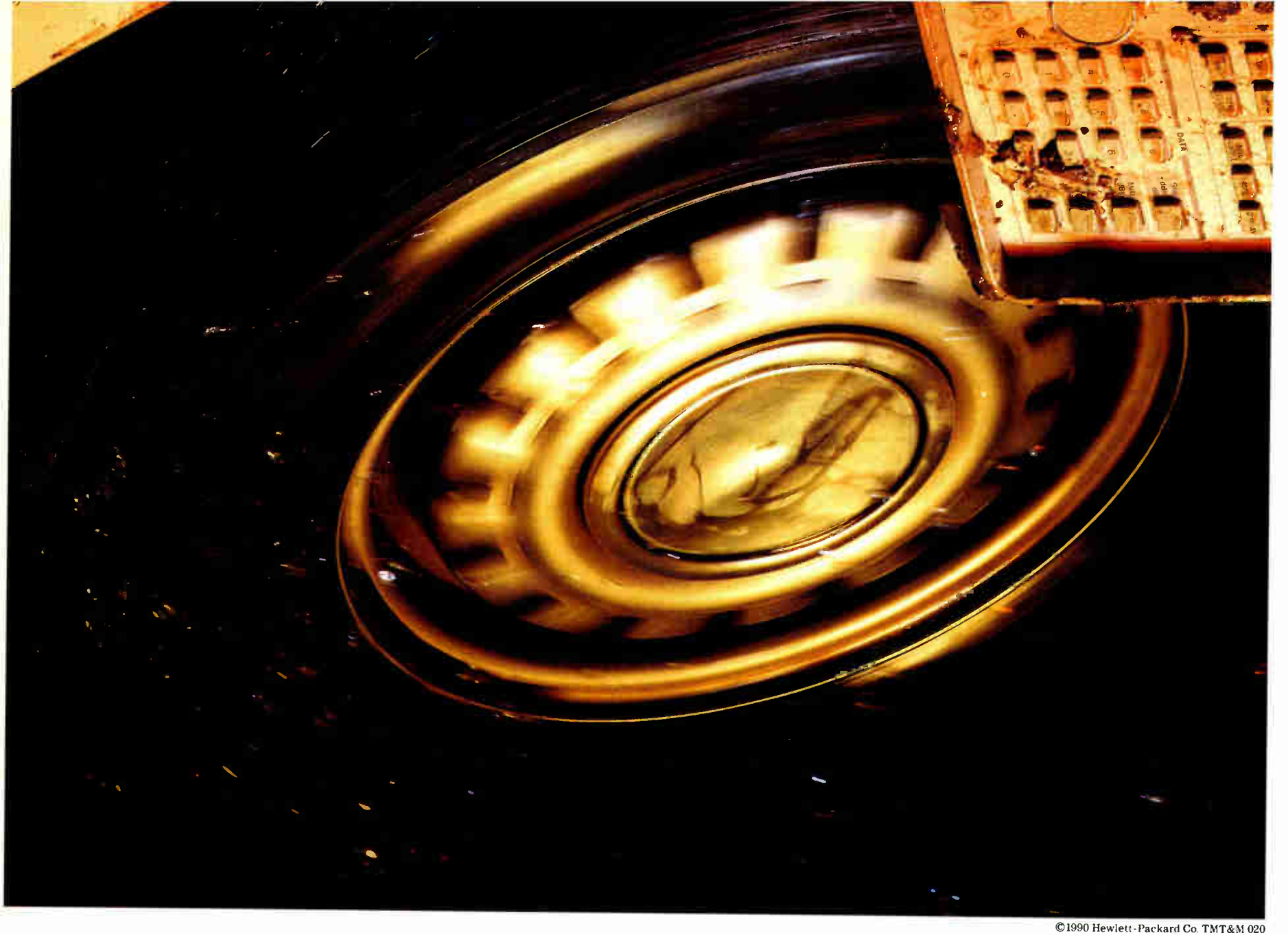
Call (800) 5 LECROY

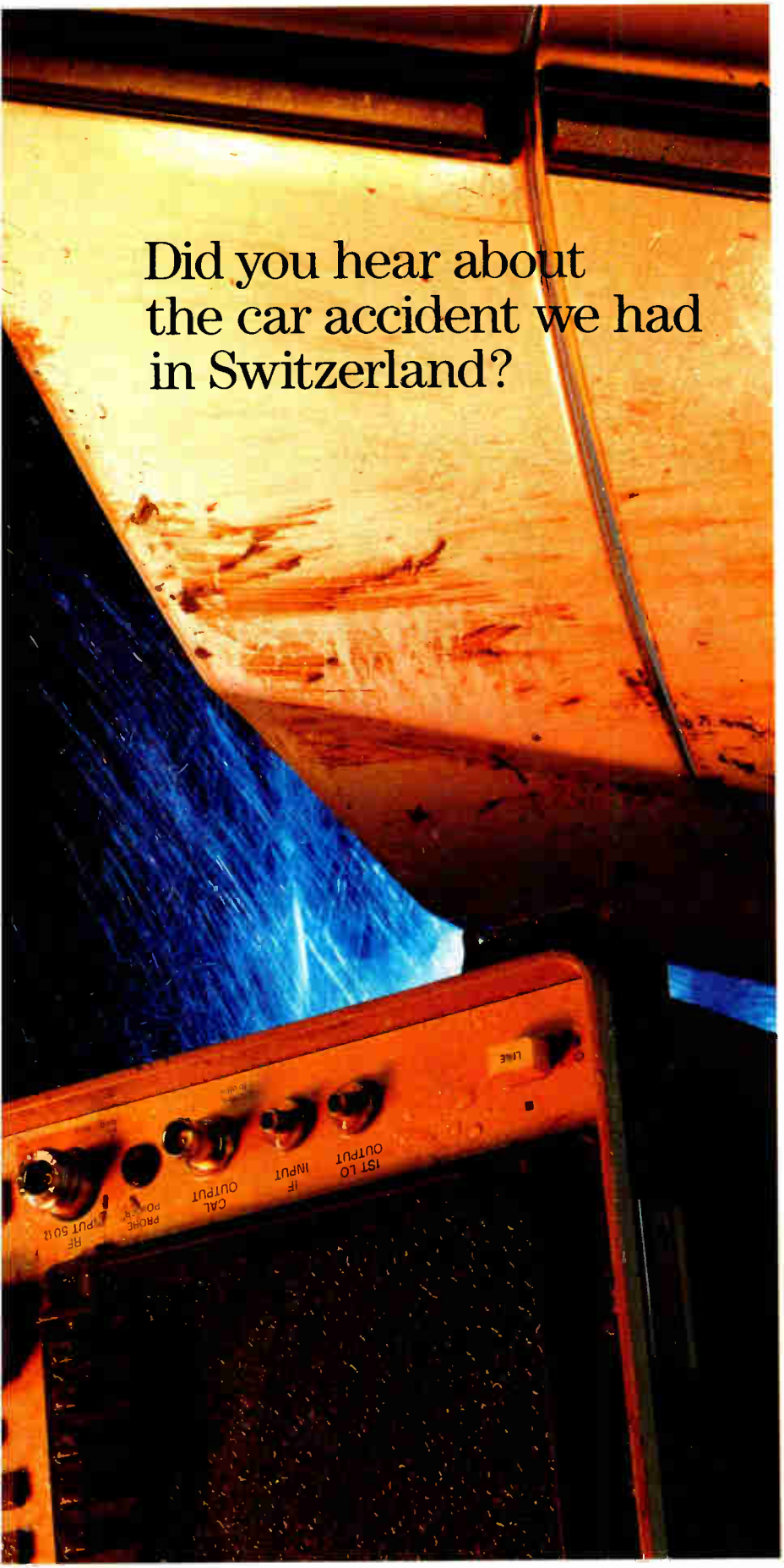
or (914) 425-2000 ext. 6038
for literature or a demonstration.
LeCroy Corporation,
700 Chestnut Ridge Road,
Chestnut Ridge, NY 10977-6499

LeCroy

Innovators in Instrumentation

CIRCLE 200 FOR LITERATURE
CIRCLE 201 FOR DEMONSTRATION





There were no serious injuries.

Not long ago, an HP salesman turned a routine product demonstration into a crash course in reliability.

Our District Manager in Switzerland, Uli Neussbaumer, had just given a demonstration of an HP spectrum analyzer. He set the analyzer down beside his car, intending to pack it last.

Well, there was a lot to pack. And when Uli backed the car out, an ear-splitting screech of ripping metal made him hit the brakes. The analyzer!

It was trapped under the car. Uli jacked up the car, yanked out the analyzer, and ran back to his customer's office to test its vital signs. The spectrum analyzer worked perfectly. The customer was incredulous.

Stories like this underscore why HP rates highest for reliability among engineering managers. And we're still not satisfied. In fact, in 1979 we started our Total Quality Control program to increase quality ten-fold in 10 years. A goal we'll reach this year.

It just goes to show that when design and manufacturing productivity are at stake, there is no reliable substitute for HP. Because you never know what you might run into.

There is a better way.

HEWLETT PACKARD

CIRCLE 251

1985 : smallest

VI-100 family
4.6" x 2.4" x 0.5"
50, 75, 100 Watts

1990 : smaller

VI-200 family
4.6" x 2.4" x 0.5"
50, 75, 100, 150, 200 Watts

MiniMod™ family
2.28" x 2.4" x 0.5"
25, 50, 75, 100 Watts

1-800-735-6200

Component Solutions For Your Power Systems
23 Frontage Road, Andover, MA 01810

VICOR

CIRCLE 266

CAE Technology Report

Vol. 2, No. 4 April 1990

Why is VHDL Quickly Becoming a Standard in IC Modeling?

When an IC device is bad, it is easily located and replaced, but when an IC model is bad, it is detected only after expending considerable effort. This is why the number one priority for the CAE industry is the quality of IC models. Because VHDL compilers automatically generate IC models, the models are very reliable; and for this reason, designers should only use CAE systems which support VHDL IC models. Once designers realize the high quality of VHDL IC models, VHDL will be the dominant IC modeling tool.

CAD Software Offers a Complete Design Solution

Two leading CAE companies, ALDEC, Inc. and CAD Software, Inc., have signed an OEM agreement that will benefit all users. CAD Software (800-255-7814) is a manufacturer of PADS-P.C.B.™*, one of the best selling P.C.B. layout and schematic capture software packages. ALDEC (805-499-6105) is the developer of the EDA industry's most populator PC-based logic simulator – SUSIE™*. SUSIE outperforms workstation-based simulators and has the world's largest library of IC parts. Close integration of PADS-PCB and SUSIE gives designers a complete, low cost design environment. **CIRCLE 101**

386-Based Simulators Match Performance of Workstations at a Fraction of the Cost

For many engineers, logic simulator performance is a direct function of the raw power of hardware platform. However, some innovative companies are able to provide 386-based simulators that outperform expensive workstations. The key improvements in simulation technology are incremental design compilation, software acceleration and dynamic netlist modeling which treat each connectivity node as an IC (these improvements are pioneered by ALDEC, Inc. which holds several patents on its simulation technology). This means that the user should select the simulator based not on the hardware platform, but rather on simulator technology and available libraries. **CIRCLE 102**

Real-Time Simulators Zoom Ahead of Batch Processing

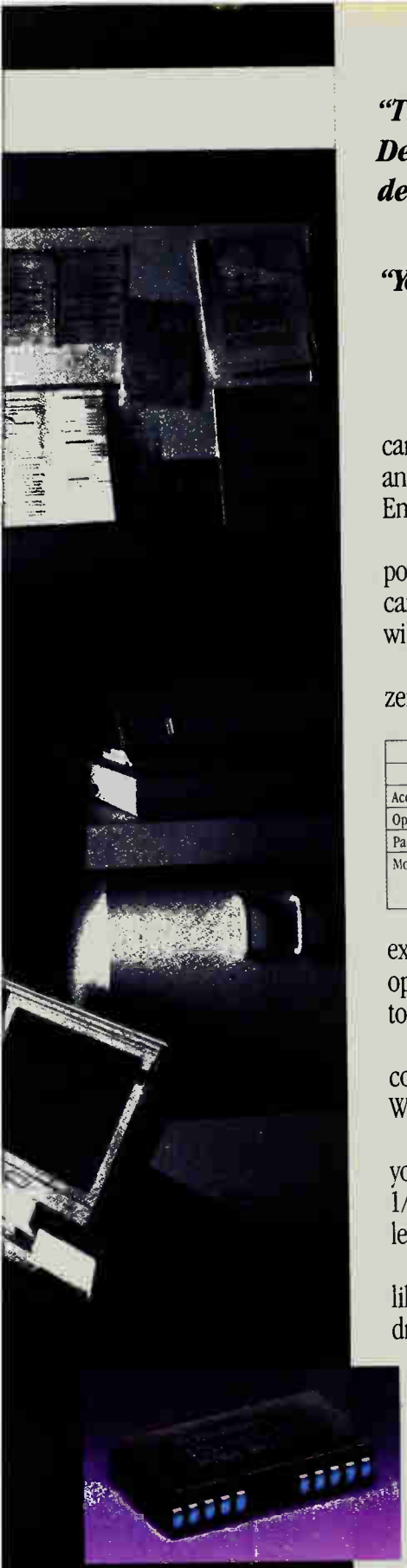
Despite all the hoopla, simulators are not widely used for board level verification. However, simulators for special applications such as programmable gate arrays (PGAs) and programmable logic devices (PLDs) are being used extensively. One of the best values for its money is the SUSIE simulator from ALDEC, Inc. (Newbury Park, CA) which simulates multiple PLDs and XILINX™* parts in real-time and also allows for concurrent design modification during simulation. Since test vectors can also be changed on-the-fly without any compilation, the user can test various design modifications in a fraction of the time taken by batch simulators. Thanks to the real-time simulators, debugging of PLD and PGA-based designs have taken a major step forward . **CIRCLE 103**

Printed Circuit Board Simulation is Fast Becoming Practical

Only a year ago, full simulation of a printed circuit board (P.C.B.) seemed far away mainly because of lack of IC models . However, with the introduction of low cost VHDL IC modeling tools from ITEX (805-499-6860) and the SUSIE simulator from ALDEC, the simulation of P.C.B.'s has taken a new dimension. SUSIE allows the user to continue simulation with unknown models in the design. For example, to test an interface between a 68040 processor and a DRAM, the user can feed hex files that represent a read or write cycle operation onto the 68040 output pins and automatically determine if DRAM reads and writes correctly. **CIRCLE 104**

*PADS-P.C.B. is a trademark of CAD Software, Inc., and XILINX is a trademark of Xilinx, Inc.
*SUSIE is a trademark of ALDEC, Inc. **(805) 499-6105; FAX (805) 498-7945** .

"What do you think of when I say 4 Megabit DRAM?



"There's so much. New applications. New markets. Denser memory for our systems. We could release that design we made last year."

"So what are you waiting for? Get to work."

"You're kidding. Is the 4 Megabit DRAM out? Who's got it?"

"Toshiba. And you. It should be here this afternoon."

They're here all right. 4Mb DRAMs from Toshiba. Just think what you can do with them. You can attack whole new markets. Design new portable and lap-top applications where you've never had room for enough memory. Embedded applications, too, where you're always so cramped for board space.

Here's the best part. You get the 4Mb density without any penalty in power. In fact, they use no more power than a 1Mb DRAM. That means you can upgrade a system without major redesign. It also means your system will run cool, for added reliability.

Or how about that 80ns access time. That means you can design true zero wait-state systems without resorting to cache memory or complex interleaving schemes.

4Mb DRAM SPECIFICATIONS		
	4M x 1	1M x 4
Access Times	80ns, 100ns	80 ns, 100ns
Operating Power	550mW, 468mW	578mW, 495mW
Packaging	ZIP & SOJ	
Modes	Fast Page Nibble Static Column	Fast Page Static Column Write Per Bit

The high density is made possible by our 0.8 micron design rules, and our Twin Tub CMOS fabrication process. But you'd expect that from the world leader in DRAMs. You'd expect them to be available in all standard JEDEC package and mode options. And they are. You'd expect them to operate on a single 5 volt supply, too. And they do.

But we give you a few things you might not expect. A master slice concept, for instance. That will cut your qualifying costs tremendously. When you qualify one part, you qualify the whole family.

We save you costly testing time, too. The 8-bit parallel test mode lets you test the unit as if it were eight 512K blocks in parallel. That takes only 1/8th of the time. And the test can be done at the component, board or system level. In fact, your customers can test memory every time they power-up.

There's more to tell. Much more. But we've run out of room. If you'd like complete information, give us a call at 1-800-888-0848 ext. 517. We'll drop a data sheet in the first mail. *Service is our key component.*

In Touch with Tomorrow

TOSHIBA

TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC.

CIRCLE 308

MST-89-014-1

These excellent suppliers to worldwide quality

A M ORETA & CO.
ADVANCED MICRO DEVICES, INC.
AMP INCORPORATED
ANDERSON FISCHEL THOMPSON
ANIXTER BROS., INC.
ARKWRIGHT MUTUAL INSURANCE COMPANY
ASTRO INSTRUMENT CORPORATION
AUSTIN FOAM PLASTICS, INC.
BEACON INDUSTRIES, INC.
BMC SOFTWARE, INC.
BODENSEEWERK GERAETETECHNIK GMBH
BOLIDEN METECH, INC.
BOURNS, INC.
BOWCAM CONTAINER, INC.
BRADFORD ELECTRONICS, INC.
BRIGGS-WEAVER, INC.
BURLE INDUSTRIES, INC.
COMDISCO, INC.
COMPOSIDIE, INC.
CORR TECH INCORPORATED
DAI NIPPON PRINTING CO., LTD.
DEGUSSA ELECTRONICS PTE. LTD.
DIXIE ELECTRONICS, INC.
DONOTECH ELECTRONIC MANUFACTURING, INC.
ELECTRO SCIENTIFIC INDUSTRIES, INC.
ERNI COMPONENTS, INC. (USA)
ESAU & HUEBNER GMBH
FORTUNE INDUSTRIES
FRITZ COMPANIES, INC.
G & G INDUSTRIES
GOLDSMITH'S INCORPORATED
GRAYBAR ELECTRIC COMPANY, INC.
HEMLOCK SEMICONDUCTOR CORPORATION
HENLEY PAPER COMPANY
HITACHI CHEMICAL CO., LTD.
HO CHEN COMPANY
IMPRIMERIE BAUD
INDY ELECTRONICS, INC.
INSTALLATION & DISMANTLE, INC.
INSTANT PHOTOS, INC.
INSULFAB PLASTICS, INC.,
PLASTIC FABRICATORS DIVISION
INTEL CORPORATION
INTEROX AMERICA
KEMET ELECTRONICS CORPORATION
KES SYSTEMS & SERVICE PTE. LTD.
KESU SYSTEMS & SERVICE, INC.
KOA SPEER ELECTRONICS, INC.
KOMATSU ELECTRONIC METALS CO., LTD.
KTI BI-METALLIX, INC.
KYOCERA CORPORATION
KYOCERA NORTHWEST, INC.
K. F. BASSLER COMPANY, INC.
LAUBE TECHNOLOGY
LEA RONAL, INC.
LEYBOLD VACUUM PRODUCTS, INC.
MAJOR ELECTRIC SUPPLY, INC.
MAJORS SCIENTIFIC BOOKS, INC.
MANVILLE FOREST PRODUCTS
MICRO METALLICS CORPORATION
MICRO TECHNOLOGY OF BREVARD, INC.
MOORE BUSINESS FORMS, INC.
MOTOROLA SEMICONDUCTOR PRODUCTS, I
MICROPROCESSOR PRODUCTS GROUP
MOTOROLA SEMICONDUCTOR PRODUCTS, I
STANDARD LOGIC/ANALOG IC GROUP
MRL INDUSTRIES, INC.
M.M. MICROWAVE LIMITED
NARUMI CHINA CORPORATION
NOVELLUS SYSTEMS, INC.
OPTO MECHANIK, INC.
PHOTOCIRCUITS

support TI's commitment leadership.

POWR-LIFT CORPORATION
PRECISION PRODUCTS CO., INC.
PREH WERKE GMBH & CO. KG
REAL-TIME LABORATORIES, SUBSIDIARY OF ARGO-TECH CORPORATION
REED PLASTICS CORP.
REVERE COPPER PRODUCTS, INC.
REYNOLDS METALS COMPANY
SEIKO INSTRUMENTS GMBH
SHELDAHL INC.
SHIPLEY COMPANY, INC.
SIGNETICS COMPANY, DIVISION OF NORTH AMERICAN PHILIPS CORP.
SOUTH CAROLINA BOX, INC.
SOUTHWESTERN BELL MOBILE SYSTEMS, INC.
SOUTHWIRE COMPANY
SPECIALTY OPTICAL SYSTEMS, INC.
SPINCRAFT, WI DIVISION OF STANDEX PRECISION ENGINEERING
TDK CORPORATION OF AMERICA
TEMPLE, BARKER & SLOANE, INC.
TEXAS INSTRUMENTS INCORPORATED, SEMICONDUCTOR GROUP, GENERAL PURPOSE LOGIC DIVISION
TEXAS INSTRUMENTS INCORPORATED, SEMICONDUCTOR GROUP, LINEAR PRODUCTS DIVISION
TEXAS VALVE & FITTING COMPANY
THE COLOR PLACE, INC.
THE TRIDENT COMPANY
TOKYO OHKA KOGYO CO., LTD
UNITED STATES INSTRUMENT RENTALS, INC.
WHITTAKER POWER STORAGE SYSTEMS
ZILOG INCORPORATED

Congratulations to the winners of the 1989 Texas Instruments Supplier Excellence Award.

Customer satisfaction through Total Quality is one of TI's most important corporate objectives.

We are meeting this challenge through the pervasive integration of a Total Quality Culture into our organization, our processes—and our supplier relationships. It involves every employee in more than 50 TI plants and 17 countries. And, it involves our suppliers throughout the world.

It is with special pride that we announce the recipients of the 1989 Texas Instruments Supplier Excellence Award. This select group, chosen from our supplier base around the world, has demonstrated an unusual commitment to the principle of total quality in supplying their products and services to Texas Instruments.

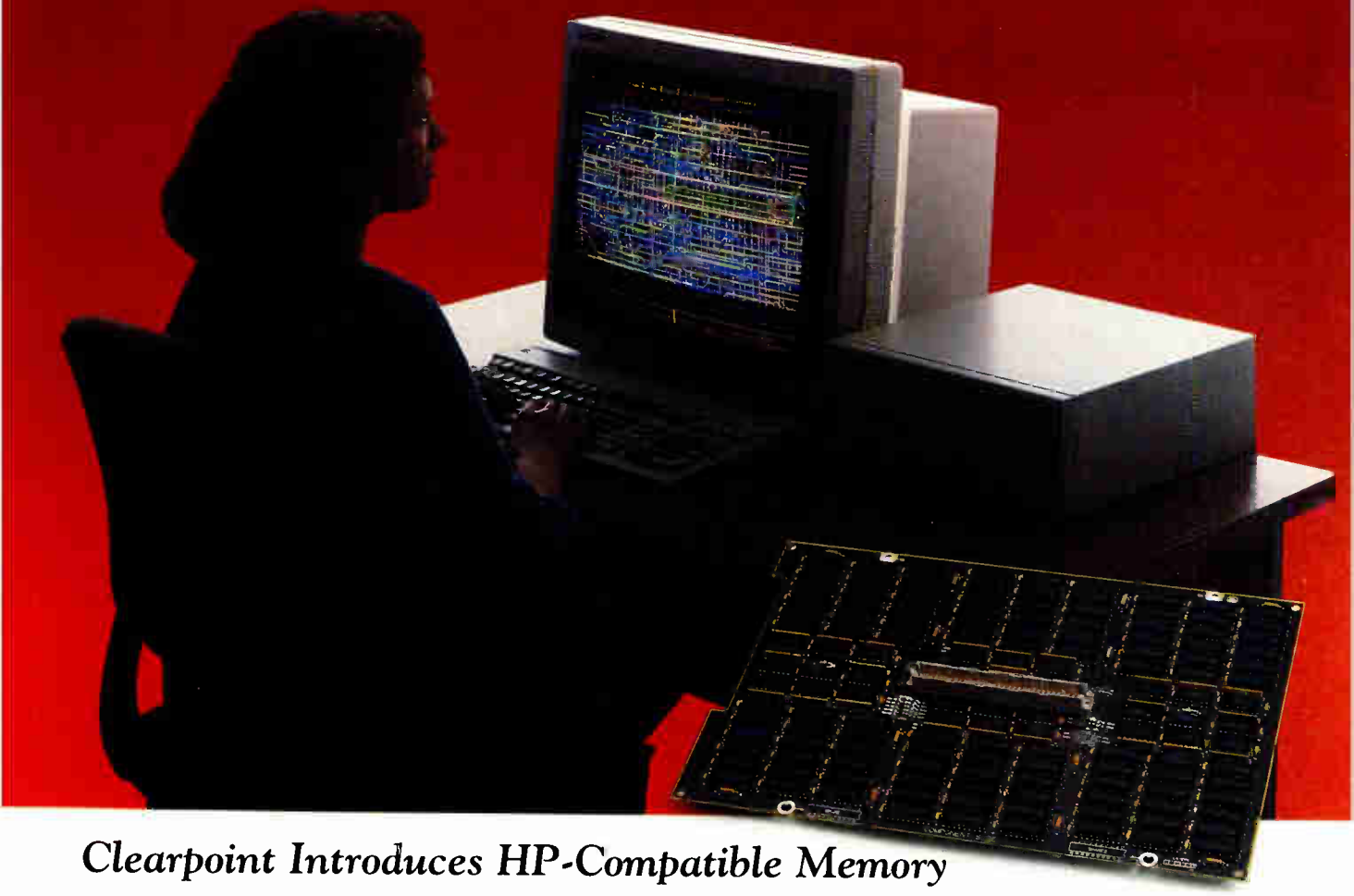
We congratulate each of these suppliers and their employees for outstanding performance in meeting our requirements . . . with excellence.

TEXAS INSTRUMENTS

23-0286

CIRCLE 203

The #1 Workstation Memory Vendor Now Supports the #1 Workstation Company



Clearpoint Introduces HP-Compatible Memory

Clearpoint, the only manufacturer of memory for both Hewlett-Packard and Apollo systems, now offers memory 100% compatible with the HP 9000 Series 350/370 workstations. The HPME-93P is backed by Clearpoint's comprehensive support program:

- lifetime warranty
- next day repair/replacement
- 24-hour technical support hotline.

The HPME-93P array board is available in both 4 MB and 12 MB configurations. Using 1 MB DIP technology, the array board brings your system to its full 16 MB/slot capacity.

The HPME-93P is user-installable; no jumper configuration is needed. The HP 9000 Series 350/370 includes built-in diagnostic testing to insure easy installation and a high-speed bus for no-wait state processing.

Memory for the full line of Apollo workstations... Clearpoint's DNXRAM series.

The DNX4RAM, available in 4 MB and 8 MB configurations, is a one board memory solution for the Apollo Domain 4000 series — the DN 3500, 4000, and 4500. Populated with 100 ns fast page-mode DRAMs, the DNX4RAM offers performance identical to Apollo boards.

Harness the full power of your Apollo 3000 series of workstations! The DNXRAM offers 1 MB or 2 MB capacities on a single board. By using 256 Kb ZIP DRAMs, the DNXRAM delivers twice the density per slot.

CLEARPOINT

Other Clearpoint Workstation Memory Families:

- ❒ APPLE
- ❒ SUN
- ❒ COMPAQ
- ❒ DEC
- ❒ IBM

Call or write for Clearpoint's comprehensive workstation brochure and the Designer's Guide to Add-in Memory.

Clearpoint Research Corporation
35 Parkwood Drive
Hopkinton, MA 01748
1-800-CLEARPT (508) 435-2000
Telex: 298281 CLEARPOINT UR
Clearpoint UK Limited: 44-628-667-823
Clearpoint Europe B.V.: 31-23-273-744
Clearpoint Deutschland: 49-6430-2222
Clearpoint Japan KK: 81-3-221-9726
Clearpoint Canada: (416) 620-7242

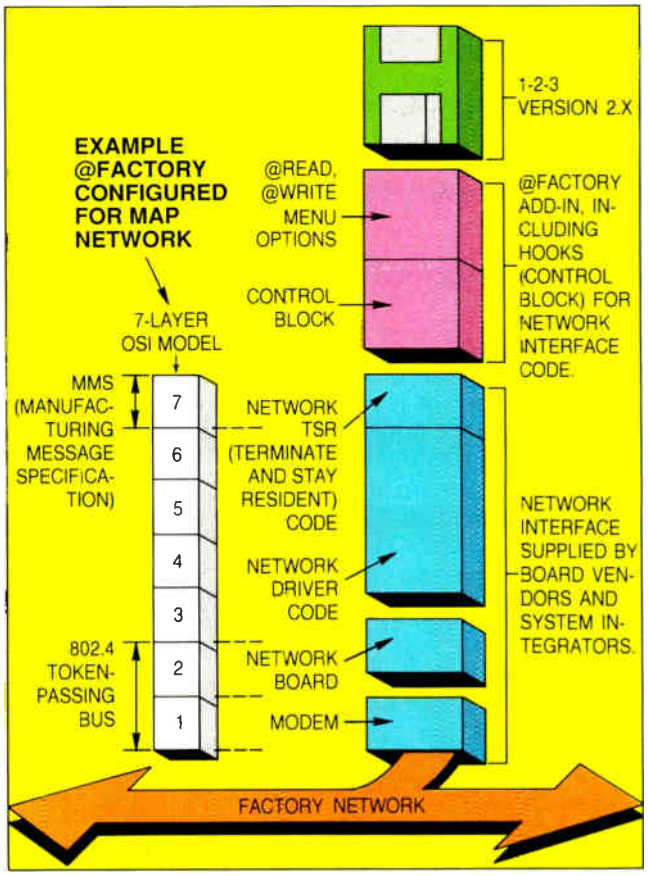
CIRCLE 236

HERE'S A 1-2-3 FOR FACTORY . . .

It must be spring, because Lotus Development Corp. is positively abloom with new versions of its mainstay spreadsheet, 1-2-3. There's one for the factory and others for VAX, Sun, and IBM systems.

This month's International Programmable Controller conference will host a splashy welcome for the new factory-floor program. Called @Factory, the software works with ordinary 1-2-3 version 2.X programs, allowing spreadsheet users to send and receive information over local-area networks. Developed by the Cambridge, Mass., company in conjunction with General Motors Corp., @Factory can read data into spreadsheet cells from networked manufacturing equipment such as programmable controllers, robots, and CNC machines. Likewise, it can pull information from spreadsheet cells and send it to equipment on a network. @Factory will carry a $795 suggested list price.

Lotus says that third-party integrators are developing versions to work with specific kinds of LANs. The first such program, designed for Manufacturing Automation Protocol nets, is from Systems Integration Specialists Co. of Warren, Mich. The price of a total system—1-2-3, @Factory, network-interface software, and a network board and modem—will vary with the supplier. E



One version of Lotus's @Factory, from Systems Integration Specialists, works with MAP networks.

. . . AS WELL AS VERSIONS FOR DEC'S FAMILY OF VAX MACHINES

Extending its so-called cross-platform strategy, Lotus has unveiled two versions of 1-2-3 for the VAX family of computers from Digital Equipment Corp. The two are for VAX/VMS computers and for DEC's All-in-1 integrated office software. Both are based on 1-2-3 release 3, the long-delayed variation of the spreadsheet that became available in mid-1989.

Both versions are the fruits of a November 1988 joint development and marketing agreement between Lotus and DEC, based in Maynard, Mass.

The version for VAX/VMS lets users share spreadsheets around a network, providing cross-platform file and data sharing as well as access to corporate data on a VAX.

Lotus's plan is to offer versions of the spreadsheet, which is widely used in personal computers, for all major vendors' computers; providing 1-2-3 for the VAX world is the latest move in that growth strategy.

In January, Lotus introduced 1-2-3 for Sun Microsystems Inc. Unix workstations, followed in February with a version for IBM Corp. mainframes and last month with one for OS/2. Still to come: Presentation Manager and the Apple Macintosh. E

THIS MONOLITHIC DSP INCLUDES 16-BIT DATA CONVERTERS

Analog Devices Inc. expects to see first silicon in July of a mixed-signal processor that the Norwood, Mass., company is counting on to boost its fortunes in the growing DSP business. It's a digital device that also incorporates 16-bit analog-to-digital and digital-to-analog converter sections in one monolithic CMOS chip.

This isn't the first such mixed-signal processor; AT&T Co. has also announced one, aimed primarily at digital mobile radios. But Analog Devices will quote full 16-bit resolution for the analog stages, against 13 bits for the AT&T unit.

Designated the ADSP-21MSP50, the circuit extends the company's ADSP-2100/2101 family. Those products probably account for about 5% of a 1989 DSP device market estimated at $270 million by Forward Concepts. The Tempe, Ariz., research house says the DSP and mixed-signal processor market could hit $1.8 billion by 1995.

The new part should put Analog Devices in a position to sweeten its reputation—and its market share—as the device wins sockets in digital mobile radio, industrial noise cancellation, and secure communications. E

EDA SOFTWARE MARKET GROWS UP—AND UP, AND UP...

Chalking up a billion dollars in revenue in 1989, the market for electronic design-automation software tools has finally matured. And there's no end in sight: the market will forge ahead at a compound annual growth rate of 30% through 1993, says Victoria Hinder, director of research at the Technology Research Group in Boston.

Signs of market maturity are everywhere, says Hinder. One is the fact that Thomas Bruggere, chairman of EDA heavyweight Mentor Graphics Corp. of Beaverton, Ore., is making the keynote speech at the Electro/90 show in Boston on May 9. Another is the rapid onslaught of standards.

Hinder breaks the tools market into three parts. The first contains software sales into applications in custom IC and ASIC design. The second is for tools used for both ASIC and board design, such as those from Mentor Graphics. The third category encompasses only those tools used for board design.

Where EDA Software Dollars Go

($ Millions)

	1990	1991	1992	1993
For ICs	613.9	790.8	1,073.3	1,396.6
For ICs and boards	374.9	520.2	685.9	851.7
For boards only	665.9	842.7	1,050.3	1,236.1
Total	1,654.7	2,153.7	2,809.5	3,484,4

SOURCE: THE TECHNOLOGY RESEARCH GROUP INC.

MENTOR AND HP EXTEND CONCURRENT ENGINEERING TO TESTING

Concurrent engineering is the latest catchphrase in the CAE/CAD market these days and everyone in the business is busily climbing on the bandwagon (see p. 50). This month, Mentor Graphics Corp. of Beaverton, Ore., and Hewlett-Packard Co.'s Loveland Instrument Division in Loveland, Colo., have joined forces to extend concurrent engineering into test development. Mentor has agreed to connect the HP line of board testers to its CAE/CAD environment.

"Customers want a solution to their entire product-development problem," says John Young, HP's president. "They also want to link their design activities with manufacturing and test, something that HP is uniquely positioned to do. And by integrating Mentor's simulator with HP's board-test system, we'll be able to provide even stronger links."

What that means initially is that Mentor will provide a model of the HP board testers in its CAE/CAD simulator. This will enable the designer to determine if the simulation vectors he develops when designing a board will be useful for testing the board on the HP test system. This capability will be expanded further to include a test-engineering workstation where test engineers can become an integral part of the design team.

In this capacity the test engineer can contribute data about how testable a design is before the design is actually realized. Currently, designers pass a completed design to test engineers.

DG'S SOVIET VENTURE IS OPEN FOR BUSINESS

Data General Corp.'s joint venture with an Austrian and a Soviet firm is open for business. Called Perekat, the operation links the Westboro, Mass., computer maker with NPO Parma, a Moscow software developer, and Voest Alpine Vertriebs, which is the Moscow-based marketing organization for an Austrian industrial engineering and contracting firm [*Electronics*, January 1990, p. 17].

Perekat, headquarted in Perm, is now registered and recognized by the Soviet government, and last month at a meeting in Westboro it elected its board of directors and chairman. The head man is Dieter Cehovin, a Voest Alpine senior vice president. The managing director in Moscow is Valery Borduger, deputy director general of NPO Parma, who says he's "anxious to get" the MV/7800 computer from Data General.

To date, NPO Parma has been porting its software to the less powerful MV/2000, which was cleared for export to East Bloc nations earlier by Cocom.

EUROPE IS BECOMING THE HOT AREA FOR SOFTWARE SALES

For software companies, the action is in Europe. The reason: there will be steady growth in the European market for the next two years, according to a study by senior analyst Dennis Exton of Merrill Lynch in London. He is predicting 12% to 15% sales gowth in 1990 and a full 20% rise in 1991. These come on the heels of a 15% jump in 1989.

Europe has always lagged behind the U. S. in creating a well-developed, homogeneous market for software. The industry is fragmented. Even the leading European software manufacturer, Paris-based Cap Gemini Sogeti, has no more than 5% of the European market, says Exton, and only 10% of its native French market. The result has been a smaller market producing discrete, customized software.

Now three factors are changing all that: the attempt to create a "common tool environment"—that is, a standard—for European software, increasing competition from hardware vendors, and the need to upgrade systems to cope with the single integrated market in 1992, Exton says.

As computer makers go international to deal with those changes, software makers will have to follow suit. Concentration can be expected parallel to the shakeout taking place among hardware manufacturers. While software firms in Europe are generally small and undercapitalized, expect a wave of mergers and acquisitions to create bigger international players, Exton says.

Here's your answer for complete testing of today's complex boards. The HP 3070 AT-Series combinational tester.

Its advanced pin electronics means high-performance testing...including testing of fast microprocessors with clock rates to 40 MHz. A flexible system architecture delivers hundreds of thousands of test vectors without segmenting or reloading. And allows easy expansion to more than 2500 nodes. An integrated fixturing system helps lower your fixturing costs. And the HP IPG Test Consultant software speeds test development.

Call **1-800-752-0900** today. Ask for **Ext. 501D** and we'll send you more details on the tester that does it all.

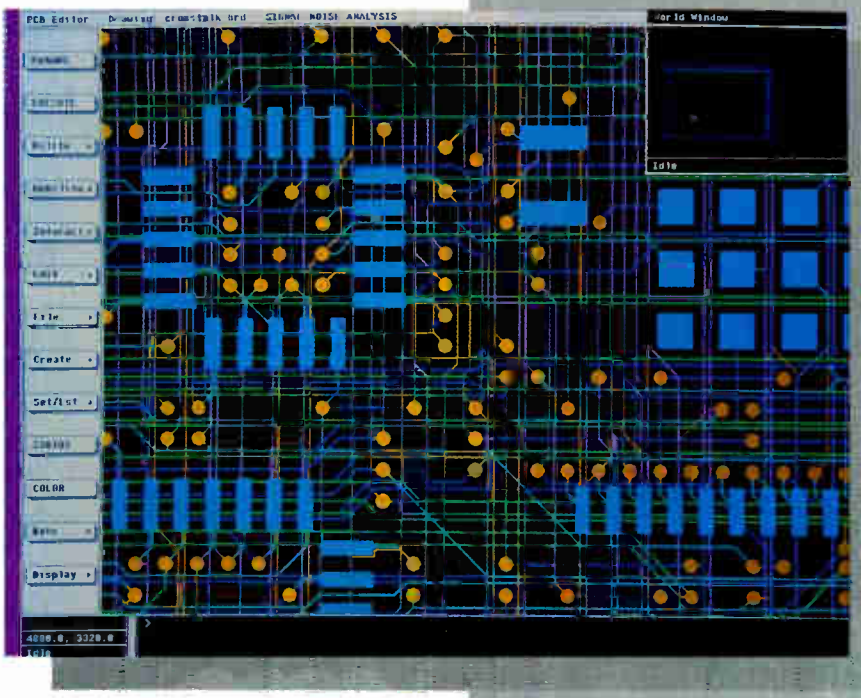
There is a better way.

HEWLETT PACKARD

CIRCLE 235

TOUGH ISSUES
VALID ANSWERS

CAN YOU SPOT THE CROSSTALK PROBLEM IN THIS DESIGN?



If not, you're not alone. High-speed board designs can create electrical problems that even the most experienced designer can't spot. And that usually means schedule slips and several costly prototypes before you get it right. But now you can catch these hidden problems *before* prototypes are built, using Valid's Allegro PCB design system.

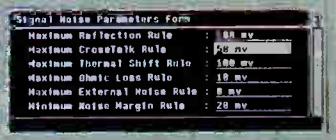
Allegro's Signal Noise Analysis and on-line Electrical Parameter Calculator enable you to eliminate potential electrical errors early in the design cycle, without resorting to clumsy "rules-of-thumb" methods. With Allegro, you get actual electrical analyses of the physical design including reflection, crosstalk, thermal shift, and ohmic loss. Plus detailed data on impedance, capacitance, inductance and etch delay.

Catching electrical problems during the design process helps ensure design teams of first-time working prototypes.

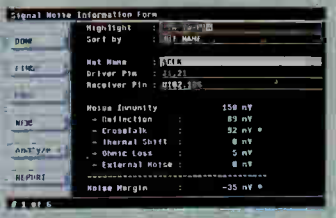
Allegro's advanced design tools provide a total PCB engineering environment to handle even the most complex board designs. With rules-driven component floor planning and route prioritization. Automatic route-to-length/delay. Automatic interconnect scheduling, terminator assignment, and 45-degree routing. And more.

With this unique combination of features it's not surprising that almost every major U.S. computer manufacturer uses Allegro for their PCB designs. If high-speed design is an issue for you, then you need a Valid answer. For complete details, call 1-800-821-9441. In California: 408-432-9400 x 2207.

Valid, 2820 Orchard Pkwy, MS-27, San Jose, CA 95134



With Signal Noise Analysis, users define acceptable levels of crosstalk, reflection, thermal shift, ohmic loss and other transmission line characteristics.



When violations are found, they're highlighted in a data table and on the layout for easy correction.

VALID

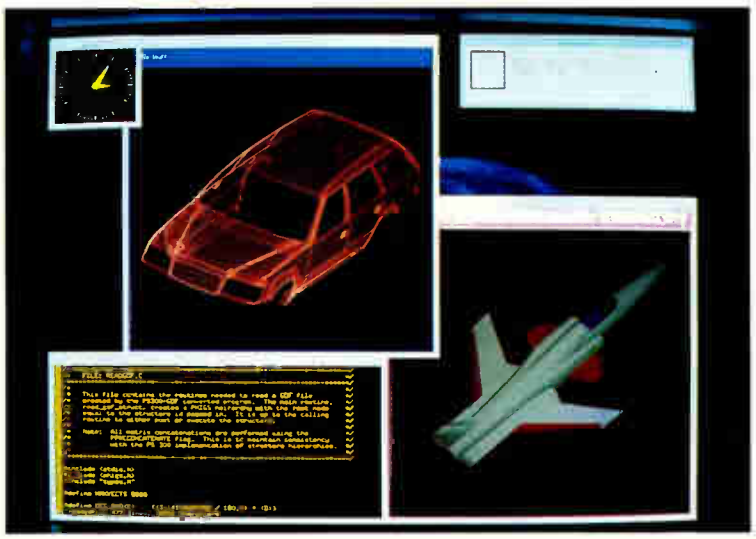
Automating the Process of Design

CIRCLE 252

TO WATCH

3-D GRAPHICS THRIVE ON STANDARDS

Graphics standards are stealing the scene in the workstation business, and Evans & Sutherland Computer Corp., a longtime star in proprietary graphics hardware, has just adopted them with a vengeance. To deliver the performace of proprietary hardware but conform to the emerging ANSI standard for three - dimensional graphics in the X Window environment, the firm has implemented PEX in hardware.



PEX is the X-Window extension of ANSI's Phigs (Programmer's Hierarchical Interactive Graphics System) standard. E&S is the first to market PEX in hardware or software, says H. Quintin Foster, vice president of the graphics workstation unit. Just for good measure, the Salt Lake City company also uses the Motif graphical user interface and a Unix operating system. All this makes the company's ESV series of workstations more attractive to systems integrators and value-added resellers. OEMs and VARs have not been E&S's favored marketing channels in the past, but Foster says the company is receptive to new relationships there.

Under the hood of the ESV workstation family is the R3000 RISC chip set from MIPS Computer Systems Inc. But the ESV's graphics performance is more dependent on digital-signal-processor arrays along with E&S's famed graphics algorithms. Up to four DSP coprocessor cards can be added to the base system, which is field-upgradable. The top-of-the-line ESV50 can draw 100,000 Gouraud-shaded polygons/s. The ESV series is available now at prices from $49,000 to $85,000.

TI BROADENS ITS DSP LINE TO ATTACK LOW-PRICE APPLICATIONS

Texas Instruments Inc.'s digital-signal-processor division has started to deliver floating-point performance at prices usually associated with integer DSPs. The vehicles: TI's TMS320C31 and TMS320C30-26 chips.

Recognizing that DSPs are headed for price-sensitive applications such as high-speed modems, three-dimensional graphics, and multimedia workstations, TI's Houston-based DSP operation has trimmed some of the high-end features from its top-of-the-line, 32-bit, floating-point TMS320C30 to create the two new devices.

For example, the C31 is object-code-compatible with the C30 but has just one internal bus, one serial port, and no on-chip read-only memory. It comes in a 132-pin plastic package, instead of the C30's 181-pin ceramic pin-grid array. The device can perform 33 million floating-point instructions/s, just like the C30.

When the C31 goes on the market during the fourth quarter, it will be priced below $35, says Kun-Shan Lin, DSP marketing manager.

The second device, the C30-26, has the same feature set as the C30, but runs at 26 MHz instead of 33 MHz. It has a typical cycle time of 75 ns, compared with the C30's 60 ns. Consequently, performance is downgraded to 26 megaflops.

The C30-26 is available now and is priced at $100 each in 10,000-unit purchases. That's half the price of the C30.

KONTRON'S INDUSTRIAL-STRENGTH PC USES THE EISA BUS

The IP Lite portable computer from Kontron Elektronik, which is rugged enough for industrial applications, is the first of its kind to use the Enhanced Industry Standard Architecture, says the Munich, West Germany, company. The ruggedized 22-lb, 32-bit machine offers two microprocessor options—Intel Corp.'s 80386SX or 80386DX chips—and the choice of MS-DOS, OS/2, or Unix operating systems.

Seven slots in the passive EISA bus permit substantial expansion opportunities so the machine can be used as a programming unit for industrial controllers, a portable development system for Unix applications, or a network analyzer for the integrated services digital network.

A die-cast magnesium housing enables the 40- or 100-Mbyte hard-disk drives to withstand a 3-ft drop while they're up and running. The machine operates at temperatures up to 50°C. Prices range from $8,395 to $9,995, depending on the processor. Volume deliveries are planned for June, with an 80486-based version to come later this year.

Kontron distributes and services the IP Lite through three U. S. firms: Kontron Northeast, Beverly, Mass.; Kontron Mid-Atlantic, Laurel, Md.; and Kontron West, Sunnyvale, Calif.

TO WATCH

RADIUS ROTATES ITS MAC MONITOR AND TARGETS IBM

The desktop publishing market continues to demand system-specific hardware, and a pivoting display-controller combination from Radius Inc. of San Jose, Calif., may start a new trend for the 1990s.

Aptly named the Pivot, the 19- and 21-in. diagonal monitors for Apple Computer Inc.'s Macintosh machine swing from a portrait (vertical) orientation to a landscape (horizontal) position. This movement allows for either large single-page displays or side-by-side, two-page displays.

When the Pivot is reoriented, a position-sensing device signals the controller card to rotate pixels at a rate of 51.27 MHz as they are sent from the interface to the display. At the same time, software automatically reorganizes the Macintosh's internal graphical interface as well.

Although primarily a Macintosh-oriented company for most of its five-year history, Radius is moving quickly into the IBM Corp. world.

At the Pivot product introduction, Radius president Mike Boich described the two-page-display market for the IBM sector as being equal to the Mac market in size. Radius started shipping its first two-page display for the IBM PC AT architecture last month.

Pivot displays two or four shades of gray and may be upgraded to 16. Resolution is 640 by 864 pixels in the landscape position. The display is priced at $995 and the controller lists for $695. The 19- or 21-in. PC-AT-compatible display is priced at $1,395 and its controller card, $795. E

NATIONAL'S ECL SERIES MIMICS TTL'S TRAITS

Responding to an increasing demand from systems designers for emitter-coupled logic that is as easy to use as TTL, National Semiconductor Corp. of Santa Clara, Calif., this month introduced a new ECL family: the F100k 300 series.

This new logic series boasts the same 750-ps switching rate as the 100k and 10k ECL familes that were first marketed by Motorola Inc. and later followed by similar product lines from other semiconductor makers.

But the F100k 300 series reduces the skew commonly found in ECL and—perhaps more importantly—adds a number of sought-after features. Among them: TTL-like power dissipation, operating temperature, electrostatic discharge tolerance, and supply-voltage ranges.

All this will boost acceptance of ECL among TTL users, says Peter Groth, ECL product marketing manager at National. So far, these users have been reluctant to shift to the more complex board-design rules of traditional ECL families, despite the throughput improvement. E

LSI LOGIC PUTS TOGETHER A SPARC SOLUTION FOR $1,300

Following a success strategy formulated by others in the personal computer market, LSI Logic Corp.'s Microprocessor Group in Milpitas, Calif., has devised a complete motherboard logic chip set to support the Sun Microsystems Inc. Sparc chip.

The Sparkit will create a path to low-end workstations competitive with high-end PCs based on CISC processors, says Prem Nath, the Sparc division's marketing manager. Besides the three core processing chips—the integer, floating-point, and memory-management units—Sparkit will have a memory-control unit, standard I/O controller, Mbus-to-Sbus controller, and the direct-memory-access controller. The chip set will be available in two speeds—25 and 40 MHz—which will deliver 18 million instructions/s and 29 mips, respectively.

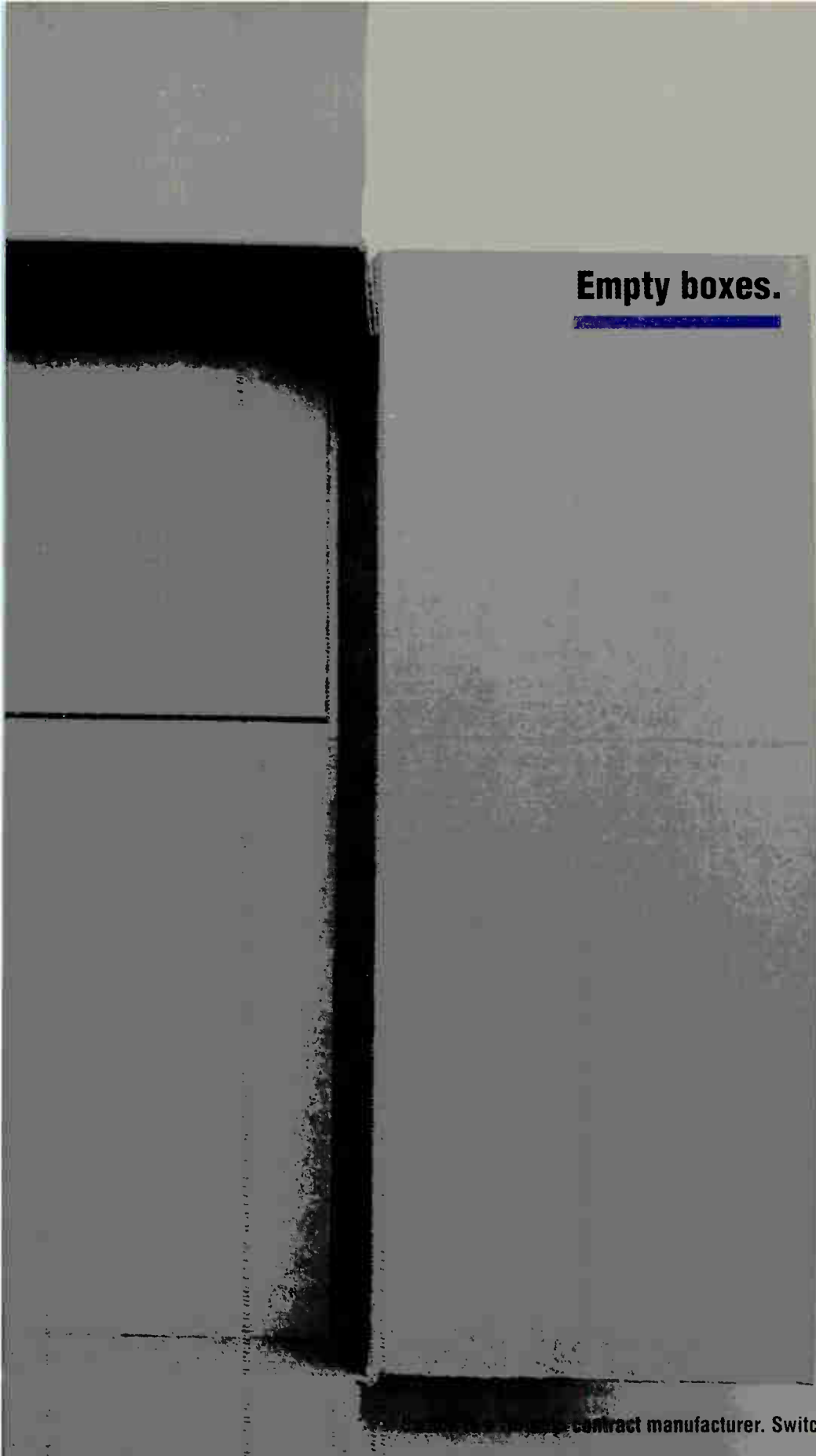
Samples of the 25-MHz set will be priced at $1,327 in 100-unit quantities. They will be available in June, with the 40-MHz version coming on line by the end of the year. E

TADPOLE'S 68040-BASED BOARD CHECKS IN AT 20 MIPS

Two single-board computers from Tadpole Technology Inc. use 25-MHz versions of Motorola Inc.'s 68040 to deliver up to 20 million instructions/s and 3.5 million floating-point instructions/s.

The Waltham, Mass., firm's TP40V and TP41V are the latest entries in the market for 68040-based products. Their performance places them between a 13.5-mips 68040 board from Heurikon Corp., Madison, Wis., and a 26-mips model from Force Computers Inc., Winchester, Calif., both of which were introduced recently [*Electronics*, February 1990, p. 21].

The TP40V offers a Small Computer Systems Interface and is aimed at high-end VMEbus applications that call for SCSI, networking, and serial input/output on one board. The TP41V provides a VSB bus interface for dual-bus architectures. Both sell for about $4,000, depending on options. Tadpole's TPIX version of Unix is available, as are various real-time kernels and development environments. E



Empty boxes.

Empty promises.

You can't build a production schedule on empty promises.

When your success depends on being first to market, nothing costs you more money — or credibility — than a product that isn't shipping.

Your contract manufacturer has to deliver on time. And there is no substitute for technical professionals who are flexible, responsive and dedicated to completing your product.

AVEX built its business by delivering SMT and through-hole products on time, to specifications and within budget. Our production team makes your emergencies *their* emergencies and does whatever it takes to get your product delivered on schedule.

[illegible] contract manufacturer. Switch to AVEX

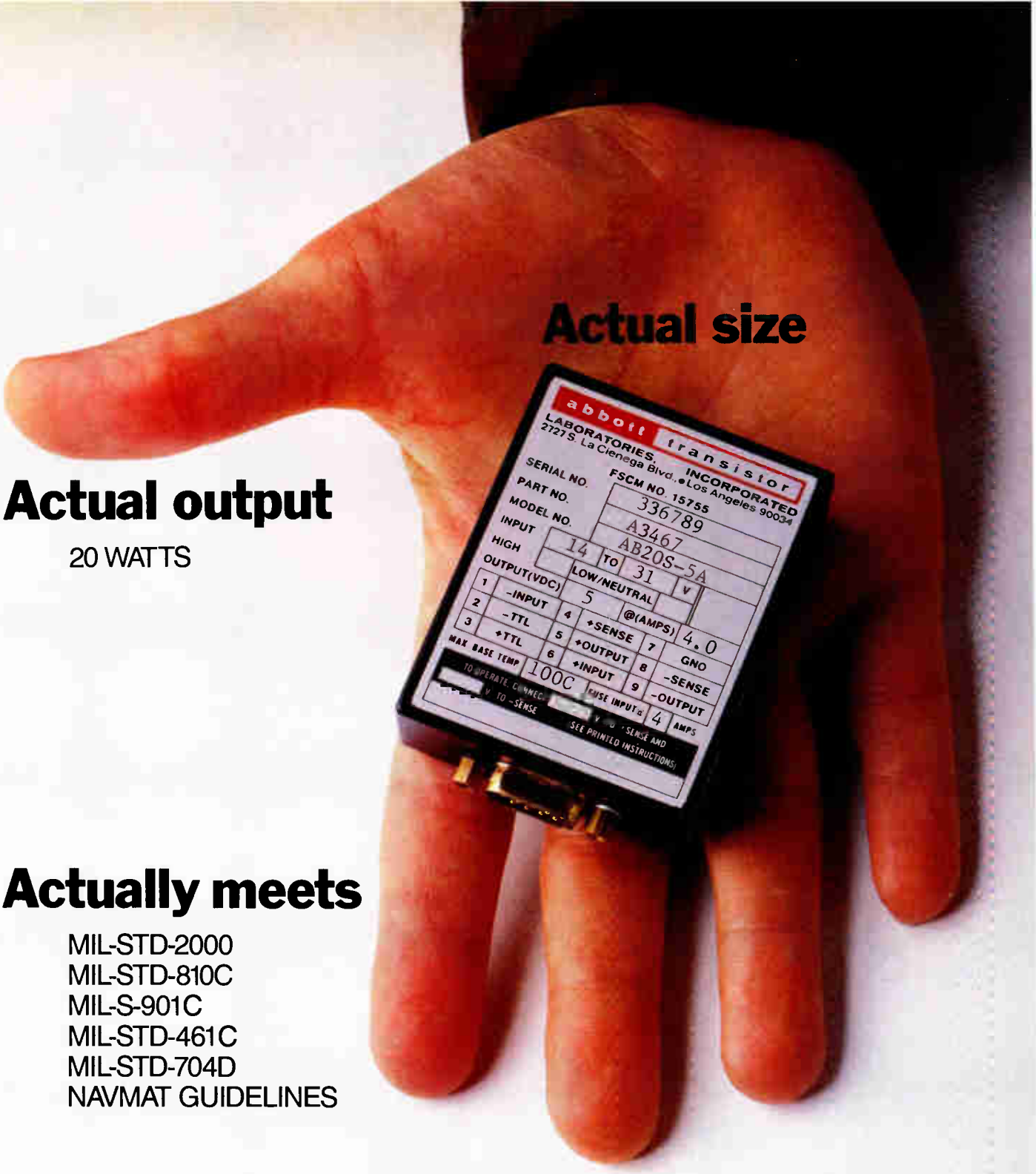
A Subsidiary of J. M. Huber Corporation

CONTRACT MANUFACTURING AND ENGINEERING SERVICES

Huntsville, Alabama ■ San Jose, California ■ Singapore
Nashua, New Hampshire ■ East Kilbride, Scotland

4807 Bradford Drive
Huntsville, AL 35805
Telephone (205) 722-6340
FAX (205) 722-6232

CIRCLE 296



Actual output

20 WATTS

Actually meets

MIL-STD-2000
MIL-STD-810C
MIL-S-901C
MIL-STD-461C
MIL-STD-704D
NAVMAT GUIDELINES

Mil/Pac™ high-density military power supplies. Introducing NDI DC-to-DC converters that meet an unprecedented combination of military design demands. Plus having the highest power-to-volume ratios of any full-mil qualified products.

Mil/Pacs come in 20W, 35W and 50W configurations, with single (5, 12, 15, 24, 28V) and dual (±12V; ±15V) outputs.

They handle a wide 14V to 31V range of input. And operate at temperature extremes from −55°C to +100°C.

Mil/Pacs are designed with a field-proven topology that's been verified by rigorous environmental stress screening. They're available with MIL-STD-2000, or without. Either way, the specs are worth reading.

Just write us at 2727 S. La Cienega Bl., Los Angeles, CA 90034. *Or* call (213) 936-8185.

abbott

WHEN RELIABILITY IS IMPERATIVE.™

CIRCLE 205

ELECTRONICS EXECUTIVES ARE HOPING FOR MOVEMENT IN MAY TO EASE EAST BLOC TRADE

COCOM DRAGS ITS FEET

BY ANDREW ROSENBAUM

ANYONE WHO WAS HOPing for a rapid relaxation of trade restrictions to the Eastern Bloc has a little bit longer to wait. Cocom, the international association that controls sales of security-sensitive technology, has so far been implacable. Insiders say the earliest any change might emerge is May.

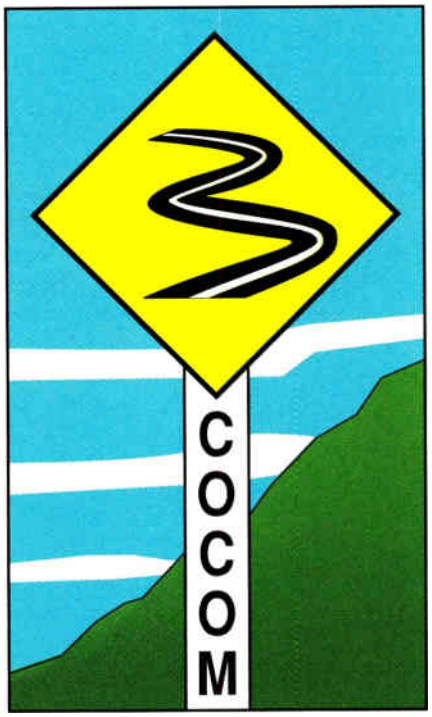
The global electronics industry had high hopes for a meeting of the group—formally, the Coordinating Committee for Multilateral Export Control—Feb. 14 in Paris. After all, the U. S., historically the most hard-line Cocom member, early this year had announced its support for a sweeping liberalization of export rules [*Electronics*, March 1990, p. 44].

"But virtually nothing did change," says Deborah Waggoner, manager for international trade policy at the American Electronics Association in Washington. The only exception, she says, was a shortening of the review procedure for exports from 12 weeks to eight. "The areas where we expected to see change, like the decontrol of too many low-end, older technologies that are still restricted, were not even addressed," she says.

That means that Western manufacturers still have to wait to enter Eastern Europe with their best products, while Southeast Asian manufacturers are already becoming established there, especially in computers. "It's a very frustrating situation," complains Simone Cools, East European manager for Intel Europe, based in Paris.

Despite its public support of trade relaxation, it was the U. S. that apparently held things up. When other nations—besides the U. S., Cocom members include the NATO allies, Japan, Australia, and Iceland—proposed relaxing many restrictions at the February summit, the U. S. tabled the proposals. Allied frustration rose to the point where the U. S. was accused of using Cocom to cut down on foreign competition. Negotiations are proceeding, but industry insiders—though hopeful of some movement in late spring—describe the atmosphere as tense.

The irony of U. S. foot-dragging is not lost on European-based firms, which are just waiting for their chance



to compete in the newly open Eastern European market. "This is a market of 420 million people. That's larger than that of the U. S. or of Western Europe," says Walter Schramm, marketing manager for Compaq Computer Corp. in Munich. "We simply can't afford not to reach it."

For example, Intel Europe has a seven-member task force ready to move its products into the East Bloc, if the restrictions are ever revised. "We are hoping for 386 deregulation this spring," says Cools. The company is already selling one computer in the East that it has been obliged to downgrade in order to meet Cocom rules, she says.

Similarly, Compaq has "only limited arrangements for sales in the East Bloc under current conditions," says Schramm. "Meanwhile, we have seen aggressive attempts by Southeast Asian clones to take over the market." Both Compaq and Intel are hoping that current discussions will lead to liberalized Cocom rules, perhaps as early as May. "We hope that SX technology will be freed up, as well as the 386 machines," says Schramm. "We have reason to believe that IBM-type mainframes in the range of 400 million instructions per second will also be decontrolled."

For its part, the U. S. State Department is optimistic that the changes will, indeed, arrive. In a statement released after the Feb. 14 conference, a spokesman said that the Cocom working parties would "undertake expeditiously" to "adapt the Cocom regulations to a changing environment."

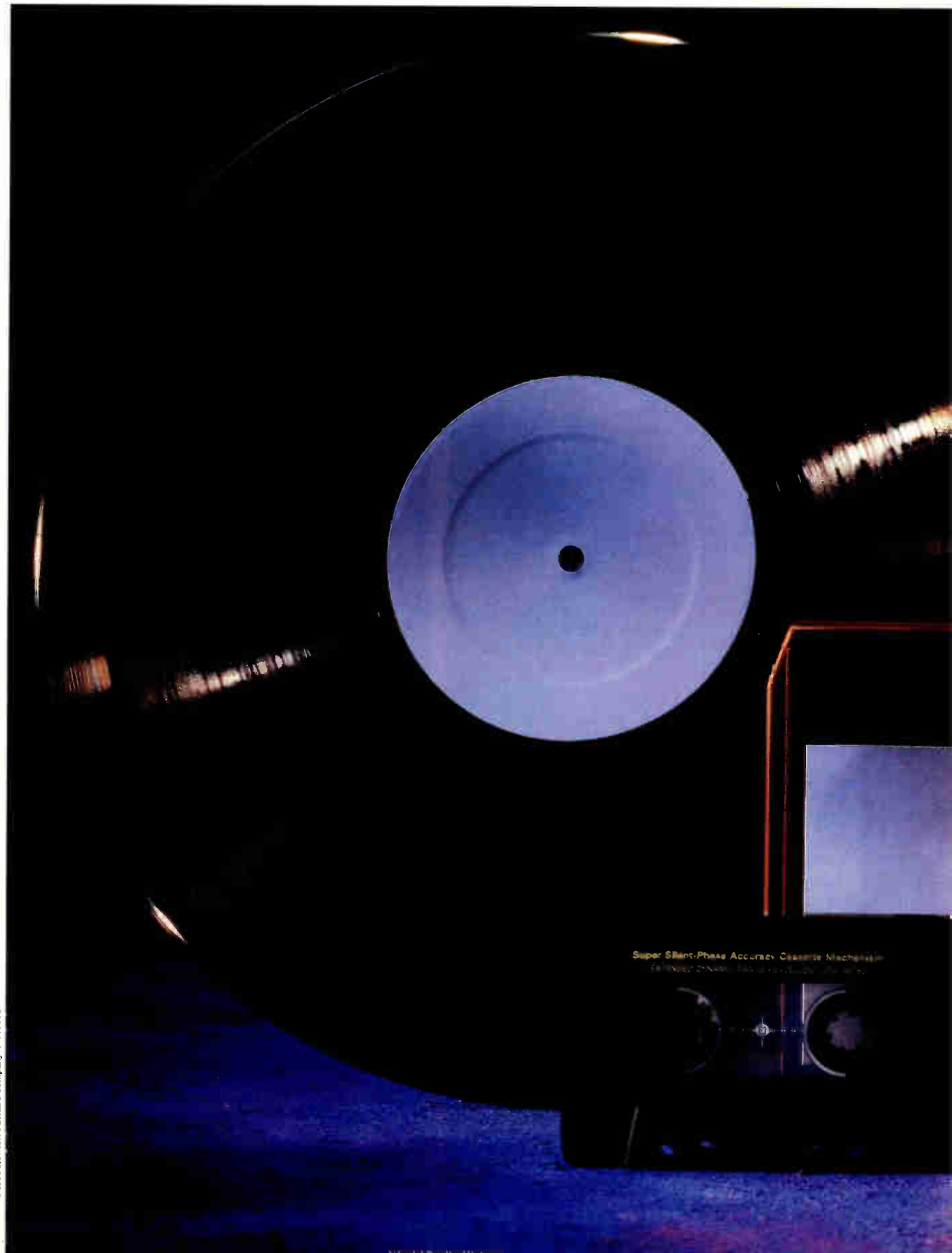
The AEA hopes that this will be the case. Besides seeking a significant number of reductions in the list of products under Cocom supervision, the group is pushing for other changes. One is the suppression of licenses within Cocom member countries, so that a license from one country would be valid for all of them.

"Sales are being lost because of [Cocom] policy," says the AEA's Waggoner, who believes the rules inhibit American competition unfairly. "The West just doesn't control technology anymore. There was a time when determining what the U. S. and Western Europe would export controlled the level of technology everywhere. That time is past."

The AEA would, in fact, like the Cocom member nations to consider whether the pact, forged after World War II, is still useful. "There is a real need to ask Cocom to move into the 21st century," Waggoner says.

For its part, Cocom itself is keeping mum. The organization is hidden away at a mission within the U. S. embassy in Paris. Embassy press officials won't help reporters gain access; there is no way to obtain official comment from the group.

What happens when the market



turns faster than your product?

In electronics, sometimes the life of your product is measured in months. But it can take years to get a product off the "drawing board" and onto the shelf.

Hewlett-Packard has a better way.

Solutions that combine computer products of the highest quality with industry-leading applications. Solutions that can dramatically reduce your design and manufacturing cycle times. Solutions that get your products to market before their best years are over.

In order to retain a leading position in an increasingly competitive semiconductor market, Texas Instruments looked to HP. An interactive network of HP Apollo Division workstations, running both proprietary and industry-standard design tools, helped TI reduce its design cycle time by over 50%. And it did so during a period when integrated circuit designs were doubling in complexity.

Even industrial-automation experts like Foxboro have turned to HP. Powered by HP computer systems, an underutilized Foxboro factory is now running with unprecedented efficiency. Inventory holding times have been slashed and production cycle time has been cut by more than 75%.

HP has achieved equally dramatic reductions in design and manufacturing cycle times for our own products, and our manufacturing and R&D managers would like to share their insights. To learn more about qualifying for an in-depth seminar at an HP manufacturing site, call **1-800-752-0900, Ext. 1029.** We'll start by sending you some informative case histories.

There is a better way.

HEWLETT PACKARD

CIRCLE 309

IBM SYSTEM/6000 COMES ON STRONG, LEAVING THE RT WORKSTATION JUST A BAD MEMORY

WORTH THE WAIT

BY LAWRENCE CURRAN

IF IBM CORP. DOESN'T take a sizable chunk of the workstation market with its long-awaited second-generation reduced-instruction-set-computing platforms, it won't be for lack of trying. Perhaps smarting from the failure of its original RISC workstation—the RT line—introduced four years ago, Big Blue has endowed the new family with impressive technology credentials and is pushing hard to get third-party software vendors to commit to the RISC System/6000.

Competitors and analysts aren't surprised at IBM's technology arsenal, which the System/6000 family abundantly reflects. Charles Casale, president of the Aberdeen Group, a Boston market-research firm, characterizes the semiconductor technology in the new workstations as "impressive. The basic architecture of the chips is quite good," he says. "Some of the beta users I've talked with say they've blown away a competitor's workstation by a factor of 3 : 1 running actual code. IBM's field sales people are ecstatic about the 6000."

But this product's success will be measured in large part in terms of how quickly third-party application software is available for it. Casale says he understands that "not much of the porting of applications is complete, and that's a real issue."

About 85 third-party developers demonstrated their applications at the New York and San Francisco introductions of the System/6000, and Big Blue hopes to have as many as 1,500 programs ported to the family by the end of the year. IBM is confident that 1,500 is a real number, says Jon Newman, manager of AIX application solutions in IBM's Personal Systems business unit in White Plains, N. Y. (AIX is IBM's version of Unix).

"We dealt with the applications challenge by starting the porting process as early as last summer," he says. "It's as aggressive a program as we could put together." To assist in that process, IBM opened 15 porting centers in the U. S., Canada, Europe, Japan, and the UK by the end of last month, and says it will open others in coming months.

Beta users say the 6000 has "blown away a competitor's workstation by 3 : 1 running actual code," an analyst reports.

But analyst Casale says that the computer giant may have another bomb to drop, one that could blunt the concern about software availability: a newer new product.

"IBM has everyone's attention after a blockbuster workstation announcement," Casale says. Now he sees evidence that the company is just waiting for the response from competitors—products likely to come soon from Digital Equipment, Hewlett-Packard, and Sun Microsystems in an attempt to steal the System/6000's thunder. Once that happens, Casale says, "It appears that IBM would be ready the next day to announce its next entry, which would again leapfrog the competitors" in performance.

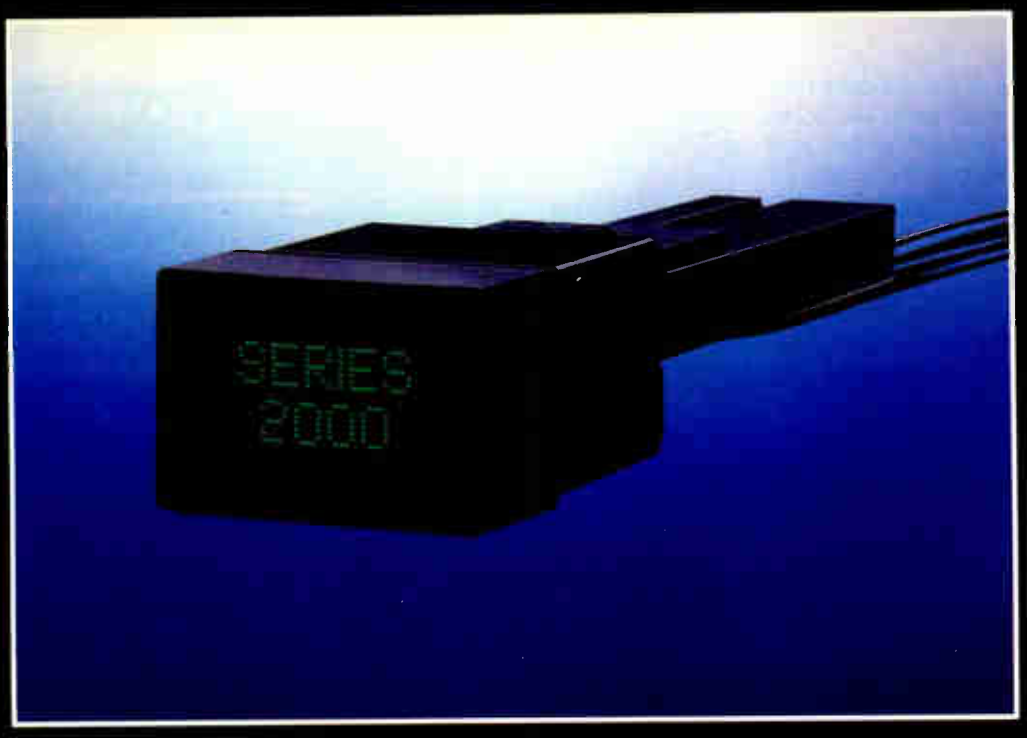
Asked about the likelihood of such a quick counter-response, an IBM spokesman says only that the original announcement included the news that additional entries are planned in the System/6000 family. These will include machines positioned both above and below the initial workstations unveiled in February.

Casale believes that Sun is the most vulnerable to market-share erosion from IBM because it doesn't have the product breadth that HP and DEC do to absorb low profit margins on workstations. "DEC and HP are extremely large and well-established. They can tolerate low margins in workstations for a while," he says. "But workstations are Sun's only business, and their margins are even lower. IBM [people] are masters at understanding financial statements" and then positioning their products shrewdly in response, Casale adds.

Sun Microsystems Inc. has a two-pronged reaction to IBM's products. On the one hand, the Mountain View, Calif., workstation market-share leader regards the System/6000 "as a definite plus for the Unix-based RISC market," says spokesman John Loiacono. "IBM was the last major holdout to support a RISC-Unix platform. Their solid second debut adds a lot of credibility to this style of computing. Their stature will drag a lot of historical IBM customers into the market who will evaluate other vendors, too, which will benefit us," Loiacono says.

But Sun's other response is that even IBM can't fly in the face of a customer clamor for standards, and Big Blue isn't providing the major industry standards in the System/6000 family, Loiacono maintains. "IBM is using an open-system/standards marketing approach when in reality they've taken a proprietary approach [technologically]."

The System/6000 chip set is propri-



The program in a switch.

Introducing Vivisun Series 2000, the programmable display pushbutton system that interfaces the operator with the host computer. The user friendly LED dot-matrix displays can display any graphics or alpha-numerics and are available in green, red or amber. They can efficiently guide the operator through any complex sequence, such as a checklist, with no errors and no wasted time.

They also simplify operator training as well as control panel design. Four Vivisun Series 2000 switches can replace 50 or more dedicated switches and the wiring that goes with them. In short, Vivisun Series 2000 gives you more control over everything including your costs.

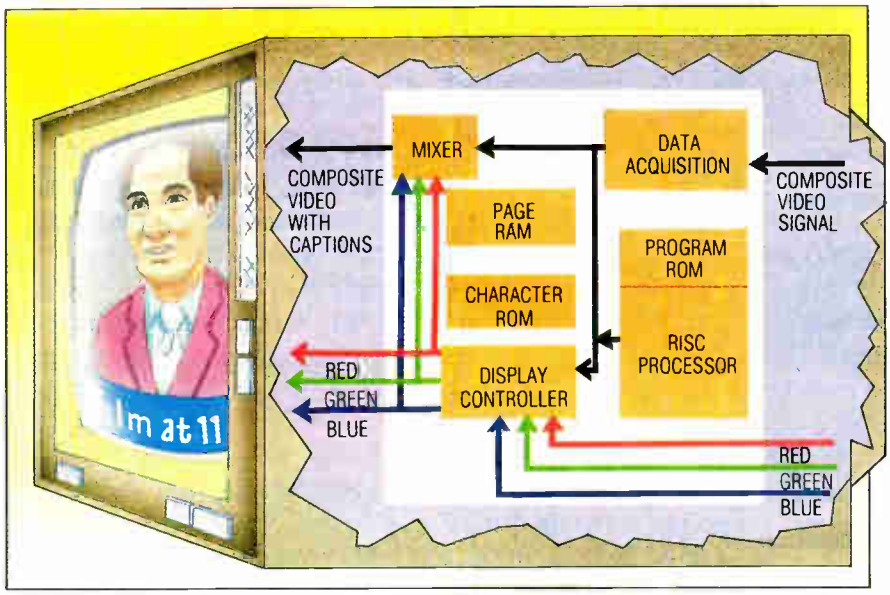
Contact us today.

AEROSPACE OPTICS INC.
3201 Sandy Lane, Fort Worth, Texas 76112
(817) 451-1141 · Telex 75-8461 · Fax (817) 654-3405

SERIES
VIVISUN 2000™

Programmable display switches. Making the complex simple.

CIRCLE 271



The chip takes the composite video signal from the receiver's baseband processing circuitry (far right) and feeds it to the data-acquisition stage.

CONSUMER

ITT CHIP IS THE FIRST TO PUT CAPTIONS ON A TV SCREEN FOR THE HEARING-IMPAIRED

SOLID-STATE CAPTIONS

BY JOHN GOSCH

BARELY SIX MONTHS AGO, the National Captioning Institute awarded ITT Corp. a $1 million contract to develop a chip that puts captions on a TV screen for deaf and hearing-impaired viewers. Already the landmark component is on its way to becoming a commercial device, with first silicon expected next month.

Built into a TV set to decode the digital captioning data contained in the 21st line in the vertical blanking interval of an NTSC signal, the chip was conceived at Intermetall GmbH, lead house of the ITT Semiconductors Group in Freiburg, West Germany.

Now in the final stages of development at the group's facility in Shelton, Mass., the chip could be available to set makers as engineering samples late this year. Receivers using the device could be on U. S. markets by late 1991 or 1992.

There are some 12 million Americans with hearing disabilities, 4 million of whom have said they would be interested in buying a caption-capable TV set, says Don Thieme, executive director for public affairs at the National Captioning Institute in Falls Church, Va. If that weren't enough to spur TV set makers to take notice of this market, some legislation might. Sen. Tom Harkin (D, Iowa) has introduced a bill to mandate caption-decoding devices in all TVs sold in the U. S. with screens of 13 in. or more. Introduced last December, the bill is with the Senate's Commerce Committee; a companion measure is to be introduced in the House this month.

Essentially, captioning, or line-21 technology, delivers the audio portions accompanying a TV program as text, which is displayed on the screen much like subtitles. The captions can be shown anywhere on the screen or can be scrolled over it, and the viewer can switch them on and off at will. Besides giving deaf and hearing-impaired people access to TV, such captions are also a boon to children and illiterate adults who are learning to read, and to anyone learning English as a second language.

Under the auspices of the NCI, the major networks and cable companies offer several hundred hours of captioned TV programs a week. To watch them, viewers now need a separate decoding unit that hooks into their TVs. The unit is bulky—about the size of a flat cigar box—and at about $100 it's also expensive.

The ITT chip, which will be priced at under $10 in quantity purchases, is the first solid-state solution. To meet NCI's needs, "the big challenge for us was to combine a number of technologies and functions on a single chip," says Ulrich Sieben, manager of ITT Semiconductors' Concept Engineering Department in Freiburg. First is the line-21 technology, which encompasses data acquisition, data processing, and on-screen display techniques.

This technology had to be married to that involving TV signal processing and decoding, which is ITT's forte. The company has been a leader in digital TV signal processing since it introduced its mainstay Digit 2000 chips in the early 1980s.

In addition to the high circuit integration, Sieben says, the captioning chip had to be low in cost, unlike the external decoding units with their many discrete components. Here too the company met its goal. The captioning chip's price tag is in line with ITT Semiconductors' policy of a $10 ceiling for any consumer circuit it sells.

Industry insiders believe that the chip will add only $20 to the retail cost of a TV receiver. Response from TV makers with whom the NCI has met to discuss the device "ranges from interested to downright enthusiastic," according to Thieme. The chip could also be built into an add-on decoder box to make that alternative smaller and less expensive, or into video cassette recorders and cable converters to produce captions on a TV screen.

The chip takes the composite video signal coming from the receiver's baseband processing circuitry and feeds it to the data-acquisition stage. This stage separates the digital captioning data in line 21 from the video signal and decodes instructions as to where the caption should appear on the screen.

A reduced-instruction-set processor interprets the captioning data stream

and generates the captions to be displayed. For this, the RISC processor uses the program contained in a 2-Kbyte read-only memory. The processor is built around a 65C02 core from Western Design Center in Mesa, Ariz., which Intermetall souped up to give it the speed to handle high-frequency TV signals.

A page random-access memory, which builds up a page or part of a page of text information, feeds its data to a display controller. The latter, together with a character ROM, transforms the text information into the red, green, and blue color components of the characters. These are then displayed as written words on the screen.

The chip will be made in 1.2-μm technology and will be housed in a 24-pin dual in-line plastic package. It will be manufactured either at the Shelton facility or in Freiburg.

ITT has no plans to market the chip in Europe, where captioning has a limited market at present because of the widespread use of teletext as an alternative. Though not many TVs are set up for teletext, the concept—which displays the information that TV stations transmit in a blanking interval along with the TV program—is gaining popularity, especially in West Germany. A disadvantage of teletext is that its signal frequency is too high—around 6 MHz—to be recorded with a VCR. Captioning, by contrast, uses a signal with a frequency around 1 MHz, making it VCR-recordable.

The NCI, a nonprofit, partially government-funded organization, is now lobbying with consumer electronics makers to make caption-capable sets available. The group is responding to the recent Commission on Education of the Deaf report to the President. E

Additional reporting provided by Jacqueline Damian

MICROMACHINING

WEST GERMAN RESEARCHERS' SILICON MICROPUMP IS A MICROMACHINING COUP

TINY JUST GOT SMALLER

BY JOHN GOSCH

IMAGINE, IF YOU CAN, A tiny pump made entirely of silicon, a pump so small that it fits on the head of a nail and can transport up to 20 ml of fluid a minute without needing any moving parts. Such a pump is not a fantasy—it's the latest product in the field of micromachining, a technology that combines microelectronics and micromechanics.

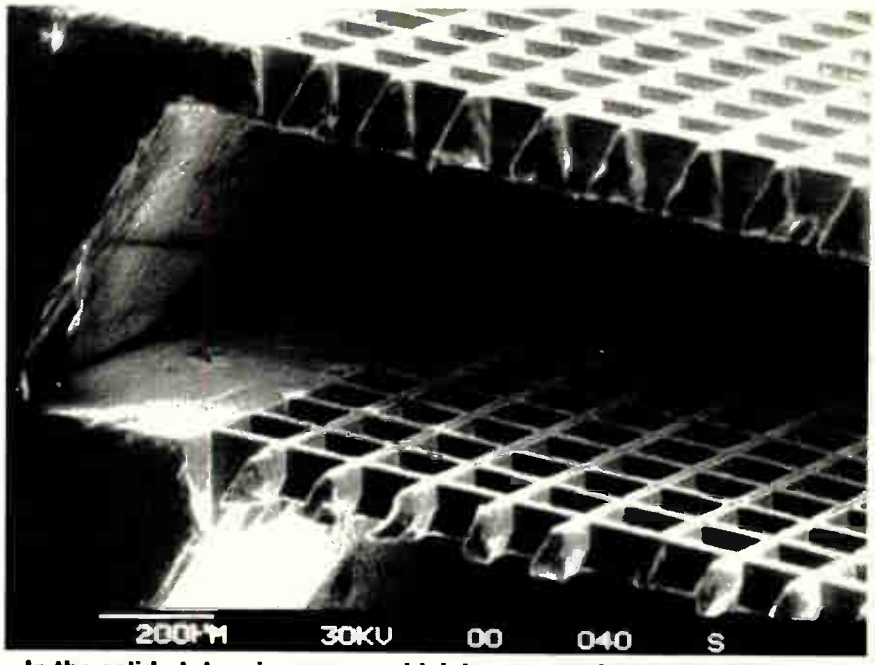
Now getting off the ground in Europe and the U. S., micromachining makes it possible to build electromechanical devices in the millimeter and even submillimeter range for use in electronics, robotics, optics, medicine, chemistry, and fluidics.

The micropump comes from the Fraunhofer Institute for Solid State Technology (IFT) in Munich, West Germany. Active in micromachining since the late 1970s, this government-supported institute is Europe's first organization to dive into the new technology and one of the world's few research centers pursuing it. Others are located at the University of California at Berkeley and the Massachusetts Institute of Technology.

Using micromachining, which is basically an etching technique, IFT has so far built force transducers, accelerometers, and pressure, thermal, and flow sensors, some of which are being fabricated in volume at semiconductor manufacturers for industrial applications. For the micropump, too, "there's much industry interest, not only in Europe but worldwide," says Axel Richter, the device's inventor.

Richter started developing the pump just last summer and had prototypes ready late last year. Its operation is based on a principle dating back to the last century: when a voltage is applied across a pair of electrodes submerged in a dielectric fluid, tiny drops of this fluid will rise on one of the electrodes. This so-called electrohydrodynamic (EHD) principle remained unexploited till the 1960s when researchers in the U. S. and Europe built EHD pumps with no moving parts for heat pipes. But the pumps remained a laboratory curiosity. They were too bulky and required too much juice—up to 40 kV—for practical applications. But now micromachining is making it possible to miniaturize low-voltage EHD pumps, opening the door for widespread use.

Basically, the IFT device is an injection pump consisting of two electrodes



In the solid-state micropump, which has no moving parts, fluid flows through orifices in the top and bottom electrodes or grid structures.

designed as 3-by-3-mm grid structures made of monocrystalline silicon and stacked on top of one another. They are separated by a 3.0-μm insulation layer. Structures of this sort can be fabricated precisely and in bulk with etching processes that are common in chip-making technology.

Each structure, about 30 μm thick, has an array of orifices each roughly 70 μm across. The spacing between the structures is currently 380 μm, but this distance can be varied over a wide range through the etching process. The volume the two structures enclose is about 3 μl.

When this micropump is submerged in a polar fluid—one containing ions or dipoles—and a voltage is applied across the two grid structures, forces acting on the fluid particles are generated by the interaction between the high electric fields and the fluid's ions or dipoles.

The fluid particles are accelerated between the structures, thus generating a fluid motion through the orifices in one direction. When the voltage across the structures is reversed, the fluid flows in the other direction.

THIS WAY, A VARIETY OF oils and polar fluids—such as ethanol, methanol, acetone, freon, and a host of other nonconducting fluids with a specific resistance ranging from 10^{10} to 10^{14} Ω/cm—can be pumped. Ordinary water cannot be pumped, since electrolysis sets in under the influence of the electric fields.

The voltage applied across the grid structures may be between 40 and 700 V, but in most applications it is below 100 V, Richter says. As a rule, for a given field strength, the smaller the distance between the structures, the lower the voltage across them can be made. The pressure and throughput are determined by the grid size, the size and shape of the orifices, and the operating voltage. The maximum throughput is 20 ml/min.

With no moving parts, the IFT micropump is wear-resistant, highly reliable, and easy to fabricate. Among the possible applications are microminiaturized ethanol- and methanol-based cooling systems for electronic components, says Hermann Sandmaier, head of IFT's Sensor and Actuator Department. Other possibilities are devices to actuate small membranes used in electronics, and microhydraulic actuators, he says.

REPORT URGES A LONG-LINES MARKET, CENTRAL R&D, AND EVEN AN FCC FOR EUROPE

GETTING THAT U. S. RING

BY PETER FLETCHER

IF A GROUP OF MARKET analysts is right, by the end of the century Europe will have a familiar ring to U. S. telephone companies. In a study commissioned by the European Community's telecommunications policy body, one of the prime conclusions is that Europe must have continent-wide integrated broadband communications with universal access. And that means the establishment of an independent long-distance carrier market, the study says.

THE NEW BROADBAND NETWORK MUST BE USED FOR HOMES AS WELL AS BUSINESSES, WHICH MEANS IT MUST ALSO CARRY TV

The report, called "Perspectives on Advanced Communications for Europe," known as PACE, was put together by analysts from seven companies in Paris, London, Munich, Milan, Tokyo, and the U. S. In addition to a long-lines market, the PACE group also wants Europe to have its own equivalent of Bell Communications Research (Bellcore) and the Federal Communications Commission. The current national administrations would then take on some of the functions of the U. S. state public utility commissions.

Behind the political changes is the urgent need for a broadband switched telecommunications service capable of delivering data at a rate of at least 150 Mbits/s end-to-end right across Europe. Usage by business and residential users could generate carrier revenues of at least $10 billion by the year 2000.

Achieving that level of revenue will depend on the integrated broadband communications network, or IBC, being used for homes as well as business purposes—and that means it must carry TV programs. But "unless legislation prohibiting telephone companies from providing home entertainment video is changed, revenues generated by residential broadband services are expected to remain marginal at less than 10% of the total," says the report.

The situation that British Telecom faces in the UK highlights the regulatory problem. There, cable TV franchise holders may be licensed to carry business and residential telephony traffic and to switch it from one cable territory to the next where there is a common boundary. So for the first time British Telecom is facing the prospect of stiff competition for local telephone services. The logical counter to this competition would be for BT to carry competing video signals over its telephone network. But that is proscribed by the current regulations.

However, there is a technical solution, the PACE team concludes. They believe the personal computer could become the high-definition TV set of the future and solve the regulatory anomaly that is currently frustrating telecommunications operators and administrations in parts of Europe and the U. S. alike.

If PCs used as data communications terminals were able to reproduce real-time, moving photographic-quality images and sound as an inherent part of an overall "document image processing" capability, then the information content of data signals carried to them could not be differentiated. The network would see no difference between

a TV transmission and, say, a video-conference session, a voice-mail message, or a high-speed burst of data transferring account files.

As the PACE authors point out: "Besides its stand-alone interest, PC-based digital video technology presents enormous potential for broadband communications which can be exploited by Telecommunications Administrations with no regulatory constraint." At the same time, they believe, "there is every likelihood that this technology will enjoy earlier and bigger market growth than high-definition TV."

They recommend that "research aimed a developing a strong European position in the area should be considered a top priority."

However, the technical problems are far from trivial. The HDTV standards currently under discussion in Europe, Japan, and the U. S. all assume that they will display an image composed of at least 1 million pixels. Each pixel needs at least 12 binary bits of information associated with it. And the whole 12-Mbit picture needs to be refreshed at a rate of 20 or 30 times a second. That is equivalent to a data transmission rate of around 3,000 Mbits/s, requiring the equivalent of a supercomputer to process.

But developments in the design and production of very complex chips coupled with advances in digital signal processing and parallel computing have evolved to the point where a system can be reduced to just one printed-circuit board that could sell for less than the price of a current top-range conventional domestic TV receiver.

THE CONSULTANTS HAVE in mind the development of Intel Corp.'s Digital Video Interactive (DVI) system invented in the U. S. at the then RCA Sarnoff Laboratories. It features a digital-compression technique that can effect a 100 : 1 reduction of audiovisual data. The implication is that in telecommunications terms, a signal with all the information needed to generate an HDTV-quality image could be carried at a data rate of less than 40 Mbits/s—well within the capabilities of broadband switched networks now being planned, and in some cases built, in the U. S. and Europe. Next, the technology provides for real-time reproduction, and third, it offers a fully interactive graphics controller for a broad array of video effects.

By the end of 1991, Intel plans to have ready a single-board implementation of the circuitry needed. It will be designed to be added to an IBM PS/2 or compatible PC and is to cost around $500. A year later that price could be reduced by half. It looks as though the success of the technology is assured with its adoption by IBM, and a score of other companies are reported to be working to produce software for such systems.

THE NET RESULT, STATES the report, is that "a solid-state machine, tied to fully digital low-powered fiber-optic networks, is no longer a remote proposition. All that is needed for BT and its colleagues in other countries to take full advantage of the capabilities of this and similar technologies is the installation of optical-fiber links into business and residential premises."

Whether the EC will adopt the findings of the PACE report is another question. In the meantime, though, some of the U. S. Regional Bell Operating Companies are busy getting ready, by buying into cable TV operations in the UK and, more recently, France. Already London is ringed by a half dozen cable companies, mostly controlled by outfits such as Pacific Telesis Inc. of San Francisco and U. S. West Corp. of Denver.

Out in the English provinces, U. S. West is involved in major metropolitan franchises. Pacific Telesis' newly formed Pactel Cable Communications Inc. has total ownership of a license and is a partner in two major provincial centers. Now Nynex Corp. of White Plains, N. Y., is angling for no less than four franchises to cover the Manchester area. All of these networks plan to offer local telephony services

In the meantime, on the European mainland, Bell South Corp. of Atlanta has taken a stake in Communications-Developpment (Com-Dev), the communications arm of a French holding company, Caisse des Depots-Developpment of Paris. Com-Dev has a majority position in 21 French cable networks that together cover 2.1 million homes. Also in France, U. S. West has bought 10% of Lyonnaise Communications SA, while Nynex has formed a joint venture with the government of Gibraltar for a combined telephone and TV broadband cable network for the entire colony.

IN MEMORY OF TOM MANUEL

If words could weep, this page would be filled with tears for our dear friend and associate Tom Manuel, who died on Feb. 14. His death came after a prolonged illness that in the months since summer offered periods of hope and despair for Tom and for all of us close to him. Throughout the ordeal he carried on in illness as he had in health, with a quiet dignity and an indomitable will hidden beneath his patient, kind, and soft-spoken manner.

Tom Manuel's life and work bear witness to his powerful intellect. A graduate of the University of Alberta in his native Canada with a degree in physics, he worked for Canada's atomic energy authority before entering Stanford University for postgraduate work. That was in the early 1960s, just as the semiconductor revolution was starting to change the world. In 1967 Tom joined Tymshare Inc. in Sunnyvale, Calif., where he worked in jobs ranging from quality and reliability assurance to developing pilot applications. He once described how he convinced Tymshare to make computer time available to Sunnyvale high school students, and savored the possibility that Apple Computer founder Steve Wozniak, a Sunnyvale grad, might have learned computing on a Tymshare terminal.

TOM MANUEL

In 1977 Tom founded his own company, Magnacon Corp. in Santa Clara, Calif., providing market research, product marketing, and program-management computer consulting. After three years as an entrepreneur, he decided to head east to join *Electronics* in the Big Apple, where he became the magazine's expert on computers, computer peripherals, and software.

Tom probably understood the technology and grasped the economic trends driving these industries better than any journalist covering the field. And he delighted in explaining it all in print. "It is one of the great pleasures of my job to sit down with the executives and designers to learn the details of a technical achievement and get a small peek at how it was done, and then present that clearly to our readers," he said. He introduced the HP Spectrum computer architecture to the world in the March 3, 1986 issue, and remarked on completing that assignment, "I still have this sense that I have only seen the tip of the iceberg in this developing technology."

Beyond his professional achievements, Tom will be remembered for his eclectic interests. When asked what he found so compelling about New York, he cited the abundant cultural and ethnic diversity of the place. Besides being a cultural explorer, he was a wilderness explorer. He found much pleasure in hiking up a remote mountainside, and his wanderlust led him to seek out new places to explore. The Pacific Northwest was a favorite haunt, and he often spent weekends after a business trip visiting its many wilderness parks. Before his illness, he had planned an ambitious trip to Australia as well as a move back to California, the state that his family calls home. Tom was also a gourmet cook and a wine buff, and for a brief time owned a catering business in northern California. He loved discovering new restaurants and new vintages. Whenever special occasions brought the *Electronics* editorial staff together late on a Friday night, Tom would invariably bring in a selection of wine and cheese to liven the event.

For his many friends who have asked for a way to honor his memory, Tom was committed to environmental causes. His family suggests that a donation to the Nature Conservancy or the Sierra Club would be a fitting gesture.

JONAH McLEOD
EDITOR

At TI, we cover your ASIC needs from silicon to software to service and support.

Few ASIC suppliers match TI's breadth of choice and depth of support in helping you develop the most efficient round peg for a round hole. As you see below, our ASIC family spans the architectural spectrum from PLDs to standard cells.

PLDs: High performance, low risk

PLDs are a low-risk, affordable design solution for high-speed-logic consolidation. Stocked on TI distributors' shelves, they allow a quick ramp to volume production.

TI offers more than 40 PLD functions in industry-standard architectures, including the high-speed, 7.5-ns TIBPAL16XX-7 and TIBPAL20XX-7. For high-performance applications, TI also offers unique functions such as the programmable sequence generator, TIBPSG507, and one of industry's fastest programmable address decoders, the 6-ns TIBPAL18N8-6.

Programming is quick and easy using readily available, third-party design software and programming hardware. For your high-volume production requirements, programming and testing services are available both from TI and authorized distributors.

When low power and reprogrammability are important, an erasable PLD (EPLD) gives you the freedom to make design changes quickly and easily. For high-volume production requirements, EPLDs are also available in one-time-programmable plastic packages.

To move your EPLD design rapidly from concept to silicon, the TI EPLD Development System accepts a variety of entry formats. These include schematic capture, Boolean equations, state-machine diagrams, and truth tables. TI's desktop CAE tool runs on an IBM®-compatible PC-AT™.

FPGAs: Best of two worlds

Like PLDs, FPGAs are user programmable, provide rapid design and debug, are simple to use, and are virtually risk-free. Like masked gate arrays, FPGAs feature high gate densities, high performance, a large number of user-definable I/Os, and a gate array-like design environment.

Currently available are TI's TPC1010A (1200 gates) and the TPC1020A (2000), with higher densities to follow. Unlike PLDs and gate arrays, FPGAs have a unique architecture that allows 100% observability of the internal circuitry. This provides flexibility of design verification, either "in-circuit" or "in the programming box."

The TI Action Logic System (TI-ALS) is a powerful development tool for implementing your FPGA designs while avoiding NRE fees. The TI-ALS accepts designs from popular CAE software packages including Viewlogic™, OrCAD™, Mentor Graphics™, and Valid™ — resident on PC386, Apollo™, and Sun-3™ platforms.

Gate arrays for greater differentiation

For applications requiring higher-density, high-performance ASICs with fast prototype delivery, TI's TGC100 Series 1-micron gate arrays are an excellent choice. Offering gate-array complexities up to 26K gates and 256 I/Os, the TGC100 Series utilizes familiar general-purpose logic libraries. You can define macros and pinouts, as well as specify packages with pin counts up to 256 pins.

A comprehensive design kit provides the information you need to easily implement your gate-array design.

ASIC design centers, located at TI's Regional Technology Centers, are staffed with design specialists who are ready to help you.

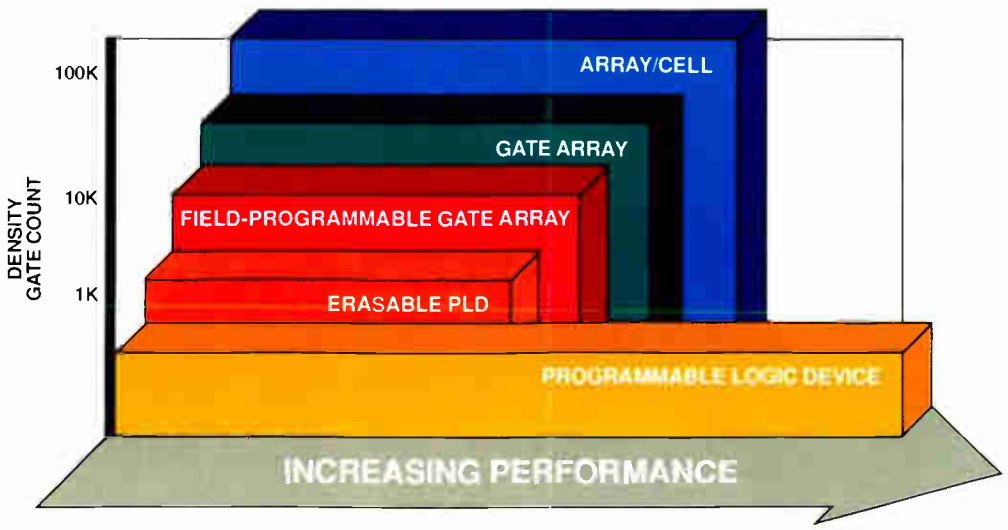
Standard cells: As specific, as complex as you need

For ultimate performance and system integration, TI's TSC500 Series is your choice. The extensive cell library contains high-performance memory, register files, FIFOs, and MegaModule™ building blocks. Realizing the need to incorporate design-for-test into today's high-density ASICs, TI also includes JTAG-compatible SCOPE™ testability cells in its library.

Thus, you can tailor a standard-cell design to meet your exact system requirements. As with our gate arrays, a design kit is available, as well as technical design assistance through TI's ASIC design centers.

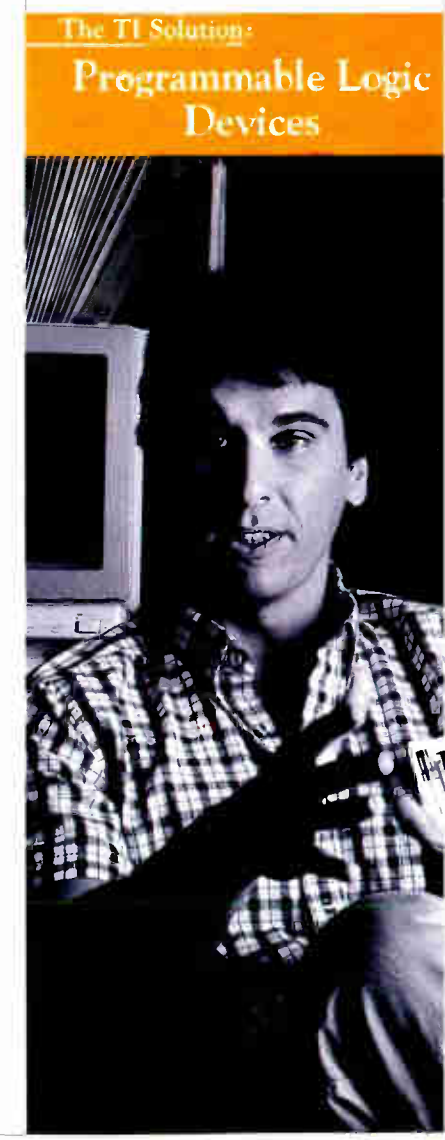
For details about the support and service TI offers, please turn the page.

TI's ASIC PRODUCT SPECTRUM



"I need a high-speed part with unique functionality. Standard architecture is a big priority, too. Plus, I'm going into production and need volume delivery now."

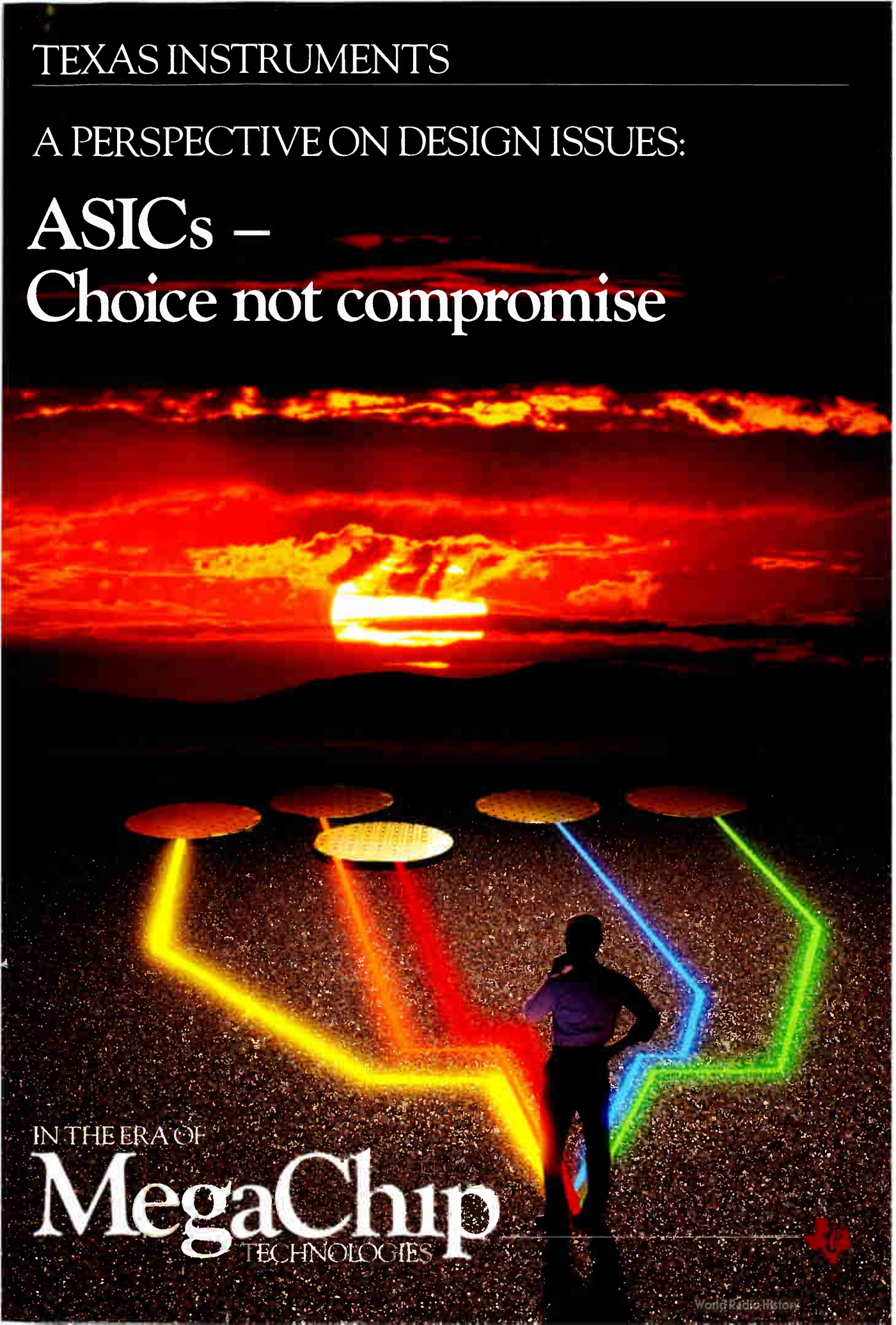
The TI Solution:
Programmable Logic Devices



TEXAS INSTRUMENTS

A PERSPECTIVE ON DESIGN ISSUES:

ASICs – Choice not compromise



A PERSPECTIVE ON ASIC DESIGN

"At Texas Instruments, you have the choices you need to get the ASIC you need. That's the difference between an ASIC device and an ASIC solution."

"An ASIC solution is more than a choice of silicon. To keep you from compromising on a square peg for a round hole, an ASIC solution involves many considerations: Your performance needs. How much control you want to exercise. The amount of support you require. What you can spend. How narrow your market window is. It's the result of you and your supplier weighing all the choices and reaching a balanced decision. At Texas Instruments, that's the way we like to work.

"A solution should not limit you to 'classic' ASICs — gate arrays and standard cells. That's why TI includes user programmables in its ASIC lineup. We manufacture high-performance, programmable logic devices (PLDs) and high-density, field-programmable gate arrays (FPGAs).

"Such a broad choice allows you to make better value judgments about control, NRE investment, and cycle times.

"TI advocates open-system CAD architectures instead of confining you to proprietary CAD systems. We support both PC- and workstation-based design systems.

"We provide as much advice and counsel as you need or want just about anywhere in the world. Our documentation is so comprehensive it can fill your bookcase as it fills your needs.

"We are looking to future solutions. For example, we are developing submicron CMOS and BiCMOS gate arrays and standard cells with densities over 100K gates. We are extending our support by developing software that migrates FPGA designs to mask-programmed gate arrays.

"An ASIC solution also brings with it assurances of the supplier's dependability, stability, and capability to produce and deliver.

"At TI, we invite you to experience the difference between compromise and choice — the difference between an ASIC device and an ASIC solution."

Walden C. Rhines, Ph.D.
Executive Vice President, Semiconductor Group
Texas Instruments Incorporated

"On my schedule, delivery delays and unnecessary risks are out. Our design requires the density of a gate array, but we need to handle all the programmation ourselves."

The TI Solution:

Field-Programmable Gate Arrays

"The system my team is designing calls for a high-density, high-performance ASIC. I want to call the shots on pin count, pinout definition, and the package itself. Fast prototype cycle time, JIT delivery, and low cost are mandatory."

The TI Solution:

Gate Arrays

"We are developing a unique product that requires high-speed memory and other complex functions integrated on the same chip. Surface-mount, high-pin-count packaging is a major requirement."

The TI Solution:

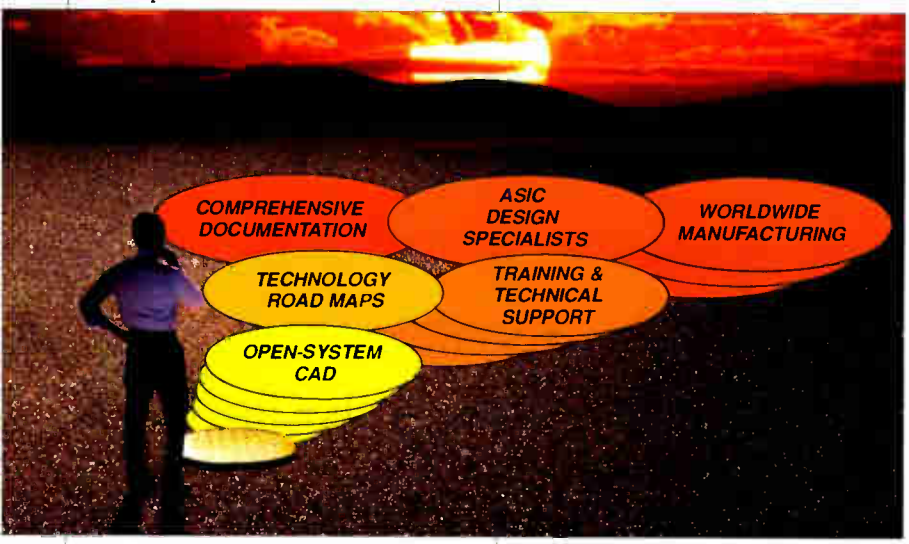
Standard Cells

The sun never sets on TI's service and support.

That's literally true. We have facilities and sites around the world. From early in your design cycle until you have the ASIC solution you envision, TI support and service are available wherever you are.

This around-the-world service and support include that which you have come to expect from TI: Comprehensive documentation and technical literature. Workshop training at our Regional Technology Centers. ASIC design and applications specialists to provide one-on-one advice and counsel. Development hardware and software.

Our design flow is straightforward and minimizes the possibility of surprises.



Our worldwide wafer-fabrication capability is unmatched and moving into the submicron era. We have disclosed a 106K gate array fabricated with our EPIC™-II, 0.8-micron BiCMOS process technology.

Such extensive service and support satisfy the majority of our customers' requirements, resulting in round pegs for round holes. But what if you are one of those whose ASIC solution must be a peg of unusual shape?

Tailoring the "fit"

In these special instances, we will tailor our procedures to your needs, striving to be as "application specific" as the term implies.

For example, certain business issues become very important when a programmable ASIC is best for you. Here, rapidly changing market conditions require absolute supplier dependability.

We can work with you to maintain your inventory levels. We can adapt our production to support your ship-to-stock or just-in-time programs. And if you'd like, we can deliver programmed or unprogrammed PLDs and other ASICs symbolized to your specifications to reduce your internal handling.

We are well aware that an ASIC solution is more than silicon, more than standard service and support.

You may want us to analyze your evolving ASIC designs and needs with you in relation to our evolving technologies. We can "tweak" our design flow to suit your requirements and integrate our design tools within your proprietary CAD systems when required. If your design calls for a proprietary function, we can also create a custom cell to suit your needs.

We at TI are willing to go the extra mile in service and support in order to achieve the ASIC solution best for you.

TI's MegaChip™ Technologies are the means by which we can help you and your company get to market faster with better, more competitive products. Our emphasis on volume manufacturing of high-density circuits is the catalyst for ongoing advances in how we design, process, and manufacture semiconductors and in how we serve our customers.

Four free ASIC DataFiles: Your choices start here and now

We've put together an ASIC DataFile — an informative package of data sheets, product bulletins, and other pertinent literature — on each type of ASIC we offer: Programmable logic devices (PLDs and EPLDs), field-programmable gate arrays (FPGAs), gate arrays, and standard cells. Choose the ASIC DataFile of greatest interest to you, or refuse to compromise and get all four. Call 1-800-336-5236, ext. 3706, and tell us what to send and where. Or write Texas Instruments Incorporated, P.O. Box 809066, Dallas, Texas 75380-9066.

TEXAS INSTRUMENTS

FLUKE®

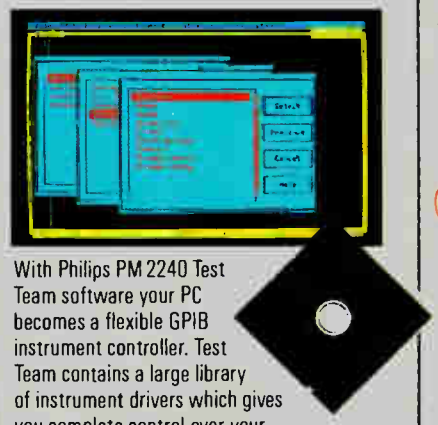
PHILIPS

Motor control boards get the Alliance test

The alliance between test and measurement giants Fluke and Philips is excellent news if you're involved in configuring a GPIB test system controlled by a PC.

The two companies are among the world leaders in instrumentation for GPIB systems. Following the alliance between them the product range now offers the best choice for PC-based GPIB instrumentation systems including:
oscilloscopes; generators; timer/counters; multimeters; switching and I/O; interfaces and software packages.

Software to cut development times



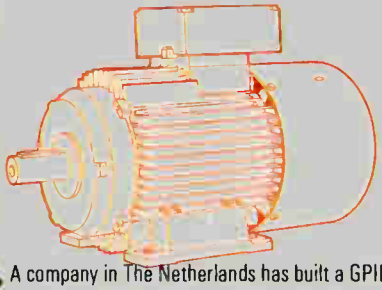
With Philips PM 2240 Test Team software your PC becomes a flexible GPIB instrument controller. Test Team contains a large library of instrument drivers which gives you complete control over your instruments without worrying about cryptic command strings.

With fast and simple program generation, plus ready-to-use graphics and analysis libraries, you can look forward to shorter development times.

GPIB interfaces for PC and PS/2

Philips offers GPIB interface cards for the PC (PM 2201) and for the PS/2 (PM 2202). All Philips GPIB software packages can be executed on PC and PS/2 and application programs written on PC can be executed on PS/2 and vice versa - that's part of our commitment to protect your investment now and in the future.

Motor Control PCB Tester



A company in The Netherlands has built a GPIB system for testing motor control printed circuit boards. The boards are built into a VME rack system used to control the heavy electrical motors in trams and trains.

This application uses two Fluke 8840 multimeters for various measurements on the PCBs. In this case the speed of data transmission over the system bus was the main reason for choosing the Fluke 8840.

Spotlight on Multimeters

The range of multimeters now offered by Fluke and Philips is one of the most comprehensive from a single supplier.
Specifications range from complex instruments for highly accurate bench measurements to tough go-anywhere handheld models for field work.
For systems builders, many models have the option of GPIB/IEEE 488, RS232 or other standard interfaces. This is encouraging for the builders of ATE since nearly every test system requires at least one multimeter and the Alliance now has a range to cover most applications.

For more information about PC controlled GPIB systems contact your local Philips sales office:

For further information, call your local supplier:
Austria (0222) 60101-1772, Belgium (02) 5256692/94, Denmark (31) 572222, Finland (0) 5026371, France (1) 49428080, Germany (561) 501466, Great Britain (923) 240511, Ireland (61) 330333, Italy (039) 3635240/8/9, Netherlands (13)390112, Norway (2) 741010, Portugal (1) 683121, Spain (1) 4042200, Sweden (8) 7031000, Switzerland (1) 4882390.
For countries not listed, write to: Philips I&E, T&M Department, Building TO III-1, 5600 MD Eindhoven, The Netherlands.

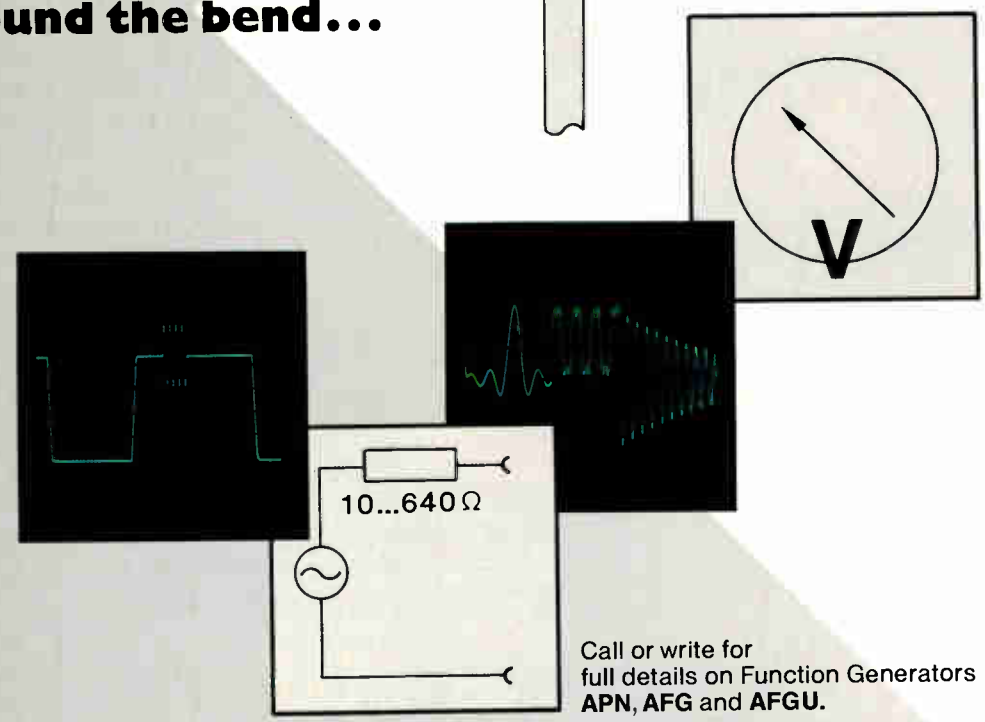
PHILIPS

PHILIPS

Function Generators

from R&S
1 µHz to 50 MHz

No curve will send you round the bend...



Call or write for
full details on Function Generators
APN, **AFG** and **AFGU.**

D-8000 München 80
Postfach 80 14 69
Telex 523 703 (rs d)
Telefax (0 89) 41 29-21 64
Tel. internat. +(49 89) 41 29-0

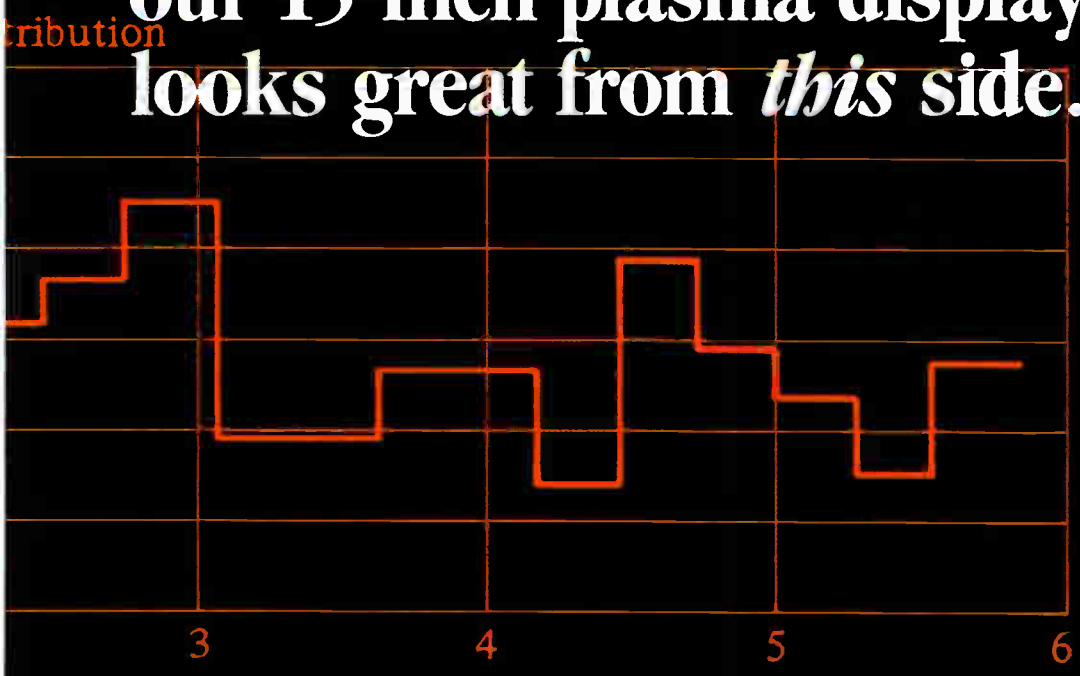
ROHDE&SCHWARZ

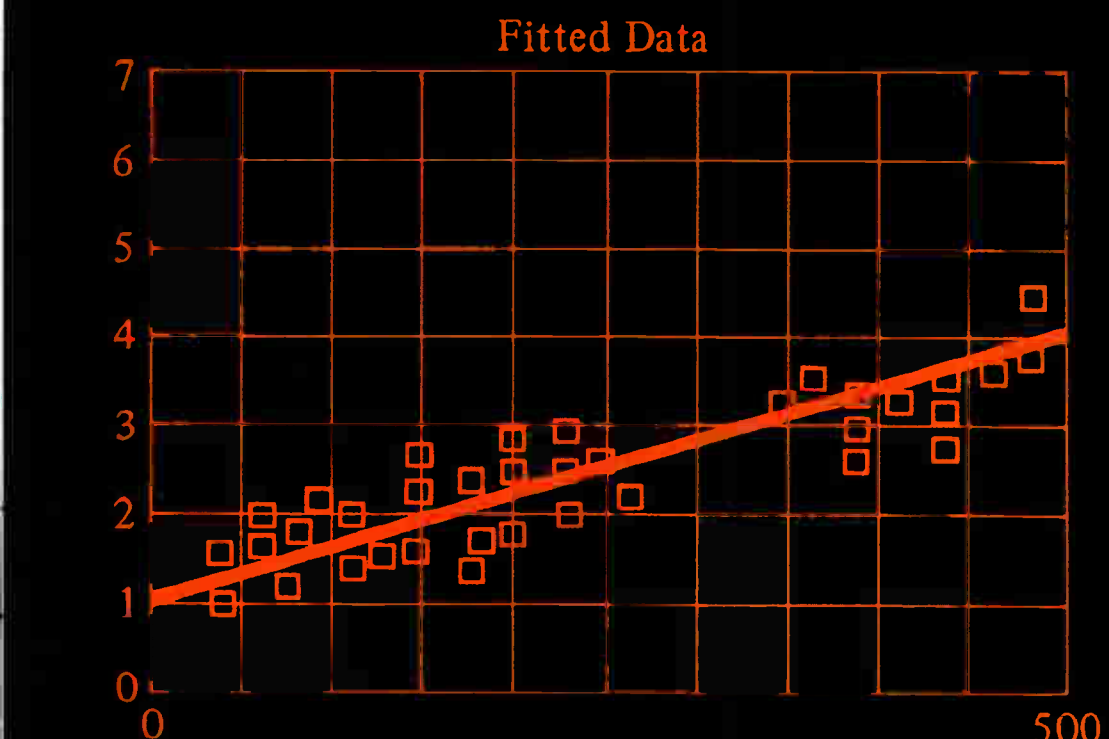
An independent concern, founded in 1933.
5000 employees, represented in 80 countries.
Design and turn-key installation
of systems with software and servicing.
Calibration, training and documentation.

A-AF.E

CIRCLE 206

If you think our 15-inch plasma display looks great from *this* side...



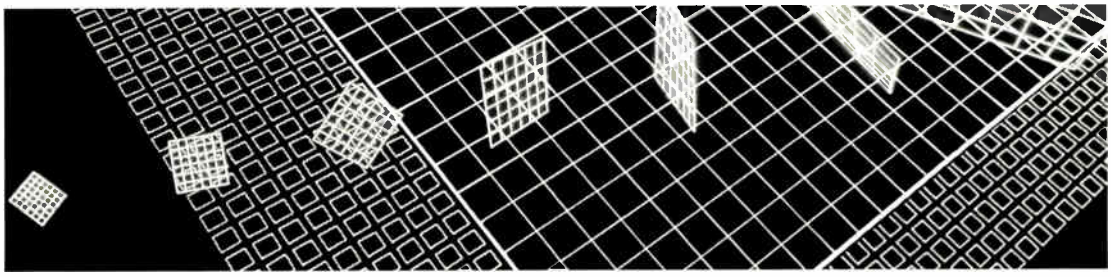


1/2 screen, shown ACTUAL SIZE

CIRCLE 310

For development and design professionals

BEST OF



HIGH-TECH

Microelectronics
Sensor technology
Control technology

On today's highly competitive markets success depends on the ability to recognize and evaluate technological trends. This knowledge is the basis for finding innovative applications and market opportunities. The survey of industrial technologies presented at Hannover provides the necessary overview. A brochure outlining the program for all 12 trade fairs at Hannover can be ordered now. Don't miss out on this important information!

2ND – 9TH MAY, 1990

HANNOVER MESSE 90 INDUSTRIE

Further information: Deutsche Messe AG, Messegelände, D-3000 Hannover 82, Tel.: (511) 89-0, Telex: 922728, Telefax: (511) 89-3 26 26

DEUTSCHE MESSE AG, HANNOVER

CIRCLE 354

...You should see it from *this* side!

It's the FPF12000S from Fujitsu, the big plasma display with all the features you've been looking for:

- 307mm x 230mm (12" x 9"), screen area
- 1024 x 768 pixel resolution
- 20-to-1 contrast ratio
- *And* a viewing angle of more than 120 degrees

But, the best news of all is that each flicker-free 15" FPF12000S screen is available in a CRT-compatible package that's only 90mm (3½") thick and less than 5 kg (11 lbs.), cabinet included.

If you're looking for a big plasma display that looks great from every angle, you've just found it. To find out what it can mean to you, please call Fujitsu Mikroelektronik GmbH at **49-69-66320**.

FUJITSU

FUJITSU MIKROELEKTRONIK GmbH: Lyoner Straße 44-48, Arabella Center 9. OG/AA, D-6000 Frankfurt Niederrad 71, F.R. Germany Phone: 069-66320 Telex: 0411963 Fax: 069-6632122
FUJITSU COMPONENT OF AMERICA, INC.: 3330 Scott Blvd., Santa Clara, California 95054-3197 U.S.A Phone: 408-562-1000 Telex: 910-338-0190 Fax: 408-727-0355
FUJITSU MICROELECTRONICS ASIA PTE LIMITED: #06-04 to #06-07, Plaza By The Park, No. 51 Bras Basah Road, Singapore 0719 Phone: 336-1600 Telex: 55573 Fax: 336-1609
FUJITSU LIMITED (Electronic Components, Electronic Devices International Technical Marketing Div.): Furukawa Sogo Bldg., 6-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100, Japan Phone: National (03) 216-3211 International (Int'l Prefix) 81-3-216-3211 Telex: 2224361 Fax: (03) 215-1961

CIRCLE 311

FLUKE AND PHILIPS – THE GLOBAL ALLIANCE IN TEST & MEASUREMENT

FLUKE®

PHILIPS

Complete calibration solutions that set the standard!

New standards (ISO 9000/9004) and ever increasing product liability demands make quality assurance and documentation essential. That means your measurements must always be traceable. So you need the precision calibration facilities that the Fluke-Philips alliance offers!

As the world leader in this field, the Fluke-Philips alliance offers you complete, thoroughly proven solutions.

Solutions that start with hardware and software, and extend through intensive personnel training, right up to the facilities of the Philips calibration lab. These facilities are directly traceable to the standards of the relevant National Metrology Organisation.

If you prefer to perform your own calibration, in-house and independently, you can make substantial savings in time and cost, by using the Fluke 5700A. Or – even more economically – with the Fluke 5100B.

So for complete calibration solutions, it's the Fluke-Philips alliance that sets the standard!

For further information, call your local supplier:
Austria (0222) 60101-1772, Belgium (02) 5256692/94, Denmark (31) 572222, Finland (0) 5026371, France (1) 49428080, Germany (561) 501466, Great Britain (923) 240511, Ireland (61) 330333, Italy (039) 3635240/8/9, Netherlands (13)390112, Norway (2) 741010, Portugal (1) 683121, Spain (1) 4042200, Sweden (8) 7031000, Switzerland (1) 4882390.
For countries not listed, write to: Philips I&E, T&M Department, Building TQ III-1, 5600 MD Eindhoven, The Netherlands.

FLUKE AND PHILIPS
CONFIDENCE IN CALIBRATION.

PHILIPS

PHILIPS

SLA8000 Series
CMOS High Speed Gate Arrays

System on Chip

Design of a system on chip is now possible with the SLA8000 Gate Array Series.
This large-scale Gate Array from SEIKO EPSON is the solution to the ever-increasing design requirements.

1. Sea of Gates *channelless type*
2. Super high speed, high integration
3. Comprehensive cell library
4. SRAM/ROM cells are available
5. Latch-up free
6. High pincount

SEIKO EPSON has developed the SLA8000 Series to meet a variety of logic design requirements in special processor and controller applications. The large number of available/usable gates enable the integration of extensive peripheral functions onto one Gate Array – an important step forward for one-chip system design.

Gate Array SLA...		827S	847S	872S	890S	8B3S	8F0S	8J3S
Gates (2-input-NAND)		5.304	9.416	14.336	18.300	22.680	30.000	38.550
Technology		Silicon Gate CMOS 2 Layer Metallization, Sea of Gates						
I/O Level		TTL, CMOS						
Delay Time	*Internal Gates*	0,47 ns typ.						
	Input Buffer	1,4 ns typ.						
	Output Buffer	3,5 ns typ. CL 15 pF						
Total I/O Pads		82	108	136	152	168	194	222
Total Power/GND Pads		4	4	4	4	4	4	4
Output Mode		Normal, Open-drain, 3-state, Bi-directional						

SLA8000 Series – pioneering the way towards higher functionalization and setting new standards.

LADS (SEIKO EPSON's proprietary design software) running on a PC gives you the added opportunity of...

...Desk Top Customizing ■■■

EPSON

Where everything is possible.

EPSON Semiconductor GmbH

D-8000 Munich 50, Riesstr. 15, Tel. 0049.89/14 97 03-0, Fax -10 *A Subsidiary of SEIKO EPSON Corporation*

CIRCLE 213

A2e NEW 27

Test Stations

for automating production

The R&S family of board testers from Europe's biggest test-equipment producer with more than 20 years' experience in test systems:

- **In-circuit Test Station TSI**
- **Combinational Test Station TSIC**
- **Performance Test Station TSP**

Instrumentation for every test strategy imaginable:

- In-circuit test
- Cluster test
- Digital and analog function test
- Automatic learning
- Microprocessor emulation
- Logic and error simulation
- Automatic diagnostics

Integration into CIM:

- CAD and PLD test processors
- CAE test generators
- Paperless repair/quality management software
- Control software for transport and handling systems

An independent concern, founded in 1933.
5000 employees, represented in 80 countries.
Design and turn-key installation
of systems with software and servicing.
Calibration, training and documentation.

D-8000 München 80
Postfach 80 14 69
Telex 523 703 (r s d)
Telefax (0 89) 41 29-21 64
Tel. internat. +(49 89) 41 29-0

ROHDE&SCHWARZ

A-TST E

CIRCLE 218

TWO U. S. FIRMS—ATEQ AND LEPTON—SLUG IT OUT IN NEXT-GENERATION PRODUCTION GEAR

IT'S LASERS VS. E-BEAMS

BY BERNARD C. COLE

IT'S NO SECRET THAT U. S. manufacturers of semiconductor capital equipment took a financial beating in the 1980s. But a comeback may now be in the making on two fronts: submicron mask and reticle writing, and direct writing on wafer. Atypically, the fight for domination is not between Japanese and U. S. companies. Rather, it is a duel between two American concerns: Ateq Corp. and Lepton Inc. Each has developed lithography technologies boasting minimum feature sizes good enough to make reticles and masks for 16-Mbit dynamic random-access memories, with Ateq using optical-laser and Lepton electron-beam technology.

Ateq, headquartered in Beaverton, Ore., in February released details of its CORE-2500 scanned-laser lithography system. Research on the CORE series has been funded by Sematech, the chip-manufacturing consortium. The CORE-2500 meets Sematech's Phase 2 specifications, which are closely tied to the needs of 16-Mbit DRAMs. Meanwhile, Lepton, based in Murray Hill, N. J., had its EBES4 e-beam system selected by the Naval Research Laboratory in Washington to provide masks for evaluating integrated circuits using 0.25-μm design rules.

Besides being a critical technology for U. S. global competitiveness in semiconductor manufacture, microlithography is a growing business. The demand for this equipment is expected to rise 70% between 1988 and 1992, according to Dataquest Inc., a San Jose, Calif., market-research company. The mask-patterning market segment in which Lepton and Ateq are competing will total $100 million this year. Fueling the need for masks is the swelling demand for application-specific ICs, says Jim Schoeffel, Ateq marketing manager.

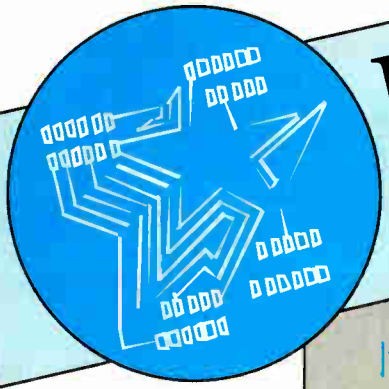
Traditionally, it has been difficult for U. S. e-beam-machine manufacturers to compete on price with Japanese companies. Ateq's laser-lithography system sidesteps that issue and, at $2.5 million, "is significantly less expensive than most e-beam machines," says Schoeffel. Ateq's CORE 2500 delivers a minimum feature size of 0.6 μm and a placement accuracy of 0.025 μm.

By comparison, Lepton's MEBES4 e-beam machine is expensive—$6 million. But, says the company, the beam is powerful enough to bypass mask creation and write directly on wafers. Lepton is working on software and hardware peripherals to implement direct-write capability, which is especially useful in the production of low-volume ASICs. "Our business isn't really the mask business," says Martin Lepselter, Lepton's president. "The future is in direct write." MEBES4 boasts a minimum feature size of 0.125 μm and a placement accuracy of 0.05 μm.

The direct-write edge will not last long if Ateq has anything to say about it. On April 1, the company revealed that by the end of the year it will be in volume production with its Wafer-Writer-6000, a $2.5-million system that combines direct-write capability with mask generation. The system achieves minimum feature sizes of 0.50 μm and a placement accuracy equivalent to that of the CORE 2500, says Barry Cox, president and chief executive officer.

Moreover, he says, it converts to a reticle writer for production with a minimum of mechanical changes. And unlike the Lepton offering, it can use the same IC pattern data for reticle writing and direct writing, eliminating translation errors and time lost in data conversion.

Additional reporting by Jack Shandle



ELECTRO: It's Revolutionary!

It's not just a components show, it's much more!

What distinguishes ELECTRO and sets it apart from all other conferences on the East Coast?

The breadth and depth of the many segments of the electronics industry gathered in one forum, at one time with the newest and most advanced electronics products and technologies. Only ELECTRO successfully integrates product presentations and updates on the current state of technology into a multidisciplinary concurrent engineering framework.

When you come to ELECTRO, it's like attending several vertical shows at once. Nowhere else can you see what's new in components, instruments, EDA tools, power supplies, production materials, engineering services and more at one industry event. No other conference offers you the wide variety of learning opportunities available at ELECTRO.

This revolutionary approach makes ELECTRO your best learning value and the one event YOU CANNOT MISS in 1990. Don't be left behind.

▲ More than 5,000 products being demonstrated by experts knowledgeable in their uses and applications

▲ More than 800 vendors

▲ 51 educational idea-generating tutorials and technical sessions organized in the following tracks: • Marketing • Devices • Electronic CAx • Mechanical CAx • CASE • Manufacturing CAx • Test • Quality • Education • General

▲ Keynote address by Thomas H. Bruggere, chairman of the board and chief executive officer of Mentor Graphics Corp.

▲ Purchasing conference on "Purchasing's Role in Corporate Success" with Frank Tahmoush, Polaroid Corp., and Robert Nahabit, Nahabit Associates

Electro®/90

The Boston T.E.A. Party

May 9-10-11, 1990

John B. Hynes Veterans Memorial Convention Center and Bayside Exposition Center in Boston, Mass.

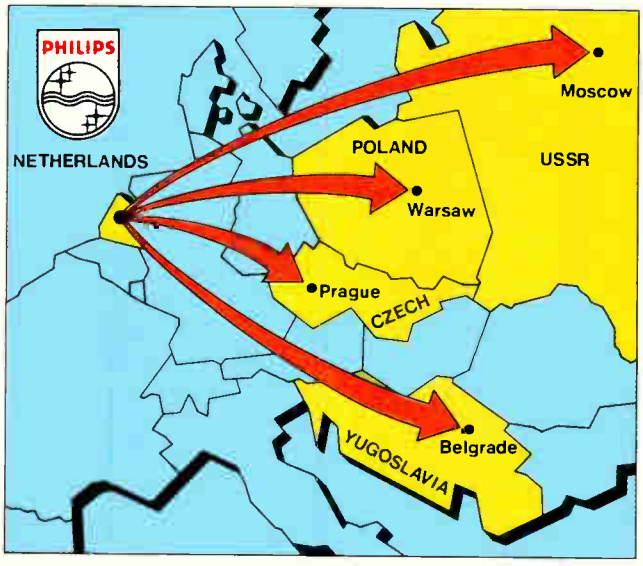
For FREE registration and more information, call 213/215-EXPO

Sponsored by Region 1, CNEC and METSAC, IEEE and New England and New York Chapters, ERA

PHILIPS MOVES INTO EAST EUROPE . . .

Look for Philips International NV to begin spreading its presence throughout East Europe. The Dutch giant plans to set up two offices, one in Prague and the other in Warsaw, this year.

The new offices could well be the nucleus of future nationwide sales organizations in Czechoslovakia and in Poland. Initially, though, they will operate as liaison offices supporting Philips' product divisions, act as contact points for local authorities and industries, and identify opportunities for cooperation. Philips already has offices up and running in Moscow and Belgrade.



In the Soviet Union, the Eindhoven company is involved in projects worth about $150 million, while in other Eastern European countries its projects are worth $75 million.

In addition, Philips will set up a joint organization in East Germany to produce X-ray equipment. Meanwhile, in Czechoslovakia, it will develop and manufacture electron microscopes. E

. . . WHILE FIRMS IN THE TWO GERMANYS AGREE ON CD VENTURE

Meanwhile, the first major joint venture in electronics between the two Germanys is being negotiated. The object is a $140 million company owned by West Germany's Reiner Pilz GmbH and East Germany's computer builder VEB Kombinat Robotron to manufacture compact disks.

Current talks are aimed at 33% and 67% participation by Pilz and Robotron, respectively. The operation may later go public, Western style, the companies say.

The joint venture, to be established in Zella-Mehlis, East Germany, will employ Pilz's latest CD production equipment. The venture's aim is to produce 24 million CDs annually.

The endeavor will be run according to the rules of a market economy, a novelty in East Germany with its 40-year tradition of a planned economy. E

SILICON SHIFT REGISTER RUNS AT 3.4 GHz

With conventional silicon bipolar technology using 2.0-μm emitter widths, researchers at Ruhr University, Bochum, West Germany, have built a shift register that can handle 3.4-GHz frequencies. Today's limit for other silicon-type shift registers is 2.3 GHz; for GaAs versions it's 3.2 GHz. The speed comes from the use of three logic levels in current switching, an all-differential circuit design, and bipolar transistors whose size is carefully optimized. E

SHARP SETS UP THE FIRST JAPANESE R&D LAB IN EUROPE

Claiming to be the first Japanese company to establish a basic research lab in Europe, Sharp Corp. has opened a facility in Oxford, England, that will concentrate initially on optoelectronic materials and devices. It will support the company's French and Spanish production operations, where Sharp builds photocopiers and fax machines. The focus is expected to be on display and image-capture technology based on laser techniques and LCDs, including Sharp's high-resolution 14-in.-diagonal active-matrix color panel.

Apart from devices, the laboratory will research information processing, including natural-language processing and the application of artificial-intelligence systems to word processors, machine-translation systems, electronic organizers, and PCs. That work will also extend to encompass an exchange of expertise with Sharp's Japanese R&D center on two pressing sectors: high-definition TV and mobile communications. E

OPTICAL RECEIVER BOOSTS SENSITIVITY EIGHT TIMES

Using an old concept from radio design, the superhet principle, researchers at West Germany's Siemens AG have pushed the sensitivity of optical receiving systems to a record level: 5.9 nW for a system run at a 565-Mbit/s data rate, a 10^{-9} bit error rate and a 3-mW local oscillator power.

The experimental optical receiver raises the sensitivity by a factor of 8.5 beyond the level obtainable with systems using conventional intensity modulation at the transmitter. Since sensitivity is improved about 10 dB, it should be possible to place repeaters in fiber-optic transmission lines 40 km farther apart.

As in a superhet system, the transmitted signal is mixed with the local oscillator frequency to generate a fixed i-f. This is amplified, filtered, and demodulated to yield the desired signal. E

4-MEGABIT DYNAMIC RAM: NEC'S GLOBAL SUPPLY PROGRAM.

The transition to second generation megabit memories is speeding up and high performance systems incorporating 4-megabit dynamic RAMs will make a major impact this year.

NEC is ready with a comprehensive line of 4Mbit DRAMs offering access speeds of 80 and 100ns and organizations of x 1 and x 4.

Options include fast page, nibble, static column, and write per bit. Package choices are SOJ, ZIP and SIMM. In the latter half of this year, we will further diversify our 4Mbit line by adding 60ns versions and organizations of x 8 and x 16.

As the leading chip producer, NEC is committed to a steady, global supply of 4Mbit DRAMs. They are now in volume production at two plants in Japan.

Our U.S. fab in Roseville, CA will start 4Mbit DRAM production in 1991. Our European fab near Edinburgh, Scotland, which is producing 256K and 1Mbit DRAMs, will also gear up for denser chips next year.

NUMBER 143

CHILE AIMS FOR NATIONWIDE DIGITAL NETWORK.

Compañia de Teléfonos de Chile, S.A. (CTC) is aiming to double telephone subscribers by completing a nationwide digital network. NEC is supplying the advanced digital switching and transmission systems necessary for this ambitious project.

The core of the network is the NEAX61 digital switching system, which is either already in service or soon to be installed at 127 exchanges with a total of 483,000 subscriber lines. The exchanges are connected in Santiago and neighboring cities with 34MB-to-565MB fiber optic transmission systems and 2MB cable PCM systems.

NEAX61 switches in other Chilean cities will be networked with 2GHz–8MB, 6GHz–140MB, and 8GHz–34MB digital microwave systems.

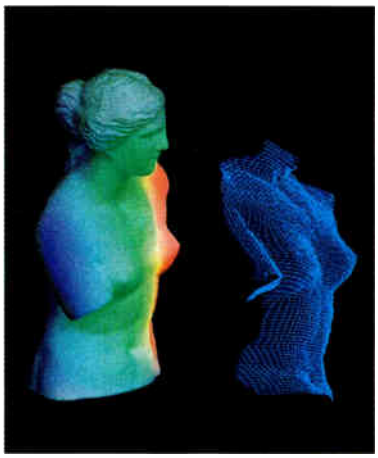
The microwave link uses 50 hops to cover a distance of 1,300km from the Northern border to the Southern end of the South American Continent and across the Strait of Magellan.

CTC is also actively introducing innovative services such as an NEC-equipped cellular telephone system already operating in the Metropolitan Region and Fifth Region. The 800MHz network with 31 cells accommodates a total of 25,000 mobile, transportable and handheld subscriber telephone terminals.

REAL-TIME, 3-DIMENSIONAL MEASUREMENTS.

Making 3-D measurements of moving objects has been a difficult task. Now NEC is developing a simple PC-based system at its C&C Information Technology Research Laboratory.

The Rainbow Range Finder (RRF) uses a triangulation principle to take 3-D measurements. Light emitted from a xenon lamp is diffracted through a grating and projected onto a target object in a rainbow pattern.



The object is observed by a color TV camera with two special optical filters. The camera is installed at a fixed distance from the grating. The precise distance to each pixel of the object is obtained by determining the wavelength of the pixel. Measurements can be made with one TV frame in 1/30 of a second.

RRF is expected to become an efficient tool in factory automation, the fashion industry, surgery and many other applications requiring real-time, 3-D measurements.

PASOLINK: SHORT-HAUL MICROWAVE RADIO.

How can you link multiple LANs in situations that rule out cable? Or set up emergency or temporary communications links in next to no time? NEC's PASOLINK is a reliable, cost-effective answer to these and a number of other applications.

PASOLINK is an advanced point-to-point microwave radio operating in frequency bands from 13GHz to 50GHz. Coverage extends about 20km for data, voice and video links. Transmission capacity is from 2.048 to 34.368Mbps,* providing up to three service channels, or one video plus two sound channels.

PASOLINK is easily transported and simply consists of a compact outdoor transceiver with antenna, and indoor modulator/demodulator unit.**

Communications links are easy to set up and no special shelter or tower is required.

*1.544–44.736Mbps also available. **Not needed for 50GHz use.

NEC

A NEW KIND OF ENGINEERING FUELS CAD

'CONCURRENT ENGINEERING' SPARKS MULTILEVEL SIMULATORS AND A PUSH FOR FRAMEWORKS

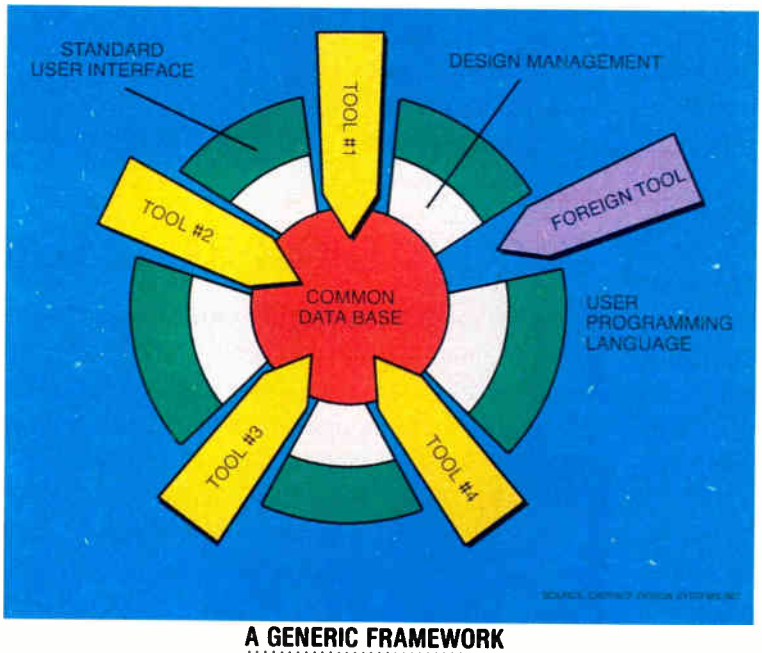
BY JONAH McLEOD

SINCE ITS INCEPTION A LITtle over a decade ago, computer-aided design and engineering has grown into a hot-blooded marketplace where a handful of large suppliers are competing fiercely for their share of the pie. The newest battleground: "concurrent engineering," which is Department of Defense jargon meaning to design in parallel instead of in series. Vendors are scrambling to support the methodology with a blitz of new products.

Among the latest launches are multilevel simulators that handle chips and boards containing a mix of behavioral, functional, and gate-level descriptions—preferably using VHDL, the VHSIC hardware-description language mandated by the Pentagon and taken up with gusto by the commercial sector. Once simulated, the descriptions are automatically synthesized into circuits optimized for speed and silicon area, thus contributing to a concurrent-engineering environment. To tie all these tools together, vendors are also starting to deliver CAD frameworks that integrate their own tools with proprietary and third-party offerings.

Sales of CAD/CAE tools, both hardware and software, reached $2.7 billion last year, up 17% over 1988 totals, says Ron Collett, industry analyst at market-research firm Dataquest Inc. in San Jose, Calif. And the market is still growing fast: Collett predicts that by 1993, sales will have nearly doubled, to $4.6 billion. As with any maturing market, this one is beginning to consolidate as large companies buy smaller ones to achieve market share or to nail down tools that are cheaper to buy than to build (see p. 52).

CAD/CAE



A GENERIC FRAMEWORK

All the major vendors are developing frameworks, software shells that can accommodate proprietary and third-party tools.

One tool that suppliers are all beginning to offer is a multilevel simulator with high-level description language capability. The average application-specific IC being designed today is on the order of 8,000 to 10,000 gates, says Aart de Geus, vice president of engineering and founder of Synopsys Inc. in Mountain View, Calif., and advanced designs are somewhere between 20,000 and 100,000 gates. As design complexity increases, he says, designers need to work at a higher level of abstraction to keep from being overwhelmed in the details.

To cope with such large-scale designs requires a true top-down design methodology, says Bruce Bourbon, executive vice president of corporate marketing at Cadence Design Systems Inc. in San Jose. In such an environment, Bourbon sees a large system containing multiple blocks each described at different levels of complexity. A complex library cell—say, a controller—might be described functionally, a set of logic behaviorally, and glue logic tying these elements together might be described at the gate level.

To simulate such a design requires one or more simulators that can handle each block at its appropriate level in the design hierarchy. Cadence's solution is the multilevel Verilog simulator from Gateway Design Automation Corp. of Lowell, Mass., now Cadence's Advanced CAE Division. It works with the HiLo logic simulator from GenRad Inc. of

Concord, Mass., which Cadence offers, and with other logic simulators that operate in the Cadence environment.

This month, Cadence's archrivals—Mentor Graphics Corp. of Beaverton, Ore., and Valid Logic Systems Inc. of San Jose—have rolled out multilevel simulators of their own, both aimed squarely at Verilog. Mentor's is Quicksim II, which may well be the "Verilog killer" that Prabhu Goel, Gateway's founder, had speculated Mentor was developing [*Electronics*, February 1989, p. 77]. Valid's entry is RapidSIM (see p. 55).

MENTOR CLAIMS THAT Quicksim II, which works with behavioral-to-gate-level descriptions, is three to seven times faster than Verilog and handles designs that are two to four times larger. Joe Prang, vice president of marketing at Valid Logic, makes similar claims for RapidSIM. Simulation speed has much to do with the way design primitives are represented in a simulation file and the algorithms that operate on the primitives. Earlier simulators could take 2,000 bytes to represent each gate in a design, Prang says. That means a workstation with 32 Mbytes of main memory could contain a design of around 15,000 gates. For large designs, the computer must page portions back and forth between main memory and hard disk, and the slower disk access time increases the time it takes for simulation. In RapidSIM, a gate is represented in just 250 bytes, and the algorithms to operate on the gates have been enhanced to speed the simulation run. Similar improvements are found in Quicksim II.

Another "must-have" item is VHDL capability. A spinoff of the Very High Speed Integrated Circuits program, VHDL is fast becoming the lingua franca of the CAD/CAE community. Most of the multilevel simulators—including Verilog, Quicksim II, and RapidSIM—have their own high-level description languages that provide only a subset of total VHDL functionality. But a handful of companies are further along, offering multilevel simulators that provide all or a portion of VHDL capability. Among them are Aldec, Intermetrics, Vantage, Viewlogic, Zycad, plus Mentor with its upcoming VHDL-capable System 1076.

Some of the big CAD/CAE players are buying VHDL capability from the smaller companies. For example, Intermetrics Inc. of Bethesda, Md., last December ported its VHDL Simulator to the Valid Logic environment for RapidSIM. And Vantage Analysis Systems Inc. of Fremont, Calif., has ported its VHDL simulator into both the Valid and Mentor environments.

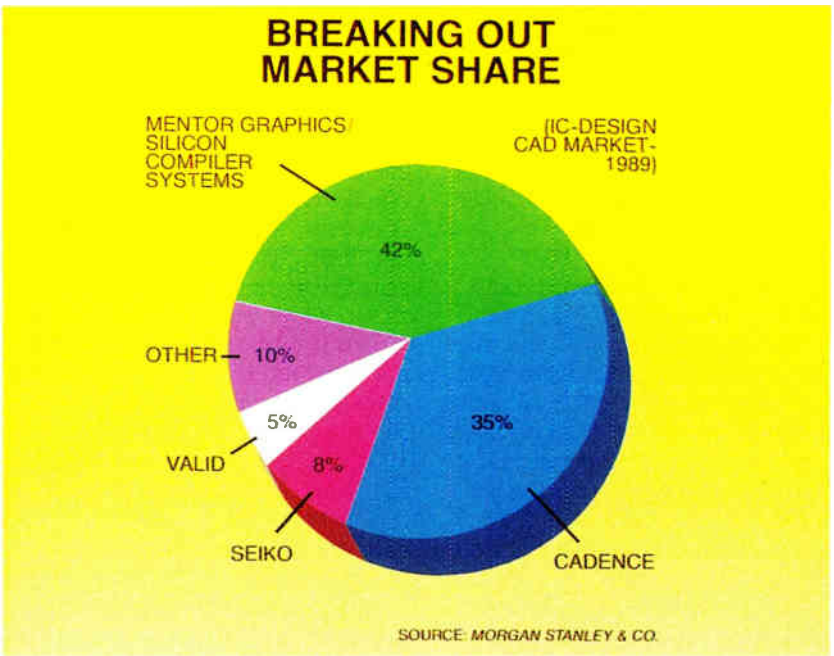
The Vantage simulator is faster, more accurate, and more interactive than competing products, asserts David Coelho, executive vice president of engineering. Other simulators operate in a batch mode, he explains: the design net list is compiled and presented to the simulator for execution. By contrast, the Vantage software requires no compilation but instead executes the models in the data base representing the design. This means that a simulation can be halted, a model changed and resumed during execution.

Aldec Corp.'s Susie 6.0 VHDL simulator is also highly interactive, says Stanley Hyduke, president of the Newbury Park, Calif., company. Susie has been licensed to 17 pc-board CAD suppliers, including Accel, CAD Software, P-CAD, Racal-Redac, and Ultimate Technology.

Viewlogic Systems Inc. of Marlboro, Mass., was one of the first companies to begin shipping VHDL capability back in July 1988 and now has more than 200 installations. It supports VHDL structure by means of its simulation environment, allowing designers to instantiate an existing block at another point in the design. VHDL capability offers full concurrent simulation with the company's Viewsim logic simulator. Mentor in its latest version tool kit, Release 8.0, announced last month, has likewise integrated an internally developed VHDL simulator, called System 1076, into its complete tool offering.

ZYCAD CORP.'S OFFERING contains a core simulator—System VHDL—which contains a graphical interface for invoking the program, waveform display on output, and so on. "System VHDL is unique in that it is integrated in our accelerator environment," says Charles W. Rose, vice president of strategic planning and development at the Menlo Park, Calif., company. "The designer can run VHDL models at the behavioral level and link them with VHDL gate-level models or models described in other formats, such as EDIF [electronic design interface format], that are running on an accelerator," he says.

Tying different simulators together requires a simulation backplane, which works within a larger framework. Silicon Compiler Systems Corp., now part of Mentor Graphics [*Electronics*, February



NOT ALL ANALYSTS AGREE that the Silicon Compiler Systems acquisition makes Mentor No. 1 in IC design. Dataquest figures show Cadence shipping $51.5 million worth of hardware and software in 1988, against $49.2 million for Mentor (including SCS's $21.3 million).—*J. McL.*

1990, p. 15], has such a backplane for its own set of simulators. However, Teradyne EDA, Teradyne Inc.'s design-automation group based in Santa Clara, Calif., goes SCS one better: it introduced last year a backplane, called MultiSim, that can easily accommodate simulators from different vendors to build a multilevel simulation environment.

SIMULATORS FROM GENRad, Teradyne, SCS, and Gateway have been combined and are working together on MultiSim, says Joe Lassiter, vice president of Teradyne's Manufacturing Systems Division and general manager of Teradyne EDA. Teradyne has a project to port DECsim, a proprietary simulator from Digital Equipment Corp., onto the MultiSim bus. And it has been working with the CAD Framework Initiative, an industry group pushing for standards, to develop an industry-standard simulation backplane to make this capability generally available.

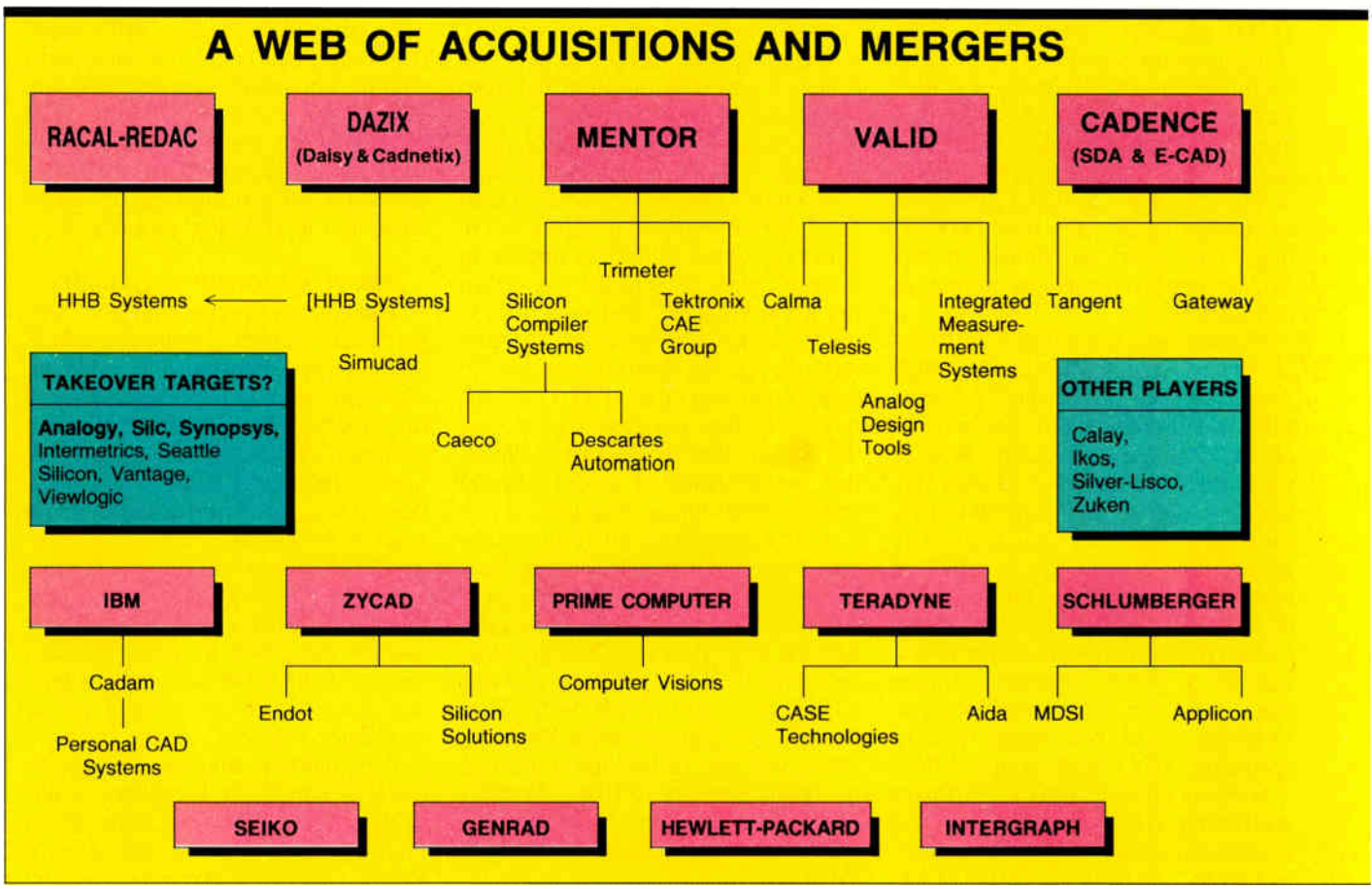
Once a design has been described in VHDL or any other high-level description language and simulated to ensure that its logic functions correctly, the designer converts the descriptions into gates and resimulates at the gate level. With the advent of logic synthesizers, this manual conversion can be performed automatically. The handful of companies that have developed logic-synthesis capability include Algorithmic Systems, Examplar, Praxis, Silc, Silicon Compiler Systems, and Synopsys.

Last year, Synopsys was the first to offer logic synthesis to create logic from VHDL descriptions. This year, Mentor, Viewlogic, and VLSI Technology offer it too. Mentor rolled out the capability first with its new Design Consultant, built around technology that came with its acquisition of Trimeter Technologies Corp. of Pittsburgh in 1988. This year, Mentor boosted its strength with the acquisition of SCS, which also has a synthesizer that converts high-level descriptions into logic.

Viewlogic's synthesizer entry is Viewdesign, which is part of its new VHDL Designer 4.0 (see p. 59). The tool was developed in conjunction with Exemplar Logic Inc., a Berkeley, Calif., synthesis company that OEMs its software to third parties. Its clientele includes suppliers of field-programmable logic devices—such as Xilinx Inc. of San Jose—which need an automatic tool to create optimized FPGA layouts from a schematics input, says Exemplar president Ewald Detjens.

Silc Technologies Inc. of Burlington, Mass., was the first company to offer synthesis from a high-level description language, a proprietary one. It plans to introduce synthesis from VHDL descriptions at this year's Design Automation Conference, June 24 to 27 in Orlando, Fla. The very first synthesizer on the market was from Algorithmic Systems Corp., a small Braintree, Mass., company, which began shipping its Ascyn tool in March 1986. Ascyn converts a high-level description written in the company's proprietary language into logic, but president and founder Jay Southard promises VHDL capability as well. Chip maker Advanced Micro Devices Inc. of Sunnyvale, Calif., has purchased rights to incorporate the synthesizer into its programmable gate array tool kit.

YET ANOTHER SYNTHESIZer comes from Praxis Systems plc, based in Bath, England, whose Locam offering operates with its Ella design system. It generates logic from an Ella high-level-language description.



This year, the company will support VHDL by offering a translator between the two languages.

Like the others, VLSI Technology Inc. of San Jose also plans logic synthesis from VHDL descriptions with its new ASIC Synthesizer, though the tool currently supports synthesis from Verilog descriptions. Beyond supporting high-level languages, the new tool will handle more of the design than simply the combinatorial glue logic and state-machine controllers, which are the blocks in an ASIC design that a synthesizer normally produces. The software operates with the company's state-machine and memory compilers to produce an entire chip, says Michael O'Brien, compiler and synthesis product manager for the company. From the tool, the designer can specify all the blocks of his design and the ASIC Synthesizer will produce a complete chip.

"We built a 37-tap FIR filter with 16 data bits and a 16-bit coefficient using standard cells and compiled read-only and random-access memory," says O'Brien. "It required a chip 19,000 mils^2 in size, operated at a data rate of 219 KHz, and took three weeks to build. Giving the same circuit to the ASIC Synthesizer, it took two days to complete, was 32% smaller in size—13,000 mils^2—and operated 58% faster, at 346 KHz." Logic synthesizers such as the ASIC Synthesizer are a scarce commodity in this highly competitive market, and this one has been second-sourced by Daisy/Cadnetix Inc. of Boulder, Colo.

To facilitate incorporation of third-party tools, CAD/CAE tool vendors and ASIC suppliers are looking to build or buy a framework that their own and outside tools can plug into. At the start of 1990, only Cadence offered a product called a design framework. As of this month, both Mentor and Valid are claiming similar capability, Mentor with the Falcon and Valid with the Communications Manager. Falcon is part of Mentor's Release 8.0 tool set, which the company is calling the Concurrent Design Environment. "Release 8.0 is a combination of framework and integration of multiple design disciplines in single design environment," says Collett of Dataquest.

"Up until now, a designer could evaluate a prototype to see if it worked," says Thanasis Kalekos, director of marketing for advanced product development at Mentor. "With the concurrent design environment, he can now determine which alternative design is the best, ascertain if it works, then determine if can be built, all before the design is complete." (One company—startup Quickturn Systems Inc. of Mountain View, Calif., specializes in emulating a logic design before it is implemented; see p. 70).

To achieve this end, Mentor has integrated all of its tools—IC and pc board, electrical and mechanical—into Falcon. Along with design tools, Mentor has added a design manager that provides versioning and configuration controls and tool registration. A similar capability is provided by DEC's DECframe/Electronics (see p. 65).

In addition, using a spreadsheet paradigm, Falcon's decision-support system allows designers to create custom tools that encode their expertise, provide access to outside data bases, and establish relationships with other tools.

Falcon's data base is the first object-oriented CAD data base, though others are being proposed (see p. 66). It uses a single parent object from which all design objects are derived. All of these—schematics, component descriptions, design viewpoints, and documents—are unified by common models and management schemes. Models are easily modified and extended to accept new tools in the data base. Prang at Valid agrees that object-oriented data bases are the way to go in the future. But Valid found the performance hit using a pure object-oriented data base too great. Instead, it uses a hybrid relational and object-oriented scheme.

CADENCE'S FRAMEWORK, also built around a hybrid relational and object-oriented data-base management system, has been shipping the longest. ASIC suppliers such as NCR Microelectronics Corp. of Ft. Collins, Colo., and Harris Corp. of Melbourne, Fla., find the framework attractive to integrate their proprietary tools with those from third-party vendors because of the Skill programming language. It lets you access the Cadence data base directly rather than pass net-list or EDIF files between tools, says W. Terry Coston, Harris's CAE director. Interfacing third-party and proprietary tools at the data base allows more information to flow from one tool to another than is possible by passing a net list.

Eventually, the CAD Framework Initiative, a two-year-old organization of vendors and end users, plans to have a framework standard that will enable a user to hook all CAD/CAE tools together. Jack Mullins, NCR's director of engineering and one of 17 candidates vying for a slot on the nine-member board, says there are 50 supporting the CFI effort, each with different needs.

For example, ASIC supplier NCR uses the Cadence framework for its tool-set offering. But National Semiconductor Corp. of Sunnyvale, Calif., which also uses a number of Cadence tools in its new DA4 design-automation tool kit supporting all its ASIC process technologies, developed its own framework, called Rain, says Van Lewing, market manager for design automation products at the company.

To achieve a common framework, Mullins sees CFI melding the features of various commercial frameworks and introducing the solution in stages, one for design management, another for data management, etc. Eventually, the CFI solution will be an industry standard, with which other commercial frameworks will interface. Thus, CAD/CAE companies can migrate toward the standard over time, Mullins says.

MERGER MANIA IS TURNing the CAD/CAE landscape into a Monopoly board. The latest target: Silc Technologies Inc. of Burlington, Mass., which this month will be acquired in a friendly takeover by Racal-Redac Inc. of Westford, Mass.

Mergers and acquisitions are a time-honored way of gaining market share, as Mentor Graphics Corp. showed early this year when it bought IC-design market clout by acquiring Silicon Compiler Systems Corp. of San Jose, Calif. The purchase puts Mentor, the Beaverton, Ore., CAD giant, nose to nose with rival Cadence Design Systems Inc. of San Jose, itself a grand acquisitor.

The Silc deal demonstrates another lure of mergers: it's a cheaper way of getting technology—in this case, Silc's synthesis savvy—than developing it in house. Cadence has already proven the power of astute acquisitions. Its recent takeover of Gateway Design Systems Inc. brought it capability in high-level language and system-level simulation. And its earlier Tangent acquisition gave it ASIC tools.—*J. McL.*

AVOID GRIDLOCK

Jams, delays, detours—Manhattan distance can cost hours when you're routing dense, complex, compact board designs. Now you can get through fast with the SCICARDS *gridless router*—a true gridless routing algorithm that lets you push, shove and jump traces to save hours of interactive editing. You can put your components anywhere on the board and send the traces weaving between pads and pins with an unlimited number of bends. And the router's push and shove capability makes drilling vias easy, because it will still push and shove the etch *on all layers*. The router is part of the dynamic layout functionality of SCICARDS that lets you handle the most complex designs in all major technologies, including SMT, High Speed Logic and Hybrids. And SCICARDS is part of a totally integrated state-of-the-market front to back design solution: Viewlogic's powerful desktop CAE toolset for schematic capture and simulation, precise thermal analysis from Pacific Numerix, the superior drafting and documentation capabilities of AutoCAD, plus the flexibility and adaptability of framework architecture. What's more, it's all on the industry standard Digital and Sun platforms. True gridless routing, true integration, true open architecture. Your tools and ours. An unbeatable combination. Because when we say "We bring the best together," "We" means you and us.

HARRIS
SCIENTIFIC CALCULATIONS DIVISION

7796 Victor Mendon Road • P.O. Box H • Fishers, NY 14453
1-800-4-HARRIS Ext. 4411 • 1-800-344-2444 (Canada)

CIRCLE 300

A FAST, POWERFUL WAY TO SIMULATE ASICs

BY COPING WITH TIMING EFFECTS, VALID'S RAPIDSIM OFFERS UNPRECEDENTED MODELING ACCURACY

BY SAMUEL WEBER

SYSTEM DESIGNERS AND vendors of application-specific integrated circuits are being swept along on a technological tide of denser, faster chips, but their ability to utilize these advances can be severely compromised by the lack of electronic design tools that can handle today's semiconductor technologies.

Simulation is one area where available tools often fall short in terms of accuracy, speed, and ease of use. That's especially true as chip geometries edge into the submicron region and speeds exceed 33 MHz.

The reason: as system clock frequencies go up, the secondary effects—like noise, transmission-line reflections, and wire-segment delays—that could safely be ignored by simulators at lower frequencies become more significant. With submicron geometries, layout-dependent delays emerge as much more important. Simulators must be able to accommodate such factors as fanout loading, input slew-rate impacts, and nonlinear delays.

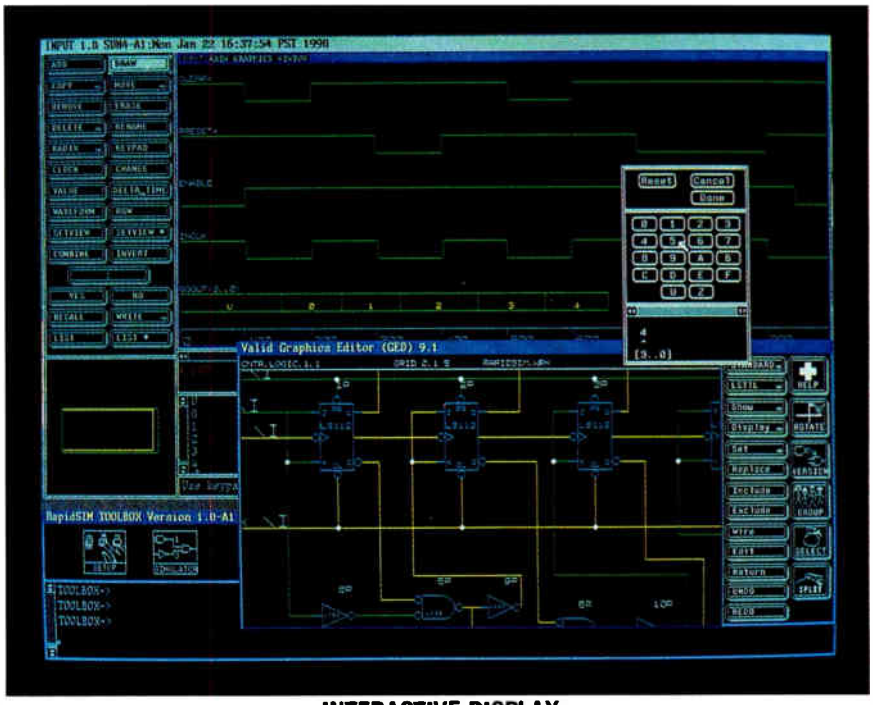
With the introduction of RapidSIM, designers of ASICs and high-speed boards can now achieve what may be the highest level of modeling accuracy available in a standard logic simulator, with the capability of handling very large gate-level simulations. That's because this new digital simulator from Valid Logic Systems Inc. of San Jose, Calif., has an unprecedented capability to accommodate secondary and tertiary timing effects. What's more, RapidSIM will be part of a mixed-level simulation environment, in which a single design can contain VHDL, behavioral, hardware, and gate-level models.

"This isn't just a random product introduction," says Robert Herwick, a senior technology analyst for Hambrecht & Quist Inc. in New York. "It's part of a clear, focused strategy to have a strong ASIC design capability. Valid has a very strong offering on the printed-circuit-board side, and they've been working very hard to improve their ASIC capabilities."

CAD/CAE

A successor to but fully compatible with ValidSIM, Valid Logic's preceding digital simulator, RapidSIM is seven to 12 times faster and has three to five times the capacity of its predecessor, says Joe Prang, Valid Logic's vice president of marketing. Prang points out that the history of simulation has been marked by periodic discontinuities as silicon technology advanced to new levels of density.

"In the early days," Prang recalls, "all we used to model was gate delays, and that was enough. With the advent of submicron geometry and high-speed devices, gate delay is only about 30% of the total delay. Now interconnect delay dominates—it can be 70% or 80% of the total delay." Other effects such as noise and wire-segment delays



INTERACTIVE DISPLAY

RapidSIM is linked with the ValidGED schematic editor and an instrument console containing simulation-preparation and control tools.

can no longer be ignored.

Furthermore, Prang points out, the interconnect delay varies over the circuit. "You just can't impose an arbitrary time delay anymore as some simulators do. The length of the path determines the resistance and inductance of that path; then you have to know if there is fanout from an output pin, because you have to drive the capacitances on that whole line," Prang says.

"Then there can be skew on the rise and fall of pulses on the transmission line—the slope of the ramp can change and you have to model that." Most simulators don't have the architecture to handle those timing variations, he says; "they are set up to handle timing in a very specific way."

One of the most important and unique features of RapidSIM is that it offers vendor-definable algorithms for layout-dependent timing calculations. Today, most simulators provide a set of standard equations that ASIC vendors must use to model the layout-dependent delays for their processes. Often this limitation compromises the accuracy of the vendor's process model. Some simulators now support piecewise linear modeling to simulate the ramp effects more realistically.

RapidSIM can capture both linear and nonlinear effects, says Prang, and thus gives the ASIC vendor complete flexibility in modeling delays for any layout in any process.

ANOTHER KEY FEATURE is a glitch propagation algorithm that can work in both the so-called inertial and transport modes. In an inertial delay mode, two or more pulses on a line would be flagged as a glitch. The transport mode allows multiple signals to be carried on a line. The ability to handle both modes is unique, says Prang.

RapidSIM is part of Valid Logic's Logic Workbench, an interactive simulation environment or framework that ties simulation together with a number of analysis tools. This gives the designer powerful debugging capability. Logic Workbench is modeled after Valid Logic's highly successful Analog Workbench, an analog CAE system, which the company has just revamped. The new version was introduced as Analog Workbench II last month.

Like Analog Workbench, Logic Workbench employs a Communications Manager to act as a switchboard between Valid's schematic editor, ValidGED, and RapidSIM, VHDL, and assorted other tools, including Valid's physical layout tools and external commercial and user-proprietary tools.

IN A NUTSHELL

RapidSIM is seven to 12 times faster than its predecessor and boasts three to five times the capacity.

It offers vendor-definable algorithms for layout-dependent timing calculations.

It captures both linear and nonlinear effects, giving the ASIC vendor flexibility in modeling delays.

The Logic Workbench will ultimately integrate Valid's RapidTEST fault simulator, a full VHDL simulation environment, advanced design/synthesis tools for programmable logic devices, and other capabilities such as min/max timing and fast functional simulation. Customers will be able to integrate their own tools or other commercial simulators through a digital backplane integration package scheduled for release later this year.

Designers interact with RapidSIM through a user interface, employing icons and menus based on a Valid corporate interface standard. Thus, the interface will look quite familiar to users of other Valid products. Many of its features are optimized for fast debugging, says Valid marketing manager Sanjiv Kaul. These include a high-level language for stimulus creation and a waveform editor—a graphics tool for creating stimuli. Also included is a high-level language for simulator control, which allows the user to control the simulation with statements like IF, THEN, or ELSE.

Another valuable feature, says Kaul, is incremental compilation. "If a user has compiled a design and then wants to make a single change in a page, he can compile just that page and get back to the simulations very quickly," Kaul says.

As for overall capacity, Kaul says that with two-input NAND gates on a 128-Mbyte workstation, users can simulate designs of more than 300,000 primitives. "If you use Valid primitives, which are generally more complex, you can simulate 200,000-primitive designs on a 128-Mbyte machine."

Valid also sees VHDL (the Very High Speed Integrated Circuits program's Hardware Description Language) as an important factor and plans to add a full VHDL engine to the integrated simulation environment along with RapidSIM. The engines will talk to each other through a simulation backplane.

The Department of Defense has specified VHDL as a requirement for providing descriptions of all submitted designs. In its own right, VHDL has many features that make it a powerful architectural-level simulator. Additionally, most third-party vendors of simulation model libraries provide component models in VHDL.

PRANG SAYS VALID'S APproach to VHDL is superior to the way competitors are offering it. Two companies, Vantage and Intermetrics, offer VHDL as a stand-alone engine, for which there are a limited number of ASIC design kits and simulation models available. In Prang's opinion, their performance is unacceptable for large designs.

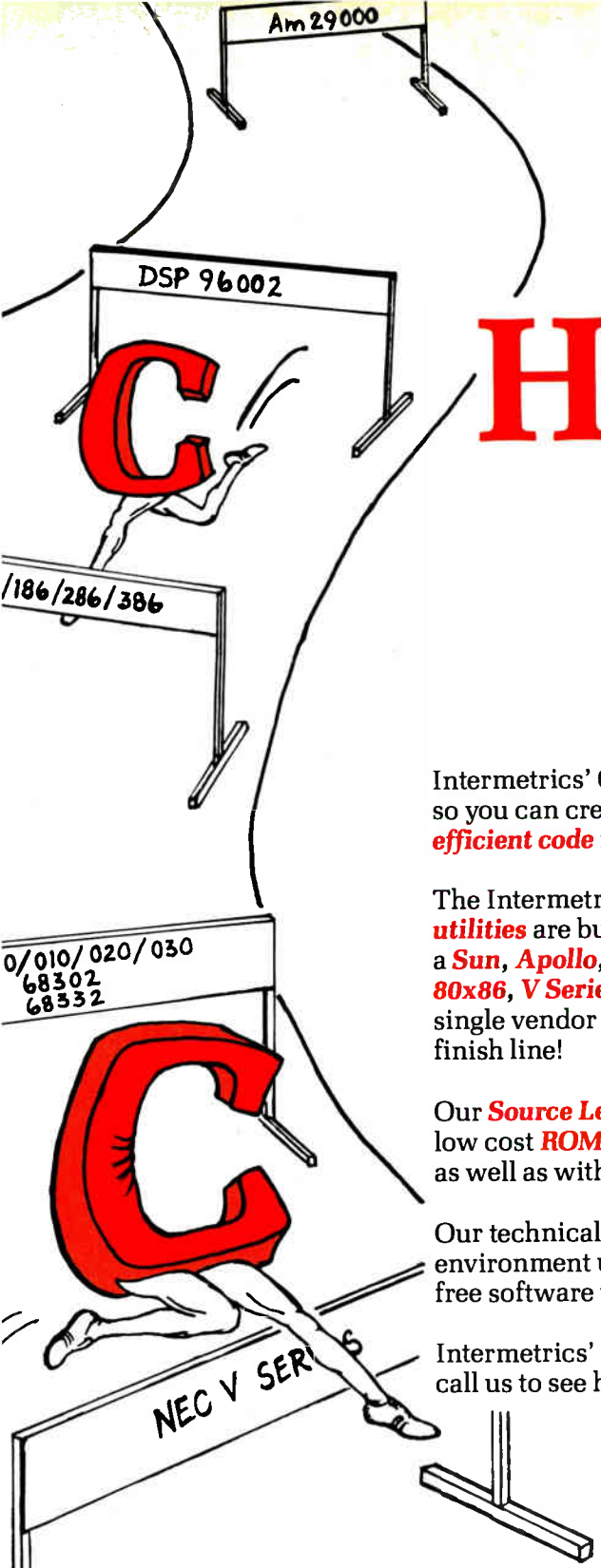
Other companies, such as Mentor Graphics, Cadence/Gateway, and Daisy/Cadnetix, offer a VHDL front end that interfaces with the base gate-level simulator. "In this case," Prang says, "the main simulator limits the extent to which VHDL can be supported, because you are forced to work with a subset that may not be the same as the one used by third-party simulation modelers or synthesis companies."

With Valid's approach—a single simulation environment—users have access to "the full power of VHDL and the functionality of RapidSIM," he says.

RapidSIM fits into Valid's overall strategy to be a broad-based supplier of CAE/CAD hardware and software while being committed to open architecture systems. It performs on Sun, Digital Equipment, and IBM workstations, including the new IBM S/6000.

It is completely upwardly compatible with ValidSIM: it uses the same libraries, design kits, data bases, scripts, and commands.

As a result, RapidSIM users have access to more than 4,300 digital components and more than 100 ASIC design kits. RapidSIM will be furnished to licensed users of ValidSIM as part of their maintenance fee, according to the company.



C How They Run!

Intermetrics' C cross development tools will help you clear the hurdles, so you can create a fully integrated environment that can deliver ***fast***, ***efficient code*** for any host-target configuration you choose.

The Intermetrics state-of-the-art ***cross compilers***, ***assemblers*** and ***utilities*** are built to work together as a team. Whether you're using a ***Sun***, ***Apollo***, ***DEC***, ***HP*** or ***IBM*** system, targeted to run on a ***680x0***, ***80x86***, ***V Series***, ***DSP96002***, or ***Am29000*** microprocessor, we are the single vendor that can help you get your development project across the finish line!

Our ***Source Level Debugger***, ***XDB***, works like a champion with our new low cost ***ROM Monitor***, and with our new ***hardware simulation board***, as well as with most in-circuit emulators.

Our technical support department will help you keep your development environment up and running by providing toll-free telephone assistance, free software updates and reduced rates for new releases.

Intermetrics' C cross development tools are the top tools in their class—call us to see how they ***run!***

1-800-356-3594

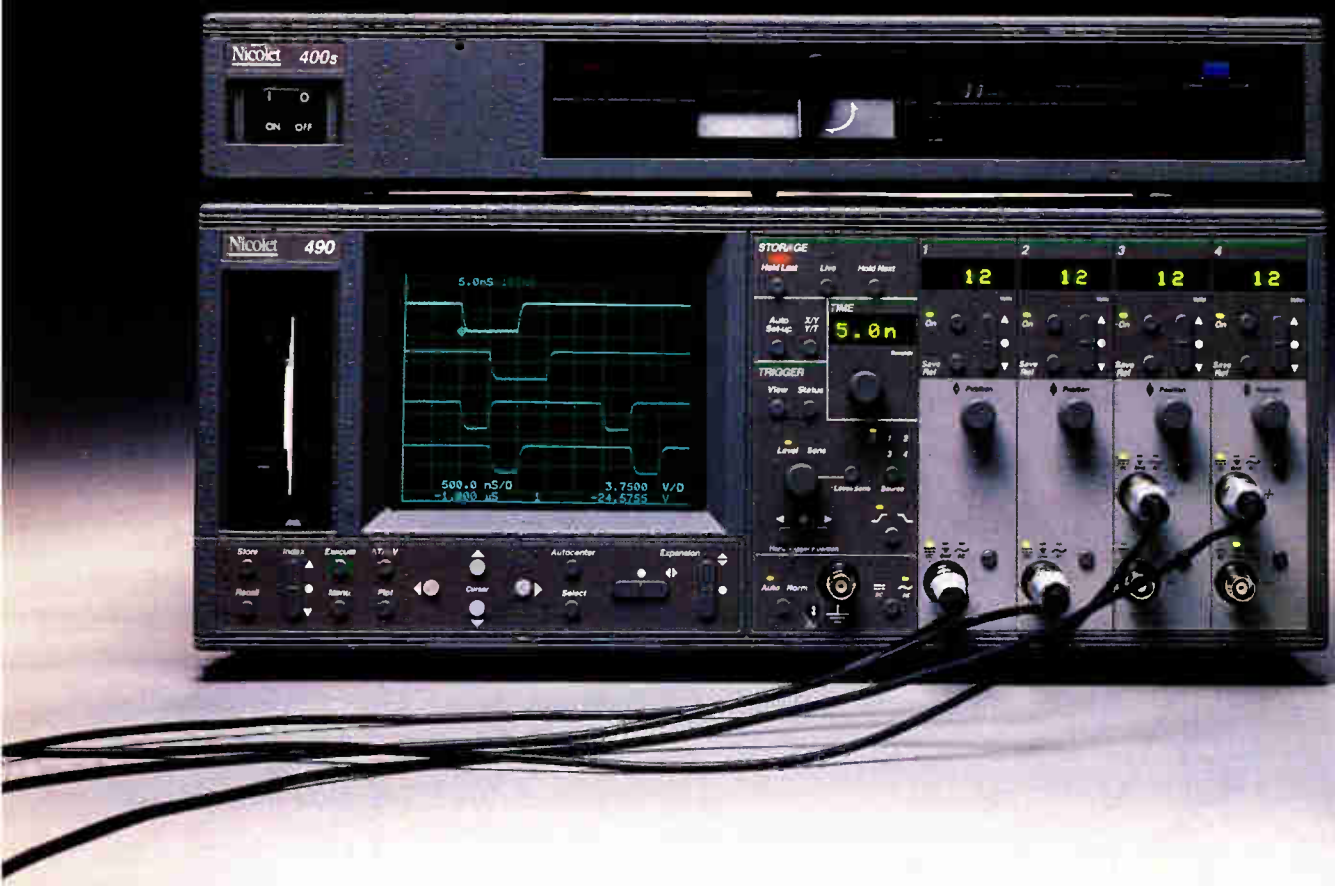
In Massachusetts or Canada (617) 661-0072

Intermetrics

Intermetrics, Inc. • 733 Concord Avenue • Cambridge, Massachusetts 02138-1002

CIRCLE 228

We could run 200 ads like this and still not show you every Nicolet 400 model available.



Which means you have *some* choice in the matter.

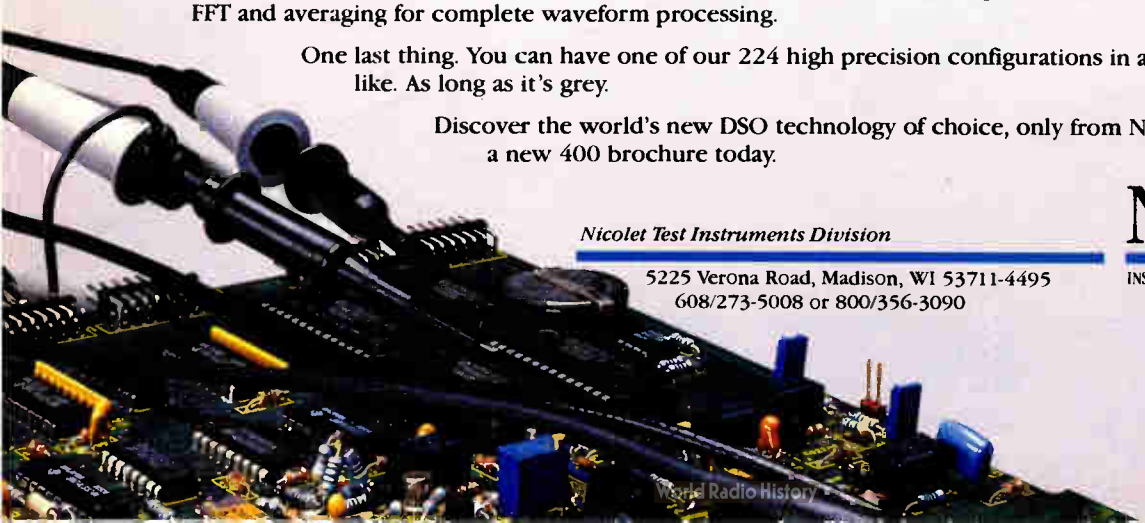
Like selecting two or four channels, with 64K to 256K memory in each. Then opting for single ended or differential inputs. A 3½" or 5½" floppy drive. And anywhere from one to 200 MS/s digitizing rates.

From there, maybe add a 44MB removable hard disk or 40MB internal disk. Then perhaps a dual timebase, or powerful *Nicolet-Windows*™ PC software for instant remote control. It's all up to you.

Keep in mind that, as standard equipment, you'd already have 8 or 12 bit digitizing resolution, or even a combination of both. A built-in MS-DOS disk drive. A LEARN mode to help automate test sequences. And FFT and averaging for complete waveform processing.

One last thing. You can have one of our 224 high precision configurations in any color you like. As long as it's grey.

Discover the world's new DSO technology of choice, only from Nicolet. Send for a new 400 brochure today.



Nicolet Test Instruments Division

5225 Verona Road, Madison, WI 53711-4495
608/273-5008 or 800/356-3090

Nicolet
INSTRUMENTS OF DISCOVERY

CIRCLE 255

HERE'S A SYNTHESIZER THAT SUPPORTS VHDL

VIEWLOGIC'S NEW VHDL DESIGNER IS PART AND PARCEL OF AN INTEGRATED DESIGN SCHEME

BY SAMUEL WEBER

LOGIC SYNTHESIS TECHnology is a powerful tool for designers of application-specific integrated circuits, but it's a rare engineer who's willing to turn over all his design prerogatives to a synthesizer. That's because most such tools can't optimize a large design completely, to the exact point the designer is aiming for.

But ASIC designers will welcome a new entry in the synthesis arena, VHDL Designer from Viewlogic Systems Inc. This tool is "the first synthesis tool that is part of a complete design environment," says Rick Sullivan, manager of synthesis products at Viewlogic, in Marlboro, Mass.—namely, Viewlogic's Workview Series of computer-aided-engineering tools. "We call it 'CAE-based logic synthesis,'" Sullivan says. "It's tightly integrated into our simulation, schematic-entry, and design-entry capabilities"—and that's the only condition under which an engineer will fully accept synthesis, he says.

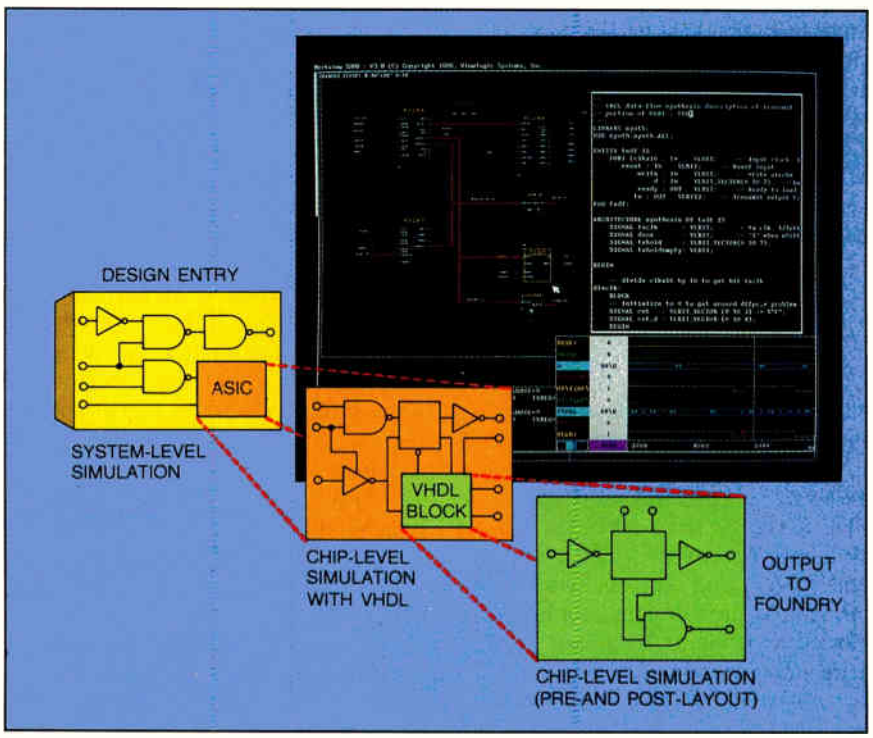
As its name suggests, VHDL Designer supports VHDL, the Very High Speed Integrated Circuits program's Hardware Description Language. "What people are looking to do is design at higher levels of abstraction and couple that with synthesis," says Andy Rappaport, president of the Technology Research Group in Boston. "What's needed is a standard representation format, and VHDL has emerged to fill that hole." With VHDL Designer, Viewlogic "clearly is staking out a claim there," Rappaport says. "What they're doing is definitely representative of the direction in which the industry is headed."

Based on the so-called MIS algorithm (multiple-level logic-optimization system), which was developed at the University of California at Berkeley, VHDL Designer is a multilevel tool. It permits a system or IC designer to begin the design process at the system level. In this phase, he can partition the circuit into structural elements, hardware models, software models, and user-created VHDL descriptions for all the ASIC parts.

CAD/CAE

The entire system can then be simulated on Viewlogic's system-development simulator, Viewsim/SD. When the designer is satisfied with the system simulation, he can then proceed with the ASIC design, breaking it down into its logical-function and structural-design elements. At this level, the designer can implement the logic using VHDL descriptions or gate-level design elements in the target silicon vendor library—or a combination of both.

Viewsim/SD verifies the ASIC-level logic design. The designer generates



TAKING AIM AT ASICs

With Viewlogic's VHDL Designer, a user can mix structural design elements from the target design library with user-defined blocks (at center in the illustration) expressed as VHDL descriptions. The screen shows a description being automatically synthesized as a circuit.

simulation pattern files that can be used to verify the logic after the VHDL blocks are synthesized into structural elements. VHDL Designer can implement the logic by synthesizing the VHDL descriptions. It generates a netlist data base composed of design elements at the library level of the target technology. Then the designer can invoke Viewgen, Viewlogic's schematic generator, to create a schematic of the synthesized logic.

A postsynthesis simulation is then performed, again using Viewsim/SD to verify the ASIC or the system. The test patterns created during the presynthesis simulation can be used to verify correct operation of the new circuit.

The goal, says Sullivan, "is to reduce the time a designer takes for exploration in implementing his design." With VHDL Designer, he can "express the design at very high levels and push a button, get an implementation, and explore that implementation. He can simulate both prior to and after synthesis. And he can simulate not only the module he's designing, but the entire system that module is sitting in."

Viewlogic may well be in the right place at the right time with VHDL Designer, says Peter Schleider, a partner at the Minneapolis venture firm Wessels, Arnold & Henderson. He sees a tremendous need for synthesis capability in the ASIC world. "There are truckloads of engineers out there who say they just can't do the ASICs or custom IC designs at the gate level any more," says Schleider. "It's just not possible at their current complexity."

BUT MOST SYNTHESIZERS fall short, he says. "Right now, most of the available logic-synthesis tools are being used as adjuncts to schematic capture," he says. "Designers are taking that net list and optimizing as much as they can through the synthesizer." A notable exception is the HDL Compiler from Synopsys Inc. of Mountain View, Calif., which provides both VHDL and Verilog synthesis. It can handle large designs, not just logic blocks, says Pierre Wildman, product marketing manager. Engineers can enter designs in any manner they're familiar with, he adds; the input will be automatically converted into a VHDL description, which is then synthesized.

Schleider dubs Viewlogic the "silent winner" in the CAE marketplace. "They don't have the visibility of a Mentor or a Cadence," he says, referring to two CAE market leaders. "But they are doing extremely well. They probably have the largest base of VHDL users."

Rappaport, too, rates Viewlogic as a real comer in the CAE marketplace. "The product is ahead of the pack. And what isn't very widely know about Viewlogic is that they've shipped a lot of products ahead of the pack. They were among the first to ship a VHDL simulator, for example. What Viewlogic is hanging its hat on is focusing on the front-end design process to yield products earlier than their more diversified competitors. And they're succeeding. They're growing significantly faster than the market."

CAE-BASED SYNTHESIS

VHDL Designer is the first synthesis tool that's part of a complete design environment.

With the multilevel tool, designers partition a system into structural elements, hardware and software models, and user-defined VHDL descriptions for ASIC parts. These blocks are automatically synthesized and optimized for speed or area.

Sullivan says that besides ASICs, the tool is aimed at field-programmable gate arrays. "The kind of designs we're targeting are state machines, decoder logic, or random logic in the range of 500 to 2,500 gates," he says. "There's no hard limit—the trade-off is always the time it takes to synthesize. Customers don't want to be bothered with the details of state-machine design—they'd much rather just specify the state transition table in VHDL and let the tool generate the sequential design for them."

Sullivan says one beta-site customer uses VHDL Designer to implement the design of parts of very large chips. "They're not willing to commit the entire design to synthesis tools; they want to retain tight control over implementation of many parts of the chip," he says. "They do that by drawing the schematic for those pieces."

But other pieces—typically state machines and random logic—aren't worth the time and effort to create a schematic. These are the province of VHDL Designer. "They'll draw a box around that part of the schematic they want to synthesize and fill it with a VHDL description. With the push of a button they'll get a schematic for that box."

This is "consistent with what designers want to do," says analyst Rappaport. "There are a couple of attitudes about synthesis. One of them is that synthesis tools ought to be able to take a high-level description for the entire design and synthesize the entire design from that with relatively little manual intervention." While this idea is "intellectually appealing," he says, "if you think about it from the design-optimization standpoint, most designers say, 'I want to go in and optimize one particular part.' What the bulk of the market would like to have is something that aids them in designing parts of the circuit that are not critical or just take too long" to design by hand.

As with all synthesizers, optimization criteria for VHDL Designer are speed and area. "You can trade off between the two," says Sullivan. "The area optimization takes the routing density of the ASIC into account. For speed considerations, the user has the capability of specifying an absolute maximum path delay he's willing to accept in the synthesized logic." Within that maximum, Sullivan says, "he can optimize for area or timing. He also has the option of constraining specific paths to be less than a certain delay."

SULLIVAN SEES THE NEW tool as ideal for the current IC design environment. "We see a groundswell of interest in field-programmable gate arrays and the capability to move up easily into gate arrays and standard cells. Some of the ways our customers can use this tool is to implement a prototype with FPGAs and later on, when they are getting close to production, they'll produce actual gate arrays without changing one line of design entry code," he says. "They'll just retarget the output of the VHDL Designer."

VHDL Designer runs on Sun Microsystems Inc.'s Sun 4 and SparcStation workstations and on 386-based personal computer platforms that operate in a Unix environment.

Schleider believes that VHDL Designer, if successful, will position Viewlogic tools at the next level of abstraction in design. "And that's where vendors will have to be to penetrate the next level of the market," he says.

HITACHI AND VLSI TECHNOLOGY, INC. ANNOUNCE THE MOST IMPORTANT BREAKTHROUGH IN RECENT MEMORY.

SRAM²: HITACHI AND VLSI TECHNOLOGY, INC.

Hitachi and VLSI Technology have signed a pact.

One of the major purposes of this alliance is to create high-performance CMOS SRAMs. The kind of high-speed, high-density SRAMs that could only be produced by combining both companies' SRAM design and submicron manufacturing expertise with VLSI's tools.

After over a year of very close cooperation and teamwork, the first two products of that pact are here.

Announcing the 35ns 256Kx4 and 32K x8 SRAMs from Hitachi and VLSI.

Like every chip in the SRAM² family to come, both Hitachi's and VLSI Technology's new 1 megabit and 256K chips share the

same design, the same process.

We're also sharing product definitions, characterizations, qualifications, and product intros. The works.

What that means to you is a continuous supply of high-density, high-performance SRAMs from two sources.

Not just for now. But for years to come. (We're already working together on a family of processor-specific cache memories.)

Call 1-800-872-6753, your local sales office, or Schweber Electronics. Or write 1109 McKay Dr., M/S 32, San Jose, CA 95131 and ask for a free SRAM brochure including our new VT624256 and VT62832.

And see for yourself why SRAM^2 is the biggest breakthrough in recent memory.

VLSI TECHNOLOGY, INC.

Fast Memory Products from VLSI Technology, Inc.

Type	Product	Description	Organization	Access Time
1K SRAM	VT7C122	High-speed SRAM	256 x 4	12 ns
4K SRAM	VT20C50	Clearable SRAM, sep. I/O	1K x 4	15 ns
16K SRAM	VT20C18	SRAM ($\overline{CE}$), Auto Power-Down	2K x 8	20 ns
	VT20C19	SRAM ($\overline{CS}$), Fast Chip-Select	2K x 8	12 ns
	VT20C68	SRAM ($\overline{CE}$), Auto Power-Down	4K x 4	15 ns
	VT20C69	SRAM ($\overline{CS}$), Fast Chip-Select	4K x 4	12 ns
	VT20C72	Separate I/O SRAM (High-Z Output)	4K x 4	15 ns
	VT20C78	SRAM ($\overline{CE}$), Auto Power-Down, with $\overline{OE}$	4K x 4	15 ns
	VT20C79	SRAM ($\overline{CS}$), Fast Chip-Select, with $\overline{OE}$	4K x 4	12 ns
64K SRAM	VT20C98	SRAM ($\overline{CE}$), Auto Power-Down	8K x 8	15 ns**
	VT20C99	SRAM ($\overline{CS}$), Fast Chip-Select	8K x 8	20 ns**
	VT6285H(L)	SRAM, Separate I/O, (O/P Track I/P)	16K x 4	15 ns**
	VT6286H(L)	SRAM, Separate I/O, (High - Z Output)	16K x 4	15 ns**
	VT6287H(L)	SRAM, Separate I/O	64K x 4	15 ns**
	*** VT6288	SRAM ($\overline{CE}$), 3-state I/O	16K x 4	25 ns
	VT6288H(L)	SRAM ($\overline{CE}$), Auto Power-Down, (low power)	16K x 4	15 ns**
	VT6289H(L)	SRAM ($\overline{CE}$), Auto Power-Down with $\overline{OE}$, (low power)	16K x 4	15 ns**
	VT6290H	SRAM ($\overline{CS}$), Fast Chip-Select	16K x 4	15 ns**
	VT6291H	SRAM ($\overline{CS}$), Fast Chip-Select with $\overline{OE}$	16K x 4	15 ns**
256K SRAM	*** VT6208(L)	SRAM ($\overline{CE}$), Auto Power-Down, (low power)	64K x 4	35 ns
	* VT62832(L)	SRAM ($\overline{CE}$), Auto Power-Down, (low power)	32K x 8	35 ns
	* VT62832H(L)	SRAM ($\overline{CE}$), Auto Power-Down, (low power)	32K x 8	25 ns
1M SRAM	* VT624256(L)	SRAM ($\overline{CE}$), Auto Power-Down, (low power)	256K x 4	35 ns
Dual-Port	VT7132	Dual-Port RAM (Master)	2K x 8	25 ns
	VT7142	Dual-Port RAM (Slave)	2K x 8	25 ns
	UT7132A	Dual-Port RAM (Master)	2K x 8	25 ns
	VT7142A	Dual-Port RAM (Slave)	2K x 8	25 ns
	VT71321	Dual-Port RAM (Master)	2K x 8	25 ns
	VT71421	Dual-Port RAM (Slave)	2K x 8	25 ns
	VT16DP8	Asymmetric Dual-Port	2K x 8/1 x 16	70 ns
Cache Tag	VT7152	Cache Tag RAM, Totem-pole match	2K x 9	25 ns
	VT7154	Cache Tag RAM, Open-drain match	2K x 9	25 ns
Cache Data RAM	* VT62A168	Cache Data RAM for 82385 †	8K x 16	25 ns
	* VT62A188	Cache Data RAM for 82385/82385SX †	8K x 18	25 ns

* A product of the Hitachi and VLSI Technology, Inc. alliance.
** Available 2nd quarter, 1990.
† Also compatible with VLSI Technology TOPCAT 386DX/386SX Chip Sets.
*** OEM Products from Hitachi

VLSI TECHNOLOGY, INC.

DEC MAKES AN AGGRESSIVE CAD MOVE

EDA SYSTEMS' FRAMEWORK IS BEING ENHANCED AND MERGED INTO DECFRAME

BY LAWRENCE CURRAN

DIGITAL EQUIPMENT CORP. is no stranger to computer-aided design of electronic products, such as integrated circuits and printed-circuit boards. The company's VAX systems have been used for years as CAD departmental computers, and for the last couple of years DEC has been selling the PowerFrame CAD software framework from EDA Systems Inc. of Santa Clara, Calif. Now the Maynard, Mass., computer giant has plunged headlong into the market by acquiring PowerFrame outright [*Electronics*, March 1990, p. 22].

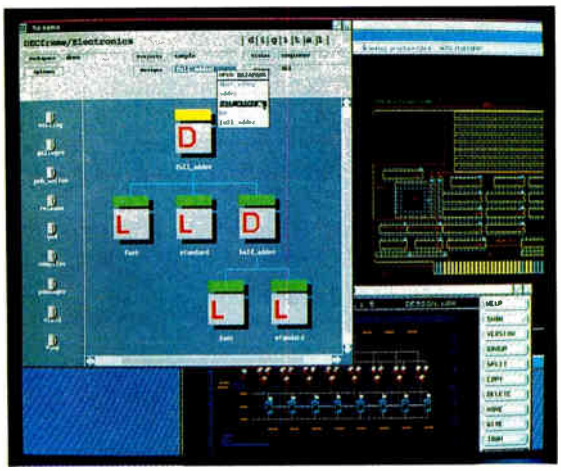
DEC has assumed all of EDA's contracts for PowerFrame customer support and original equipment manufacturers. And it has assimilated PowerFrame into its own CAD framework—called DECframe/Electronics—yielding an open design framework that runs on DEC's reduced-instruction-set-computing work stations.

The Technology Research Group, a Boston market research and consulting firm, has estimated that designers spend as much as 30% of their time on nonengineering work, such as searching for files, correcting errors in data bases, and laboring for days getting a design released from layout to manufacturing.

PowerFrame automates all of those processes and more. Because the software knows the location of all the data and how it is organized, it simplifies the use of complex tools and processes. PowerFrame invokes application tools automatically, such as Valid Logic Systems Inc.'s ValidGED graphics editor and Allegro pc-board design software. PowerFrame can also find all relevant data for a particular design, then save all changes and parameter settings when the designer is finished with a task. To those core attributes DEC has added a few flourishes.

CAD/CAE

These include multistation workgroup support; design-release management features to assure that design revisions are current; checkpointing for rapid design review and reconstruction; a common data model and user interface for all applications; and a standard window interface based on DECwindows.



MANY WINDOWS

DECframe users can call up multiple design applications on a multiwindow screen display.

Besides Valid Logic's application programs, DECframe/Electronics' initial release also integrates the Verilog design-verification software from Cadence Design Systems Inc. DEC will also incorporate other application software selected by customers into DECframe, or train a customer's CAD organization to do that integration.

All this means a productivity boost, says Donald McInnis, Engineering Systems Group vice president at DEC. "Design engineers can cease worrying about data integrity and detail-oriented data management, stop wasting time on outdated designs, and spend more time improving design quality," he says.

Analysts agree. PowerFrame is "a pretty solid product, and what DEC has added to it has been well thought out," says Cindy Thames, executive vice president at the Technology Research Group. Moreover, "DEC is close to the ideal kind of company to offer a design framework."

Her only quibble is with timing. "DEC would be much better off if they'd [acquired and enhanced PowerFrame] a year ago," Thames says. "DEC is perceived to have lost some ground in the workstation market, especially after the [February] IBM Corp. announcement" of the new System/6000 workstation. As a result, some CAD application developers may be nervous about porting to DEC platforms, she says. "But there's a lot of loyalty to DEC out there, which shouldn't be underestimated."

DECframe/Electronics now runs on DECstation 2100 and 3100 RISC workstations as well as on DECsystem 5400 RISC servers, all of which use Ultrix, DEC's variation of the Unix operating system. A version for VAXstation computers running DEC's VMS operating system will be offered later this spring.

WILL VENDORS LINE UP BEHIND OBJECTIVITY?

THE STARTUP'S OBJECT-ORIENTED DATA BASE COULD BE A KEY TO INTEROPERABILITY IN CAD, CASE

BY JACK SHANDLE

CAD/CAE

AFTER A DECADE OF INtense competition among computer-aided-design companies to corner the market with proprietary tools, the day of standard interfaces and interoperability may soon be drawing near. And object-oriented data bases are one way to get there, says Peter Schleider, a partner in the Minneapolis consulting firm of Wessels, Arnold & Henderson. "The technology is still two years from being widely incorporated in the various product sectors," he says, "but it is desperately needed. It means a fundamental restructuring of the business."

Bob Field and Drew Wade are betting their futures on that premise.

The cofounders of Objectivity Inc., a Menlo Park, Calif., startup, believe the electrical and mechanical CAD communities, as well as the companies that develop computer-assisted software engineering tools, are ready to cooperate. An engineering data-base management system (EDBMS) will be one of the foundations for an ECAD/MCAD/CASE interface standard, and that's exactly what their company is promising in its Objectivity/DB.

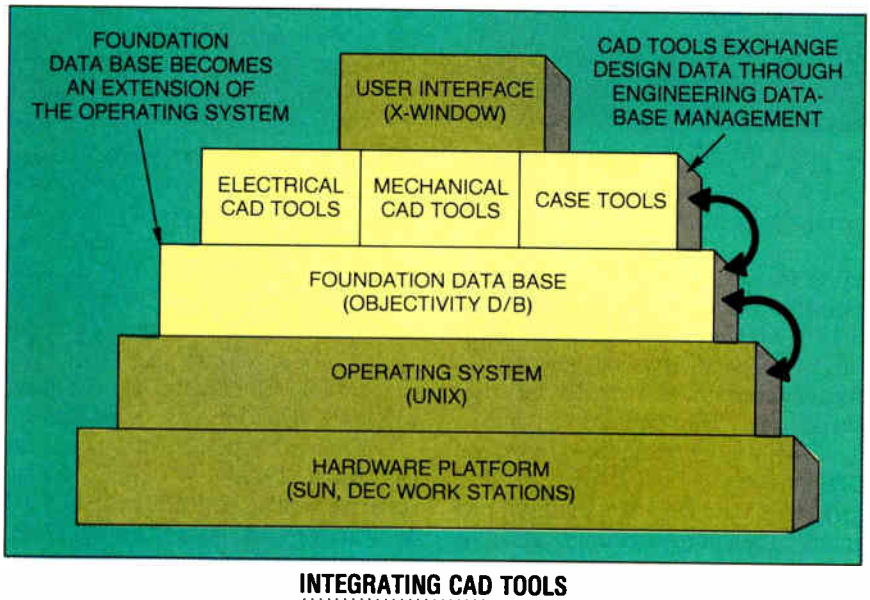
As the name implies, Objectivity/DB uses object-oriented programming techniques, which deliver more flexibility in defining data than any other approach, says Field. In essence, if CAD vendors join the Objectivity/DB team they will be agreeing to define, store, and retrieve data and models according to Objectivity's format. This will conform to the standards of the CAD Framework Initiative, a two-year-old organization of end users and vendors, when they are final. Objectivity/DB still has some tough auditions to face before it fills the industry's EDBMS role, but it has already enlisted two formidable allies: Sony Corp. of Japan and CAD vendor Valid Logic Systems Inc. of San Jose, Calif.

For their part, users are frustrated by being forced to cope with design tools that do not play together. They are demanding tools that do—and that deliver interoperability without a significant degradation in performance.

"CAD and CAE users all want an object-oriented data base," says consultant Schleider. "But most of the existing tools fall flat on their faces when it comes to speed and performace capability." Although Schleider has not yet evaluated Objectivity's product, he believes that the strategic partnerships with Sony and Valid bode well for its performance.

The march toward CAD standards, says Field, will be propelled by an increasingly narrow time-to-market window for the companies that use CAD tools. Right now, it is not unusual for chip designers to finish their work and pass the results on to printed-circuit-board designers in files that are incompatible with the pc-board CAD tools. Similarly, the pc-board designers pass incompatible files to the mechanical CAD engineers. Standards in general—and an EDBMS in particular—could replace that serial progression with concurrent engineering using a common, constantly updated data base.

In the new standards stack, the EDBMS sits between the operating sys-



INTEGRATING CAD TOOLS

The EDBMS, sitting between the operating system and the various CAD tools, can be considered an extension of the operating system.

tem and the various CAD tools. It can be considered an extension of the operating system, says Field, because it's independent of the application, platform, and operating system.

The problem is not a lack of such data bases, he says, but their abundance. Each is proprietary to the ECAD, MCAD, or CASE vendor that implemented it. Even the traditional data-base companies such as Oracle Corp. and Sybase Inc. have indicated a movement toward object-oriented technology, says Schleider, but "when you are dealing with geometric shapes instead of just numbers, as in CAD, you really need to be object-oriented."

OBJECTIVITY/DB IS . . .

An engineering data-base management system that can ensure that multivendor CAD and CASE tools will all play together without any loss of performance.

An object-oriented solution, and one that will conform to the standards of the CAD Framework Initiative when they are approved in their final form.

THE EDBMS PROBLEM GOES deeper than standards, however. CAD vendors compete on how well they design circuits, boards, systems, and software. Their expertise is not in data-base management, particularly not the object-oriented variety. "Companies like [CAD leaders] Mentor and Cadence have designed their own [EDBMS], but really want a third party to deliver it," says Schleider. "In general, they do as little as they need to get by," Field says. "Data-base management is a whole business in itself."

A full-featured EDBMS, says Field, gives the design engineer maximum flexibility to define objects and operations. It efficiently handles access to storage and is not subject to memory or virtual-memory limitations. It delivers high performance and is fully distributed, which means it can manage multiple data bases simultaneously. Finally, it provides sophisticated development tools.

The CAD standards situation is being addressed across a broad spectrum by the CAD Framework Initiative, whose board of directors is a virtual who's who of the field. Among the group's member companies are Cadence, Hewlett-Packard, Honeywell, Mentor Graphics, Motorola, Siemens, Sun Microsystems, and Valid Logic.

Besides being Objectivity's vice president of engineering, Wade is also the chairman of the framework organization's Storage Manager Committee. A subset of Objectivity's functionality will be shown at the Design Automation Conference June 24–28 in Orlando, Fla., with 20 companies cooperating. "A schematic editor from one company and a simulator from another will run together, for example," Wade says.

Since an EDBMS works only when the CAD vendors use standard interfaces, Objectivity's success hinges on getting the cooperation it needs. "Everybody wants to be second," says Field. "It is too risky to be first, and third is too late." Objectivity has attacked that problem on two levels. It is pursuing the standard software vendor/customer relationship of selling its EDBMS development systems to application developers. And its strategic partnering campaign includes Sony's internal semiconductor CAD group and Valid Logic.

"Valid is a reasonable win," says Schleider. "It didn't do any development of its own along these lines, so it found itself behind. It did a lot of evaluation of third-party work." And Sony's signing on with Objectivity is "a strong endorsement of the product," he says.

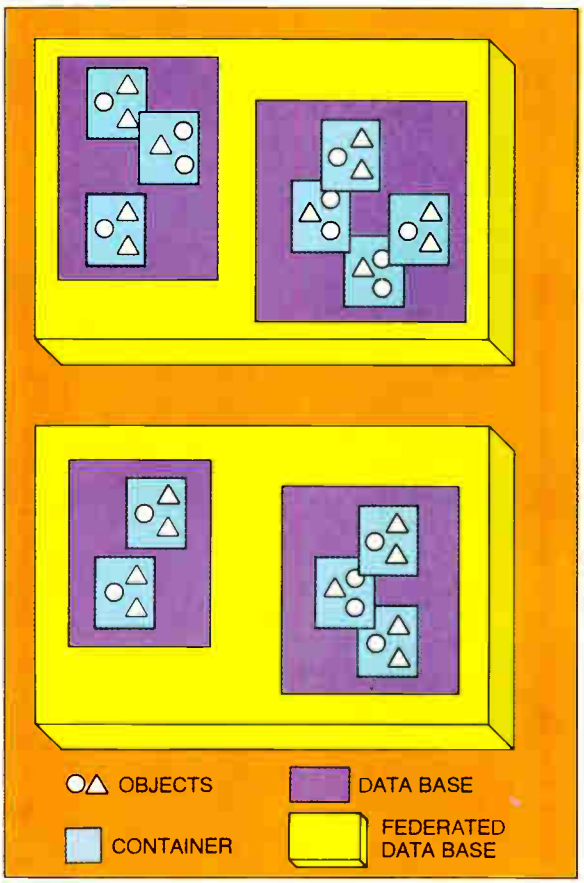
Objectivity/DB operates on a four-level hierarchy: objects, containers, data bases, and federated data bases. Using ECAD as an example, says Field, the logical design data base would consist of net lists and schematics, the test data base would include simulation and timing models, and the layout data base would include all the data needed for the physical implementation of the circuits. Finally, the manufacturing data base would include process information.

Objectivity's federated data base manages all the connections between the individual data bases—such things as where information is located in disk storage. Its functions include keeping the linked data bases consistent as changes are made in any one of them and maximizing storage efficiency. In this ECAD example, the containers would include such things as schematics, while objects are the basic building blocks of the design such as gates and channel lengths.

While Objectivity/DB is headed toward platform and operating-system independence, its first implementations, due this month, will be in Unix. They will run on Digital Equipment Corp.'s DECstation 2100 and 3100 and on Sun Microsystems Inc.'s Sun 3 and Sun 4.

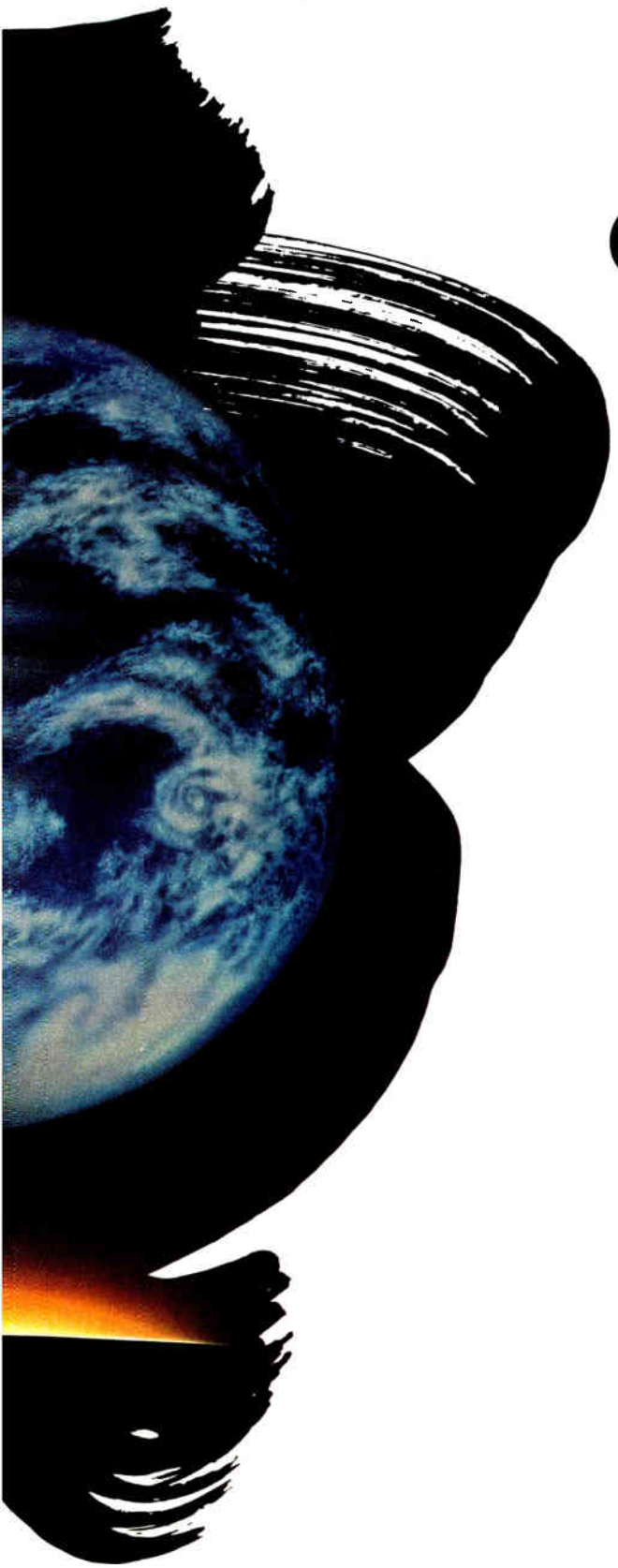
"We will be able to port to IBM Corp. mainframes and DEC's VMS, ultimately down to the desktop," says Field, "but we are in the response mode for supporting those systems when the market calls for it."

Pricing will follow the model already established by commercial data-base management systems such as standard-query language.



OBJECTIVITY'S STORAGE MODEL

The four-level hierarchy includes objects, containers, data bases, and federated data bases.



Tiny Glitches Lead to Giant Wobbles

We take it for granted that the Earth rotates stably on its axis and that the stars are fixed in the sky above us.

Yet, Hipparchus discovered more than two millennia ago that there were very slight discrepancies in the measured positions of stars over the years. Compelled to look further, he found the difference to be greater than what could be attributed to error and analyzed it.

Hipparchus

Hipparchus realized that the position of the stars was actually shifting at a constant rate, year after year. This was later shown to be caused by the Earth slowly wobbling like a top as it turned on its axis.

Stabilizing Today's Communications

The slightest deviations can be extremely important. In high-speed communications, tiny errors can garble the whole message.

Anritsu specializes in the highest levels of measuring accuracy for all types of communications. Anritsu supplies reliable test equipment for sophisticated R&D, as well as daily maintenance, in wire, radio and optical communications systems.

Advancing on the leading edge of these technologies, Anritsu provides practical answers for any testing need.

Continue the tradition of pioneering with Anritsu.

MP1608A 5GHz Pulse Pattern Generator

Anritsu

ANRITSU CORPORATION
10-27, Minamiazabu 5-chome, Minato-ku, Tokyo 106, Japan
Phone: Tokyo 03-446-1111, Telex: 0-242-2353 ANRITU J

CIRCLE 279

HOW QUICKTURN IS FILLING A GAP

ITS EMULATOR IS 'THE EQUIVALENT OF A MICROPROCESSOR DESIGN SYSTEM FOR GATE ARRAYS'

BY HOWARD WOLFF

ALTHOUGH THE ASIC DESIGN arsenal is replete with a dizzying array of automation tools, one tool has been conspicuous by its absence. Until the advent of a new product from Quickturn Systems Inc., designers of application-specific chips have gotten by without a real-time emulator—a hardware tool that performs the functions of the real hardware at a speed close to that of the actual. In effect, the emulator stands in if the real thing isn't available; it also provides more control and better debugging than the real hardware.

So Quickturn's RPM Emulation System represents a whole new category of product: a real-time hardware emulator for verifying ASICs. The Mountain View, Calif., company maintains that its only competition is from older design-verification technologies, primarily simulation accelerators, and at least one market watcher agrees. "No one else has one," says industry analyst Ron Collett of Dataquest Inc. in San Jose, Calif. "It's the equivalent of a microprocessor design system for gate arrays—a sophisticated extension of breadboarding."

Emulation can kick in at several points in the design cycle of a typical ASIC. Initial design work done in a high-level language can be emulated immediately if design synthesis is available. Portions of a design can be emulated, as a very high-speed simulator, as soon as they exist at the gate level. Once a full chip design is available, it can be emulated both independently with test vectors and in-circuit for full hardware and software debugging.

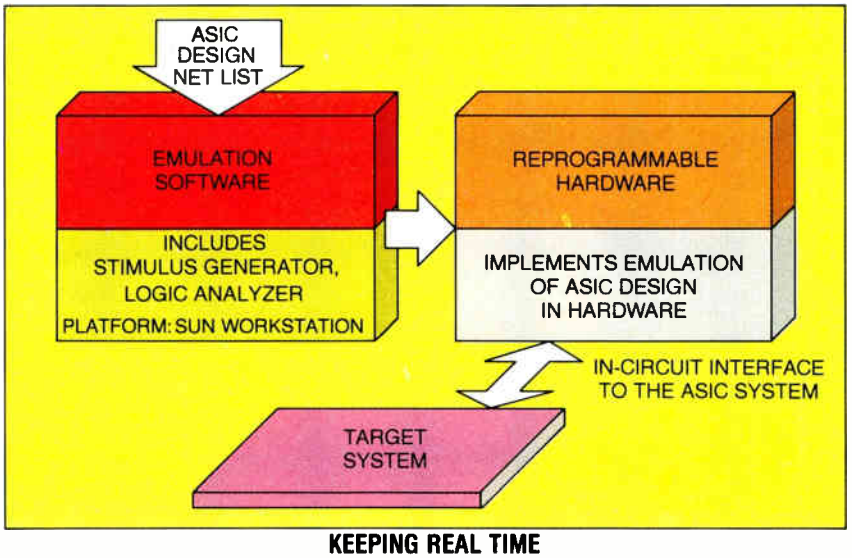
An advantage of the Quickturn approach is that it can run in both in-circuit emulation and simulation modes. With in-circuit, the emulation is plugged into a target system where it receives all the system's actual signals. In simulation mode, the emulation is driven not by real signals but by a set of simulation vectors; the result is compared with expected results.

CAD/CAE

The product is very fast. And this month, the company doubled both its capacity and speed. Designers now can emulate up to 50,000 gate designs at a speed of up to 10 MHz. They also can perform static timing analysis and, through data synchronization, repair and hold time violations of data input to registers in the event of late arrival of clocking.

"Production started in September 1989," says Quickturn marketing director Stephen Walters, "and we sold a million dollars' worth in the first quarter of production." A basic copy sells for $125,000, which buys capacity of 25,000 gates. Though the technology is exciting, says Collett—"I've spoken to several ASIC designers and they're hot on it"—he believes the company is at a critical juncture. "It must sell people on the idea, but the potential customer doesn't want to pay all that to be a guinea pig. So Quickturn is walking a narrow line between cutting the price to make it more attractive or getting turned down by prospective users."

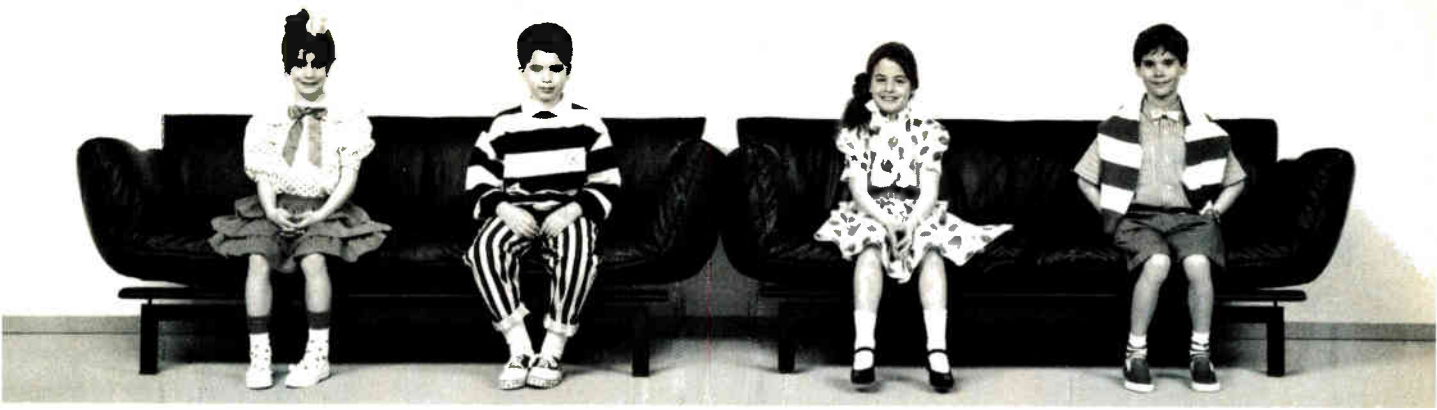
Nevertheless, Collett says he believes that in time the RPM emulator will find its niche. One reason: "It's a partner to simulation—complementary to the tools from companies like Mentor Graphics and Valid Logic." E



KEEPING REAL TIME

Quickturn's RPM Emulation System can do hardware emulation for ASICs in an in-circuit mode; that is, actually plugged in like a real chip.

Their way.



Our way.

Here's how to turn a relay with 2 changeover contacts into one with 4.

The MT4, our new relay with 4 changeover contacts, hardly occupies more board space than the MT2, our relay with 2 changeover contacts.

So if you need 6 twin changeover contacts on your board, simply install an MT2 and an MT4. Two relays of virtually identical size.

And the expensive space you formerly needed for a third MT2 is now free for other important functions.

Plus: less testing, less component cost, less assembly effort, greater reliability.

What more can you want?

(The new MT4: Power consumption at 20 °C 300 mW. Temperature range −55 °C to 85 °C. Space occupied per contact 12 M^2.)

I'm interested in the new MT4 relay. Please send me your literature.

Company _____ ELE 2•4•90

Name _____

Address _____

_____

Telephone _____

Standard Telephon und Radio AG
CH-8055 Zurich/Switzerland, Friesenbergstrasse 75

ALCATEL
STR

Dr. Juchli 924 STR

CIRCLE 202

CHIP MAKERS EYE A NEW MARKET: PC FAX

HIGH-END FAX IS SHOWING UP IN DESKTOP COMPUTERS, AND SEMICONDUCTOR HOUSES ARE READY FOR A BOOM

BY BERNARD C. COLE

THE HIGH-END FACSIMILE market is exploding, and a growing band of chip makers is looking to share in the bounty that until recently was almost exclusively Rockwell International Corp.'s. For many of these new players, the strategy is to go for what they perceive as the communications giant's soft underbelly: a fax-chip repertoire optimized for stand-alone machines rather than the newly emerging personal computer add-in fax boards.

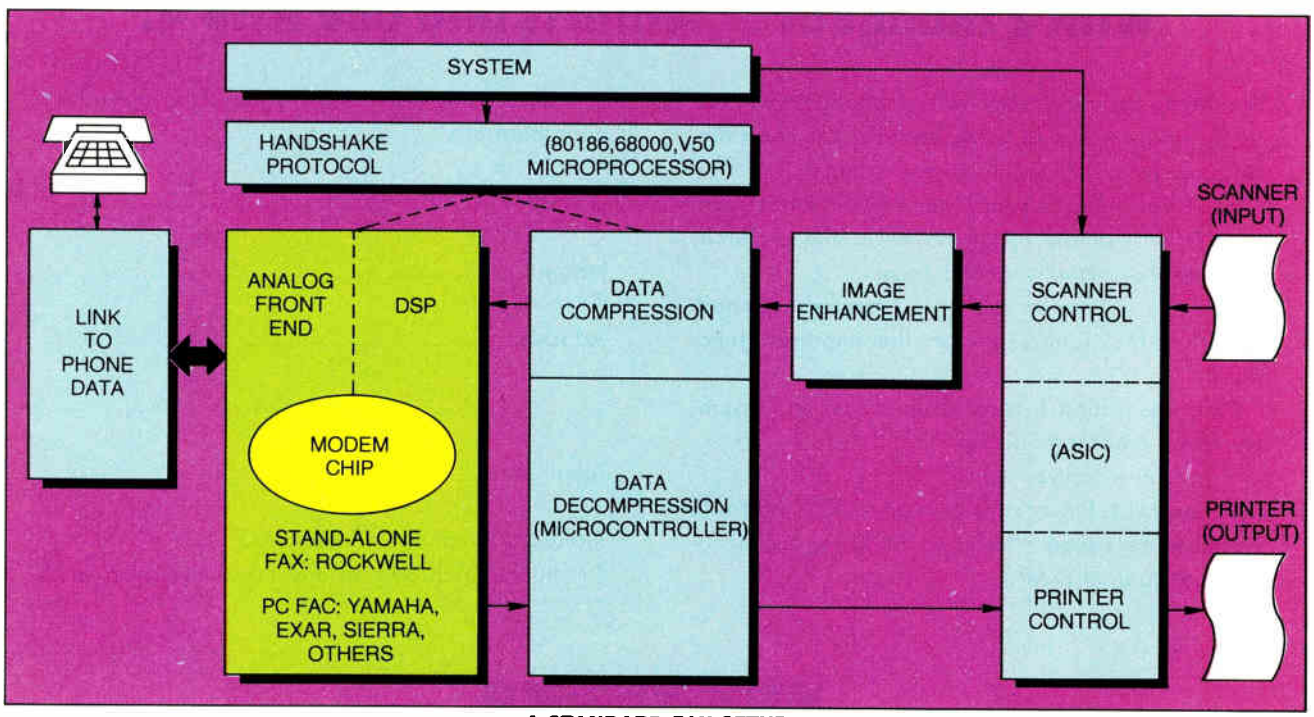
Once consisting of a few hundred thousand companies and organizations, the market for high-level fax—machines that can transmit exact copies of documents, photographs, and illustrations at rates up to 9,600 bits per second—has blossomed. Last year, according to industry watchers, sales topped about 4 million units worldwide, and the market is growing at about 20% or more annually. By many estimates, sales of 9,600-b/s fax machines will hit 13 million units by 1993.

FACSIMILE

Rockwell has been sitting pretty with a market share estimated at between 60% and 80%. But now the company's Data Communications System operation in Richardson, Texas, has competition. Rather than take on Rockwell directly in the stand-alone mechanical-fax market, many of these competitors are focusing on the newer niche for fax boards.

Among them is Exar Corp. of San Jose, Calif., which this month enters the fray with the XR-2900 FaxPlus chip set. Targeting mainly PC applications, the two-chip set integrates a 9,600-b/s send/receive facsimile capability with a more traditional 4,800-b/s data modem.

Exar will be up against Yamaha Ltd.

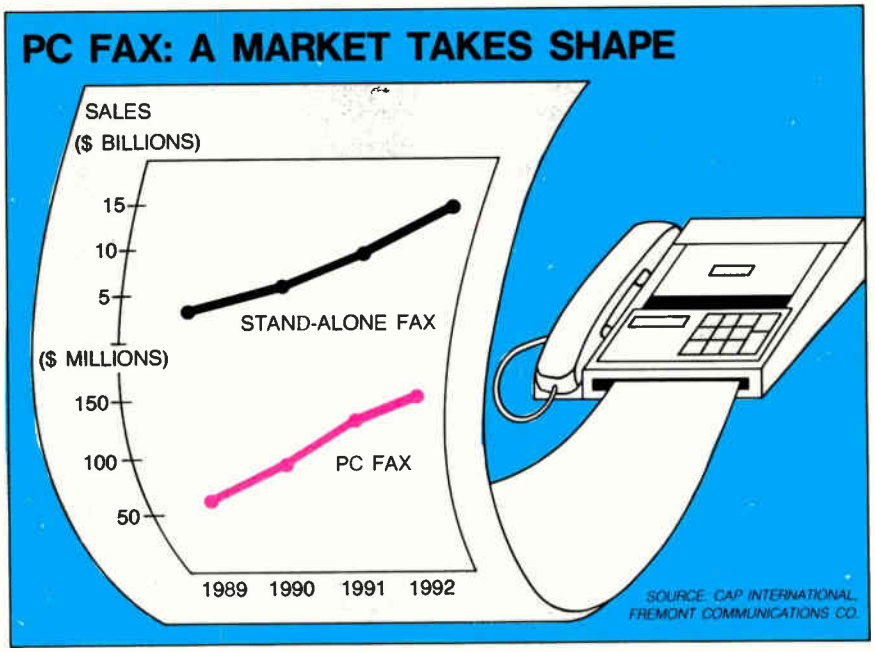


A STANDARD FAX SETUP

Although Japanese manufacturers dominate the market for fax machines, most of the chips that power them—modems, converter chips, data-compression devices, and so on—are American-made.

of Tokyo, which is firmly ensconced in the PC-fax arena with its fax-only YM3418. In the two years since the device has been available, it has garnered a market share of 5% to 10%, analysts say. In the middle of last year, Yamaha was joined by Sierra Semiconductor Corp. of San Jose, which is initially targeting the portable and laptop PC market with its single-chip SC11046 device. It combines a 4,800-b/s send-only fax capability with a 2,400-b/s data modem.

A number of other companies are testing the market with prototypes, among them Hitachi Ltd. with its fax-only HD81900 and Matsushita Electric Industrial Co. Ltd. with its fax-only MN8605. Also eyeing PC fax are Japan's Oki Semiconductor and Taiwan's United Microelectronics Corp. In the U. S., Macronix Inc. of San Jose is expected to introduce a PC-fax chip set and boards built around it, while two major semiconductor houses—Intel Corp. and National Semiconductor Corp.—are nibbling at the edges of the chip business by supplying fax boards to the PC market. Meanwhile, not to be outgunned by the upstarts, Rockwell itself recently introduced devices aimed at PC fax.



AT PRESENT, THE MARKET for PC-fax boards is minuscule compared with that for stand-alone fax machines: an estimated 80,000 boards were installed in 1989 in the U. S. against 864,000 fax machines, according to market watcher Dataquest Inc. of San Jose.

However, the total available market is staggering: some 40 million installed PCs, says Paul Masters, president of fax-board maker Fremont Communications Co., Fremont, Calif. That's at least as large as the installed base of stand-alone fax machines, he says. And an additional 6 million desktop and 500,000 laptop machines are added to the pool each year. "Long term, we feel that the potential of the facsimile market is unlimited," says Bill Nickerson, director of standard-product marketing at Sierra Semiconductor.

The key to expansion is in spreading the word to business users that fax can be a PC function, says Michael Atkinson, vice president of Imavox, a Sunnyvale, Calif., fax-board maker. What a fax board offers them is nothing short of "a worldwide audience accessible by a single fax system with multiple-call capability," he says. "It's like having a low-cost 1-W radio transmitter with the broadcasting range of a multimillion-dollar, megawatt commercial radio station."

Around 50 fax-board manufacturers have emerged in the last two years, and they are the targets of Exar, says company vice president Ilhan Refioglu. "As the [board] market has become more competitive price-wise, their strategy has been to offer more functionality by adding modem functions to their boards," he says. "While it is possible to combine fax-only chips with data-modem chips to create a combined-function board, this is an extremely expensive route to go," he says. Other drawbacks: combined-function boards consume more power and space, require more glue logic to combine the integrated circuits, and result in redundancy of function, Refioglu says.

TARGETING PC FAX

In 9,600-b/s facsimile chips, Rockwell has the market for stand-alone machines sewn up, so competitors are edging in by concentrating on a new market: PC add-in fax boards

So far, Exar, Rockewll, Sierra Semiconductor, and Yamaha are the only players shipping devices, but a half dozen other chip houses are testing the waters

The Exar chip set offers an integrated approach, says the company's modem engineering manager, Demonder Chan. The two chips provide the complete data pump for fax and data communications, he says. The only other external device required is a host microcontroller for graphics control and for implementing the modem's command set.

Fabricated in 2.0-μm CMOS and created using the company's in-house design-automation system, the Exar offering includes the digital-signal-processing XR2901 and the XR2902 analog front end. The 2901 has the modulation and demodulation circuitry for both the fax and digital-modem functions, says Chan. It also supports the DSP functions, including the adaptive equalizer, scrambler and descrambler, automatic gain control, and carrier functions.

The 2902, he says, combines analog and digital functions. The analog portion contains the transmit and receive filters, which provide band separation and equalization for the full duplex modes. It also contains a 9-bit analog-to-digital converter that handles incoming voice-line signals and a 10-bit digital-to-analog converter for transmission. The digital portion contains the handshaking logic necessary for interfacing to a host processor or on-board controller, as well as necessary clock-generation circuitry.

As Exar takes aim at board makers, Sierra is taking a different slant on the market. Sierra's aim is to provide an inexpensive send-only fax capability for a

specific class of users, says Nickerson: PC and laptop users in departmental or group environments. The company, which is now readying new products, got its feet wet last year with the first single-chip combined data/fax modem offering. The SC11046 SendFax combines 4,800-b/s send-only fax with a 2,400-b/s send/receive modem.

"In general, what these users require is not a receive-fax capability so much as the ability to send electronic messages in fax form to fax machines at remote locations," Nickerson says.

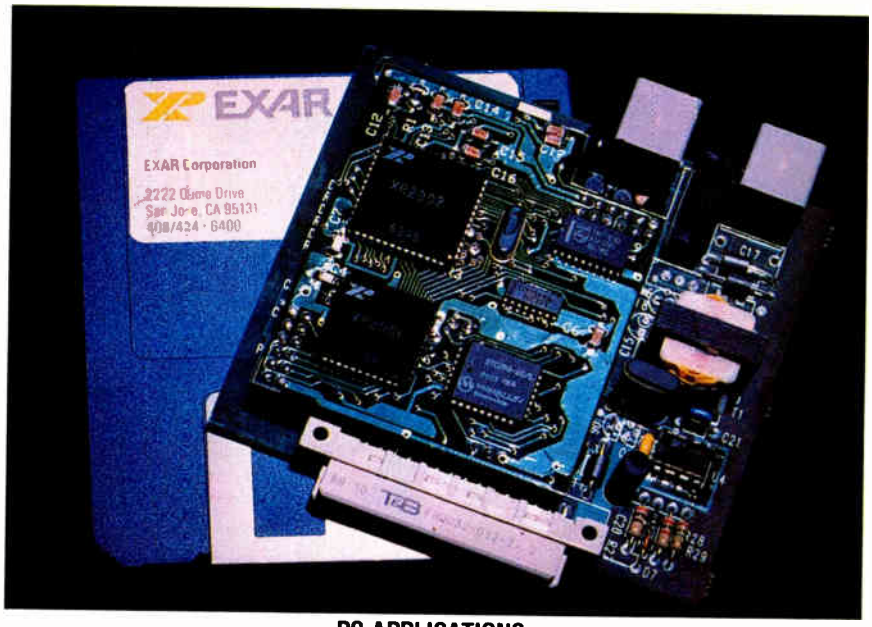
"In the departmental environment, a computer with a send-fax capability allows a company to buy simpler, less expensive stand-alone fax machines instead of more expensive ones designed for multiple users. In a laptop, a send-fax capability means that a businessman [who is traveling] can avoid the exorbitant prices that are being charged to send faxes. He can maintain regular contact with his office and his customers over the telephone."

THE BIG QUESTION, SAYS Sierra Semiconductor's Nickerson, is how much the user is willing to pay for fax capability. "At this point in time, we do not feel the vast majority of users are willing to pay the several hundreds of dollars for a capability they can get with their stand-alone fax machines," he says, "especially if they have to give up a slot in their PC to do it." What they might go for, he says, is a high-performance 2,400-b/s modem with a send-only fax capability "for a few tens of dollars over the price of the modem."

The company has aggressive plans to blanket the market with a variety of facsimile and mixed fax/data-modem chip offerings over the next year, including a low-power version of its current chip, 2,400- and 9,600-b/s send-and-receive chip sets, and a 19,200-bit data and fax modem chip set.

For its part, Macronix is involved not just with chips but also with boards. The company believes it is possible to make some improvements over the current fax-chip offerings and later this year will introduce a fax/modem chip set and a new generation of more powerful boards based on them.

Right now Macronix is building boards around the Yamaha YM3418 fax-only chip combined with a 2,400-b/s Hayes-compatible modem and an Intel Corp. 16-bit 8096 microcontroller.



PC APPLICATIONS

Exar's two-chip set, the XR-2900 FaxPlus, integrates 9,600-b/s send/receive capability with a 4,800-b/s data modem.

Using these devices it supplies two half-card offerings: the Maxfax9624, with data modem and full 9,600-b/s fax send and receive for desktop PCs; and the Maxcomm 2448, with data modem and send-only 4,800-b/s fax capability for portables and laptops.

"While it does require additional logic and components to implement a combined fax/data modem," says company president Paul Liu, "it does not necessarily mean compromising performance to achieve lower cost. And with proper design it does not necessarily mean a large form factor."

THE TOTAL AVAILABLE FAX MARKET IS STAGGERING: SOME 40 MILLION INSTALLED PCs. 'LONG TERM,' SAYS ONE EXECUTIVE, 'THE POTENTIAL IS UNLIMITED'

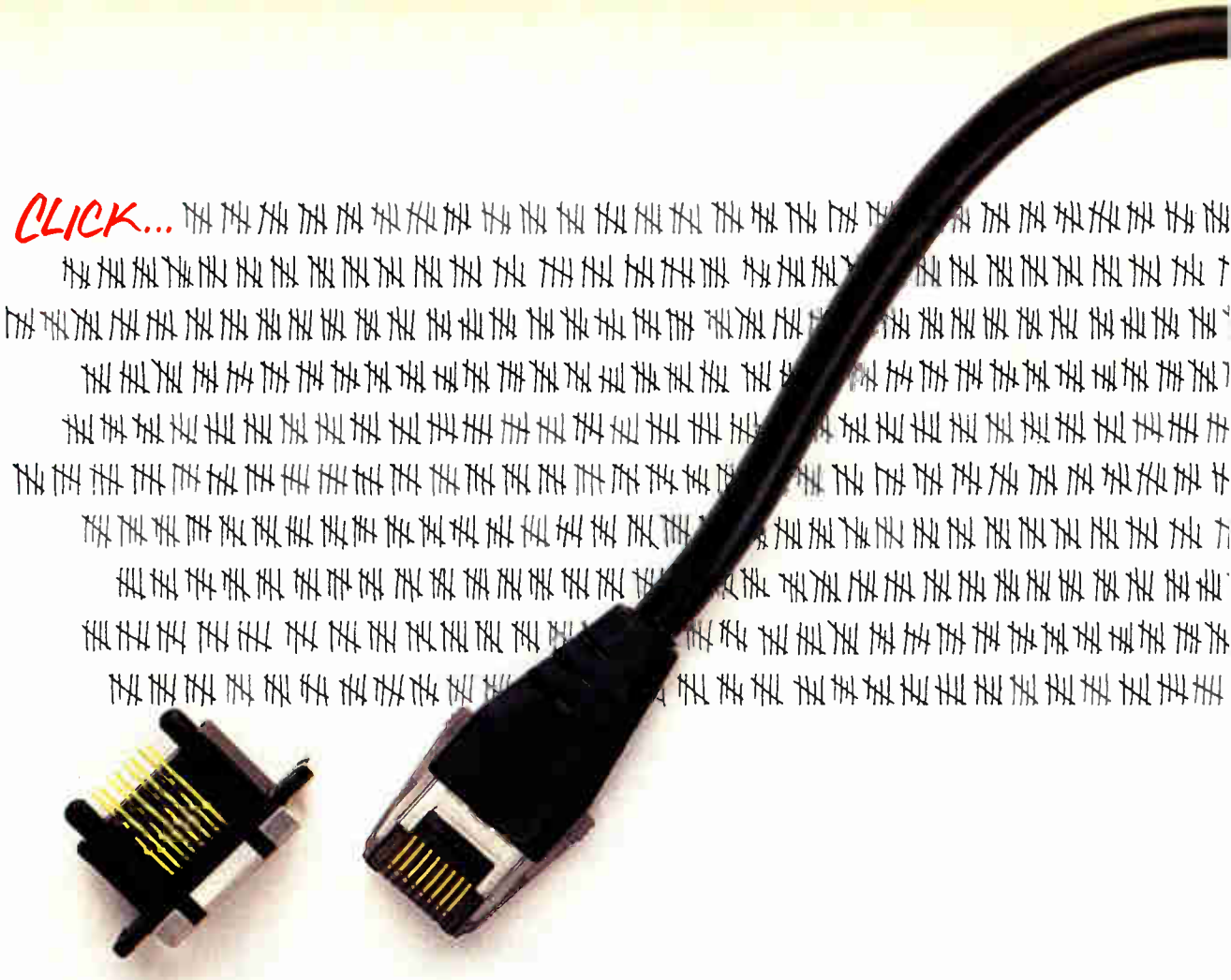
The company, with the backing of Hambrecht & Quist Inc. and a group of private investors, is now breaking ground on a $100 million fabrication facility in Taiwan devoted mainly to data communications circuits, including fax and modem ICs.

Looking over its shoulder at these newcomers, Rockwell is continuing to add to its family of devices with both lower-cost and higher-functionality offerings. Rockwell is in its fourth generation of fax-only products designed primarily for stand-alone machines, says Duane Smith, director of the facsimile modem product line. In addition, he says, Rockwell recently introduced a family of eight data/facsimile modem-device options for PCs.

Designated the RC9624AT series, the offerings combine a 2,400-b/s data modem with either a 4,800- or 9,600-b/s fax capability in one or two package configurations. Included also are a range of added software and firmware options, including data compression and error correction.

For the PC-fax market to really take off, says Masters of Fremont Communications, board makers must identify the requirements of key vertical business segments and develop the application software they need for easy access to their customers. "Once that is done," he says, "you will see an explosion in fax-board and chip use, and sales unmatched in recent years."

CLICK...



Great ideas tend

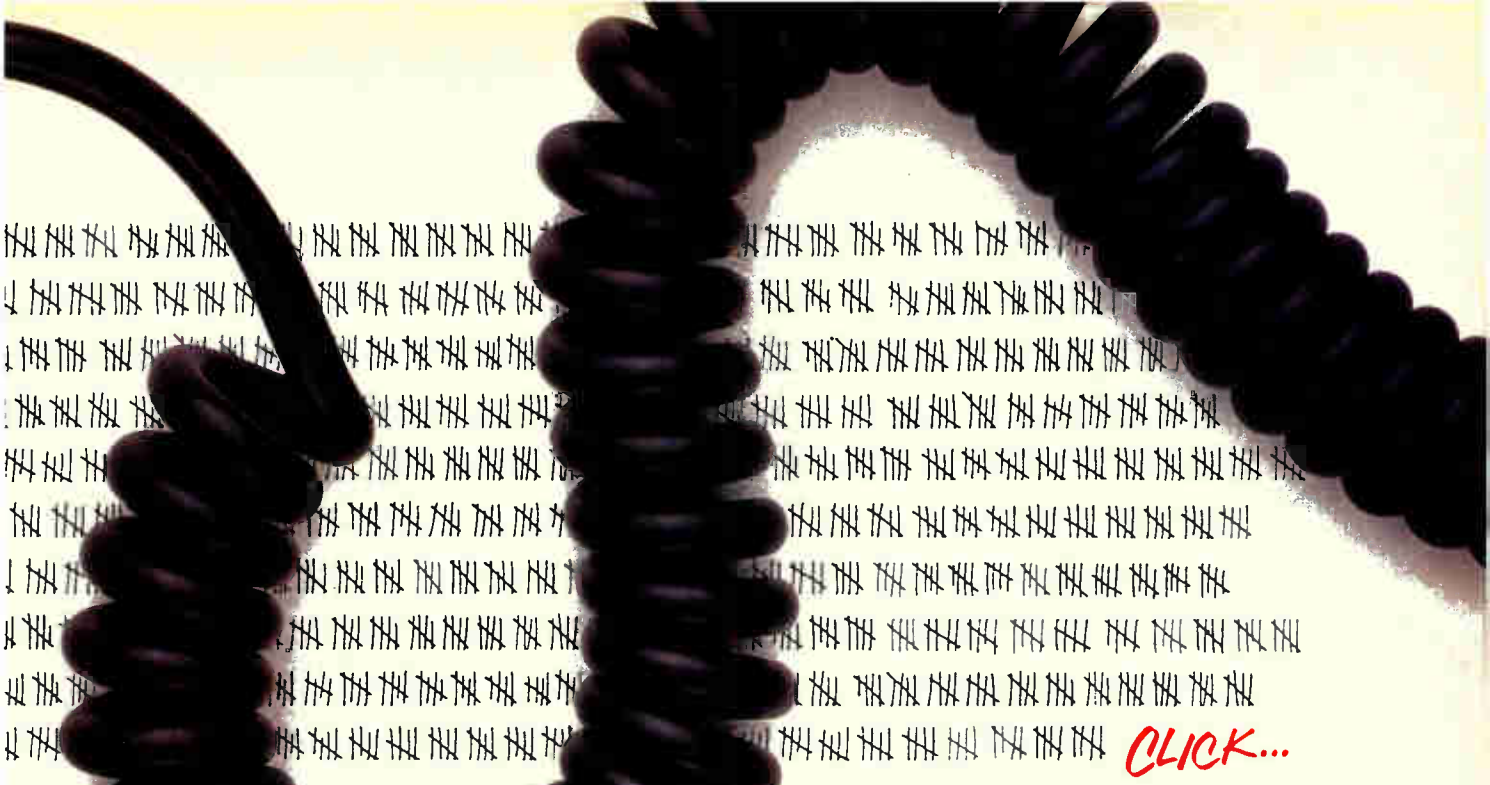
They're simple. They're shielded. They go in with a solid click, and release with a gentle squeeze. Keying and polarization are implicit.

And they're very, *very* durable. In fact, our Shielded Data Link (SDL) connectors are rated at 3000 cycles. They owe their toughness to design and engineering, and attention to such details as selective gold plating. Dependability is the essence of friendliness.

But good-looking and hard-working start well before the user sees this connector. The highly effective shield is designed in, so our SDL connector comes as a no-hassle, one-

AMP SDL connectors—selectively gold plated for reliability and durability—come in 4, 6, 8, and 16 positions. Optional boot for round cable version protects against electro-static discharge.

Offset flange receptacle makes good use of real estate.



to hang in there.

piece assembly. It terminates to flat shielded cable in a single step—conductors and shield, plus two-point strain relief. Round cable takes only two steps.

AMP SDL connectors are a cost-effective alternative to crimp-snap type products, whether you do-it-yourself or order custom cables from us in flat, round, or coiled styles. Either way, you benefit from the same ease of application, the same well-thought-out design. And you walk away with the reliability and durability you need.

Receptacle options: top and side entry, and shunted side entry versions for network applications.

For technical information and literature on SDL connectors, call 1-800-522-6752. AMP Incorporated, Harrisburg, PA 17105-3608.

AMP Interconnecting ideas

CIRCLE 204

The EXABYTE family of 8mm data storage solutions. The capacity to succeed.

EXB-8200
8mm Cartridge Tape Subsystem

EXB-8500
8mm Cartridge Tape Subsystem

2.5 gigabytes of information. On a single 8mm tape.

The first in EXABYTE's family of 8mm data storage solutions, the **EXB-8200 8mm Cartridge Tape Subsystem** can store up to *2,500 megabytes* of information on a single 8mm data cartridge. Packaged in a 5¼-inch form factor, and combined with an integral SCSI controller, the EXB-8200 is the answer for today's data-intensive storage requirements. And with over 70,000 installed worldwide, the EXB-8200 has become the *de facto* standard in workstation, UNIX,® and file server environments.

Double the transfer rate. Double the capacity.

The **EXB-8500** advances beyond the performance of the EXB-8200 by achieving an extraordinary data transfer rate of *500 Kbytes/second*, while providing over *5 gigabytes* of storage capacity. In addition, high speed search at *37.4 Mbytes/second* allows rapid file retrieval. Simple plug 'n play capability enables current EXB-8200 users to easily take advantage of the EXB-8500's speed and capacity. Data interchange between the two models is assured through full read and write compatibility.

50 gigabytes of data storage. Right on your desk.

The **EXB-10 Cartridge Handling Subsystem** (CHS) provides access to as much as *50,000 megabytes* of data storage in an unparalleled compact design. An integral robotic handler performs automatic, sequential loading and unloading of up to ten 8mm data cartridges, eliminating the need for manual intervention by delivering up to 28 hours of nonstop, unattended data backup. Voted product of the month by *UnixWorld*!

EXB-10 Cartridge Handling Subsystem

Over ½-terabyte capacity. In only 4 square feet of floor space.

Just as the EXB-8200 revolutionized the tape storage industry, the **EXB-120 Cartridge Handling Subsystem** (CHS) redefines mass storage. With up to *580 gigabytes* of data storage available in a space-saving design, the EXB-120 CHS eliminates manual intervention in traditional labor-intensive operations. It's ideally suited for those applications that demand extraordinary storage capacity such as the backup of very large computer systems or network data bases, and online access to sequential data sets. With a potential for 12 days of nonstop, hands-off data recording, the robotically-driven EXB-120 makes long-term unattended storage a reality.

EXB-120 Cartridge Handling Subsystem

If you're an OEM, VAR, or systems integrator in search of **the** data storage solution to your backup/restore, journaling, archiving, data interchange, data acquisition, and software distribution needs, call us today at **(303) 442-4333** or write EXABYTE Corporation at 1745 38th Street, Boulder, CO 80301.

And discover the capacity to succeed.

CIRCLE 298

EXABYTE™
The Capacity to Succeed

WELCOME TO HARD TIMES IN HARD DISKS

A SHAKEN INDUSTRY STRUGGLES TO MEET THE CHALLENGE OF THE SMALLER FORM FACTOR

BY JONAH McLEOD

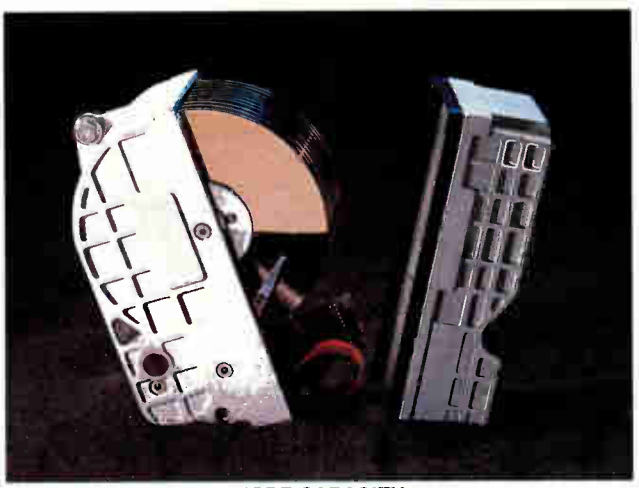
STORAGE

CHIPS MAY BE SILICON Valley's glamour business, but a low-profile mainstay is where the money is. "Magnetic disk drives have generated more revenue in Silicon Valley than silicon devices," says Mark H. Kryder, a professor of electrical and computer engineering at Carnegie Mellon University in Pittsburgh, who estimates that disks account for 20% to 30% of all computer hardware sales. So it was cause for some concern 18 months ago when the $20.4 billion disk-drive industry went into a tailspin brought on by a worldwide glut.

The oversupply and sagging market boded a shakeout the likes of which the business had never seen. Still reeling nearly two years later, the industry is beginning to show signs of renewed vigor. But the aftershock from the 1988 debacle remains. Manufacturers are struggling to regain make-or-break gross margins at the same time they're being challenged by small-is-beautiful technological demands.

Drive makers are rushing to produce next-generation drives, those in the 3.5- and 2.5-in. sizes needed to compete in notebook, laptop, PC, and workstation markets. Though small, these mass-storage drives boast increased performance, as measured in average access time, and are doubling in capacity every two years.

New drive companies are starting to ship 2.5-in. hard drives that stand 1 in. tall or less to exploit the notebook market. And everyone's making 3.5-in. products, which are displacing the 5.25-in. drives in PCs and edging toward a capacity of 300 Mbytes. The 5.25-in. units, in their turn, are moving into workstations in place of the older 8-in. and larger drives. These 5.25-in. products are sailing beyond the 760-Mbyte capacity ceiling in a push to 1 Gbyte and beyond.



MORE CAPACITY

In 5.25-in. drives, vendors are upping storage, as in the 1.6-Gbyte HP97560 from Hewlett-Packard.

The 3.5-in. drives represent the liveliest market right now, says Philip Devin, senior analyst at Dataquest Inc. in San Jose, Calif. Unit sales will be 17.6 million this year, a whopping 55% boost over last year's 11.3 million units, he says. Through 1994, Devin expects a compound annual growth rate of 22% and shipments of 31.4 million units in 1994. As the 3.5-in. hard-drive business waxes, the 5.25-in. business wanes. Shipments of the latter peaked at 8.2 million units in 1988, Devin says, and dipped to 7.8 million last year. By 1994, the total will drop to 2.2 million, a compound annual decline of -22%. The bright spot is in higher-capacity products: 760-Mbyte drives will enjoy 29% compound annual growth through 1994, he predicts.

The market figures tell the story of success and failure in the disk-drive business. Companies that weathered the glut best were those with 3.5-in. products or with offerings in the high-capacity 5.25-in. segment, where margins are high and competitors few. "The hard-disk industry still suffers gross margins in the high teens and low twenties—nowhere near their proper levels of around 30%," says David Vallenti, vice president of storage research at International Data Corp. in Framingham, Mass. "The only good that came out of this downturn is that the drive companies retrenched before the computer-industry slowdown," he says. And trimmer, more efficient drive makers will be better able to ride out the hard times.

They'll be doing so with less competition. Noteworthy casualties of the industry shakeout include drive makers Priam Corp. in San Jose, Calif., and Miniscribe Corp. in Longmont, Colo., along with disk-media supplier Domain Technology Inc. in San Jose. All are either in Chapter XI or are bankrupt. Priam's failure stemmed from its inabil-

ity to launch next-generation products fast enough, says Jim Porter, president of Disk/Trend Inc., the Mountain View, Calif., industry watcher. Miniscribe—which took 60% of Domain's production—died from bad management and took Domain down with it, Porter says.

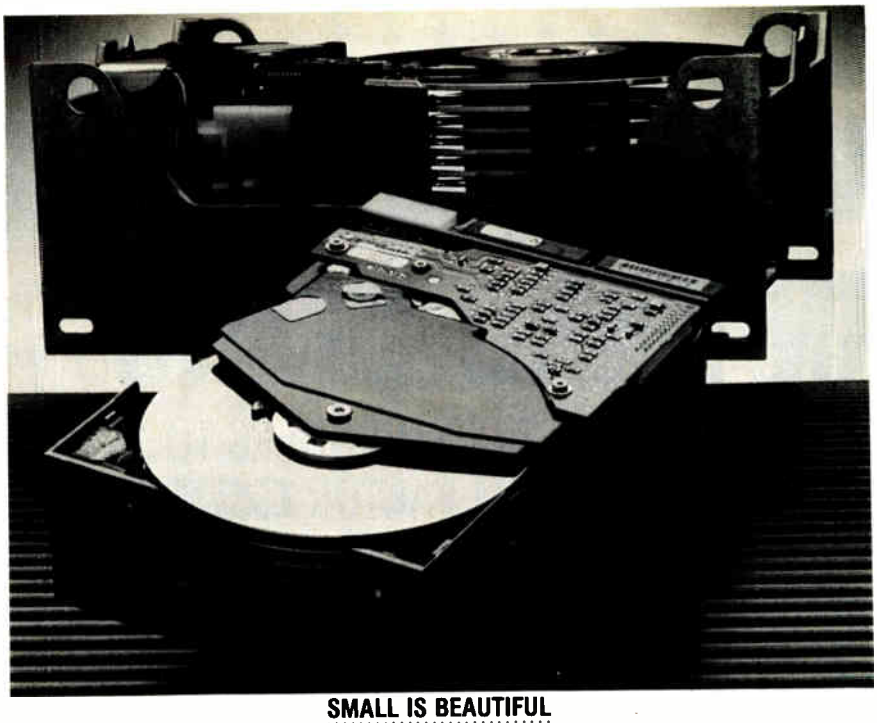
THE REMAINING COMPETITORS—who in Porter's view are not yet out of the woods—are all eyeing the same markets: emerging notebook and laptop computers along with high-end PCs and workstations. Prairietek Corp. of Longmont, the first to ship a 20-Mbyte drive for the notebook market in 1989, has just rolled out its 42.8-Mbyte 2.5-in. Model 240. However, Mike Kirby, vice president of sales and marketing at Areal Technology Inc. in San Jose, believes that even the diminutive 1-in. form factor being used in this market is too big for notebook PCs. "OEMs need a drive that is around 0.7 in. high," he says, "so that the computer itself can be an inch thick."

Last November, Areal introduced its solution, the MD-2100. It is a mere 0.59 in. high yet offers 100 Mbytes of capacity in a package that weighs 4.8 oz. and uses a single 5-V power supply. Areal gets its high capacity by using glass disks and its light weight by building the drive enclosure out of plastic instead of metal. This unconventional approach pushes the state of the art, and competitors wonder if the company can build the product in volume.

U. S. manufacturer Conner Peripherals Inc. has for some time now been carrying coals to Newcastle: shipping 3.5-in. hard-disk drives in the small form factor to Japanese-based computer manufacturers, including NEC Home Electronics (U.S.A.), Sharp Electronics, and Toshiba America.

It, too, has jumped into the 2.5-in. arena with its CP-2024, a 20-Mbyte drive standing just 0.69 in. high and code named Kato—with apologies to Inspector Clouseau's manservant. Kato and three other new drives were designed with input from major U. S., European, and Asian computer OEMs, says Scott Holt, executive vice president of sales and marketing at the San Jose company.

"Conner's secret is to stay close to its customer and build a quality product at a good price to meet his needs," he says. Compaq Computer Corp. of Houston, a Conner investor, has already used one of the company's new 0.69-in.-high, 3.5-in. drives in its LTE notebook PC.



SMALL IS BEAUTIFUL

Replacing 5.25-in. drives (background) in PCs and workstations are high-capacity 3.5-in. products, like this 320-Mbyte unit from IBM.

Kato is the first wave of a coming product surge. "By the end of the year upwards of 50,000 [2.5-in.] drives will have shipped," says Dataquest's Devin. "Japanese drive makers have all started developing 2.5-in. products and are no longer looking at 3.5-in. Every 3.5-in. drive maker will roll out a 2.5-in. product." Devin expects the downward spiral in disk-drive size to continue. He says that IBM Corp. has its eyes on a 1.8-in. disk drive and may well take the technology initiative in building this next-generation product.

Big Blue has speculated on mounting such a unit directly on a PC's motherboard. With existing technology, a 1.8-in. drive could hold 10 Mbytes of storage, but by the end of the year 20 Mbytes will be possible.

In the fast-moving 3.5-in. market, drives in the 100-to-200-Mbyte range have had the most sales activity recently. In this market, Quantum Corp. of Milpitas, Calif., will be a force. At nearly 30%, Quantum has one of the best gross margins of any disk-drive company in the business. Though the quarter ending in December last year was 18% below the quarter ending in October, it was up 212% over the same quarter a year ago.

"Drives in the 100-to-200-Mbyte category are aimed at workstation suppliers looking for a higher entry-level product," says Mark Wilson, vice president of marketing at Quantum. The company is producing its ProDrive Models 120, 170, and 210 offering 120, 170, and 210 Mbytes, respectively. Models 120 and 170 are already shipping.

By Disk/Trend's count, companies battling Quantum for market share in this segment include Areal, Conner, Hitachi, Maxtor, Rodime, Toshiba, and eight others. "Maxtor—one of the first with a high-capacity 3.5-in. drive—plans to ship more than 10,000 of the 200-Mbyte units per quarter this year," says George Scalise, Maxtor Corp.'s president and chief executive officer. He says the market demand is about 40,000 a quarter.

One major disk-drive company that has not been a big factor in 3.5-in. products is Seagate Technology. The billion-dollar, Scotts Valley, Calif.-based behemoth lagged in developing a low-end 3.5-in. drive, relying instead on low-end 5.25-in. products.

However, Seagate's acquisition last year of Imprimis Technology Inc., a subsidiary of Minneapolis-based Control Data Corp., plugs all the holes in its product line, says Carla Kennedy, vice president of marketing. In the last quarter of 1989, the company began rolling out its 126-Mbyte ST1144A 3.5-in. drive, so the competition in this

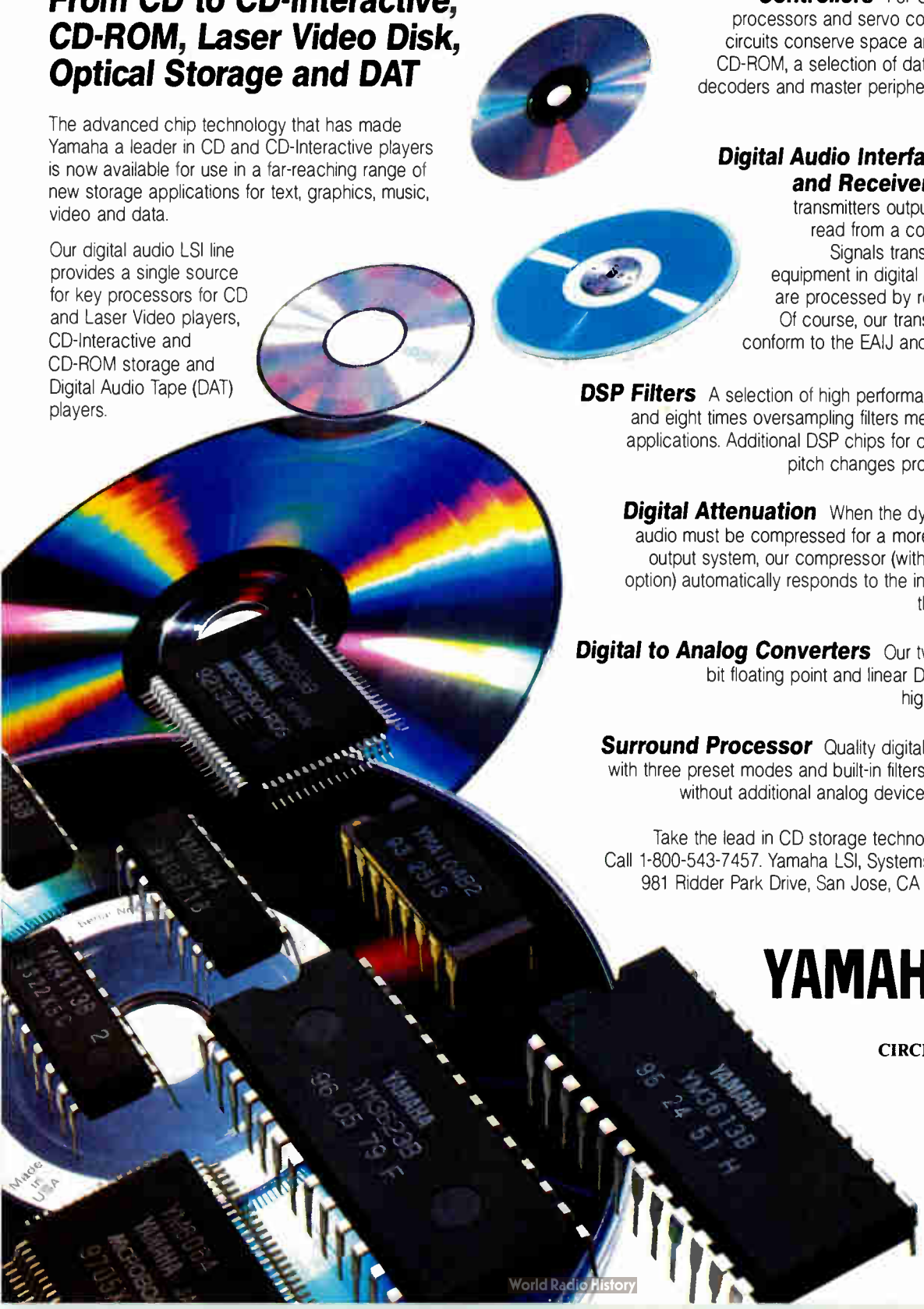
YAMAHA LSI.

Leading the Way in CD Storage Technology.

From CD to CD-Interactive, CD-ROM, Laser Video Disk, Optical Storage and DAT

The advanced chip technology that has made Yamaha a leader in CD and CD-Interactive players is now available for use in a far-reaching range of new storage applications for text, graphics, music, video and data.

Our digital audio LSI line provides a single source for key processors for CD and Laser Video players, CD-Interactive and CD-ROM storage and Digital Audio Tape (DAT) players.



Controllers For CDs, single-chip signal processors and servo controllers for peripheral circuits conserve space and power. For CD-I or CD-ROM, a selection of data controllers, ADPCM decoders and master peripheral controllers provide the circuitry needed.

Digital Audio Interface Transmitters and Receivers Signal processing transmitters output digital audio signals read from a compact or optical disk. Signals transferred between audio equipment in digital audio interface format are processed by receivers for playback. Of course, our transmitters and receivers conform to the EAIJ and AES/EBU standards.

DSP Filters A selection of high performance, two channel, four and eight times oversampling filters meet the needs of many applications. Additional DSP chips for digital equalization and pitch changes provide flexible solutions.

Digital Attenuation When the dynamic range of digital audio must be compressed for a more limited-range analog output system, our compressor (with a volume processing option) automatically responds to the input level to compress the digital audio signal.

Digital to Analog Converters Our two channel, 16 and 18 bit floating point and linear D/A converters provide high quality audio output.

Surround Processor Quality digital surround capabilities, with three preset modes and built-in filters, can be implemented without additional analog devices or microprocessors.

Take the lead in CD storage technology with Yamaha LSI. Call 1-800-543-7457. Yamaha LSI, Systems Technology Division, 981 Ridder Park Drive, San Jose, CA 95131 (408) 437-3133 FAX (408) 437-8791.

YAMAHA® LSI

CIRCLE 208

market segment is about to begin in earnest.

While drive makers are shipping products in the 100- to 200-Mbyte capacity range, the next brass ring everyone is reaching for is over 380 Mbytes (unformatted). Only two companies have managed to snag it so far: IBM and Maxtor. IBM got there first with the Model 320, a 320-Mbyte (formatted capacity) drive, which is shipping in the company's recently announced System 6000 workstation.

"IBM got to be first the hard way," says Vallenti of IDC. "Instead of packing more bits and tracks per inch on the four disks normally used in a high-capacity 3.5-in. drive, IBM used eight disks. In addition, to push performance, the drive rotates at 4,300 rpm instead of the 3,600 rpm of other drives." Turning the disk faster increases the data-transfer rate and reduces latency—the time it takes a block in a track to rotate to the drive's read/write head. With a 3,600-rpm rotational rate, latency is around 8 ms. In the IBM drive, it's about 6 ms.

What the drive buys IBM is time to market, Vallenti concludes. The company can ship a workstation with a 320-Mbyte 3.5-in. drive when no other workstation vendor can. IBM is not offering the product on an OEM basis "and probably couldn't, because no computer maker will buy a key component from its archrival," says Gerald Boudreau, director of marketing and business planning for Hitachi America Inc.'s Computer Division in Brisbane, Calif. However, "Big Blue is selling the drive to third-party add-on equipment manufacturers, such as Western Digital, Systems Industries, and CMS Enhancement," he says.

As a result, the OEM business is left wide open for Maxtor and its LXT-340 drive with 340-Mbyte formatted capacity, announced in January. Scalise says the company began shipping beta units this month. "The LXT-340 will move into slots where 380-Mbyte 5.25-in. drives were used previously," Scalise predicts.

Boudreau says Hitachi plans a model in that capacity range, too, but has not yet decided how many megabytes to offer. "The range will be 320 to 400 Mbytes," he says, hinting that the product is likely to be at the higher end of this span. "In the 3.5-in. market, the previous-generation capacity was 200 Mbytes. So the next step up should be double that, or 400 Mbytes."

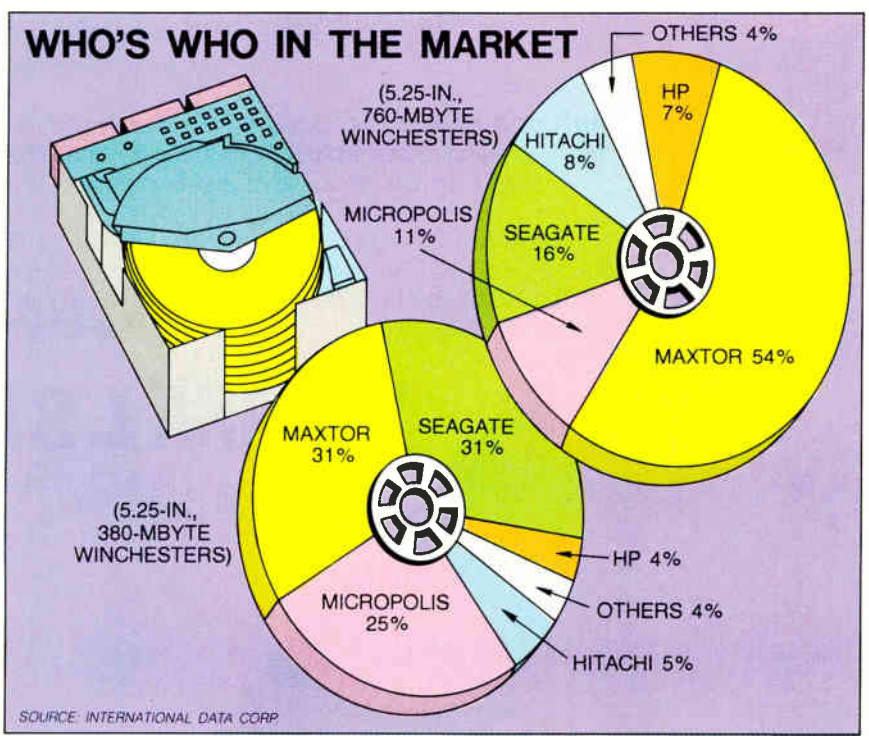
Maxtor's Scalise sees his company's competition coming not from other 3.5-in. offerings but from suppliers of half-high 5.25-in. 380-Mbyte drives. "In this product category, only Imprimis and Micropolis have a product," says Porter of Disk/Trend. "The advantage for the OEM of a half-high drive is that he can buy the product now and not have to wait for volume production of the 3.5-in. drive later in the year." Scalise concedes the half-high 5.25-in. drive has its attractions, but he's betting on the 3.5-in. units: "once in volume production, 3.5-in. will cost less."

COMING ONSTREAM

For notebook computers, a new generation of 2.5-in. disk drives packing 20 Mbytes or more and standing under an inch tall;

For PCs and workstations, 3.5-in. drives with 300-Mbyte capacity;

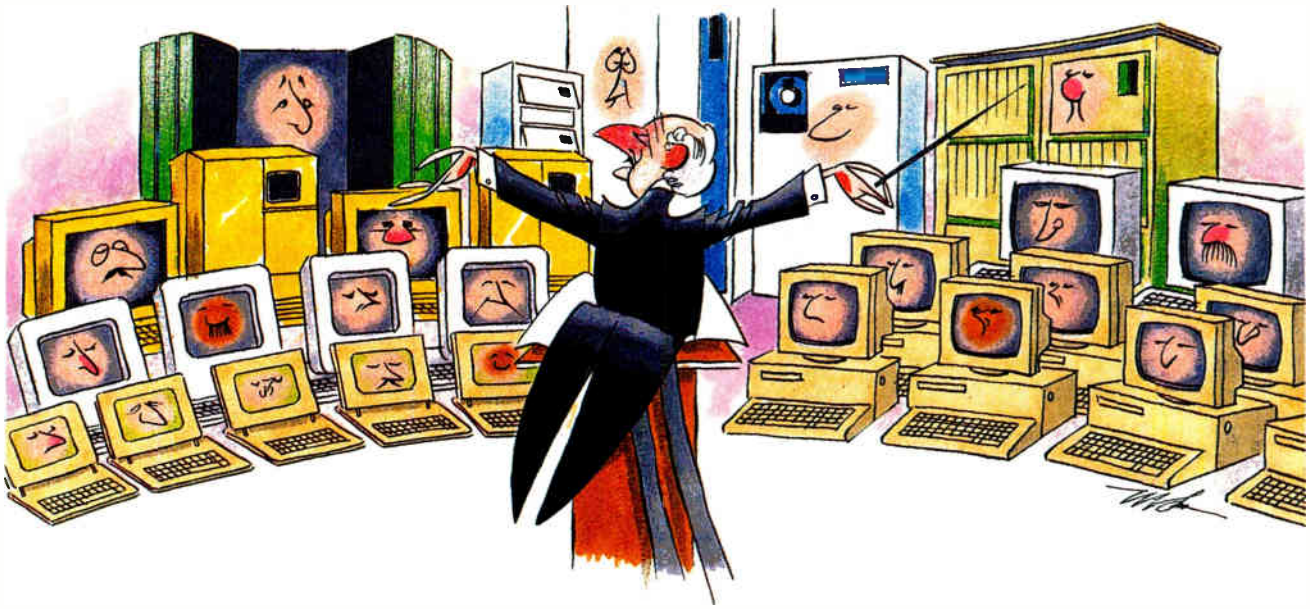
For file servers, minis, and mainframes, 5.25-in drives breaking the 1-Gbyte barrier.



HOWEVER, FOR MICROPOlis Corp. of Chatsworth, Calif., the half-high product is the ticket back to good times. "The company was so hard hit by the glut in 380-Mbyte 5.25-in. drives that it gave up its 3.5-in. drive development," says analyst Vallenti. Its strategy now is to use the half-high 5.25-in. drive to fund the development of the 1-Gbyte full-height 5.25-in. product, he says.

In the full-height 5.25-in. arena, "the 760-Mbyte and 1-Gbyte product categories are doing well and will continue to grow," says analyst Devin. "While the lower-capacity product will see a 29% compound annual growth rate over the period 1989 to 1994, the higher-capacity unit will grow a whopping 328%." Among the makers of these drives, which are destined for file servers, minicomputers, and mainframes, are Imprimis, Hitachi, Maxtor, Micropolis, NEC, and newcomer Hewlett-Packard. All have shipped samples.

The offering from Micropolis is the Model 1518-14, which boasts 1.12 Gbytes of capacity (unformatted). Maxtor's P1-13 and P2-17S, nicknamed Panther, offer capacities of 1.35 and 1.42 Gbytes respectively. The Imprimis Model 94601-12G, one of the first to ship, holds 1.1 Gbytes, while its 97501-15G offers 1.21 Gbytes. Hitachi's offering is the DK516-12, with 1.2 Gbytes, and the DK516C, with 1.6 Gbytes (unformatted). NEC Corp.'s 5.25-in. unit is the D5892, which offers 1.6 Gbytes of unformatted capacity. Finally, the HP97558 and HP97560 from Hewlett-Packard Co. in Palo Alto, Calif., offer capacities of 1.26 and 1.6 Gbytes (unformatted).



SYSTEMS INTEGRATION: DEFINING A BIG BUSINESS

MAJOR COMPUTER VENDORS SCRAMBLE FOR OPPORTUNITIES TO DESIGN CUSTOMER INFORMATION RESOURCES

BY LAWRENCE CURRAN

SYSTEMS INTEGRATION IS a hot topic again in the computer business, just as it was a decade ago. But the term is being defined much more broadly now as major corporations—mostly computer and consulting firms—hustle to win new business as systems integrators.

Ten years ago, many computer makers were satisfied to sell "iron"—boxed mini- or microcomputers—to small firms that specialized in systems integration. Those integrators put the processor together with peripheral equipment and specialized application software, then sold the whole package as a solution tailored to the needs of a class of customers seeking to automate, say, a factory or a law office. Value-added resellers perform that kind of systems integration today.

Now, however, computer vendors and consulting firms alike are taking on the task of designing, installing, and managing most or all of a customer's information-management resources, acting as a sort of data-processing prime contractor. Much like the conductor of a symphony orchestra, the systems integrator makes a collection of dissimilar equipment play well together.

COMPUTERS

Digital Equipment, Hewlett-Packard, IBM, and Unisys are just a few of the leading computer firms that have set their sights on substantial new revenues from systems integration, or variations of SI. At Hewlett-Packard Co., the emphasis is on consulting, with true SI coming via third-party teaming arrangements. Others are forming strategic alliances with major consulting organizations, which, in their turn, often find it advantageous to tap into a hardware vendor's expertise in hardware, software, and networking to plan a customer's information-management needs.

For example, Digital Equipment Corp., the Maynard, Mass., computer company, has paired with a big accounting-consulting firm to pursue SI opportunities in the discrete and process manufacturing industries. And Unisys Corp., headquartered in Blue Bell, Pa., has likewise joined forces with Deloitte & Touche, a consulting and professional services firm based in Wilton, Conn., to serve state and local governments as well as companies. Electronic Data Systems Corp. and Texas Instruments Inc., both based in Dallas, are also looking for SI and/or facilities-management business.

There's a different kind of entry in the SI game as well, perhaps typified by Nynex Information Resources Co., which has set up a Complex Systems Integration Group in White Plains, N. Y. Nynex brings strong communications credentials to the business, but will do both system and network integration.

The lure of SI comes from a lucrative

market that promises enhanced profits for a company offering more than hardware, software, or networking alone. Estimates peg that market at about $5 billion now and triple that sum by 1993. Walter Ulrich, client-services director at Arthur D. Little Inc., a Cambridge, Mass., consulting firm, sees "billions of dollars being spent in systems integration in the '90s, and there will be plenty of competition. But the market will be big enough for a large number of players." ADL penned a service alliance with DEC in January; the two will jointly pursue SI and information-technology projects.

SOME OF THE PLAYERS have restructured into business units that are responsible for the corporate SI thrust. DEC, for example, introduced its so-called Digital Enterprise Integration Services in September 1988.

In company parlance, "enterprise" is synonymous with "corporate-wide," which means that DEC's aim is to provide and/or pull together all of a customer's worldwide networked computers—including non-DEC products—into an enterprise-wide information-management resource. Included in the services are conceptual planning and design, program management, integrated support services, and SI service alliances with other companies, such as the one with Deloitte & Touche.

TI, too, created last fall an Information Technology Group to bring a more concentrated focus to its systems-integration push. More recently, Unisys in January merged elements of its commercial and government business groups into a Systems Management Group, based in McLean, Va., which directs the Unisys SI efforts. IBM has both a Systems Integration Division and a strong but separate facilities management operation.

BILLIONS OF DOLLARS WILL BE SPENT IN SYSTEMS INTEGRATION IN THE 1990s, A MARKET THAT'S BIG ENOUGH TO ACCOMMODATE A LARGE NUMBER OF PLAYERS

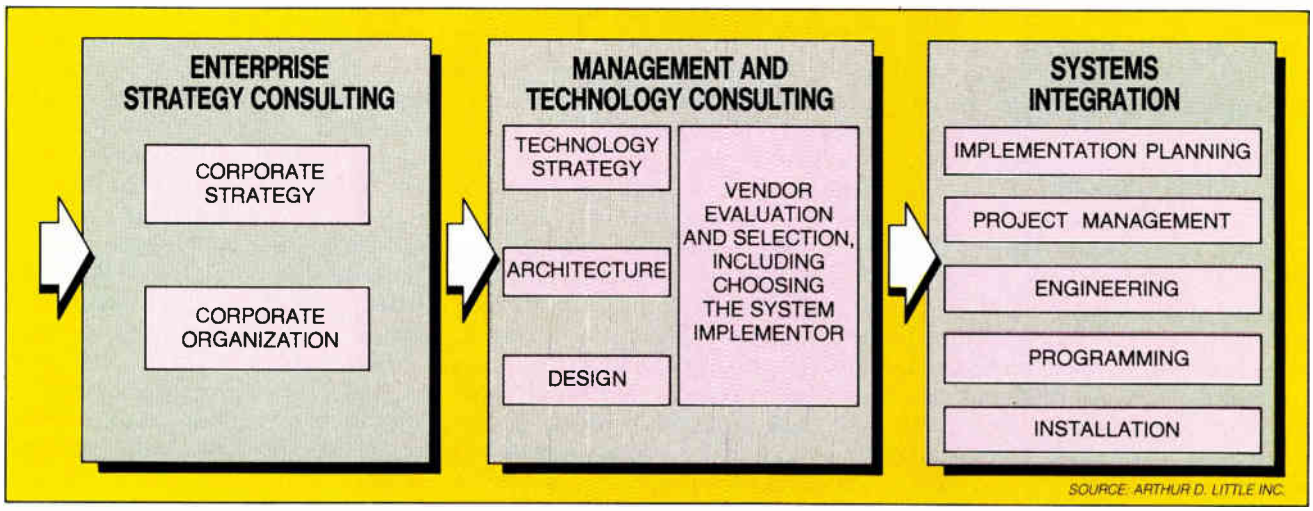
As for HP, the Palo Alto, Calif.-based firm prefers to serve as a professional-services consulting organization that teams with outside systems integrators. In February, the company upgraded its HP Consultline program, which can call on 3,000 HP field consultants to configure multivendor consulting solutions for customers in information management, manufacturing, finance, networking, and engineering automation. HP announced at the same time that the organization would team with outside partners—a Big Five accounting firm, for example—to gain some special expertise.

While the HP program can deliver a hardware-independent wide-area network that integrates computers from multiple vendors, the company won't bid on large government data-processing facilities-management projects, says Susan Cook, product marketing manager in HP's Applications Support Division, Mountain View, Calif. The latter kind of business "requires a large central organization that keeps a stable of bodies who can be rotated on a job basis," Cook says. "That's a lucrative business, and some companies do it well, but we won't do it." Instead, Cook says "we'll work with an outside partner to offer some component of that solution."

At Unisys, the restructuring into an easily recognizable SI organization "isn't just another reorganization," says David C. Gompert, newly named president of the Systems Management Group. "It's a strategic initiative decided at the highest levels to provide an important avenue for growth."

Unisys offers a good example of how the new SI organizations are structured and how they go after business. SMG is part of the company's U. S. Information Systems Division. It can call on the skills of some 1,500 employees, of whom about 5% are program managers.

Roughly 25% of the total are hardware specialists, 10% or less are network designers or managers, "and most of the rest are software special-



ACTIVITY FLOW

Enterprise-wide integration calls for a broad view of systems integration, involving consulting on corporate strategy and design architectures before a single piece of hardware is specified.

ists—programmers, application engineers and designers, and software developers," says Gompert. There's another small cadre (5% to 10%) of "high-level technical people," as Gompert describes them, such as senior technical managers and consulting systems engineers. Another way of looking at SMG's makeup shows that about a third of the organization have expertise in Unisys technology, while two thirds are skilled in non-Unisys multivendor environments.

The Unisys sales force has been trained to recognize opportunities that suggest SMG get involved. The dollar potential varies greatly—from a few million dollars to $100 million or more. More important as criteria for calling in SMG is the complexity of the job and identifying who will bear responsibility for the finished system.

SMG usually gets involved if there are needs for extensive special design work, the use of diverse technologies (a mix of Unisys and non-Unisys computers, for example), and networking. The most important criterion, however, is whether or not a customer "plans to place the full responsibility and risk on the shoulders of the systems-integration vendor," Gompert says.

A $12.3 million contract awarded to SMG and Grumman Data Systems in January is a good example of how the Unisys SI approach works. Unisys and Grumman will design and implement a public-safety information-management system for Suffolk County, N. Y. As subcontractor, Grumman "will do a large piece of development work" for a network that will link the county's police and fire departments, jail, district attorney's office, rescue and emergency services. The network will include Unisys mainframes, departmental computers, 799 work stations, communications equipment, and software tailored to the county's needs.

ULTIMATE RESPONSIBILITY falls to SMG. "While there are provisions in contract law for a flow-down of risk to subcontractors, that doesn't relieve the prime [contractor] of the first responsibility to the customer," Gompert says. "We're ulitmately responsible, and that's part of what we sell: a willingness to back what we sell." He says SMG will account for some $100 million in 1990 revenues.

The revenues are larger at both HP and DEC. HP Consultline's consulting sevices earned $200 million last year, says Taia Ergueta, multivendor support-product marketing manager in Mountain View. But HP acknowledges that customers are wary of system integrators that are also hardware/software vendors. Consultline's requirements analyses for customers stop short of making specific product recommendations.

DEC's Enterprise Integration Services organization is expected to generate more than $1 billion in 1990 SI revenues, encompassing hardware, software, services, and support. Based in Stow, Mass., EIS is not a stand-alone division, says David Creed, its corporate marketing manager. Instead, EIS can call upon the services of some 20,000 DEC employees in the company's worldwide customer service and sales organizations.

HELP!

Customers in government and at large corporations are clamoring for help in designing, installing, and managing multivendor information-processing networks.

And computer companies including DEC, HP, IBM, and Unisys see their need as a big revenue producer: $5 billion this year, triple that amount in 1993.

Creed says that DEC has put in place the machinery and process to identify whether or not a business opportunity warrants EIS consideration. It consists mainly of program-management offices around the world that take over a task after a sales team has turned up a likely EIS candidate—an opportunity the sales team believes exceeds the bounds of being locally deliverable off the price list. Then the program-management office invokes what Creed loosely calls an "algorithm."

This calculation is "a combination of size, complexity, and risk," Creed says. "And if the potential business meets the [SI] test, EIS is called in." He describes SI as providing "something beyond just a product." If the sales force can satisfy the customer's need by selling "just a product, or a product plus a third-party application, there would be no EIS involvement."

Creed regards SI as a three-dimensional task. The first dimension consists of platform integration or systems engineering—essentially "plugging the hardware and software together to assure circuit integrity and data flow," Creed says.

THEN COME THE APPLICAtion and systems-operation dimensions. In this phase, EIS would "craft the custom part of the solution," most likely software, and integrate it with the platforms. Finally, the systems-operation dimension is usually called facilities management. It encompasses managing the enterprise-wide system once the platforms and custom components have been successfully integrated.

All three dimensions are delivered and managed by "a single point of responsibility," Creed says, "because customers are applying information technology on such a broad scale that they want to buy solutions, not just products. And they want to buy those solutions from a systems-integration company."

A good example of an EIS project is the manufacturing system DEC is developing for the Convair Division of General Dynamics Corp. in San Diego [*Electronics*, January 1990, p. 15]. DEC is systems integrator for the multiyear, multimillion-dollar project, which will integrate thousands of workstations. Subcontractor Matra Datavision Inc. will supply CAD/CAM solids-modeling software for engineering and manufacturing.

Nynex also assumes full responsibility for its SI projects, much as a general contractor shoulders the responsibility for constructing a building, says Gad Selig, vice president and general manager of the Nynex Complex Systems Integration Group.

Selig explains that systems integration at Nynex consists of consulting, design decisions, implementation, testing, maintenance, and facilities management—or any combination of these ingredients. "We sell people and services. We're solution folks looking for the best and least expensive solution" for a customer, he says.

Like the systems integrators coming from computer-industry roots, Nynex is teaming with other companies for specific projects. For example, IBM is its partner on EmpireNet, a five-year, $170 million New York state government network project. Nynex handles the planning, especially for the network-control center and network-management software. ■

Additional reporting by Jack Shandle

INFORMATION CENTER

Use the postage-paid card on the facing page;
circle the number of each company you would like to know more about.

BATTERIES

414 - **Sonnenschein Lithium**—For the widest range of professional needs in the electronics field.

CAE/CAD SOFTWARE

101 - **Aldec**—CAD software offers a complete design solution. 102 - 386-based simulators match workstation performance at a fraction of the cost. 103 - Real-time simulators zoom ahead of batch processing. 104 - Printed-circuit board simulation is fast becoming practical.
30 - **Harris**—Scicards gridless router saves hours of interactive editing.

COMMUNICATIONS

330 - **Intel**—There are 32 incredible reasons for using the 82596 LAN CoProcessor.

COMPONENTS

202 — **Alcatel**—The MT4 relay, with 4 changeover contacts.
418 - **Hirose Electric**—The right high-density connectors.
408 - **Wickmann-Werke**—Starlights: a new fuseholder generation.

COMPUTER BOARDS

236 - **Clearpoint**—Memory compatible with the HP 9000 Series 350/370 workstations.
241 - **Matrox**—The Image Series board set for hardware resources and software support.

COMPUTER I/O DEVICES

471 - **Itac Systems**—Mouse-Trak: accurate and precise cursor control; user-definable keys.

COMPUTER PERIPHERALS

298 - **Exabyte**—The family of 8-mm data-storage solutions with the capacity to succeed.
484 - **Recognition Concepts**—The "C" Series versions of the TRAPIX PLUS image processors.

COMPUTERS & WORKSTATIONS

309 - **Hewlett-Packard**—Solutions that combine highest quality computer products with leading applications.

CONNECTORS & SOCKETS

204 - **AMP**—Shielded Data Link connectors are simple, shielded, go in with a solid click, and release with a gentle squeeze.

CONTRACT MANUFACTURING

296 - **Avex**—SMT and through-hole products on time, to specifications, and within budget.

DEVELOPMENT SYSTEMS

228 - **Intermetrics**—C-language cross-development tools can create a fully integrated environment that delivers fast, efficient code.

DISPLAY DEVICES

271 - **Aerospace Optics**—The Vivisun Series 2000, the programmable display pushbutton system.
311 - **Fujitsu**—The 15-in. plasma display with all the features you've been looking for.
498 - **Hewlett-Packard**—Commitment to meeting your needs in optoelectronics, optical communications, and microwave technology.

MATERIAL

428 - **Daicel Chemical Industries**—Recording materials for optical and magneto-optical disks.

MEMORY ICs

208 - **Yamaha LSI**—Leading the way in CD storage technology.
400/401 - **Vitelic**—With 60- and 70-ns access times, Vitelic's CMOS DRAMs are the fastest SIMMs in the league. Circle 400 for literature, 401 for sales contact.

OSCILLOSCOPES

200/201 - **LeCroy**—The 1 GS/sec digital scope with many features. Circle 200 for literature, 201 for a demonstration.

PC-BOARD LAYOUT

242 - **P-CAD**—Master Designer for PCB designers can handle boards of up to 2,500 components, 4,000 nets.
252 - **Valid**—Catch problems before prototypes are built with the Allegro PCB design system.

POWER SUPPLIES

205 - **Abbot**—Mil/Pac high-density military power supplies.
266 - **Vicor**—FlatPAC takes the uncertainty out of power development.

PRODUCTION EQUIPMENT

355 - **ASM Lithography**—Introducing the first half-micron i-line stepper.
432 - **Brian R. White**—Contact-free soldering and desoldering.

SEMICONDUCTORS

213 - **Epson Semiconductor**—Design of a system on chip is now possible with the SLA8000 Gate Array Series.
212 - **Integrated Device Technology**—Leading-edge performance with the world's fastest FIFOs.

SOFTWARE

402 - **Graphicus**—Powerful solutions for powerful computers.
475 - **T-Cubed Systems**—Reliability prediction software.
327 - **Zycad**—Lower prices, highest performance VHDL, powerful ASIC simulation solutions.

SUPPLIERS

203 - **Texas Instruments**—Congratulations to the winners of the 1989 Texas Instruments Supplier Excellence Award.

TEST INSTRUMENTS

279 - **Anritsu**—The highest levels of test accuracy for all types of communications.
235 - **Hewlett-Packard**—The HP 3070 AT-Series combinational tester is the answer for complete testing of today's complex boards.
225 - **Nicolet**—The new DSO technology of choice with the 400 models.
253/254 - **Photo Research**—The new SpctraScan SpectraRadiometer. Circle 253 to have a salesman call, 254 for literature.
206 - **Rohde & Schwarz**—No curve will send you around the bend with function generators from 1 Hz to 50 MHz.
218 - **Rohde & Schwarz**—Test stations for automating production.
207 - **Wandel & Goltermann**—SNA-6: the ultimate instrument for applications in systems manufacturing.

FREE INFORMATION

Use this card to receive free information on the products featured in this issue.

Electronics
READER SERVICE CARD
04/90/490

Name _____
Title _____
Company Name _____
Company Address _____
City/State/Zip _____

TELEPHONE NUMBER
( ) _____

CIRCLE NUMBERS FOR MORE INFORMATION

1	26	51	76	101	126	151	176	201	226	251	276	301	326	351	376	801
2	27	52	77	102	127	152	177	202	227	252	277	302	327	352	377	802
3	28	53	78	103	128	153	178	203	228	253	278	303	328	353	378	803
4	29	54	79	104	129	154	179	204	229	254	279	304	329	354	379	804
5	30	55	80	105	130	155	180	205	230	255	280	305	330	355	380	805
6	31	56	81	106	131	156	181	206	231	256	281	306	331	356	381	806
7	32	57	82	107	132	157	182	207	232	257	282	307	332	357	382	807
8	33	58	83	108	133	158	183	208	233	258	283	308	333	358	383	808
9	34	59	84	109	134	159	184	209	234	259	284	309	334	359	384	809
10	35	60	85	110	135	160	185	210	235	260	285	310	335	360	385	810
11	36	61	86	111	136	161	186	211	236	261	286	311	336	361	386	811
12	37	62	87	112	137	162	187	212	237	262	287	312	337	362	387	812
13	38	63	88	113	138	163	188	213	238	263	288	313	338	363	388	813
14	39	64	89	114	139	164	189	214	239	264	289	314	339	364	389	814
15	40	65	90	115	140	165	190	215	240	265	290	315	340	365	390	815
16	41	66	91	116	141	166	191	216	241	266	291	316	341	366	391	816
17	42	67	92	117	142	167	192	217	242	267	292	317	342	367	392	817
18	43	68	93	118	143	168	193	218	243	268	293	318	343	368	393	818
19	44	69	94	119	144	169	194	219	244	269	294	319	344	369	394	819
20	45	70	95	120	145	170	195	220	245	270	295	320	345	370	395	820
21	46	71	96	121	146	171	196	221	246	271	296	321	346	371	396	821
22	47	72	97	122	147	172	197	222	247	272	297	322	347	372	397	822
23	48	73	98	123	148	173	198	223	248	273	298	323	348	373	398	823
24	49	74	99	124	149	174	199	224	249	274	299	324	349	374	399	824
25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	825

Check your one principal job function

01 ☐ Corporate, Operating or Financial Mgt.
07 ☐ Engineering Mgt.
03 ☐ Manufacturing/Production Mgt.
04 ☐ Purchasing Mgt.
05 ☐ Marketing/Sales Mgt.

How many people does your company employ?

1 ☐ 10,000 or more
2 ☐ 1,000-9,999
3 ☐ 100-999
4 ☐ Less than 100

YOUR COMMENTS PLEASE

We need your input to continue serving your information needs. Please complete and return this card. Thank you.

Electronics
READER COMMENTS
March 1990 Issue

Name _____
Title _____
Company Name _____
Company Address _____
City/State/Zip _____

1. Which articles were most interesting to you in this issue? _____
2. What topics would you like to see covered in the future? _____
3. What are your most important technology problems? _____
4. What are your most pressing management problems? _____
5. Do you have international responsibility? If so, what is your most pressing international problem? _____
6. What do you like most about **Electronics?** _____
7. What do you like least? _____

To help us code your response:

Check your one principal job function

01 ☐ Corporate, Operating or Financial Mgt.
07 ☐ Engineering Mgt.
03 ☐ Manufacturing/Production Mgt.
04 ☐ Purchasing Mgt.
05 ☐ Marketing/Sales Mgt.

How many people does your company employ?

1 ☐ 10,000 or more
2 ☐ 1,000-9,999
3 ☐ 100-999
4 ☐ Less than 100

FREE INFORMATION

Use this card to receive free information on the products featured in this issue.

Electronics
READER SERVICE CARD
04/90/490

Name _____
Title _____
Company Name _____
Company Address _____
City/State/Zip _____

TELEPHONE NUMBER
( ) _____

CIRCLE NUMBERS FOR MORE INFORMATION

1	26	51	76	101	126	151	176	201	226	251	276	301	326	351	376	801
2	27	52	77	102	127	152	177	202	227	252	277	302	327	352	377	802
3	28	53	78	103	128	153	178	203	228	253	278	303	328	353	378	803
4	29	54	79	104	129	154	179	204	229	254	279	304	329	354	379	804
5	30	55	80	105	130	155	180	205	230	255	280	305	330	355	380	805
6	31	56	81	106	131	156	181	206	231	256	281	306	331	356	381	806
7	32	57	82	107	132	157	182	207	232	257	282	307	332	357	382	807
8	33	58	83	108	133	158	183	208	233	258	283	308	333	358	383	808
9	34	59	84	109	134	159	184	209	234	259	284	309	334	359	384	809
10	35	60	85	110	135	160	185	210	235	260	285	310	335	360	385	810
11	36	61	86	111	136	161	186	211	236	261	286	311	336	361	386	811
12	37	62	87	112	137	162	187	212	237	262	287	312	337	362	387	812
13	38	63	88	113	138	163	188	213	238	263	288	313	338	363	388	813
14	39	64	89	114	139	164	189	214	239	264	289	314	339	364	389	814
15	40	65	90	115	140	165	190	215	240	265	290	315	340	365	390	815
16	41	66	91	116	141	166	191	216	241	266	291	316	341	366	391	816
17	42	67	92	117	142	167	192	217	242	267	292	317	342	367	392	817
18	43	68	93	118	143	168	193	218	243	268	293	318	343	368	393	818
19	44	69	94	119	144	169	194	219	244	269	294	319	344	369	394	819
20	45	70	95	120	145	170	195	220	245	270	295	320	345	370	395	820
21	46	71	96	121	146	171	196	221	246	271	296	321	346	371	396	821
22	47	72	97	122	147	172	197	222	247	272	297	322	347	372	397	822
23	48	73	98	123	148	173	198	223	248	273	298	323	348	373	398	823
24	49	74	99	124	149	174	199	224	249	274	299	324	349	374	399	824
25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	825

Check your one principal job function

01 ☐ Corporate, Operating or Financial Mgt.
07 ☐ Engineering Mgt.
03 ☐ Manufacturing/Production Mgt.
04 ☐ Purchasing Mgt.
05 ☐ Marketing/Sales Mgt.

How many people does your company employ?

1 ☐ 10,000 or more
2 ☐ 1,000-9,999
3 ☐ 100-999
4 ☐ Less than 100

Reader Service Dept.

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 25029 CLEVELAND, OH

POSTAGE WILL BE PAID BY ADDRESSEE

Electronics
A Penton Publication
1100 SUPERIOR AVENUE
CLEVELAND OH 44197-8058

Attn: KATHY TORGERSON

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 25062 CLEVELAND, OH

POSTAGE WILL BE PAID BY ADDRESSEE

Electronics
A Penton Publication
1100 SUPERIOR AVENUE
CLEVELAND OH 44197-8124

Reader Service Dept.

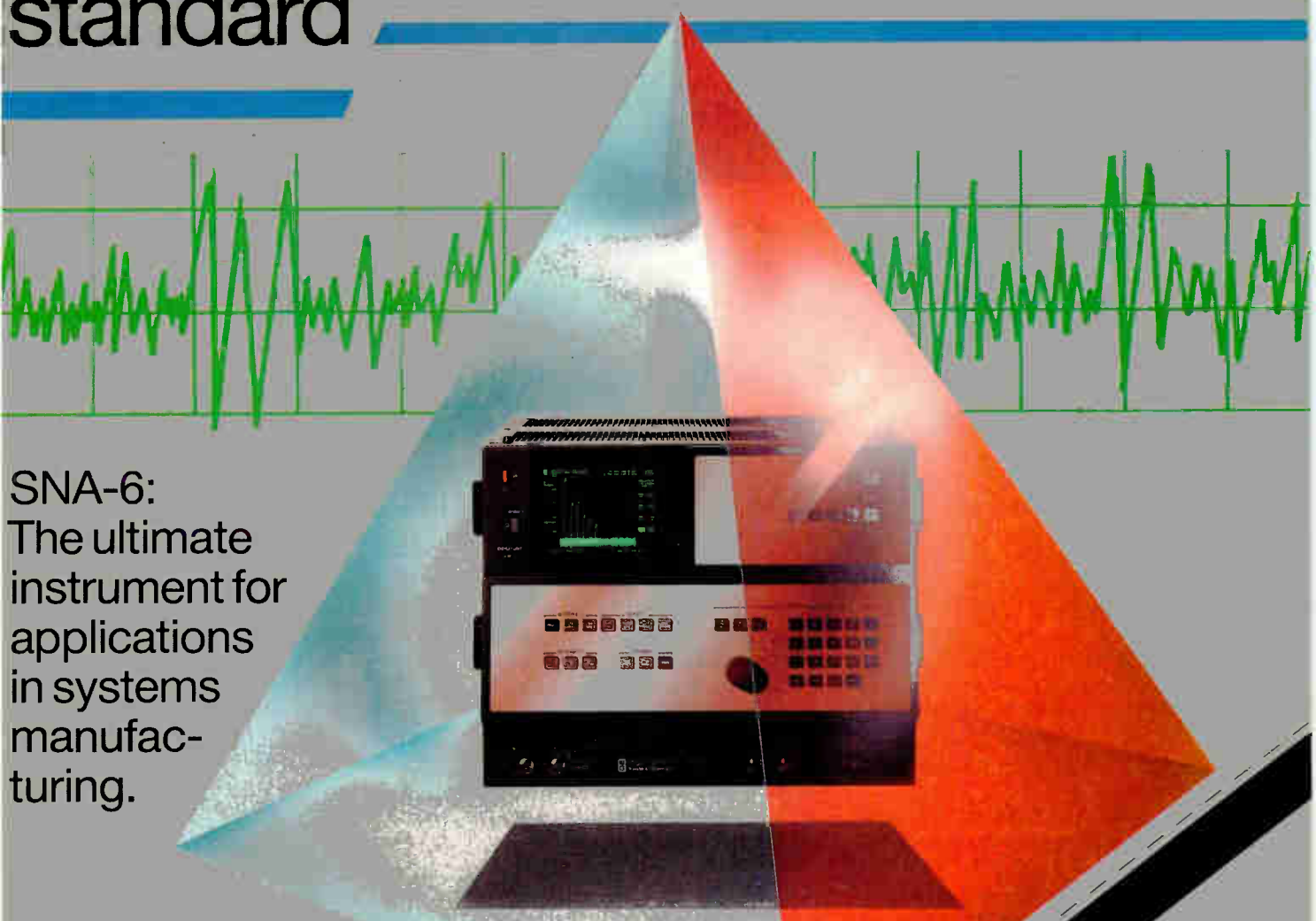
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 25029 CLEVELAND, OH

POSTAGE WILL BE PAID BY ADDRESSEE

Electronics
A Penton Publication
1100 SUPERIOR AVENUE
CLEVELAND OH 44197-8058

The new performance standard



SNA-6: The ultimate instrument for applications in systems manufacturing.

SNA-6: 50 Hz to 3.2 GHz

Designed for applications from the audio to the microwave range, the dual-function SNA-6 handles spectrum analysis from 50 Hz to 3.2 GHz. The instrument's excellent dynamic range and accuracy permit analysis of **densely spaced line spectra.** The narrowest analyzer filter (3 Hz bandwidth) allows detection of extremely low amplitude a. c. line interference superimposed **on a 3 GHz carrier.** This is just one benefit of the low-noise synthesizer oscillator.
The SNA-6 also sets new standards in scalar network analysis. The 0.1 Hz resolution synthesizer can be tuned across the entire frequency range without skips or phase hits. The same synthesizer also provides the signal for the tracking generator. When testing active two-port networks, the gain/attenuation vs. frequency can be determined from +30 to −140 dBm and 100 kHz to 3.2 GHz with excellent precision.

You can use our bar code reader or your PC with our software for remote control applications on the IEEE 488/IEC 625 bus.
You will also be impressed by the versatile evaluation functions and hardcopy capabilities of the SNA-6.

For more information about the state-of-the-art SNA-6 from Wandel & Goltermann, please fill out and send in the coupon below.

USA: Wandel & Goltermann Technologies, Inc., 1030 Swabia Court, P.O.B. 13585, R.T.P., N.C. 27709, Tel. 1 919 941-5730, Fax 919 941-5751
Canada: Wandel & Goltermann Inc., 21 Rolark Drive, Scarborough, Ontario M1 R 3B1, Tel. 1-416 291-7121, Tlx. 266 104 922 712 wg inc tor, Fax 1 416 291-2638. **Worldwide:** Wandel & Goltermann, VMW, Postf. 12 62, D-7412 Eningen, FRG, Tel. +(49) 71 21-86-0, Tlx. 7 29 833, Fax +(49) 71 21-8 84 04.

CIRCLE 207

COUPON

☐ More information about the SNA-6
☐ Please arrange for a sales engineer to call

Name .....

Company .....

.....

Street .....

Town/postcode .....

Telephone no. .....

EL/04/90

E 10.89/VMW/14/4C/NA

Wandel & Goltermann

Electronic Measurement Technology

OPTICAL COMPUTING SHEDS 'BLUE-SKY' IMAGE

BELL LABS PROJECT YIELDS SUCH SPINOFFS AS NEW I/O STRUCTURES AND MICROLASERS

BY JACK SHANDLE

THE CIRCUMSTANCES WERE less than auspicious when Alan Huang started his digital optical computing project at AT&T Bell Laboratories in 1985. AT&T Co. was in the throes of divestiture. Huang was an electrical engineer and VLSI designer—not a physicist. His team consisted of himself and one colleague, and they had no lab. They were, in short, an operational definition of uncertainty for long-term research.

But by 1989, the team had grown to 12 people working in labs that fill an entire corridor in AT&T's Holmdel, N. J., complex. The time and energy of another dozen researchers, although not under Huang's direction, are committed to digital optical computing too. AT&T is betting a lot on the technique, and Huang sums up the prospective payout succinctly: a thousand input/output channels, each running at a gigabit per second.

The object of all this attention has been shrinking in rough proportion to the team's growth. The module that spread across three lab tables three years ago now occupies one square foot, and Huang hopes it will shrink down into a 2-by-3-by-1-in. box sometime this year. A planar, or "flat-optic," version could cut off another factor of 10.

The planar version is being designed so that it can be fabricated with existing photolithographic techniques. Also, a new pipeline architecture that leverages the massively parallel capabilities and regularity of optics has been devised. Useful prototypes lie somewhere in the future. "We've identified a path from the pipeline to the operating system," says Huang. However, "I'm not claiming any practicality now."

Digital optics is just one branch of optical computing. The other is based on analog pattern recognition implemented on neural networks. Although the underlying concepts differ, the technologies developed by Bell Labs are useful for both the analog and digital branches, says Demetri Psaltis, professor of electrical engineering at Cal Tech University in Pasadena. In particular, Bell Labs' microlasers and monolithic light-sensitive devices are "superb," he says.

OPTICS

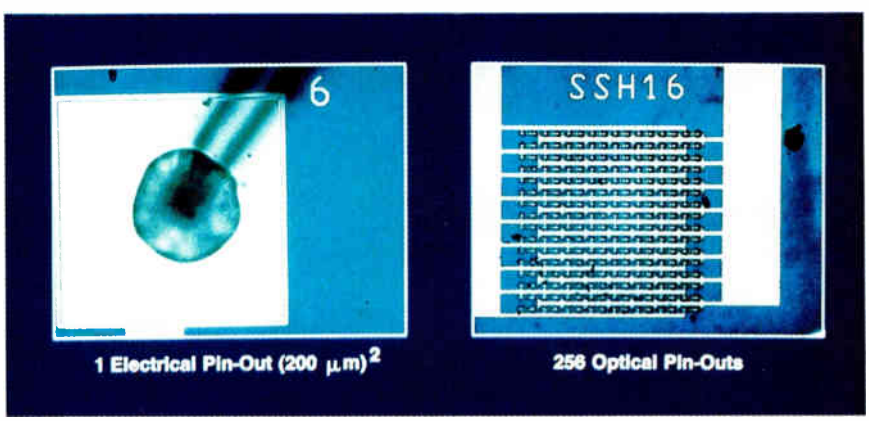
Practical uses of digital and analog optical computing are at least five years off, says Psaltis. On the neural-network side, practical algorithms are just now being created and the task of mapping them onto optical hardware still lies ahead. In the digital domain, Huang considers the year 2000 as a target for a general-purpose optical computer.

Many technologies needed to implement an optical processor have been proven over the past five years by Huang and his colleagues. The task ahead is to make them play together.

The heart of the AT&T processor is a monolithic device grown with molecular-beam epitaxy on gallium arsenide, the S-SEED. These symmetric self-electro-optic-effect devices operate on the principles of quantum-well physics. They consume about 1 pJ and switch at 1 GHz. "They could be viewed as electrical devices that reflect light," says Huang.

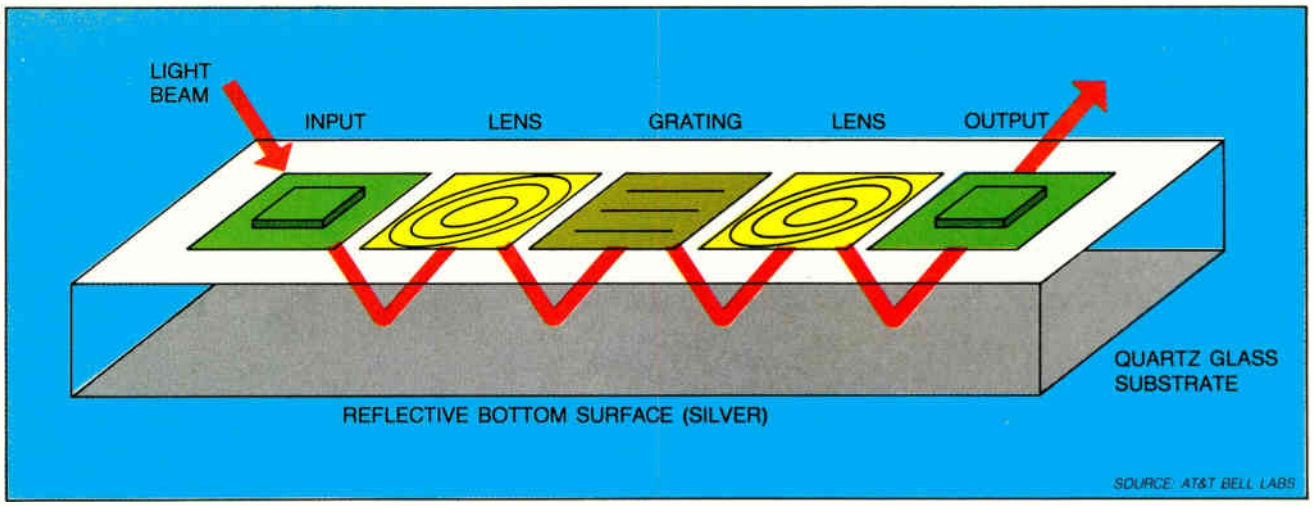
The reflectivity of an S-SEED is voltage-sensitive. It changes from 10% to 60%—roughly the on-off sensitivity of conventional TTL circuits, he says. By growing p-n junctions near each S-SEED to generate voltage, these tiny mirrors become light-sensitive. They are designed to behave as optical flip-flops.

The researchers have fabricated arrays of 2,000 S-SEEDs. One application that may not be too far off would replace the I/O pads on conventional chips with S-



INPUT/OUTPUT POWER

Optical S-SEED arrays could replace the I/O pads of conventional chips; 256 S-SEEDs fit in the space taken up by one electrical pinout.



PLANAR PROCESSOR

A planar optical processor could be built on a thin sheet of quartz silvered on the bottom for reflectivity. Optical outputs of S-SEEDs would be directed by holograms and masks etched on the surface.

SEED arrays. The real estate needed for one conventional I/O pad could hold 256 S-SEED I/Os. While S-SEEDs have been grown on silicon, no one has demonstrated that they can be compatible with advanced CMOS, says team member Michael Prise.

Another spinoff is the microlaser developed to power connections between S-SEEDs, a device about 2 μm in diameter and also grown with MBE. (Laser light reads the state of the S-SEED modulator and carries it to the next chip by exciting a photodiode.)

Exploratory work has begun on a modular, planar implementation. The concept, says Huang, is based on laser light being diffracted by holograms, which can be etched onto quartz with photolithographic techniques.

USING THIS APPROACH, A planar optical processor could be built on a thin sheet of quartz that has been silvered on the bottom for reflectivity. Optical outputs of S-SEEDs would be directed by holograms and masks etched on the surface. Electrical-optical hybrids could have conventional chips on the surface interfaced with S-SEEDs to take advantage of the massively parallel communications capabilities of optics.

Huang points out, for example, that massively parallel chip-to-chip communications could improve system speed by as much as factor of 1,000 over today's best rates. Simply put, chip-to-chip communication accounts for the thousandfold slowdown between the picosecond cycle times at the transistor level and the nanosecond cycle times of supercomputers. Increased connectivity is one way to address that problem.

FRUITS OF THE RESEARCH

A path toward optical computing and 1,000 I/O channels running at 1 Gbit/s apiece by the year 2000.

Monolithic light-sensitive devices that switch at 1 GHz.

A planar optical processor based on the concept of light diffracted by holograms, which can be etched on quartz by photolithography.

But if optical processing brings new meaning to the term "massively parallel," it also demands a new architectural foundation that is, in Huang's words, "counterintuitive." The core idea is to make a logical circuit layout ultraregular—a homogeneous matrix of processing elements similar to programmable gate arrays. Each can be configured to function in any of four basic ways: as a NOR gate or as a crossover, bypass, or broadcast connection.

"This regular virtual array of processing elements can be folded onto a smaller array of real processing elements with the aid of delay lines," says Huang. "The end result is that a fixed amount of hardware can emulate a much larger circuit."

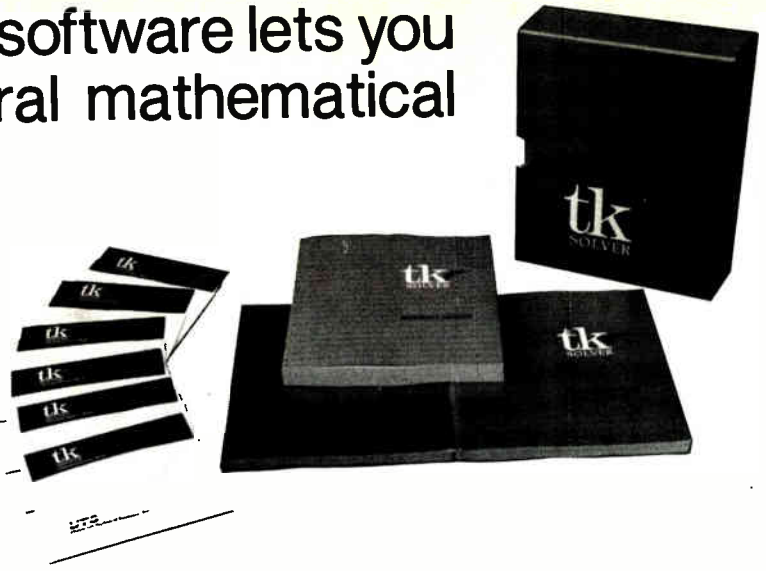
The ultraregular virtual array can be thought of as an array of processing tiles in which information flows only vertically. Since there are no lateral connections between tiles, says Huang, processing can proceed piecemeal. The large virtual array can be "folded" onto a much smaller hardware array. The process begins by emulating in hardware a limited number of tile columns of the virtual array. Since there are no lateral data dependencies, and since exactly the same number of rows exist in each column of tiles, the results from each column pop out at exactly the right time and exactly the right sequence.

These results flow into a pipeline that can be used as inputs for the next series of columns in the virtual array. "What you are doing is raster scanning a hardware window of the virtual array," says Huang. Setting up the virtual array without lateral data dependencies is a challenge, of course, but Huang has developed the algorithms needed to translate conventional logic circuits into the ultraregular processing matrix that's required.

The idea of reducing the circuit by folding it in upon itself gives rise to the architecture's name: computational origami. "It allows us to exchange hardware for time," says Huang. "We could make a general-purpose computer based on it, but it would take a long time to solve a problem."

Despite its counterintuitive roots, computational origami has applications in mainstream parallel processing as a multiple-instruction, multiple-data architecture, he says. Its very daring pleases Huang. "At the very least," he says, "we've made it less risky for others to do research. They can tell their bosses that their proposals are not as crazy as Bell Labs'." E

This microcomputer software lets you program using natural mathematical notation



Wouldn't it be nice if you could solve your mathematical problems by simply typing them into your PC just as you would write them down on paper? With **TK**Solver**PLUS** you can do just that.

- *You just enter the set of equations you want to solve using natural math symbols,*
- *Define the variables you know,*
- *Specify the units of measurement you want,*
- *Press the solve key.*

Then see your solutions in tabular form or plot the results on the screen or printer.

TK can do reverse calculations, or goal seeking! This powerful feature is best explained with this simple example.

Suppose you're buying a $15500 car and you want to compute your loan payments. You're paying $3500 down and planning a 4-year, 12½% loan. You enter the equations below, plug in the values and find your monthly payment is $318.96.

```
price - down = loan
payment = loan * (rate/(1 - (1 + rate) ^ - term))
```

But suppose you'd rather pay $350 per month and shorten the term of the loan. Just enter your preferred payment and tell **TK** to solve for the new loan term — without you having to rearrange the equations.

Or perhaps you'd like to shop for a new interest rate. **TK**'s iterative solver will compute the interest rate you need to pay off the loan in 3½ years paying $350 per month.

This ability to *backsolve* makes **TK** incredibly easy to use and saves you countless hours of programming time.

Of course not everyone wants to compute loan payments. But the benefits are the same no matter what type of problems you have to solve . . . business, engineering, statistics, or science.

Solve dozens of linear, non-linear or differential equations simultaneously * backsolving * if, then, else rules * iterative solving * complex numbers * automatic plotting * Automatic unit conversion * over 300 built-in functions and library routines * math co-processor support * store equation models for later retrieval and use * not copy protected.

TKSolver**Plus** disks and full documentation $395
Satisfaction Guaranteed! Or return the program within 30 days for full credit or refund.

System Requirements: IBM PC line or 100% compatibles; 384K min memory; DOS 2.0 or higher; CGA, EGA, or Hercules graphics

Chargecard users order toll-free 800-321-7003
(in Ohio 216/696-7000)

Penton Education Division
1100 Superior Avenue
Cleveland, Ohio 44114

GROWING PAINS AND A SEARCH FOR ANSWERS

NO ONE REALLY KNOWS HOW MULTIMEDIA HARDWARE AND SOFTWARE WILL FIT TOGETHER

BY JACK SHANDLE

MULTIMEDIA HAS NOW reached the Oval Office. As part of its pitch to become the official depository for records of George Bush's presidency, the University of Houston created for the president a five-minute multimedia montage of still photos, text, graphics, music, and voice, all running on a personal computer. The university and the other competing colleges are still waiting on a decision, but the fledgling multimedia industry is basking in the high-profile exposure.

Still, one public relations coup can't conceal the fact that the multimedia industry is in such ferment that no one really knows how the components of hardware and software will ultimately fit together. The industry is still groping for standards on sound and on image compression. But the lack of standards hasn't slowed the torrent of multimedia hardware and software products continually arriving on the scene.

The show for the White House was the work of Houston's Compaq Computer Corp., which, along with Meridian Data Inc., teamed up with the University of Houston on the presidential presentation.

Their multimedia production was stored on a CD-ROM disk, and Compaq used Meridian's new authoring system for the CD-ROM-XA audio standard. The VR Publisher authoring-system software creates a virtual read-only memory to make information placed randomly on the disk appear as though the files were recorded in the exact order in which they are played back, says Fred Meyer, president of Meridian, which is based in Scotts Valley, Calif.

MULTIMEDIA

"A mixed-up physical layout can be very complicated for someone trying to author a presentation," he says. "Our software makes the various files seem to be interleaved."

Meyer expects CD-ROM-XA to evolve into a standard for multimedia presentations because it is expandable—it will support digitized video—and can be transported to more and more powerful computing platforms. It also boasts some important supporters—IBM, Microsoft, and Sony—and as a result can be seen as a shared standard, something the multimedia industry in general is sorely lacking.

Compaq's workstation—its audio and video cards, for example—also involved a unique set of de facto standards, including data compression. This arena is bedeviled by competing standards. Intel's Digital Video Interactive technology, Motorola/Philips' Compact Disc-Interactive, and the Massachusetts Institute of Technology all have data-compression algorithms that could become de facto standards. But only by adopting a common standard can the multimedia industry hope to avoid hopeless fragmentation, says Meridian's Meyer.

In a more formal way, the International Standards Organization is in the process of putting together two standards—one for still and one for moving images—and last year adopted a standard for video teleconferencing, an application that does not require high-

BEFORE AND AFTER

There is no discernible difference between the original color photo and the one at right, which was processed by C-Cube's new video-compression chip, the CL550.

quality moving images. The ISO's video-conferencing standard is called Px64, a name that derives from the fact that digital signals can be sent in highly compressed form at 64 Kbits/s, at less compression at 128 Kbits/s, and so on in 64-Kbit/s increments up to almost 1 Mbit/s. The Px64 standard employs discrete cosine transform algorithms for its compression.

The ISO committee formulating the still-image standard—the Joint Photographic Experts Group, or JPEG—is expected to adopt a standard soon, says Alain Rossmann, vice president of marketing for C-Cube Microsystems Inc. of San Jose, Calif. Like Px64, the still-image standard is based on discrete cosine transform algorithms, he says.

The MPEG standard being formulated by the Moving Picture Experts Group will not be ready until 1991 or 1992. Rossmann believes discrete cosine transform has a good chance of being the basis for the MPEG standard as well.

TRAINING APPLICATIONS

Matrox's Private Tutor II workstation for commercial users integrates a video-disk player.

IN THE MEANTIME, C-CUBE, which sits on the JPEG committee, has come out with a single-chip implementation of the JPEG standard. A special-purpose digital signal processor, the CL550 has a 328-stage pipeline architecture instead of the eight to 10 stages that are found in a general-purpose DSP, says Rossmann.

This architecture delivers impressive performance in executing the algorithm when compared with standard microprocessors or DSPs. C-Cube contends that an 8.5-by-11-in. color image with 300 dots-per-in. resolution and 24 bits of color per pixel can undergo 20 : 1 compression in one second. An off-the-shelf DSP would take five minutes to complete the 10 billion operations involved and an off-the-shelf microprocessor, one hour or more.

C-Cube's market strategy is to move quickly into color desktop publishing and digital color cameras. "If you have a digital color camera," says Rossmann, "you also have a scanner." Digital video cassette recorders are another targeted application, as are multimedia PCs. C-Cube has agreements with "one computer company, one peripherals company, and two consumer electronics companies," he says, and the first CL550-based product may be announced in August.

It is not surprising that even though the components of the multimedia workstation have just begun to coalesce, some companies are leapfrogging the standards-based solution and delivering full-blown personal multimedia platforms.

Among them is Headstart Technologies, a Great Neck, N. Y.-based division of North American Philips, which is offering a low-cost multimedia platform with an integrated CD-ROM drive that handles either authoring or interactive viewing. Headstart's LX-CD, an Intel Corp. 8088-based machine, costs less than $2,000, while the Headstart III-CD costs about $3,000. The basic difference between the two lies in graphics capability and software. The LX-CD interfaces only with a VGA monitor; the III-CD handles VGA, MCGA, EGA, CGA, and Hercules graphics.

The biggest selling point on both machines is the amount of bundled software that will be offered on CD-ROM, more than any manufacturer has bundled with the purchase of a system before. Both machines come with two CD-ROM disks containing a little more than a gigabyte of information incorporated in such volumes as the *American Heritage Dictionary*, the *World Almanac*, the U. S. Zip Code Directory, and *Bartlett's Familiar Quotations*, among many others.

Also bundled with the hardware on both machines is MS-DOS 3.3, GW-Basic, an organizer utility, an integrated word processor, spreadsheet, and database program, a desktop-publishing program, and a file-management program. In addition, the III-CD also contains a disk with Framework II from Ashton-Tate, Microsoft's Small Business Consultant, and Perspective 3-D graphics, among other programs.

IBM Corp. has been in the interactive video-training business for more than five years with its popular InfoWindow system, which uses analog laser disks instead of CD-ROM or other digital-based storage. Proof that a market exists is found in IBM's 75 business partners and hundreds of applications programs. Most of these are used by large corporations for in-house training.

The military has also found multimedia training an attractive solution to its educational deficit problem. The leading military vendor is Matrox Electronic Systems Ltd. The Dorval, Canada, company's Electronic Information Delivery System, or EIDS, will garner some $80 million to $90 million from the U. S. Army by the time its contract is completed. The EIDS workstation is a PC AT-compatible computer and integrated commercially purchased video-disk player that presents information to students in text, graphic, and analog or digital audio form.

Matrox sells a commercial variation of the system, called Private Tutor II, to nonmilitary clients. One of them, Northern Telecom Corp. of Nashville, Tenn., employs it to show customers how to use various features of their telephones, such as call forwarding, speed dialing, conference calling, and last-number redialing.

NOT ALL THE ACTION IS in platforms, however. IBM has squeezed high-quality audio and full-motion color video-capture capability onto a single card with its M-Motion Video Adapter/A board for Personal System/2 desktop computers. The board follows up on IBM's commitment to a smooth migration path from its analog-based video products [*Electronics*, February, 1990, p. 49].

The adapter receives analog signals from external video and audio sources, processes and digitizes them, and then sends them to a PS/2 monitor and external speaker for use in multimedia applications. Users can change the size

and position of still-frame pictures and motion video, superimpose graphics over video, and view several different video images simultaneously. Video disks—the storage technology for InfoWindow—can be used for storage, as can video cameras, VCRs, and closed-circuit TV.

IBM is actually something of a latecomer in the add-in board arena. Despite, or perhaps because of, the limitations of the basic computing platform in both the PC-XT/AT and Apple Macintosh worlds, third-party vendors wasted little time moving in with a variety of boards.

At least 20 to 25 add-in board vendors are offering products for the PC-AT/XT. DoubleTake AV, developed by Brett Nelson, managing director of Logos Systems International, Scotts Valley, Calif., digitizes NTSC, PAL, or Secam video into a PC's random-access or extended memory, with resolutions ranging from 160 by 120 to 640 by 480 pixels. A single board supports CGA, EGA, VGA, extended VGA, Hercules, Genius, Multiview, Verticom, Cornerstone, and Sigma L-View monitors without modification.

DOUBLETAKE AV TECHnology combines dithering with gray-scale manipulation to customize the saved image to the monitor upon which it will be displayed. The board also captures audio signals at sound quality similar to that of the telephone or AM radio. Compression routines offer 4 : 1 or 2 : 1 compression.

Another board company, Data Translation Inc. of Marlboro, Mass., offers an extensive lineup of imaging products, including frame grabbers, frame processors, and image-processing software. It supports IBM, MicroVAX, Sun, and VMEbus computers. Data Translation also has desktop video hardware for the Macintosh, PC AT, and PS/2.

Meanwhile, two companies in Beaverton, Ore.—Metheus Corp. and Magni Systems Inc.—have teamed up on a video solution that combines Metheus' VGA graphics adapter and Magni's VGA Producer. Using scan-converter techniques, VGA Producer reformats Premier VGA's graphics output to meet video parameters. The system lets users create special effects such as video-to-graphics and graphics-to-video fades and luminance keying. The system can be configured to support NTSC, VHS, and European PAL standards.

AI Tech International Inc. of San Jose has come up with a PC-video product to test the ingenuity of systems houses. The frame-grabber board, called VI Imager, runs on a VGA monitor and allows the user to make any number of adjustments after a frame has been captured. Generally, the adjustments are the sort that would be made in graphic arts. These software-implemented enhancements include sharpening or softening the image, changing it to its negative, and edge enhancement.

Another option converts the image to a binary bit map with black and white pixels. Images can be cropped and the pieces saved, and they can be edited with a painting program. Another useful feature is that the package allows images to be saved in a variety of formats. Any VGA resolution from 640 by 480 to 2,560 by 1,920 pixels can be used.

The problem facing the half dozen or so makers of video digitizer boards for the Apple Computer Inc. Macintosh machine is of a slightly different variety than it is for those involved in IBM support, says Louise Kohl, director of product management at Aapps Corp., Sunnyvale, Calif. Apple's rigorous enforcement of specifications concerning screen display, resolution, and makeup forces manufacturers of video boards to make some hard choices.

Most video capture and editing must be done off line, first stopping the action, then capturing the image, and then editing it. Aapps has circumvented this problem with its Micro-TV board. Micro-TV captures NTSC, PAL, or Secam signals in real time and displays the moving video image directly on the Mac. An on-screen display lets users change channels, control tuning and contrast.

New Media Graphics Inc., Billerica, Mass., has three products for the multimedia market. VideoWindows is a real-time (30-frame/s) frame grabber for the PC AT or XT that allows the computer to display some or all of the digitized video image in a VGA-compatible 60-Hz noninterlaced window running inside a spreadsheet or word-processing program.

The company's VidoeoWindows High-Res does the same thing for a Sun, Apollo, Hewlett-Packard, or Silicon Graphics workstation, but at a resolution of 1,280 by 1,024 pixels.

Instead of a board, the New Media Graphics frame grabber is a stand-alone box that sits near the workstation. For example, using a window, it will allow a stockbroker to watch live video reports on stocks from a cable network or other source while running another application program on most of the screen.

VideoWindows operates in HP's New Wave environment. The GraphOver 9500 permits text and graphics overlays on video images. One of its applications is for military command and control systems to superimpose symbols on maps that are taken from a laser video disk.

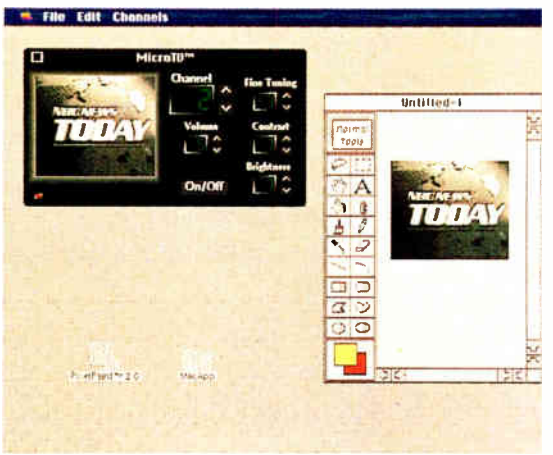
Additional reporting by Bernard C. Cole and Lawrence Curran

GROPING FOR STANDARDS

Though not an international standard, CD-ROM-XA is evolving into a shared audio standard.

In video, the ISO is promulgating standards for still and moving images and video conferencing.

Other technologies—Intel's DVI, Philips' CD-I, and an MIT algorithm—may become de facto standards.



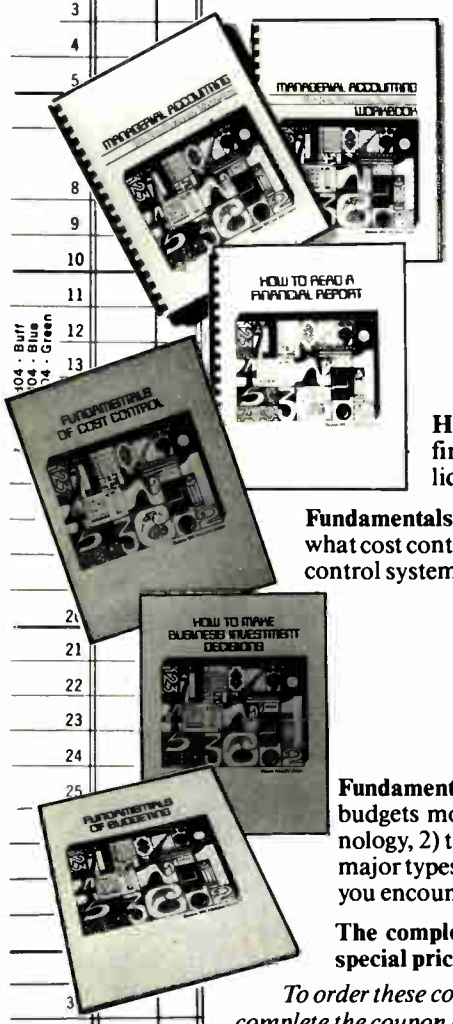
REAL-TIME CAPTURE

The Micro-TV board from Aapps nabs video signals in real time and displays them on a Mac.

WHAT EVERY MANAGER NEEDS TO KNOW ABOUT FINANCIAL PLANNING

in this easy-to-use self-study course series

Five programmed learning courses . . . 50 hours of instruction . . . at less than $1.90 per hour. Study them one-at-a-time, or buy all five courses at a special savings. Either way, 15-day review option applies. Order toll-free 800-321-7003. In Ohio call 216/696-7000.



Each course in the series is written in programmed learning format, so you can study at your own pace, in the privacy of your home or office. And when you complete each course, you can test your own comprehension.

Begin your personal financial development program today!

Managerial Accounting for Non-financial managers — You'll work as a company controller in this course. You'll learn to properly record all the company's business transactions and how to prepare the company's financial statements. When the fiscal year ends, you'll prepare the annual report, balance sheet, income statement, and the funds-flow statement. When you've finished the course, you'll understand better the role of accounting and how to use the information accounting gives you to be a more effective manager. Two volumes . . . course book and workbook $27.50

How to Read a Financial Report — In this course you'll learn how to assess the financial position of your company through the use of ratio analysis . . . analyzing liquidity, activity, profitability, and coverage ratios $19.50

Fundamentals of Cost Control — You may never design a cost control system, but you must know what cost control is, how to use it, and how to make the best decisions based on the facts your cost control system gives you $18.50

How to Make Business Investment Decisions — This course helps you understand how the relationship between money and time affects management decisions. The course covers: Present value concepts, how to use compound interest tables and equations to calculate the time value of money, and how to use these computed values and make the best economic decisions. Case studies are included $18.50

Fundamentals of Budgeting — This course shows the non-accountant manager how to use budgets more effectively. The course presents: 1) the nature of budgets and budget terminology, 2) the manager's role in the budgeting process, 3) the steps involved in budgets, 4) the major types of budgets, and 5) planning, control and data reports — the media through which you encounter and use budgets $18.50

The complete Financial Planning Series . . . all five programmed learning courses at the special price of $92.50, a $102.50 value.

To order these courses, complete the coupon below and mail to:

Penton Education Division
1100 Superior Avenue
Cleveland, Ohio 44114

For faster service call toll-free 800-321-7003 (Ohio residents call 216/696-7000)

Please send the courses indicated. I understand that I may review them for 15 days and, if not completely satisfied, return them for full credit or refund.

	Qty.
Accounting for Non-Financial Managers	
How to Read a Financial Report	
Fundamentals of Cost Control	
How to Make Business Investment Decisions	
Fundamentals of Budgeting	
Sets of all five courses at a special savings	

☐ My payment is enclosed for postage-free shipment in the U.S. and Canada.
☐ Bill my company and include shipping and handling charges. My purchase order is enclosed.

Charge my: ☐MasterCard ☐Visa ☐American Express card.

Acct. No. _____ Exp. date _____

Name _____ Title _____

Company _____

Address (not P.O. box) _____

City _____ State _____ Zip _____

Signature _____

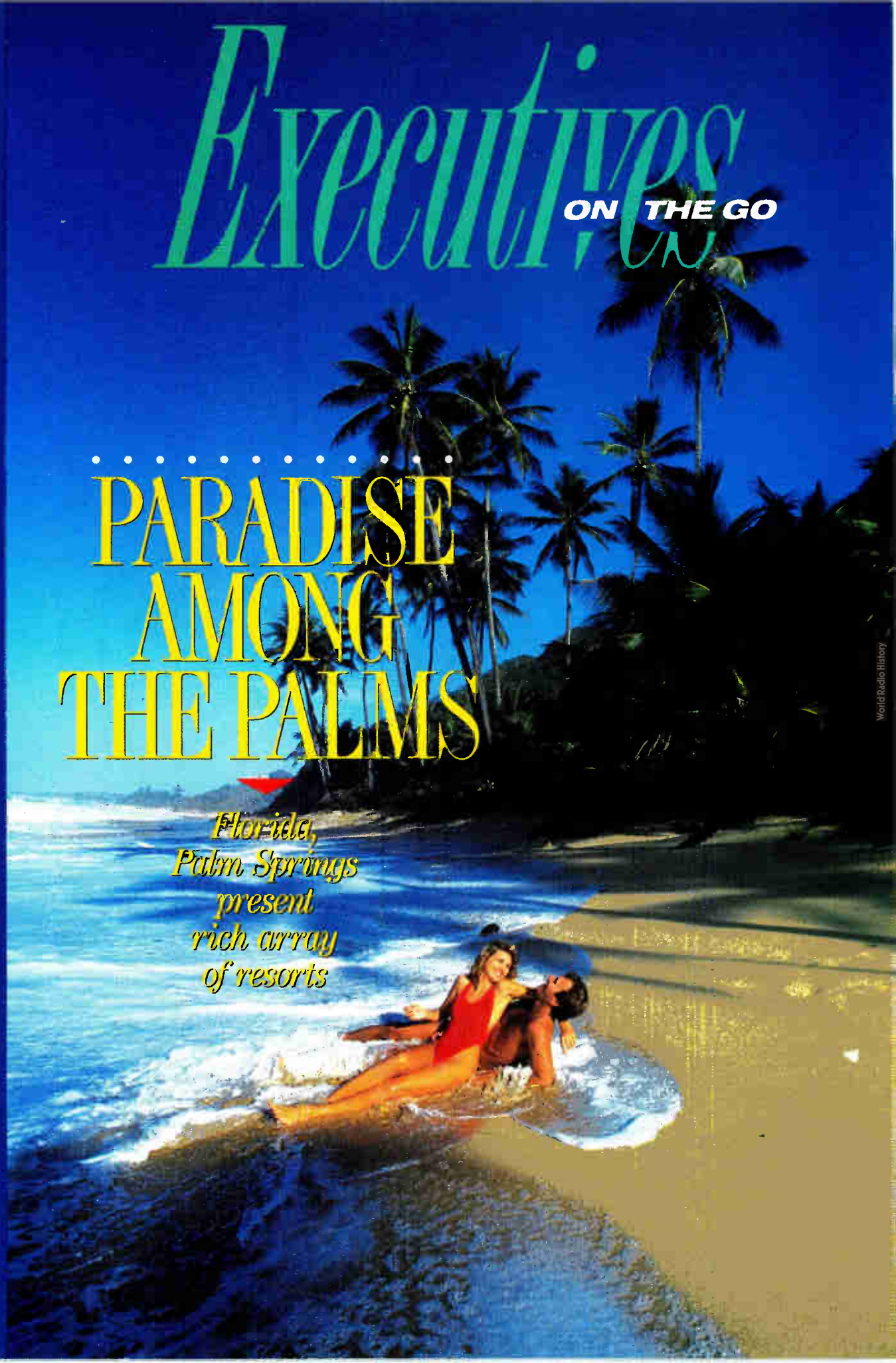
Penton Education Division • 1100 Superior Avenue • Cleveland, Ohio 44114

A Lifestyle Supplement to Penton Publications / Travel / Lodgihg / Resorts / Recreation / Leisure

Executives ON THE GO

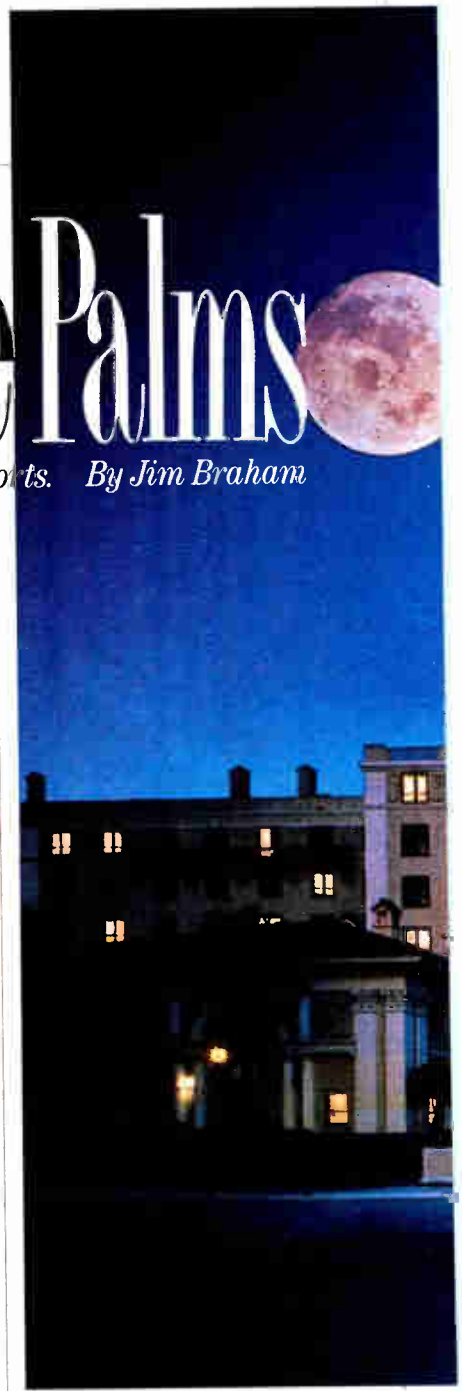
PARADISE AMONG THE PALMS

Florida, Palm Springs present rich array of resorts



Paradise Among The Palms

For the executive traveler, Florida offers a rich array of resorts. By Jim Braham



Cover Photography ©Jeff Farnau/SharpShooters

A stroll through the travel sections can convey the impression that Florida resorts are somehow turning into one oversized cartoon strip. A mammoth Mickey Mouse trap, as it were. And it's true that Walt Disney World has turned Orlando into the No. 1 tourist attraction in America. For the executive traveler, however, there is much more to the Sunshine State. Here are a few resorts visited recently, including Mickey & Co.

THE BREAKERS

Palm Beach

A visit to the world-famous Breakers represents a trip back to the 1920s and European elegance. Three blocks wide and 14 miles long, the island of Palm Beach—"America's Riviera"—features some of the world's most glamorous and expensive estates, and the Breakers long has been a center of high society. They don't build 'em like this anymore. With its beige stucco front, red tile roof, belvedere towers, and graceful arches, it resembles the Villa Medici palace in Rome. A long driveway lined with pines and palm trees escorts the visitor past a majestic fountain and limousine lineup to its spectacular, twin-towered entrance. The rear view isn't too shabby, either: the Atlantic Ocean. And, say, isn't that Estee Lauder's mansion next door?

Built in 1926 in Italian Renaissance style, the Breakers presents magnificent frescoes on its vaulted ceilings and 15th-century Flemish tapestries on its walls. Among five restaurants, the 750-seat Florentine and Circle dining rooms stand out, with "celebrity aisle" and an orchestra playing at dinner. Service is what one would expect from a largely European staff of 1,200: first-class.

Beginning to show its age, however, the 140-acre resort has spent $26 million on improvements and renovations in the last three years. More than two-thirds of the 528 guest rooms have been renovated.

There's an extensive variety of activities, for guests at even this venerable resort are getting younger and less formal. In addition to the shorter, 18-hole Ocean golf course, there is the more challenging Breakers West course ten miles away. The two locations sport 15 tennis courts and a fitness center. Other activities include croquet, horseshoes, shuffleboard, bicycling, and swimming—either in the heated, oceanside pool or the Atlantic itself.

With the warm, clear Gulf Stream so close offshore, sport fishing, scuba diving, and snorkeling are popular. The coastal waters off Palm Beach have been dotted with shipwrecks, and here even the wrecks are first-class. They include a 1967 Rolls-Royce; some 85 feet down rests the $25,000 auto that a Palm Beach businessman sank to demonstrate the need for artificial reefs.

At winter rates, rooms run from

IN DESIGNING THE BREAKERS, ARCHITECT LEONARD SCHULTZE BORROWED FROM ITALY'S RENAISSANCE VILLAS. THE TWIN TOWERS ARE REMINISCENT OF ROME'S VILLA MEDICI, THE FOUNTAIN OF FLORENCE'S BOBOLI GARDENS. ►

THE BOCA RATON'S STYLE WAS ONCE DESCRIBED BY ARCHITECT ADDISON MIZNER AS "A HAPPY COMBINATION OF VENICE AND HEAVEN, FLORENCE AND TOLEDO, WITH A LITTLE GRECO-ROMAN GLORY AND GRANDEUR ◄ THROWN IN."

$215 to $375, suites from $350 to $795. In summer season, rooms are $95 to $195, suites $195 to $575.

BOCA RATON
RESORT AND CLUB

Boca Raton

Some 25 miles south along the Gold Coast, the Boca Raton Resort and Club presents another long driveway lined with palm trees, leading to another fountain and twin-towered palace. Also built in 1926, it too features gardens and courtyards, statues and fountains, nooks and walkways. It's simply larger (1,000 rooms), more spread out and up to date—and strikingly pink.

To the original Cloister have been added a modern, 27-floor Tower and Boca Beach Club. Golf villas on this 223-acre property contain another 120 guest rooms and apartments. The Cloister and Tower complex is connected to the oceanside Beach Club by the Intracoastal Waterway, and the resort has a stream of yachts docked at its side, similar to the limo lineup out front.

One of only two Five-Star/Five Diamond resorts in Florida (the other being the Ritz-Carlton in Naples), the Boca offers practically everything: two 18-hole championship golf courses, 22 lighted tennis courts, a health club, four swimming pools, a marina with full fishing and boating facilities, a half-mile private beach, snorkeling, scuba diving, waterskiing, windsurfing, bicycling, croquet, volleyball, basketball, and badminton. Besides the golf course adjacent to the hotel, another 18-hole course and seven more tennis courts are available to guests at the Boca Golf & Tennis Club.

Among the Boca's half-dozen outstanding restaurants, the Top of the Tower presents fine French cuisine with a spectacular view of the water-

ways. The Patio Royale and Cathedral restaurants epitomize old world elegance. Chicagoan Nick Nickolas (noted for Nick's Fishmarkets) recently opened the Shell dining room.

With 65,000 square feet of meeting space, the Boca serves 60% group or convention business. A $75 million renovation this year will produce a new, larger convention center and health club. Room rates during winter season are $190 to $315, suites $320 to $375. Summer room rates are $95 to $155, suites $135 to $215.

THE PGA SHERATON

Palm Beach Gardens

For golf, the PGA Sheraton, 15 miles north of Palm Beach and the new Palm Beach International Airport, is tough to match. It's stealing some of the spotlight from the older Doral in Miami. The PGA Sheraton presents five 18-hole courses, topped by the Champion. Jack Nicklaus just redesigned this course, as the nine-year-old resort continues to be upgraded.

The home of the PGA of America is also a private club. However, guests can play any of the courses. Nicklaus redesigned the 7,002-yard Champion because it was simply too difficult for resort play. Even the pros complained about this annual home of the PGA Seniors' Championship. That will command special attention Apr. 12-15 since Nicklaus, who turned 50 in January, will be in the field. Arnold Palmer will be there, and his score may hinge on how well he enjoys the gourmet Explorers, one of the resort's half-dozen dining and entertainment areas. It's one of his favorite watering holes. "Arnold has such a good time there," one PGA official notes, "and the later he stays, the better he plays the next day."

The 2,340-acre PGA Sheraton also offers 19 Fast Dry (clay) tennis courts, ten lighted; six racquetball courts inside a well-equipped fitness center; two pools; a seven-mile biking and jogging trail; beach volleyball; water sports; and croquet. Headquarters for the U.S. Croquet Assn., the resort boasts its own croquet pro and five tournament-size courts. A rejuvenating and pampering spa will open in the fall.

Each of the 335 redecorated rooms has a private terrace or balcony overlooking the lake, pool, or golf course. Eighty two-bedroom golf cottages also are available. Winter room rates are $205 to $250 a night, suites $265 to $825. Summer rooms are $75 to $105, suites $150 to $400.

Roy DeFilippes

A 26-ACRE LAKE OFFERS JUST ABOUT ANY WATER SPORT, BUT AT THE PGA SHERATON GOLF IS KING.

WALT DISNEY WORLD

Lake Buena Vista

For the executive traveler, the big news at Disney World is the addition of two major hotels, the 758-room Swan and 1,509-room Dolphin on Crescent Lake, between EPCOT Center and MGM. Operated by the Westin and Sheraton chains, respectively, the 12-story Swan (opened in November) and its sister, 27-story Dolphin (to open in July) are the first hotels in the center of Walt Disney World to be operated by outsiders.

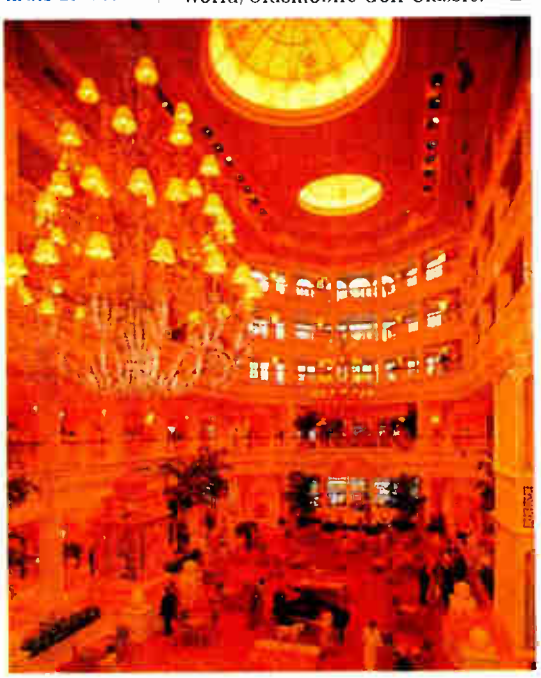
Together, their 252,000 square feet of meeting space will comprise the largest convention resort complex in the entire southeast United States. When two smaller and more exclusive Disney resorts—the 634-room Yacht Club and 580-room Beach Club—join them on Crescent Lake later this year, they will present another 52,000 feet.

With the Magic Kingdom area's six resorts—Grand Floridian, Polynesian, Contemporary, Disney Inn, Disney's Village, and Caribbean Beach—plus the Swan and the seven independently managed "official hotels of Walt Disney World," there are now 10,085 rooms in 14 resorts on the 28,000-acre Disney property.

The jewel among all these remains the two-year-old, 900-room Grand Floridian. The red-roofed, white-frame, six-building cluster along the sands of Seven Seas Lagoon is a reminder of bygone elegance. For intimate dining, Victoria and Albert's exquisite cuisine is served by a butler and a maid in a private room of a dozen tables. A large pool and health club are other attractions. Room rates in regular season run from $215 to $355, suites from $575 to $1,235. At the Swan, which offers three dining rooms, a health club, two pools, sandy beach, and eight lighted tennis courts, rooms run $210 to $325 in season, and suites $425 to $1,475.

Disney's three 18-hole championship golf courses—the Magnolia, Palm, and Lake Buena Vista—are the annual home of the Walt Disney World/Oldsmobile Golf Classic.

THE GRAND FLORIDIAN'S FIVE-STORY VICTORIAN LOBBY ABOUNDS WITH ANTIQUES AND RARE BIRDS.



WHY FORMER MARRIOTT GUESTS COME SCRATCHING AT OUR DOOR.

For the price of their room, you can get your paws on all this.

You don't have to be a fat cat to enjoy The Suite Life.® An Embassy Suites® hotel welcomes you to a world of extras you don't pay extra for.

Room for enjoyment... instead of room for improvement.

There's a difference between a hotel room and a hotel *with* room. Your two-room suite gives you a spacious living room along with your private bedroom... for all the same reasons you don't have just one room at home.

Plus there's a convenient wet bar with refrigerator, and every suite comes with two color televisions and two phones for your comfort.

And there's more...

Food for free... instead of food for thought.

You'll wake up to more than the alarm at an Embassy Suites hotel... like a delicious free breakfast, cooked from scratch to your order, and served in the cozy greenery of our atrium. And more...

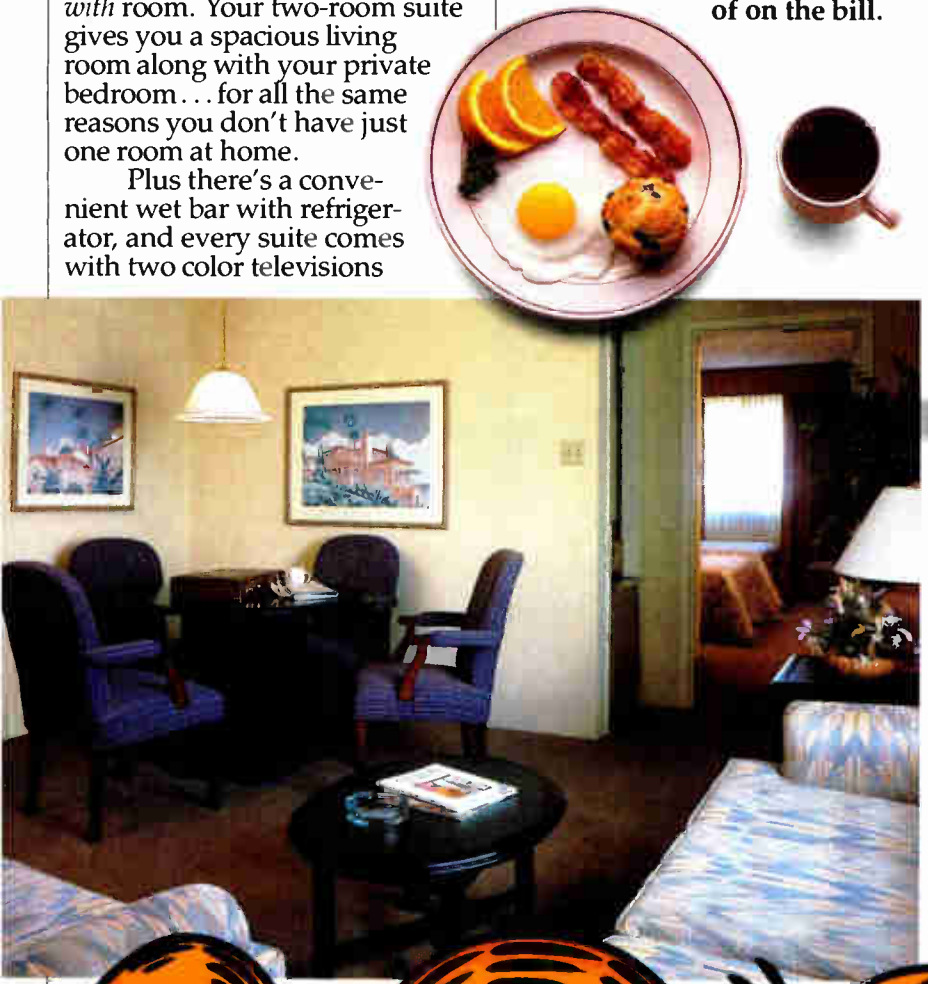
On the house... instead of on the bill.

Every evening you'll be invited to unwind with your favorite beverage at our free Manager's Reception+, hosted for two relaxing hours in the friendly atmosphere our open atrium offers. And more...

Can't wait to get back... instead of can't wait to get packed.

No wonder over 90 percent of the travelers who come to our door plan to come back on another trip. They're smart business people who figure getting more without paying more makes both dollars and sense. And that's a value worth getting your paws on.

+Subject to state and local laws.



EMBASSY SUITES HOTELS℠

1-800-EMBASSY

In Canada: 1-800-458-5848

GARFIELD: ©1978 United Feature Syndicate, Inc.

JIM DAVIS

FOR INFORMATION, CIRCLE NO. 13

©Brian Morgan

A Golfing Oasis

California's Palm Springs sports 109 golf courses —and a splashy, unforgettable resort lobby.

"Golf capital of the world," the Palm Springs area anoints itself. Imagine: 109 golf courses (and even more being planned), in a rich, green oasis carved out of one of America's more celebrated sand traps, the California desert. Still, I still can't get over that boat in the Marriott lobby.

Yes, *boat*. More properly, gondola. Right smack in the hotel lobby. Of course, just as Palm Springs is no ordinary community, Marriott's Desert Springs is no ordinary hotel. Its eight-story skylight atrium features not only terraced waterfalls and cascading plants, but a lagoon in the lower lobby. Here, sliding glass doors permit a gondola in and out, to transport guests to and from restaurants outside the main building.

A three-year-old, $250 million resort spread among 400 acres in Palm Desert (just southeast of the city of Palm Springs), Marriott's Desert Springs offers 892 rooms, 11 lakes, the Palms and Valley 18-hole golf courses, 16 tennis courts, a 27,000-square-foot health spa, plus—get this—a new, 18-hole *putting* course. The first of its kind in the continental U.S., this is not miniature golf but, rather, an all-natural-turf golf course with contoured fairways, sand traps, water, and rough. It's simply short—350 yards in all—and played exclusively with a putter.

THE NICKLAUS RESORT COURSE IS AMONG FOUR CHAMPIONSHIP GOLF LAYOUTS AT PGA WEST. (ABOVE)

IN THE LOBBY OF MARRIOTT'S DESERT SPRINGS, A GONDOLA CHECKS IN AND OUT. (TOP RIGHT)

THE STOUFFER ESMERALDA IS PALM SPRINGS' NEWEST RESORT.

It's one more reason for the Marriott's Desert Springs being, simply, the biggest and splashiest resort in one of the most affluent of all areas. Set against a brilliant backdrop of clear, blue sky and majestic mountains, just a two-hour drive from Los Angeles, the Palm Springs community long has been a playground for stars as well as presidents.

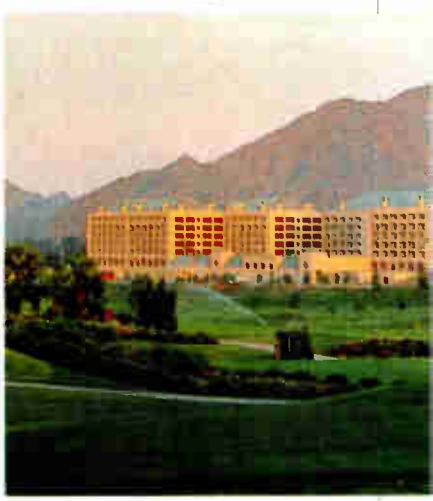
Two million visitors a year flock to this land of fun 'n sun, grand golf, and lavish resorts—from the newest, the Stouffer Esmeralda that opened last fall in Indian Wells, to the oldest, La Quinta Hotel Golf & Tennis Resort, here since 1926.

Nestled among 350 acres at the foot of the Santa Rosa Mountains, the 560-room, $117 million Esmeralda also features a glass-enclosed, eight-story lobby atrium; this has a sweeping dual grand staircase and an indoor stream running through the lobby's marble floor. The three outdoor pools comprise the area's biggest swimming hole. The Esmeralda, which also offers seven tennis courts and a small health-and-fitness spa, lies alongside two Indian Wells Golf Resort courses, shared with the neighboring Hyatt Grand Champions. In all, the valley offers 316 hotels with over 15,000 rooms.

Even legendary La Quinta is wearing a fresh look. The Spanish colonial resort that began as a six-cottage hotel, a favorite Hollywood hideaway in the golden '20s, completed a $45 million expansion and renovation in 1988; this more than doubled the number of its casita-style rooms to 640 and added two new restaurants.

La Quinta's Mountain course—one of its three 18-hole layouts (it has 30 tennis courts)—is ranked 49th among "America's greatest 100 golf courses" by GOLF DIGEST magazine. It's private but the Dunes and Citrus courses are open to La Quinta resort guests.

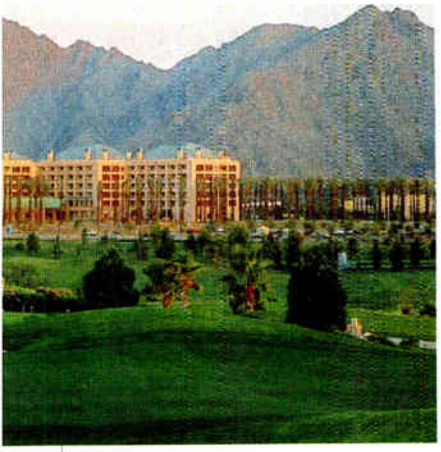
The PGA WEST's Stadium course—one of four championship courses in a country-club community of condominiums and homes spread over 2,200 acres in La Quinta—is considered by many pros to be the toughest test in the area. In GOLF magazine's last listing of the world's 100 best courses, the PGA WEST's Stadium and Jack Nicklaus private courses ranked 77th and 90th, respectively.



In 1991 PGA WEST plans to open a 1,000-room hotel, which will be the area's largest. It will have over 100,000 square feet of meeting space, as much as the new Palm Springs Convention Center and double that of Marriott's Desert Springs.

Besides golf, there are some 600 tennis courts and nearly 8,000 pools in the Palm Springs area. Oasis Water Resort offers seven slides and California's biggest wave-action pool. Horseback and bike riding, hot-air ballooning, and polo also are popular pursuits. The nearby mountains offer good skiing and the Palm Springs Aerial Tramway, the world's largest single-span lift, transports passengers in enclosed cable cars from the desert floor to the top of the steepest mountain in North America, 8,516-ft Mt. San Jacinto. From there, the scenery is spectacular. It might even beat that boat in the lobby.

—By Jim Braham



Drive An Elegant Bargain.

$49 a day. Cadillac Sedan de Ville. 100 miles/day included. 30¢/mile thereafter. Optional Collision Damage Waiver $12.95/day or less. Rate available at participating locations. Offer good through May 21, 1990.

ANOTHER GREAT OFFER FROM THE EMPLOYEE-OWNERS OF AVIS, INC.

The employee-owners of Avis want you to experience the elegance of a Cadillac Sedan de Ville or similar luxury-group car at a very special rate. With SuperValue Rates and fast service, "We're trying harder than ever" to give you what you want in a rental car.

The rate is available at participating U.S. corporate and licensee locations and is non-discountable (rate not available in Metro N.Y.). Cars and rate are subject to availability and must be returned to renting location. Blackout periods apply. There is no refueling charge if you return your tank full. Renter must meet Avis age, driver and credit requirements. There is an extra charge for additional drivers, local taxes, optional Collision Damage Waiver, Personal Accident Insurance, Personal Effects Protection and Additional Liability Insurance, where available.

To drive this elegant bargain, call Avis at **1-800-331-1212,** or your travel consultant.

AVIS®

We're trying harder than ever.℠

Avis features GM cars. Cadillac Sedan de Ville.

M/A-COM INC.

FIRST TASK IS TO PRUNE M/A-COM FOR PROFITS, THEN EXPAND INTO COMMERCIAL MARKETS

VANDERSLICE POPS UP AT DEFENSE FIRM

BY LAWRENCE CURRAN

PUNDITS MIGHT CONclude that Thomas A. Vanderslice jumped from the frying pan only to land in the fire when he moved from the former Apollo Computer Inc. to M/A-COM Inc. After all, he went from being chairman and chief executive officer of the sagging $653 million workstation pioneer to the same positions at a struggling and smaller ($441 million) defense-oriented manufacturer of components and systems.

Vanderslice's posts at Apollo were eliminated when the Chelmsford, Mass., firm became a division of Hewlett-Packard Co. last year [*Electronics*, April 1989, p. 32]. Before he departed, however, he'd been blamed in the Boston-area press for Apollo's slump as the company was overtaken by Sun Microsystems Inc. in workstation market share.

Insiders say that he didn't deserve the blame, and Vanderslice bridles at his portrayal as the Nero to Apollo's Rome. Rather, he hangs his hat on two achievements at Apollo: moving the company out of a solely proprietary operating system and into the Unix camp, and the sale to HP. "We merged with a great company," he concludes. "Otherwise it would have been a 10-year struggle to keep Apollo independent, and profits weren't assured."

Profits are again foremost in his mind as he structures M/A-COM (formerly Microwave Associates) to compete in a world of shrinking defense budgets. He took command last Nov. 28 and lost no time in starting a reorganization intended to return the company to continuing profitability.

One of his first moves was to convince M/A-COM veteran James Bunker to stay on as vice president for business development. Bunker was about to resign as the company drifted in the aftermath of the death of Vanderslice's predecessor, Thomas F. Burke, in an auto accident.

Vanderslice's plan for the next six months is to show "that we are sound and can run profitably."

It's Bunker's task to divest the company of the businesses that Vanderslice views as a drain, including some subassemblies, microwave high-power amplifiers, transmission equipment, and radar antenna assemblies. "The device and component business is where we've made money," Vanderslice points out, "and systems is where we lost it."

Thus he plans to lop off some 31% of M/A-COM's mass, leaving a $375 million core business that Vanderslice believes can boost profits at least two to three times over current levels. Net income on 1989 revenues of $441 million was just $178,000, and most of the operations to be divested were unprofitable.

At the core of the downsized M/A-COM will be radio-frequency and microwave semiconductor devices, including various kinds of diodes. M/A-COM also fabricates silicon epitaxial wafers and gallium arsenide ingots and substrates. The company uses its GaAs material to produce microwave monolithic integrated circuits (MMICs) for use in high-performance military and commercial communications systems. M/A-COM's component lines include miniature and microminiature connectors, along with rf and microwave sources.

Vanderslice says the bulk of the operations to be divested consumed 72% of M/A-COM's research and development funds. "That money was being spent in areas where little growth was projected," he says. Now M/A-COM will be the right size to sustain a positive cash flow, as well as profits, although Vanderslice's main concern so far is to demonstrate "in the next three to six months that we can run profitably and that we have a fundamentally sound business. That's our working plan."

Increasingly, M/A-COM is taking on the look of a microwave semiconductor and

components company rooted in the defense market. Vanderslice says that the military-to-commercial ratio of M/A-COM's business has been 90 : 10. Divesting some of the operations will make that split 80 : 20, and Bunker says the goal is eventually to reach the 70 : 30 level.

Bunker isn't overly concerned about lessened East-West tensions gutting the defense budget any time soon. "A $300 billion defense budget looks stable through 1991-92, then we expect it will roll off," Bunker suggests. Meanwhile, the company is studying ways to expand its commercial device and components business, perhaps initially for use in commercial instrumentation and radar detector systems.

But M/A-COM will continue to fund its core device and component strengths with an eye to their use in military and commercial markets. "We have a good [GaAs] development effort in MMIC," Vanderslice says. "We're the largest supplier of GaAs ingots, and we'll keep going at it, even though that's still mostly a potential business" rather than a major revenue producer right now.

Some observers questioned Vanderslice's credentials to run a mainly military company when he took over at M/A-COM. He answers by citing his relevant experience at General Electric Co. and GTE Corp. His highest post at GE was vice president and sector executive of the Power Systems Sector. Before that, however, his 23 years there included responsibilities in both the Missile and Space Division and the R&D Laboratory, where he became familiar with the military component and systems businesses.

INCREASINGLY, M/A-COM IS TAKING ON THE LOOK OF A MICROWAVE SEMICONDUCTOR AND COMPONENTS COMPANY

After GE, he became president and chief operating officer at GTE, a major supplier of military communications equipment. "I started at GE in the military communications department," Vanderslice notes, "and at GTE, I'm proud of the fact that we grew the Sylvania systems [military] business."

Now it's his task to first stabilize, then grow M/A-COM. Bunker, for one, thinks the prospects are good. "He's a leader. He convinced me that he'd do all the tough things needed to make us successful, especially the divestitures," Bunker says. "I was amazed that at our key management assembly meeting, even the [managers of] the divisions to be sold felt good about his leadership." E

BIRD

BINATIONAL R&D GROUP'S GOAL IS TO LURE U. S. FIRMS TO A COUNTRY WHERE ENGINEERING ABOUNDS

COME TO ISRAEL, SAYS BIRD

HOWARD WOLFF

THERE'S A COMPUTERIZED dating service in Israel whose matchmaking of Israeli and U. S. high-tech companies has led to some profitable marriages. The service is the Israel-U. S. Binational Industrial Research and Development Foundation, known as BIRD, and it has helped fund 250 commercial projects since it started in 1977.

BIRD's stock in trade is Israel's scientific and engineering muscle. The tiny nation, with a population of just 4 million, boasts more than 30 scientists and engineers in research and development for every 10,000 people. By comparison, the U. S. has 25, England 14, and Italy 6.

So it's no wonder that U. S. companies such as Digital Equipment, Intel, and National Semiconductor have taken advantage of the brainpower. In fact, Intel Corp.'s 8088 and 80386 microprocessors were mostly designed at the company's Haifa research center. In addition, Intel has a $150 million plant outside Jerusalem at which it makes $100 million worth of 386s and other chips a year.

Against that background, BIRD has quietly been signing up American part-

ners for Israeli companies. The ideal U. S. company for BIRD's purposes, says executive director A. I. Mlavsky, is a medium-size operation in the $10 million to $100 million range that is growing 25% a year.

All deals must involve an Israeli partner. BIRD puts up 50% of the cost of a project; the partner companies obtain the rest. The average project is $1 million. "So a typical million-dollar deal would look this way," says Mlavsky. "Say the American company's share of the cost is $300,000 and the Israeli's, $700,000. BIRD would contribute $150,000 to the U. S. partner, $350,000 to the Israeli. So by contributing only $150,000, the U. S. company gets the benefits of a $1 million program."

There are now 60 to 70 such projects going. "We started 43 in 1989 alone," says Mlavsky, "the most in a single year since we started. We wrote checks last year totaling $13 million." The foundation has so many requests for partners, he says, that it is now turning down some proposals that it would have accepted in earlier years.

OF THE 250 PROJECTS ON BIRD's books, some 100 have not yet reached the product stage. Of the 150 remaining, about 100 have led to sales of products. Through the end of 1989, these products have chalked up $700 million in sales; sales of related products were $300 million.

A look at BIRD's books show that the foundation—which is a quasi-governmental body with three board members from each country, including the U. S. Assistant Secretary of Commerce—shows it has $10 million in annual income.

Mlavsky ticks off some of BIRD's noteworthy successes in electronics:

- A flat-bed scanner from Scitex Corp., an Israeli firm that has 40% of the world market for the computer imagers that are used by magazine and book publishers.
- Tyco's DTX240 fiber-optic-cable multiplier that increases the data-carrying capacity of the cable fivefold. There's one on each end of the TAT-8 transatlantic cable.
- Solar-powered power stations, mostly for Southern California.
- A key phone for Ameritech.

Though deals can be arranged by BIRD or the companies, Mlavsky says, "The most satisfying ones are those that we put together ourselves." E

VALID LOGIC

ACQUISITIONS BEHIND IT AND A ROBUST PRODUCT LINE IN PLACE, VALID IS SITTING PRETTY

GAINING GROUND IN THE GREAT CAD RACE

BY SAMUEL WEBER

IT DOES NOT take a rocket scientist to figure out why W. Douglas Hajjar, president and chief executive of Valid Logic Systems Inc., is feeling good about the way things are going for his company. Dataquest Inc. ranks Valid No. 2 after Mentor Graphics Corp. in the design-automation industry for total hardware and software sales. Valid racked up almost $174 million in revenues in 1989, an increase of 23% over 1988. On top of that, net income was $10 million, an increase of 29%.

"We're feeling real positive about 1990," says Valid's president and CEO, W. Douglas Hajjar.

And all this happened while the San Jose, Calif., company was handling the integration of four acquisitions made over the last two years and despite a slow start early in 1989 engendered by a transition to new reduced-instruction-set computing platforms—Sun Microsystems Inc.'s SPARCstation 1 and Digital Equipment Corp.'s DECstation 3100. Valid also is a remarketer of IBM Corp. high-performance workstations, including the PS/2 Model 80 and the new RISC System/6000.

Now, with the launching of some significant new products, Hajjar believes Valid Logic is poised to take market share from its competitors in 1990. Among the introductions is RapidSIM, a digital simulator (see p. 55) that is part of a new Logic Workbench environment; Analog Workbench 2, a simulation environment for analog designers; Construct IC, a layout editor; and Compose 2, a chip-assembly environment.

Valid is already a seasoned participant in the Unix marketplace—"we are the leaders by far with 10,000 seats shipped into that environment," says Hajjar. With all of those goals met, the company's aim this year "is to continue to execute. We have no major product holes, no major integrations to do, we're totally standard, we've come through a period of transition pretty well, and we expect that to continue," he says. "We're feeling real positive

about 1990, because we've got our act together—and, more important, we've got it together at a time when competitors are in a period of transition. And that usually leads to significant market-share gains."

As examples of this transition, Hajjar points out that major competitor Mentor Graphics' recent acquisition of Silicon Compiler Systems Inc. signals an important shift in market strategy for Mentor that has to be wrung out. "In addition to absorbing their first major acquisition ever," he says, "they're bringing out QuickSIM 2, a new high-performance digital simulator. Also, they've just introduced their new Falcon 8.0 framework, and they must get through a Unix-switch strategy, all at the same time."

Cadence Design Systems Inc., too, is going through a transition, Hajjar says. "They're trying to absorb several acquisitions. They've been an IC company with 95% of their revenue in ICs, and now they're coming into the systems market for the first time. They still have some major holes to fill."

But for Valid Logic, "RapidSIM will round out our product line to a point where we feel we have the best application software in every area of the market and at the same time, no transitions to go through. If that doesn't lead to a major market-share shift, then we've totally screwed up."

BUT VALID DOES HAVE A challenge of its own, says Robert Herwick, a senior technology analyst for Hambrecht & Quist Inc. in New York: to coordinate a product line that has been largely put together by acquisitions. He refers to Valid's takeover of Telesis Systems in 1987 and of GE Calma's IC-design business and Integrated Measurement Systems, a leading maker of ASIC prototype systems, in 1988. At the same time it won analog capability by acquiring Analog Design Tools Inc. in Sunnyvale, Calif.

But Hajjar, who was president and CEO of Telesis before the merger, says the integration has gone smoothly. "Collectively, we have done a lot of acquisitions, unlike our competition. I personally have been involved in maybe 50 of them over the last seven or eight years, so it's a strategy we've felt comfortable with. We've been able to minimize the pain level of bringing new people and technologies together."

Analyst Ron Collett of Dataquest in San Jose agrees that Valid is in a very good position to take market share from some of its competitors. "They are the only company right now that's a full-line supplier with integrated systems shipping on the Sun workstation," he says. "Mentor Graphics won't be shipping for another year, and Cadence really isn't in the system market per se—they're just skimming the surface. They'll all be on the Sun eventually, but right now Valid is the only game in town." And Daisy/Cadnetix Inc.'s financial problems [*Electronics*, March 1990, p. 56] mean that "if you want to do ASIC design, it's either Valid or Mentor," Collett says.

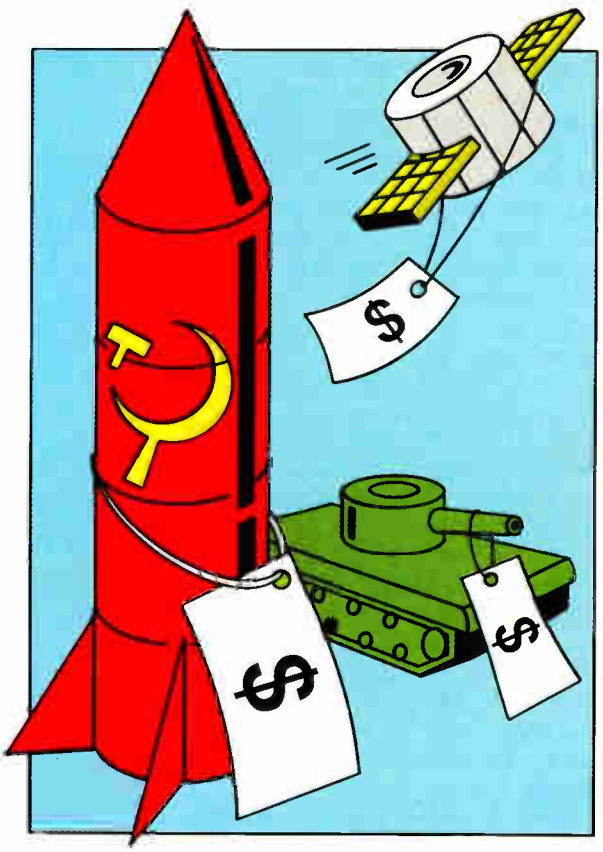
Despite Hajjar's words to the contrary, Collett sees a major hole in Valid's product line: "Valid should get some logic-synthesis products to go with their simulation capability." ■

CONVERSION 90

USSR STAGES LANDMARK EXHIBIT IN MUNICH OF MILITARY, SPACE, AND OTHER TECHNOLOGY NEVER BEFORE SHOWN IN THE WEST

A PEEK BEHIND THE ELECTRONIC CURTAIN

BY JOHN GUSCH



IN THE SPIRIT of glasnost, the Soviet Union is preparing an exhibition that's probably the most unusual it has ever staged for public viewing. Conversion 90, to be held in Munich, West Germany, April 20 to 25, will feature Soviet equipment including military hardware that up to now has been kept strictly under wraps.

On display will be more than 1,200 exhibits from 300 military-equipment production centers in the Soviet Union. The products will come from the fields of missile and satellite technology, microelectronics, communications, data processing, optoelectronics, metallurgy, medical electronics, and consumer gear, among others.

But commerce, not glasnost, is the real reason the Soviets are lifting their arms curtain. The Soviet Union wants to get Western companies interested in the products on display and spark licensing agreements to build them.

Accordingly, the show's organizers—the Munich Fair Co. and the Foreign Trade and Fair Organization of the Soviet Union's Chamber of Commerce in Moscow—are going to great lengths explaining what Conversion 90 is all about: a demonstration of what its name conveys, the conversion taking place in the Soviet armaments industry.

"Conversion 90 is not an arms fair," says Werner Marzin, general director of Munich Fair. "On the contrary, it is to demonstrate the change of the arms industry's potentials to products and processes for civilian applications."

Naturally, no one expects the Russians to raise their armaments skirt all the way to let Westerners have a peek at highly sensitive developments. Also, judging by a 50-page list of items to be displayed, showgoers will find many products not worth a second glance—tents, telex equipment, small-screen TVs, and electric samovars, to name just a few. Still, much of what's shown may interest companies in the West.

For example, the Soviet Union's ac-

complishments in space have long convinced Western experts that the nation has remarkable technology in rocket and satellite engineering, telecommunications, and metallurgy. But during the decades-long East-West arms race, most of this technology was restricted to the military sectors and hence kept secret. Now, however, with the word from the Kremlin being détente, the technology—or some of it—is being made available for international markets.

The range of products for which the Soviet industry is seeking business partners in the West extends from carrier rockets and communication satellites to 19,200-bit/s modems down to tennis racquets made from plastic materials reinforced with glass fiber.

Of particular note in the microelectronics sector will be miniature high-temperature pressure sensors, integrated silicon pressure-difference sensors, and heat-conducting pastes for mounting components on printed-circuit boards. In the optoelectronics field, the show will feature fiber-optic vibration and acceleration sensors along with mirrors that, in laser applications, need no cooling.

In medical electronics, sharp-eyed showgoers will spot a portable, small-format acupuncture electro-stimulator as well as needle-less injection systems. And in communications, in addition to high-speed modems, the Russians will show radio relay stations operating in the millimeter range, personal mobile communication equipment, and radio systems for handling telemetric data.

CONCURRENT WITH THE six-day Conversion 90 show—it will occupy an entire hall and neighboring outside areas on Munich's fairgrounds—will be a scientific-technological seminar held in adjacent congress halls. There, experts from eight Soviet ministries connected with arms production and engineers from military-hardware production centers will function as negotiating partners for Western businessmen. They will also discuss how the Soviet armaments industry is adapting to civilian production.

As if to demonstrate that they are serious about controlled détente, the Soviets will offer during the show fragments of destroyed SS-12 and SS-22 missiles as souvenirs. Mounted on a small pedestal or presented in a gift box, the fragments will be accompanied by a certificate in any one of six languages—English, French, German, Italian, Russian, and Spanish.

Conversion 90 is the first result of a long-term accord that Munich Fair completed last summer with the Soviets. It dovetails with the fair company's strategy, which is to represent Eastern European products and markets more strongly at the international expositions it sponsors.

Munich, with its long tradition of electronics exhibitions, is an appropriate venue. Says fair director Marzin, "These two aspects—the wish for long-term cooperation and Munich's popularity as a place for high-tech exhibitions—were decisive in reaching the agreement with the Soviets to stage Conversion 90 as a world premiere in this city." E

NEED SEMICUSTOMS? CHECK THESE RULES

BY HOWARD WOLFF

THERE'S A NEW FACTOR IN THE SELECTION PROCESS TODAY: VENDOR VIABILITY

WAY BACK in the early 1980s, a systems house looking for someone to make the semicustom integrated circuits it required had a relatively uncomplicated task. All that the managers had to worry about was whether the prospective supplier's engineers were competent and could deliver on time.

But the times have changed. Now, at the dawn of what could be termed the nervous '90s, the process of choosing a semicustom IC vendor has become fraught with uncertainty. Not only must the shopper worry about competency and delivery, but he must also deal with the nagging fear that the vendor he picks may be out of business even before the parts have become obsolete.

Consider the question of vendor viability in light of recent history. Fairchild is gone; the IC operations of RCA Corp. and General Electric Co. have been sold; Intel Corp. and Honeywell Inc. have closed their semicustom operations; California Devices Inc. and Telmos have gone out of business. What's a system maker looking for its first chip supplier to do?

The people who make and sell the chips have some answers. One of them is Gary Smith, the director of marketing and sales at International Microcircuits Inc. of Santa Clara, Calif., which produced the first CMOS gate array in 1974. Another is Brian Connors, vice president for strategic accounts at LSI Logic Corp. of Milpitas, Calif., the market leader.

"The new fear has become apparent to International Microcircuits during the last 18 months," says Smith. "That's because we acquired a design from a large semicustom house and picked up the remnants of another one that had gone out of business."

Smith expects more of the same. "This trend is likely to continue. It will be amazing if another major player in the semicustom market doesn't exit the scene to cut their losses," he says.

So Smith has come up with a new way to look at the problem, one that takes into account the new realities of the business by doing away with a few of the shibboleths that govern the semicustom-vendor selection process as practiced by most companies.

The first thing to be remembered, says Smith, is that traditional methods of measurement don't work when weighing a vendor's market viability. Instead, he has come up with a list of new criteria.

- Unless it has a specialty, no semicustom vendor with annual sales of less than $15 million should be considered as a prospective supplier. However, size alone cannot be the governing factor—Honeywell ranked seventh in the market in 1988. How about a company that has been around a while? That's no guarantee either: California Devices was in the business for 10 years when it closed up shop.
- If a vendor doesn't have today's mainline technology, 1.5-μm arrays, it isn't a serious player. But the vendor should also be developing new product-family members and adding macros to its library. One of the first signs of trouble in any high-tech business is a drop-off in engineering output.
- The vendor must be profitable. This sounds obvious, but profitability has been neglected in recent years as money from venture capitalists drove the market and large semiconductor companies adopted defensive stances. "Growth was the order of the day in the late 1970s and early 1980s as venture-capital-backed firms focused on going public and cashing in on the stock," says Smith. "Established IC houses reacted to this threat by pouring millions of dollars into their semicustom divisions."

But, he points out, the CMOS gate array is now 15 years old. If a company isn't making a profit from it by now, the chances are it never will.

In line with his revisionist approach to the business, Smith has taken a look at market rankings, tossed in some history, added a dash of prescience, and come up with what he considers to be a more realistic appraisal of who's on first in semicustom ICs.

In the 1988 rankings—the latest available—the top 10 were LSI Logic, To-

shiba, NEC, Fujitsu, Matsushita, National Semiconductor, Honeywell, Hitachi, Seiko, and Oki. VLSI Technology Inc. led the second 10, with Smith's International Microcircuits ranking 17th.

Smith drops Honeywell because it is no longer in the market. He eliminates the Japanese—remember, he is talking about a small company selecting a vendor for the first time—because "they do very few designs a year and deal with large-volume customers [and] are not viable vendors for companies just starting to use gate arrays."

The result is a new ranking. LSI Logic is still first, but it is now followed by National, VLSI Technology, CMD, SGS, Plessey, International Microcircuits, Texas Instruments, Harris/GE/RCA, and Motorola.

Over at the headquarters of No. 1, LSI Logic's Connors says he "positively agrees that the business has changed dramatically." The irony, he points out, is that changes in the semiconductor industry in the late 1970s opened the way for gate arrays. Now, changes in the semicustom business are creating opportunities of their own. Specifically, he says, the industry has fragmented into two approaches with two sets of requirements: those of the high-end systems people and those of what he terms the mainstream.

CONNORS'S HIGH END IS populated by the companies that want the chip maker in on the design process right from the start. An example, he says, is Sun Microsystems Inc. in Mountain View, Calif. "It's no secret that we were part of the development of the Sun Sparcstation," he says. On the other hand, the mainstreamers "still do it the old way," says Connors. That is, they simply want a chip designed and built for a particular system.

"But an evolution is taking place," he says. "The system is now in the chip, so the object is to build value added." And that, along with stability and dependability of the supplier, is what Connors believes the first-time customer should look for.

"I would establish relationships at as high a level as I could, in effect finding someone to be my guide in the company, as part of the value added. Also, with market windows cut in half in the last year, it's necessary to find a chip maker that can get it right the first time—correct all the errors before the chip is committed to silicon." E

GOING WORLD CLASS

HOW TO UPGRADE MANUFACTURING TO IMPROVE PRODUCTIVITY, QUALITY, CUSTOMER SERVICE

DEFENSE AND AEROSPACE suppliers are anxious. Actual and promised budget cuts are pressuring contractors to do more with what they have. One way, short of finding new markets for new products, is to tighten up manufacturing as a means of improving output, quality—and the bottom line.

For Dynatech Microwave Technology Inc., a Calabasas, Calif., manufacturer of microwave switches and components, there simply was no choice. "We had to go to world-class manufacturing," says president John Wetzel. "I was discouraged by our quality and customer service, and didn't see it getting any better. Productivity and morale were dropping."

For Wetzel, the only class is world class.

So two years ago, Wetzel and his $10 million company bit the bullet. "The results came in very quickly," says Wetzel, "and they're amazing. In six weeks, we were back to our original production rate—that is, we were producing as much as we were before we shut down production lines to make the changeover. In 12 weeks, we were running at 140% of the initial rate. Now we are at 180%—approaching double the productivity, with a slightly reduced labor force," which ranges from 80 to 85.

Not only that, but product cycle time, which had been 30 days, shrunk in six weeks to 2.5 days. Work orders—jobs that were on the line at any given time—were reduced from 100 to 15, and the work-in-progress inventory went down 20%. And 12 weeks after world-class manufacturing was instituted, production yields increased threefold while the on-time delivery rate rose from 40% to 95%.

Wetzel also points to the bottom line. "The project cost $250,000, or 2.5% of revenue," he says. "I figure that the productivity improvements paid it off in one year. Also, we've been able to cut our inventory in half, to $1 million." But best of all, Wetzel says, is that "last year, in a relatively flat market, our bookings were up 25%."

Wetzel is convinced that any company can benefit from such radical changes in the way it manufactures. "Put it this way," he says. "By the end of the decade, there might not be an option. As soon as someone in an industry does it, everyone that doesn't is giving away an advantage."

It isn't all that difficult for a company to make the switch to world-class manufacturing, which Wetzel defines as "that which one does to be competitive with anyone in a global marketplace." However, one thing he cautions against is trying to do it without some expert advice.

"You're going to need outside help. We called in a series of consultants, listened to their pitches, and finally selected Pittiglio, Rabin, Todd & McGrath Inc. They have offices around the country—Boston, Mountain View, and nearby in Orange County.

"They came in and gathered data, ensured management's commitment, trained our employees, and analyzed our processes. Then, they stationed one of their people here to supervise the changeover."

Wetzel cautions also that once all the changes are in place, constant vigilance is required. "For the first 12 weeks, things went well. Then everything plateaued. It took us six more months to realize what had happened: you must make continuous improvements through continuous investment and continuous support."

Not so incidentally, customers appreciate the changes. At Micorwave Technology, says Wetzel, "our three largest customers have now made multiyear commitments."—*Howard Wolff*

Electronics DIRECT CONNECTION ADS

New and Current Products Presented By the Manufacturer

To Advertise Call Brian Ceraolo (201) 393-6260

New EPROM Programmer

At $495, Wintek's Universal EPROM Programmer is a low-cost and versatile tool for programming most industry-standard EPROMs (2716-27256). Since it can operate with an IBM PC, as well as stand-alone, the Programmer is ideal for use with PC-based microcomputer development software. Credit cards are welcome.

Wintek Corporation
1801 South St., Lafayette, IN 47904
(800) 742-6809 or (317) 742-8428

WINTEK CORP. CIRCLE 114

☆ ☆ ☆ ☆ "The Best 8051 Emulator"

NEW COMPLETE C-VARIABLE SUPPORT

8051 *SEE EEM 89/90 Pages D 1324-1326*

PC based emulators for the 8051 family
(8051/51FA/31/32/44/152/451/535/552/83C751 + CMOS + more . . .

- PC plug-in boards or RS-232 box.
- Up to 20 MHz real-time emulation
- Full Source-level Debugger including *complete* C-variable support.
- 48 bit wide, 16K deep trace, with "source line trace"
- "Bond-out" pods for 8051, 83C552, 83C451, 83C652, 83C751, 80C515/80C517

Prices: 32K Emulator 8031 $1790;* 4K Trace $1495*

CALL OR WRITE FOR FREE DEMO DISK!
Ask about our demo VIDEO *US only

Please see us at Electro Booth #1121

NOHAU CORPORATION
51 E. Campbell Avenue
Campbell, CA 95008
FAX (408) 378-7869
(408) 866-1820

NOHAU CORP. CIRCLE 115

Don't Get Zapped!

High inrush current can **destroy** your sensitive VAX CPUs and peripherals **in less time than it takes to flip a switch.**

THE SOLUTION?
Power up with *Z-LINE* **TPC 115-10 MTD™ the smallest** power distribution and control system available.
POWER UP WITH Z-LINE

Our proprietary **Multiple Time Delay™ circuitry sequences** your power-up to **protect** your systems from the spikes and surges, EMI & RFI, that **destroy your hardware and erase your data.** And our remote on/off and emergency shutdown **gives the power control back to you.**

All Pulizzi Engineering MTD™ controllers are **compatible with DEC and UPS systems.**
PRICES FROM $453 TO $317

DON'T WAIT UNTIL IT HAPPENS, CALL TODAY!
PULIZZI ENGINEERING INC.
3260 S. Susan Street, Santa Ana, CA 92704-6865
(714) 540-4229 FAX (714) 641-9062

Z-LINE TPC 115-10 MTD CIRCLE 116

DESIGN ENGINEERS!

Your prototype panel in as little as 3 days...

Use our **full service wirewrap facility** to prove out designs in shortest possible time. Make design changes and upgrades in minutes.

DATAWRAP

Wirewrapping & Assembly Service
37 Water Street Wakefield, MA 01880
(617) 246-5757 FAX (617) 246-5758

DATAWRAP CIRCLE 117

SC/FOX™ High-Speed Embedded Systems Computers

SC/FOX PCS32 (Parallel Coprocessor System32) 15 MIPS, 70 MIPS burst, general purpose PC/XT/AT/386 32-bit plug-in board, 64K-1M byte 0-wait-state static memory, uses 32-bit SC32 RISC microprocessor.

SC/FOX SBC (Single Board Computer) 18 MIPS, 60 MIPS burst, for stand-alone or embedded operation, 100x160mm, 1 serial, 1 printer port, 32K-512K bytes 0-wait-state static memory, uses 16-bit Harris RTX 2000.

SC/FOX PCS (Parallel Coprocessor System) 15 MIPS, 50 MIPS burst, general purpose PC/XT/AT/386 plug-in board, 32K-1M byte 0-wait-state static memory, multiple board operation, uses Harris RTX 2000.

SC/FOX SCSI I/O plug-in daughter board for the PCS or SBC with SCSI, floppy, serial, and parallel ports, and driver software.

Ideal for embedded real-time control, data acquisition, and signal processing. Forth development software included. OEM pricing.

SILICON COMPOSERS INC. *(415) 322-8763*
208 California Avenue, Palo Alto, CA 94306

SILICON COMPOSERS CIRCLE 118

9-Track Tape Subsystem for the IBM PC/XT/AT

Now you can exchange data files between your IBM PC and any mainframe or mini-computer using IBM compatible 1600 or 6250 BPI 9-Track tape. System can also be used for disk backup. Transfer rate is up to 4 magabytes 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

QUALSTAR CIRCLE 119

INSTANT PRODUCT!

••• just add software •••

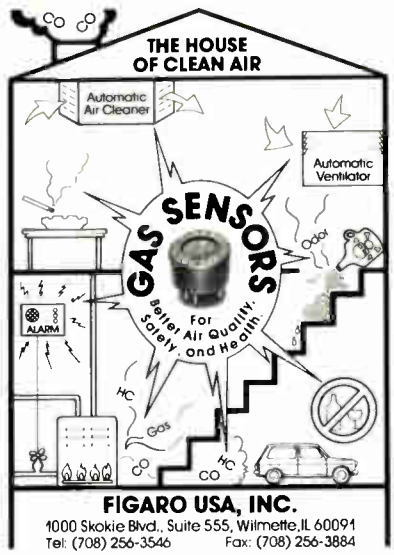
TDS9090 FORTH control computer

Powerful 4" x 3" single-board computer, based on the CMOS HD6303Y. High-level easy Forth language on board - REAL-TIME DEBUG ! 30K RAM, 16K RAM/PROM, 2K EEPROM. Attach keyboard, lcd, I2C peripherals. Built-in interrupts, multi-tasking, watchdog timer, editor and assembler. 32 I/O lines, two RS-232 ports. 6 - 16 volts operating at 3ma. Optional data-logging module : 10-channel, 10-bit or 8-channel, 12-bit A/D. 128K RAM, D/A, date/time clock -- low-power mode lasts one year on 9v battery ! Includes lots of ready-made software solutions. Program with PC. Over 4000 are in use world-wide for machine control, data-logging, inspection, factory automation, robotics, remote monitoring, etc. Available on 30-day free trial.

Only $219 (25 qty)

SAELIG Company
1193 Moseley Rd. Victor, NY 14564
(716) 425 3753 • fax (716) 425 3835

SAELIG CO. CIRCLE 129

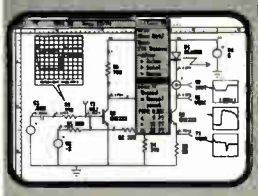


FIGARO USA, INC.
1000 Skokie Blvd., Suite 555, Wilmette, IL 60091
Tel: (708) 256-3546 Fax: (708) 256-3884

FIGARO USA CIRCLE 130

Analog Circuit Simulation

Completely Integrated CAE from $95



From Schematic Entry through SPICE Simulation to Post Processing

IsSPICE $95, the complete SPICE program, runs on all PC's.

IsSPICE/386 $386, The fastest PC based SPICE program available. Has virtually no circuit size limitations.

SPICENET $295, a schematic editor for any SPICE simulator. Generates a complete SPICE netlist.

INTUSCOPE $250, a graphics post processor that performs all the functions of a digital oscilloscope.

PRESPICE $200, extensive model libraries, Monte Carlo analysis, and parameter sweeping.

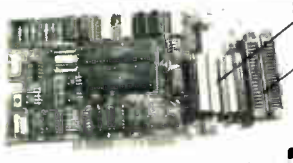
intusoft

Please Write or Call
P.O. Box 6607 (213) 833-0710
San Pedro, CA 30 Day Money
90734-6607 Back Guarantee

INTUSOFT CIRCLE 131

EPROM PROGRAMMER

FOR THE PC $139.95



- **2716 to 2 Meg**, updateable to 32 Meg
- **Programs 2764A in 10 seconds** 16/32 bit split programming
- Menu driven software
- No personality modules required
- Adapter for 8748, 49, 51, 52, 55, TMS 7742, 27210, 57C1024, and memory cards
- 1 year warranty • 10 day money back guarantee
- Made in the U.S.A.

VISA MasterCard

For more information, call (916) 924-8037

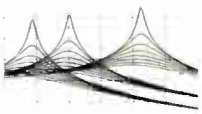
NEEDHAM'S ELECTRONICS
4539 Orange Grove Avenue • Sacramento, CA 95841
(Monday - Friday 8:00 am - 5:00 pm PST)

NEEDHAM'S ELECTRONICS CIRCLE 132

Engineering a Better Way!

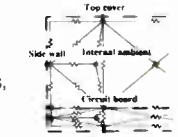
ECA-2

Analog Circuit Simulation
•AC, DC, Transient, Fourier, Worstcase, Temperature, MonteCarlo •2 to 50 times faster than SPICE •IBM or Mac



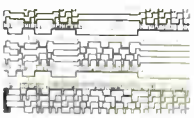
SAUNA

3D Thermal Analysis
•Models: enclosures, plates, heat sinks, circuit boards
•IBM or Mac



LCA-1

Logic Circuit Analysis
•Graphical or tabular •Typ, Min/Max or zero delay
•Design rule checks •IBM



Tatum Labs, Inc.
3917 Research Park Dr, B-1, Ann Arbor, MI 48108, USA
313-663-8810

TATUM LABS CIRCLE 133

100 MHz Dual Trace Tektronix Scope

FOR LESS THAN PRICE OF 20 MHz SCOPE

TEKTRONIX OS-245 P/U Model 7603/01 Dual Trace Oscilloscope, DC to 100 MHz bandwidth, 3.5 NSEC rise time, 6.5 inch CRT, 5-NS/DIV fastest calibrated sweep rate. Compatible with all 7000-series plug-ins incl.

2 ea 7A15AN (AM-6565/U) DC-80 MHz plug in single trace amplifier with selectable polarity

1 ea 7B53 AN (TD-1085/4) DUAL TIME BASE. Triggering to 100 MHz. 5 NSEC to div-5 sec/div

Probe, connectors, and user manual.

These oscilloscopes have been completely overhauled, tested and certified.

Price Including Shipping $495.00
ORDER TODAY—QUANTITIES ARE LIMITED

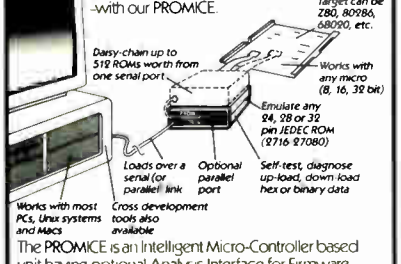
EMS 1940 Bear Corbitt Rd., Bear, DE 19701 (302) 836-3488

EMS CIRCLE 134

Still Blasting ROMs?

NEW!

Develop and test ROM code in minutes without leaving your keyboard—with our PROMICE.



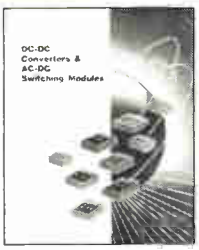
The PROMICE is an Intelligent Micro-Controller based unit having optional Analysis Interface for Firmware Debugging Support. For more information, call or write:

Grammar Engine, Inc.
3314 Morse Road
Columbus, Ohio 43231
614/471-1113

VISA and MasterCard Accepted
Dealer Inquiries Welcome

In Pacific and Mountain time zones
415/595-2252

GRAMMAR ENGINE CIRCLE 135



UNIVERSAL MICROELECTRONIC DC-DC CONVERTERS & AC-DC MODULES

WATTAGE RANGE:	.5 Watts-40 Watts
INPUT VOLTAGES:	5, 12, 24, 28 & 48VDC at ~10% Wide-Input 2 to 1, 3 to 1, 4 to 1
OUTPUT VOLTAGES:	5, 12, 15, ±12, ±15VDC Single, Dual & Triple Outputs
REGULATED:	to ~.02%
ISOLATED:	500, 2000, 2500VDC
FREQUENCY:	to 100KHz
EFFICIENCY:	to 89%
NOISE:	as low as 10mV p-p Max
OTHER FEATURES:	Over-Voltage Protection, Short-Circuit Protection, Input Filter, Shielded, Standard Industry Packages, Custom Designs Welcome
COST:	Very Reasonably Priced

STCCOMPONENTS, INC.
2277 South Grand Ave., Santa Ana, CA 92705
TEL: (714) 556-1228 FAX (714) 556-2350

STCCOMPONENTS CIRCLE 144

MORE . . .

Electronics Direct Connection Ads give you **MORE** for your advertising dollars

—More Qualified Circulation—
Over 90% has final purchase approval authority

—More International Circulation—
Over 30,000

—More Exposure For Your Ad—
Published monthly

For Further Information Call: BRIAN CERAOLO at (201) 393-6260

CIRCLE 137

IEEE-488

Complete Hardware and Software Solutions

Platforms: EISA, PC/XT/AT, PS/2, 386, RT PC, Macintosh Plus/SE/II, Sun, DEC, Apollo, , MASSCOMP, 3B2, Q-BUS, UNIBUS, VMEbus, MULTIBUS, STD Bus, S-100, and SBX Bus

Operating Systems: DOS, OS/2, XENIX, UNIX, 386/ix, Domain/OS, SunOS, AIX, RT, RSX, VMS, ULTRIX, VAXELN, PDOS, VERSAdos, RMS-86, Z-DOS, STD-DOS

Support Products: Extenders, Expanders, Converters, Controllers, Buffer, Analyzer

Call for *FREE* Catalog
(800) IEEE-488 • (512) 794-0100

NATIONAL INSTRUMENTS®
The Software is the Instrument™
6504 Bridge Point Parkway, Austin, TX 78730

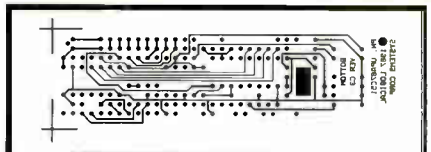
NATIONAL INSTRUMENTS — CIRCLE 138

ELECTRONIC DESIGN SERVICES

- Initial concept through prototype and production
- Design of advanced digital and analog electronics
- Approved programmable gate array design center
- Real time embedded software development — DSP code
- 7,000 square foot facility with fully equipped labs
- 12 year track record of successful product designs
- Designs are warranted Defect Free Forever

PRESCO (203) 397-8722

PRESCO — CIRCLE 139



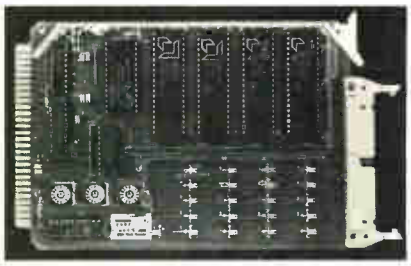
GerberJet

CATCHES ERRORS BEFORE PHOTOPLOTTING

GerberJet plots Gerber data files on HP LaserJet and compatible printers at 300 dots per inch. With GerberJet you will be sure your files are correct BEFORE EXPENSIVE PHOTOPLOTTING. Use your FAX to send proofs to your subcontracters, customers, or remote sites and get firm quotes from PCB production. **Call our BBS to download the demo file GJD11A.EXE. PRICE $ 149.00**

CALL (315) 478-0722 FAX (315) 475-8460
BBS (315) 471-3961 (2400/1200,8,N,1)
Logical Systems Corporation
P.O. Box 6184, Syracuse, NY 13217 USA

LOGICAL SYSTEMS — CIRCLE 140



COUNTER/FREQUENCY I/O CONTROLLER TO USE IN INDUSTRIAL APPLICATIONS

The CV10-20 is an STD Bus board delivering 20 channels of 16-bit all purpose counters, each having 18 different operating modes. Uses incl: an interface to transducers w/frequency I/O, high resolution programmable duty cycle waveforms, coincidence alarms and complex pause generation. $435.

STI/Datricon Corp.
31069 Genstar Road
Hayward, CA 94544
1/800/221-7060 or 415/471-9717

DATRICON — CIRCLE 141

PORTABLE BACK-UP OVER RS-232

32 Megs - "Plug and Run"
With MS-DOS Driver

- MULTIPLE PC BACK UP WITH SINGLE TAPE SYSTEM
- NO SPECIAL "ADD IN" PC CARDS NEEDED
- NO SPECIAL "BACK UP" SOFTWARE NEEDED
- RS232 INTERFACE
- PRICE IS $1295 IN SINGLE QUANTITIES
- OPTIONAL 488, 8 BIT PARALLEL, 485, 422, INTERFACES AVAILABLE FOR USE IN DATA LOGGING APPLICATIONS.

ADPI
ANALOG & DIGITAL PERIPHERALS, INC.
251 S. Mulberry St., Troy, Ohio 45373
P.O. Box 499 TWX: 810-450-2685
513-339-2241 FAX 513-339-0070

ANALOG & DIGITAL PERIPHERALS — CIRCLE 142

ULTIMATE TECHNOLOGY — CIRCLE 143

LISTEN TO WHAT OUR USERS SAY.

TESS

COMMUNICATIONS BLOCK DIAGRAM SIMULATION FOR PCs

"Eats SPICE for breakfast!..very nicely done" - G.W., Iowa

"totally amazed at how powerful it is!" - G.P., Illinois

"It's a beautiful program" - R.N. from Maryland

"really like the simplicity of using the thing" - W.F., Texas

"The program is proving very useful in designing and refining a voice inversion scrambler. Again thanks for a fine product" - R.K., Virginia

"It's an impressive program" - T.J. from Texas

"We're enjoying the TESOFT tools very much in our modem design project. My engineers say that it's easy to use" - K.D., Utah

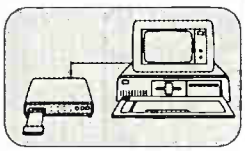
WHAT MORE CAN WE ADD? CALL FOR A DEMO DISK!
TESOFT 404-751-9785 PO BOX 305 Roswell GA 30077

TESOFT — CIRCLE 136

NEW! 8051/52 family In-Circuit Emulators

The most advanced 8051 ICE on the market

80c31/52/c154
80515/c535
80c552/652/451
80c751/752
80c152/51FA

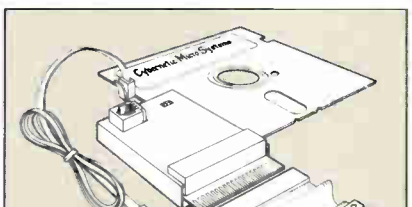


- Source level debugger for PL/M-51 and C-51
- IBM-PC/XT/AT windowing interface w/mouse
- Complex Hardware real-time breakpoints
- Breaks on SFRs and Internal Data RD/WR
- 32k*80 hardware Trace Buffer with filtering
- Performance analysis with histograms
- Hardware Pass counters, 8 level sequencer
- Interchangeable Pods for other uControllers

SIGNUM SYSTEMS

171 E .Th. Oaks Bl., Thousand Oaks CA 91360
(805)371-4608 **telex: 362439**

SIGNUM SYSTEMS — CIRCLE 145



8051 Emulator - $1250

d^2ICE is a low cost, Full Speed, real time 8051 Emulator.. Powerful user interface for Hi-level multi-window source code debugging. Uses IBM-PC COM1/2. No Slots! Portable, fits in shirt pocket. Assembler and test bed included.

Cybernetic Micro Systems
PO Box 3000 • San Gregorio CA 94074
Ph: (415) 726-3000 • Fax: (415) 726-3003

CYBERNETIC MICROSYSTEMS — CIRCLE 146

PENNEY'S EGGS AND OTHER GAFFES

BY JACQUELINE DAMIAN

THE COMPLETE MANAGER'S GUIDE TO INTERVIEWING

By Arthur H. Bell, Homewood, Ill.: Dow Jones-Irwin, $24.95

IT'S SAID THAT J. C. PENNEY liked to interview prospective employees over a good old-fashioned breakfast. The meals were more than hospitality—they were a way for the department-store magnate to size up candidates by means of a unique pass-fail test. If the person salted or peppered his eggs before tasting them, Penney wrote him off out of hand, convinced that the act disclosed a fatal inclination toward making decisions without sufficient information.

This high-cholesterol screening process is probably no more nor less scientific than what often happens today, suggests management consultant Arthur H. Bell. In *The Complete Manager's Guide to Interviewing*, Bell, who is also a lecturer in management communication at Washington's Georgetown University, argues that even the most high-powered corporate managers may be remarkably naive about how to interview and hire the best technical and business talent for their companies.

Interviewing is a skill that must be learned, says Bell, especially since, as "judge and jury over a candidate's professional future with your company," it's all too easy to let subtle biases interfere. Does the candidate have a habit you find irritating? Do you dislike the way he or she dresses? Are you so convinced you can size somebody up in a few minutes' time—the equivalent of Penney and the eggs—that you dismiss a potential winner too quickly?

Such recruiting gaffes affect the bottom line, Bell says. "In managerial time alone, American business spent approximately $26 billion in 1987 preparing for, conducting, and evaluating interviews," he writes. The American Management Association says it can cost $50,000 to find and relocate a manager for an $80,000 job. And if turning up the right person for a key job is an expensive proposition, hiring the wrong one is even more costly: *Fortune* estimates that "an employee who flops and leaves after a few months can cost a company anywhere from $5,000 for an hourly worker to $75,000 for a manager in lost productivity and money spent on training."

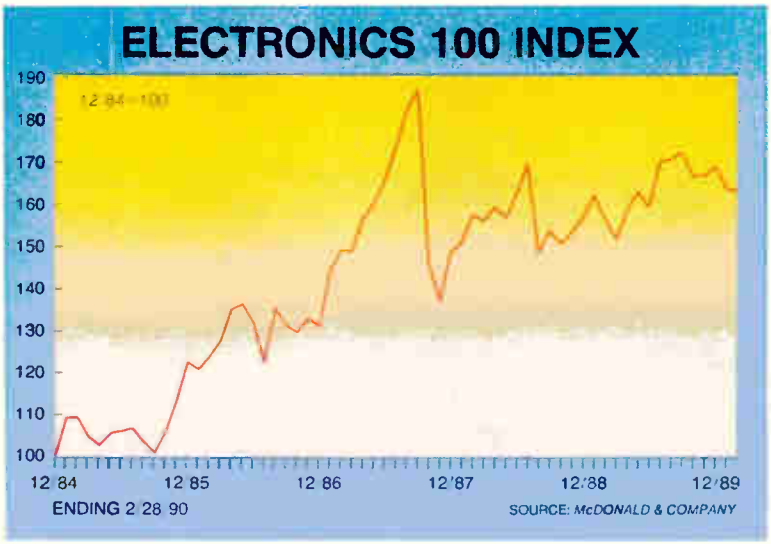
Bell's anecdotal, popularly written book is an attempt to clue managers in to the mysteries of the effective interview. It offers simple strategies and interviewing tips designed to put the candidate at ease while giving the manager the best fix on whether he or she is the right person for the job.

SOME OF THIS ADVICE IS commonsensical, though far from obvious. Bell provides techniques, for instance, for learning how to read between the lines of a resumé, how to ask questions that will elicit attitudes along with facts, how to listen for both the literal data and the subtext of what the candidate says. And some of it reads like a self-help book. For example, there's a chapter on body language ("Nonverbal techniques for interviewing") and another on "The right environment for interviewing" that addresses such questions as whether you should stay behind your desk facing the job seeker or pull your chair up alongside his. (The answer: it depends.)

Pragmatists may prefer to skim the first half of the book and dive into the second, where Bell takes the reader through an interview step by step, complete with sample questions and suggestions on how to evaluate the responses. Also useful is the chapter on the law, where Bell discusses the constraints on questioning posed by federal regulations prohibiting age, race, and sex discrimination, along with drug testing and other legal matters. This is crucial information for the manager. E

INDEX

SECOND HALF MUST BE STRONG JUST TO REACH '89 MARK



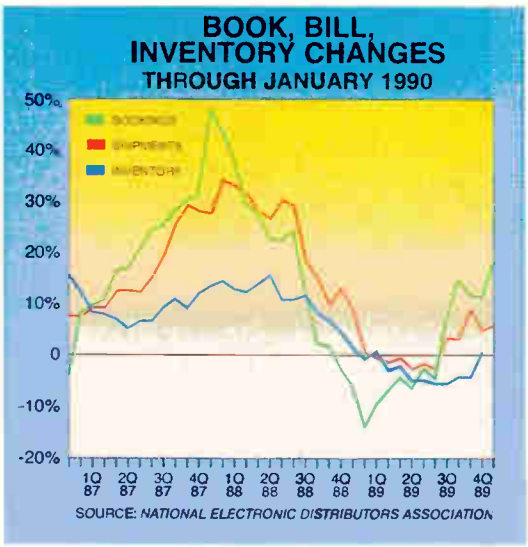
TOUGH PRICING, LACKLUSTER ORders, and weak earnings are what we hear most often these days. The domestic economy isn't disastrous, but a stronger second half is needed to maintain full-year earnings at 1989 levels. Companies heavily focused on international markets, like AMP, Molex, Motorola, and NCR, have generated a disproportionate amount of earnings from non-U.S. operations for at least 18 months. Recent interest-rate surges in the UK, West Germany, and Japan reflect policies to reduce inflation. If foreign interest rates stay high long enough, growth in those key markets could slow dramatically over the next year.

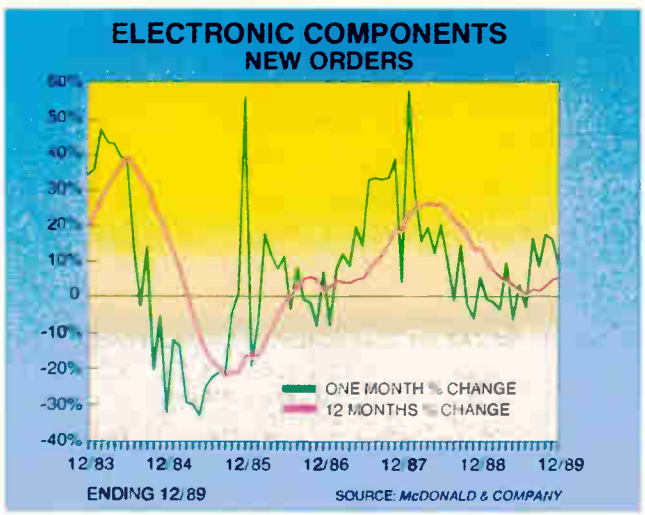
But many companies, even IBM Corp. and AT&T Co., have begun meaningful cost-reduction programs in anticipation of slower growth, a marked change from the posture taken by most electronics companies in 1985. Meanwhile, lower prices for most raw materials are helping to ease pricing pressures. Even though the dollar has strengthened against the yen (up 15% from last year) and the pound, this has been offset by weakness against the mark (down 10%) and the franc.

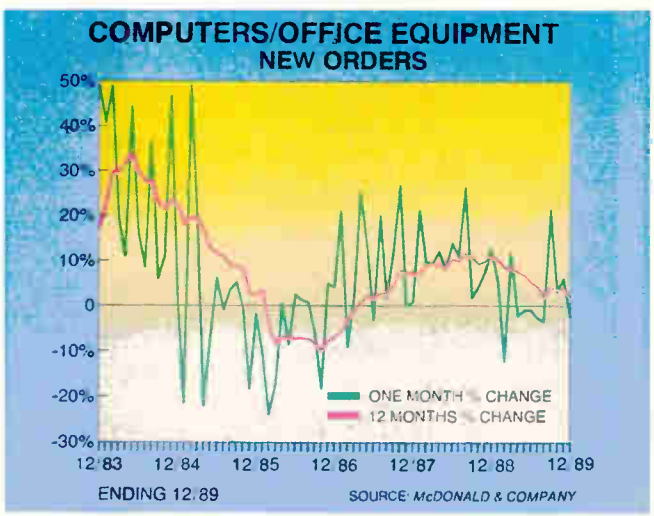
Distributor orders continue to look surprisingly strong, and component orders are showing modest strength. Though not a disaster, computer orders look weak. Communications orders, buoyed by cellular and aerospace, are in a modest uptrend.

In the NEDA chart, right, the lines show year-to-year changes in bookings, shipments, and inventories for OEM component and computer distributors. The charts below are based on the Commerce Department manufacturing survey. Our 12-month year-to-year percent change line depicts industry trends, much like a traditional pressure curve analysis. E

The index is prepared by Mark Parr of McDonald & Co., Cleveland.







Electronics

2025 Gateway Place, Suite 354
San Jose, California 95110
(408) 441-0550 ..... (408) 441-6052 FAX

Thomas L. Dempsey ..... *Chairman*
Sal F. Marino ..... *President and CEO*
James D. Atherton ..... *Senior Vice President*
James W. Zaremba ..... *Group Vice President*
James C. Uhl ..... *Publisher*

BUSINESS STAFF
John French ..... *National Sales Manager*
Ken Long ..... *Research Manager*
Kathy Torgerson ..... *Promotion Manager*
Nancy Schlachet ..... *Circulation Manager*
Bob Scofield ..... *Ad Serv/Production Manager*
Brian Ceraolo ..... *Cardecks and Quick Ads Manager*
Paula Greenleaf ..... *Reader Service Manager*

SALES OFFICES
Regional Vice Presidents:
David M. Woodward ..... *Cleveland*
Chandler C. Henley ..... *New York*
Richard B. Cutshall ..... *Chicago*
Harmon L. Proctor ..... *Atlanta*
George M. Horrigan ..... *Los Angeles*

SAN JOSE
Tina Ireland (N. California)
Dick Sanborn (N. California/Northwest/N. Canada)
2025 Gateway Place, Suite 354
San Jose, CA 95110 ..... (408) 441-0550 FAX: (408) 441-6052

LOS ANGELES
Chuck Crowe (S. Calif/Arizona/Colorado/Utah)
Neil Dant (Orange County/San Diego County)
16255 Ventura Boulevard, Suite 301
Encino, CA 91436 ..... (818) 990-9000 FAX: (818) 905-1206

CHICAGO
Charles F. Minor III (Midwest)
2 Illinois Center Building, Suite 1300
Chicago, IL 60601 ..... (312) 861-0880 FAX: (312) 861-0874

DALLAS
Bill Yarborough (Southeast/Texas)
12201 Merit Drive, Suite 220
Dallas, TX 75251 ..... (214) 661-5576 FAX: (214) 661-5573

BOSTON
Joseph Burke (New England/Eastern Canada)
400-2 Totten Pond Road, Suite 200
Waltham, MA 02154 ..... (617) 890-0891 FAX: (617) 890-3731

NEW YORK
Rit Teeling (Mid-Atlantic Region)
Brian Ceraolo (Direct Connection Ads)
611 Route 46 West
Hasbrouck Heights, NJ 07604 ..... (201) 393-6060
FAX ..... (201) 393-0204

JAPAN
Hirokazu Morita
Mizuno Building 1-2-3
Kanda Jimbo-cho, Chiyoda-Ku
Tokyo 101 Japan ..... (03) 219-5381 FAX: 81 3 2192816

AUSTRIA, GERMANY, SWITZERLAND
Friedrich K. Anacker, Intermedia Partners GmbH
Katernberger Strasse 247
5600 Wuppertal 1, West Germany ..... (02) 271-1091
FAX 49 202 712431

FRANCE
Claude Bril, IDG Communications France
Cedex 65 92051, Paris LA DEFENSE France ..... (04) 9047900
FAX 33 149 047800

HOLLAND
W.J.M. Sanders, S.I.P.A.S.
Oosterpark 6—P.O. Box 25
1483 ZG DeRyp, Holland ..... (02) 997-1303
TELEX: 13039 SIPAS NL ..... FAX: 31 2 997 1500

ITALY
Cesare Casiraghi, Casiraghi Cesare, S.A.S.
Via dei Colli, 1, 22070 Guanzate
Como, Italy ..... 011-39-031/976377 FAX: 39 031/976382

KOREA
Young Sang Jo, *President*, BISCOM
K.P.O. Box 1916, Seoul, Korea ..... FAX: 82 2 7323662

TAIWAN
Charles C.Y. Liu, *General Supervisor*
United Pacific International, Inc.
No. 311, Nanking E. Rd., Sec. 3
Taipei, Taiwan, R.O.C. ..... FAX: 886 2 7169493

UNITED KINGDOM, SCANDINAVIA
John Maycock
Huntons Bldgs., 146 West Street
Sheffield, S14ES, England ..... 742 759186 FAX: 44 742 758449

CHINA
China Consultants International HK Ltd.
Ste 904, Garden House, 32 Ol Kwan Rd.
Happy Valley, Hong Kong ..... FAX: 852 5 893 4290
Media Developments Ltd.
13/F Jung Sun Commercial Bldg.
200 Lockland Rd., Hong Kong

BPA Published by *PENTON PUBLISHING* ABP

Advertiser's Index

* Domestic only
** International only

Electronics FREE Subscription Application

☐ Mr. ☐ Ms. NEW SUB- ☐ SCRIPTION RE- ☐ NEWAL CHANGE OF ☐ ADDRESS

1 NAME — AREA CODE — OFFICE TELEPHONE

2 TITLE

3 COMPANY

4 DIVISION/DEPARTMENT — INTERNAL MAIL CODE

5 MAILING ADDRESS

6 CITY — STATE — ZIP CODE

7 HOME ADDRESS

8 CITY — STATE — ZIP CODE

Check here if you wish *Electronics* to be sent to your home address. ☐

☐ **YES!** I want to receive (continue to receive) a FREE subscription to *Electronics* Magazine.

☐ *NO*

Date: / /

Your signature (Required) Mo D Yr

*Enter complete address information in space provided. All questions must be answered. Sign and date your application. Incomplete forms cannot be processed. The publisher reserves the right to serve only those subscriptions which meet the qualification criteria for this publication.

*Check here if you wish delivery to your home address ☐ (Requests for home delivery can only be accepted if your company name and address information is entered in the grid provided).

*If you are self-employed please attach your business card or letterhead.

1. ☐ **Your principal job function: (Insert one code only)**

COMPANY MANAGEMENT
- **01.** Corporate & Operating Management (non-engineering)
- **02.** Administrative/Financial Management
- **03.** Manufacturing & Production Management (non-engineering)
- **04.** Purchasing/Procurement Management (VP, director, manager)
- **05.** Marketing Management (VP, director, manager)
- **06.** Sales Management (VP, director, manager)

ENGINEERING MANAGEMENT
- **07.** Design & Development Management (circuits, components, equipment, systems)
- **08.** Engineering Services Management (evaluation, quality control, reliability, standards, test)
- **09.** Manufacturing & Production Engineering Management
- **10.** Research & Development Management
- **11.** Executive & Operating Management (engineering/technical)

ENGINEERING
- **12.** Design & Development (circuits, components, equipment, systems)
- **13.** Engineering Services (evaluation, quality control, reliability, standards, test)
- **14.** Manufacturing & Production Engineering
- **15.** Research & Development

STAFF
- **16.** Consultant
- **17.** Engineering Support (draftsman, lab assistant, technician/applications)
- **18.** Marketing/Sales (reps, salespersons, etc.)
- **19.** Purchasing/Procurement (buyers, agents, etc.)
- **20.** Librarian/Co. Copy
- **21.** Educator
- **22.** Student
- **23.** Other _____ (please specify)

1B0024

Please complete questions on reverse side.

Electronics FREE Subscription Application

☐ Mr. ☐ Ms. NEW SUB- ☐ SCRIPTION RE- ☐ NEWAL CHANGE OF ☐ ADDRESS

1 NAME — AREA CODE — OFFICE TELEPHONE

2 TITLE

3 COMPANY

4 DIVISION/DEPARTMENT — INTERNAL MAIL CODE

5 MAILING ADDRESS

6 CITY — STATE — ZIP CODE

7 HOME ADDRESS

8 CITY — STATE — ZIP CODE

Check here if you wish *Electronics* to be sent to your home address. ☐

☐ **YES!** I want to receive (continue to receive) a FREE subscription to *Electronics* Magazine.

☐ *NO*

Date: / /

Your signature (Required) Mo D Yr

*Enter complete address information in space provided. All questions must be answered. Sign and date your application. Incomplete forms cannot be processed. The publisher reserves the right to serve only those subscriptions which meet the qualification criteria for this publication.

*Check here if you wish delivery to your home address ☐ (Requests for home delivery can only be accepted if your company name and address information is entered in the grid provided).

*If you are self-employed please attach your business card or letterhead.

1. ☐ **Your principal job function: (Insert one code only)**

COMPANY MANAGEMENT
- **01.** Corporate & Operating Management (non-engineering)
- **02.** Administrative/Financial Management
- **03.** Manufacturing & Production Management (non-engineering)
- **04.** Purchasing/Procurement Management (VP, director, manager)
- **05.** Marketing Management (VP, director, manager)
- **06.** Sales Management (VP, director, manager)

ENGINEERING MANAGEMENT
- **07.** Design & Development Management (circuits, components, equipment, systems)
- **08.** Engineering Services Management (evaluation, quality control, reliability, standards, test)
- **09.** Manufacturing & Production Engineering Management
- **10.** Research & Development Management
- **11.** Executive & Operating Management (engineering/technical)

ENGINEERING
- **12.** Design & Development (circuits, components, equipment, systems)
- **13.** Engineering Services (evaluation, quality control, reliability, standards, test)
- **14.** Manufacturing & Production Engineering
- **15.** Research & Development

STAFF
- **16.** Consultant
- **17.** Engineering Support (draftsman, lab assistant, technician/applications)
- **18.** Marketing/Sales (reps, salespersons, etc.)
- **19.** Purchasing/Procurement (buyers, agents, etc.)
- **20.** Librarian/Co. Copy
- **21.** Educator
- **22.** Student
- **23.** Other _____ (please specify)

1B0024

Please complete questions on reverse side.

2. ☐ **What is the PRIMARY end product or service performed at this location? (Insert one code only)**

01. Computers & computer systems
02. Computer peripherals: disk drives, terminals, printers/plotters
03. CAE/CAD/CAM systems
04. Software manufacturer/developer
05. Computer systems integrator
06. Office & business machines
07. Communications systems & equipment
08. Industrial controls, systems, equipment & robotics
09. Electronic instruments, ATE systems, design/test equipment
10. Medical electronic equipment
11. Avionics, marine, space & military electronics
12. Government/military
13. Automotive and other ground vehicles
14. Consumer electronics & appliances
15. IC's & semiconductors
16. Other components, materials, hardware & supplies
17. Electronic sub-assemblies (boards, modules, hybrids and power supplies)
18. Other manufacturers incorporating electronic equipment in their end product not described above
19. Independent/academic R&D laboratory
20. Technical/engineering consulting firms
21. Industrial users of electronic equipment
22. Commercial users of electronic equipment
23. Service/installation
24. Electronic distributors/manufacturer's representative/import-export
25. Public library
26. Education institution
27. Student
28. Other (please specify _____

PLEASE AFFIX 25¢ POSTAGE

Electronics
Penton Publishing
Attn: Circulation Dept.
1100 Superior Ave.
Cleveland, OH 44114

3. ☐ **Please indicate TOTAL number of employees in your entire company/ organization, including corporate headquarters, subsidiaries, divisions, branch offices and conglomerate affiliates. (Insert one code only)**

1. 10,000 or more
2. 1,000-9,999
3. 100-999
4. Less than 100

4.a. **Is your company at this location involved in government or military electronics?**
1. ☐ YES 2. ☐ NO

4.b. **Are you personally involved in government or military electronics?**
1. ☐ YES 2. ☐ NO

5.a. **Are you regularly involved in the selection of vendors or in the purchase of products?**
1. ☐ YES
2. ☐ NO

5.b. **If YES, what roles do you play in the purchasing/specification process. (check all codes that apply):**
1. ☐ Determine the need to buy a product or select a vendor.
2. ☐ Establish the product specifications.
3. ☐ Evaluate products.
4. ☐ Specify products.
5. ☐ Evaluate vendors.
6. ☐ Negotiate prices, terms, and availability.
7. ☐ Approve vendor.
8. ☐ Approve purchase.

2. ☐ **What is the PRIMARY end product or service performed at this location? (Insert one code only)**

01. Computers & computer systems
02. Computer peripherals: disk drives, terminals, printers/plotters
03. CAE/CAD/CAM systems
04. Software manufacturer/developer
05. Computer systems integrator
06. Office & business machines
07. Communications systems & equipment
08. Industrial controls, systems, equipment & robotics
09. Electronic instruments, ATE systems, design/test equipment
10. Medical electronic equipment
11. Avionics, marine, space & military electronics
12. Government/military
13. Automotive and other ground vehicles
14. Consumer electronics & appliances
15. IC's & semiconductors
16. Other components, materials, hardware & supplies
17. Electronic sub-assemblies (boards, modules, hybrids and power supplies)
18. Other manufacturers incorporating electronic equipment in their end product not described above
19. Independent/academic R&D laboratory
20. Technical/engineering consulting firms
21. Industrial users of electronic equipment
22. Commercial users of electronic equipment
23. Service/installation
24. Electronic distributors/manufacturer's representative/import-export
25. Public library
26. Education institution
27. Student
28. Other (please specify _____

PLEASE AFFIX 25¢ POSTAGE

Electronics
Penton Publishing
Attn: Circulation Dept.
1100 Superior Ave.
Cleveland, OH 44114

3. ☐ **Please indicate TOTAL number of employees in your entire company/ organization, including corporate headquarters, subsidiaries, divisions, branch offices and conglomerate affiliates. (Insert one code only)**

1. 10,000 or more
2. 1,000-9,999
3. 100-999
4. Less than 100

4.a. **Is your company at this location involved in government or military electronics?**
1. ☐ YES 2. ☐ NO

4.b. **Are you personally involved in government or military electronics?**
1. ☐ YES 2. ☐ NO

5.a. **Are you regularly involved in the selection of vendors or in the purchase of products?**
1. ☐ YES
2. ☐ NO

5.b. **If YES, what roles do you play in the purchasing/specification process. (check all codes that apply):**
1. ☐ Determine the need to buy a product or select a vendor.
2. ☐ Establish the product specifications.
3. ☐ Evaluate products.
4. ☐ Specify products.
5. ☐ Evaluate vendors.
6. ☐ Negotiate prices, terms, and availability.
7. ☐ Approve vendor.
8. ☐ Approve purchase.

The industry's next computing standard.

How the world's fastest CMOS CPU chipset advances SPARC's role as the industry's next computing standard:

Fact: Scalable High Performance. Operating from 25MHz to 40MHz, and offering 18 to 29 MIPS, this chipset demonstrates the scalability of the SPARC™ RISC architecture. That scalability has already produced high performance SPARC implementations in CMOS, ECL, and GaAs. This scalability enables high performance, binary compatible systems all the way from low-cost desktops to mainframe-class systems — consistent with the trend toward networked computing. This new chipset will enable new performance standards in desktop and workstation/server systems.

Fact: Shrink Wrapped Applications. SPARC is the only RISC architecture that is truly open, with available, binary-compatible clones. The shrink-wrapped UNIX® applications base — including the leading database, publishing, office and engineering packages — is larger than for ALL of the other RISC architectures combined. And with major new support announcements from Lotus, Santa Cruz Operations (SCO), and Wordperfect, expect significant new applications. Applications drive the industry's next computing standard.

Fact: Complete Solution. This chipset you see, designed by Ross Technology, a Cypress subsidiary, is available today. It includes the Integer Unit, Floating Point Unit, Cache Controller/Memory Management Unit, and 256K Cache RAMs.

Fact: Proven Support. SPARC runs UNIX. It runs the major windowing systems — NEWS™ and X-Windows™ It supports the AT&T OPEN Look user interface. SPARC-based development systems are available now, with a full complement of development tools, compilers, debuggers, documentation packages, and utilities.

Fact: The Leaders. The system companies that support SPARC — AT&T, Sun, Toshiba, Solbourne, ARIX, Philips, and ICL, to name a few — are moving faster toward the industry's next computing standard than are the supporters of any other RISC architecture.

Call today for this important article: 1-800-952-6300* Dept. C92.

CYPRESS SEMICONDUCTOR

*1-(800) 387-7599 in Canada. (32) 2-672-2220 in Europe. © 1989 Cypress Semiconductor, 3901 North First Street, San Jose, CA 95134. Phone (408) 943-2600, Telex: 821032 CYPRESS SNJ UD, TWX: 910-997-0753.

INSIGHT!

Competitive Advantage

Matrox has redefined high-end price/performance for imaging in the 1990s. The IMAGE Series board set provides optimized hardware resources and complete software support to meet your most demanding applications.

Based on 12 custom gate arrays and a 120M byte/sec IMAGE expansion bus, the IMAGE Series' unique architecture delivers high performance imaging and graphics and processes images in real-time.

No matter how complex the application, IMAGE Series gives you a competitive edge with a spectacular combination of speed, flexibility and price.

- 640 x 480 or 1280 x 1024 resolution
- 36 bit planes
- X-Windows support
- Available on the AT, EISA and VMEbus
- 1000 MIPS pipelined processor
- TMS 34020 GSP
- Acquisition modules
- IMAGE software library

AI-IMAGE 4/49

Call for a comprehensive information package:

1-800-361-4903

In Canada: (514) 685-2630. Matrox is a trademark of Matrox Electronic Systems Ltd.
AT is a trademark of International Business Machines Corporation.

matrox

THE LEADER IN VIDEO MICROTECHNOLOGY

CIRCLE 241