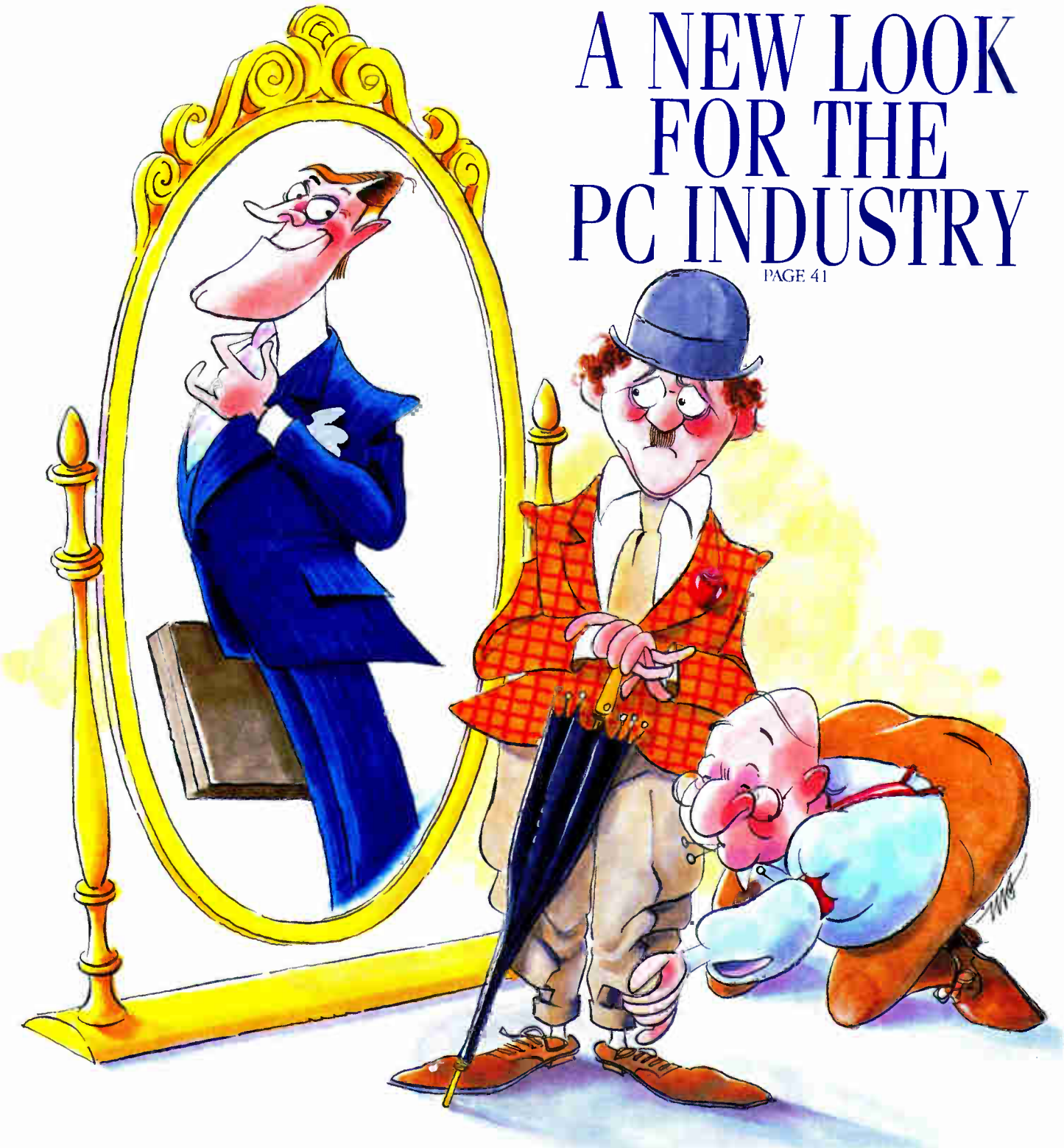
A PENTON PUBLICATION

JUNE 1991

Electronics®

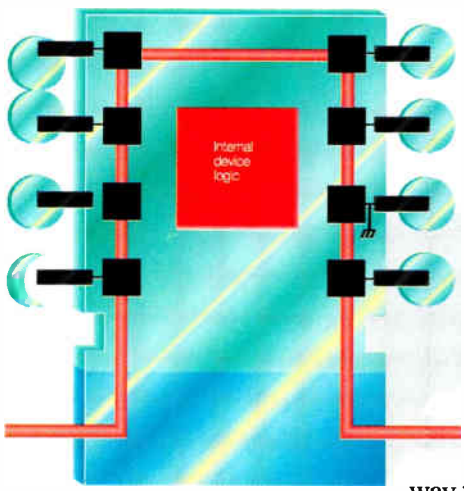
FIRST MAGAZINE OF GLOBAL ELECTRONICS MANAGEMENT



A NEW LOOK FOR THE PC INDUSTRY

PAGE 41

People say boundary in low cost, high quality Now you can test that



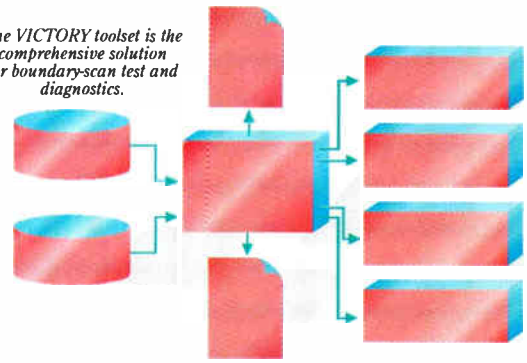
Find common manufacturing faults without test patterns libraries or physical test access with boundary-scan design and VICTORY software.

Increasing device complexity. Rising pattern development costs. High density packaging. Disappearing nodal access. These are the board test problems boundary scan was created to solve. Which is fine in theory. Only problem is there hasn't been any way to put boundary scan to the test. Until now.

VICTORY – the first software to automate boundary-scan testing.

Introducing VICTORY™ from Teradyne: the only software toolset ready to help you turn boundary-scan theory into a practical advantage. From the moment your first boundary-scan device is designed in, VICTORY starts to simplify the testing of complex digital boards. And the more boundary-scan parts you have, the more time and money you save.

The VICTORY toolset is the comprehensive solution for boundary-scan test and diagnostics.

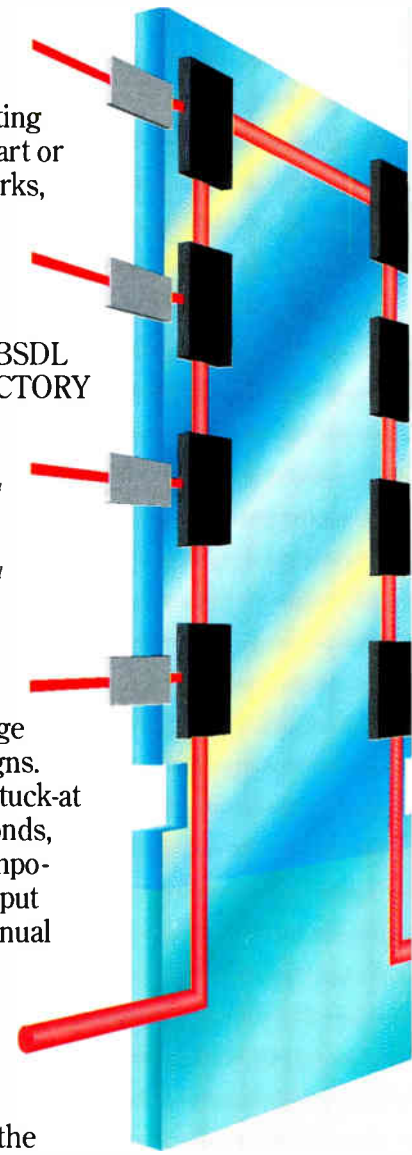


Delivers high fault-coverage.

Whether you're testing one boundary-scan part or boundary-scan networks, VICTORY software automatically gives you 100% pin-level fault coverage. Using the IEEE 1149.1 and BSDL standards, it takes VICTORY only a minute or two to generate test patterns. It would take a programmer days, even weeks to deliver the same fault coverage for conventional designs.

Concurrent engineering takes on new meaning when you use VICTORY's Access Analyzer to optimize board layout for testability and cost-efficiency.

Now you can find stuck-at faults, broken wire bonds, wrong or missing components – even open input pins – all without manual diagnostic probing. VICTORY's fault diagnostics clearly spell out both fault type and fault location. And that's just the manufacturing process

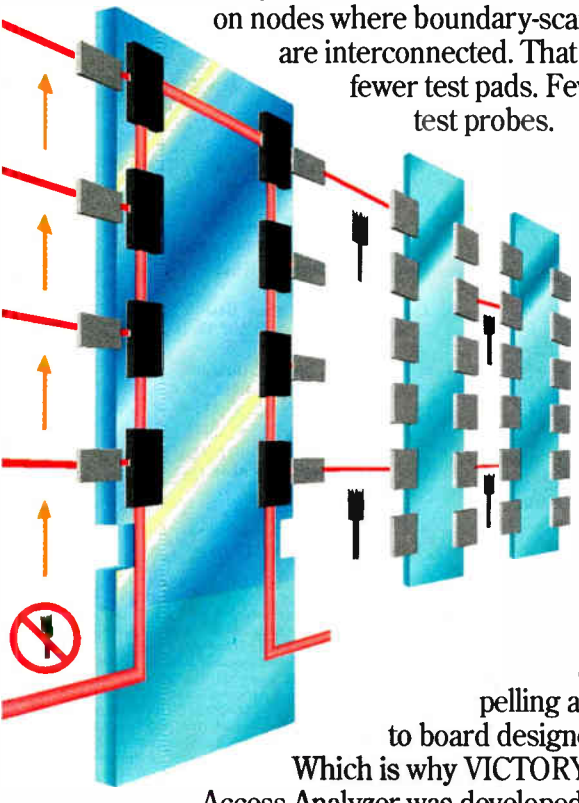


scan is a breakthrough board testing. theory.

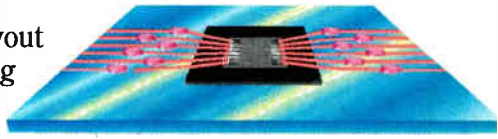
feedback you need to eliminate defects where it's most cost-effective–at the source.

Helps solve the test access problem.

With boundary-scan design and VICTORY software, you won't need bed-of-nails access on nodes where boundary-scan parts are interconnected. That means fewer test pads. Fewer test probes.



That's a compelling advantage to board designers. Which is why VICTORY's Access Analyzer was developed. With this concurrent engineering tool, designers get testability information early in the design process. They can easily see where test points are required for visibility and where they can be dropped, for optimized board layout without lowering fault coverage.



Boundary-Scan Intelligent Diagnostics identify faults by type and location without physical probing – even on high-density SMT assemblies

Good for the bottom line.

Shorter test programming time. Higher fault coverage. Lower PC board and test fixture costs. The bottom line on VICTORY is how positively it will affect your bottom line. And because VICTORY works with all Teradyne board testers, you're free to tailor a test process that's cost-effective for both your boundary-scan and non-scan boards. No matter what your test objectives. For example, with our new Z1800VP-series testers, a complete solution for in-circuit and boundary-scan testing starts at well under $100,000.

Get high fault coverage at low cost when you test boundary-scan boards with our new Z1800VP system and VICTORY software.

Make the next logical move. Call today.

Boundary scan is the design-for-test breakthrough that promises lower cost, higher quality board testing. But don't take our word for it. Call Daryl Layzer at (800) 225-2699, ext. 3808. We'll show you how, with VICTORY software and Teradyne board testers, you can test this theory for yourself.

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617-890-0891

June 1991 Volume 64, Number 6
Electronics (ISSN 0883-4989) is published monthly by Penton Publishing, Inc., 1100 Superior Ave., Cleveland, OH 44114-2543. 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 44114-2543): (216) 696-7000.

Subscriptions free to qualified managers. All others: $60 for one year in the U.S.; $70 in Canada; $136 in all other countries. For subscriber change of address and subscription inquiries, call 216-696-7000.

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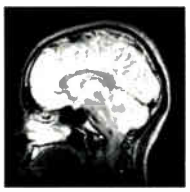

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CIRCLE 207

FRONT

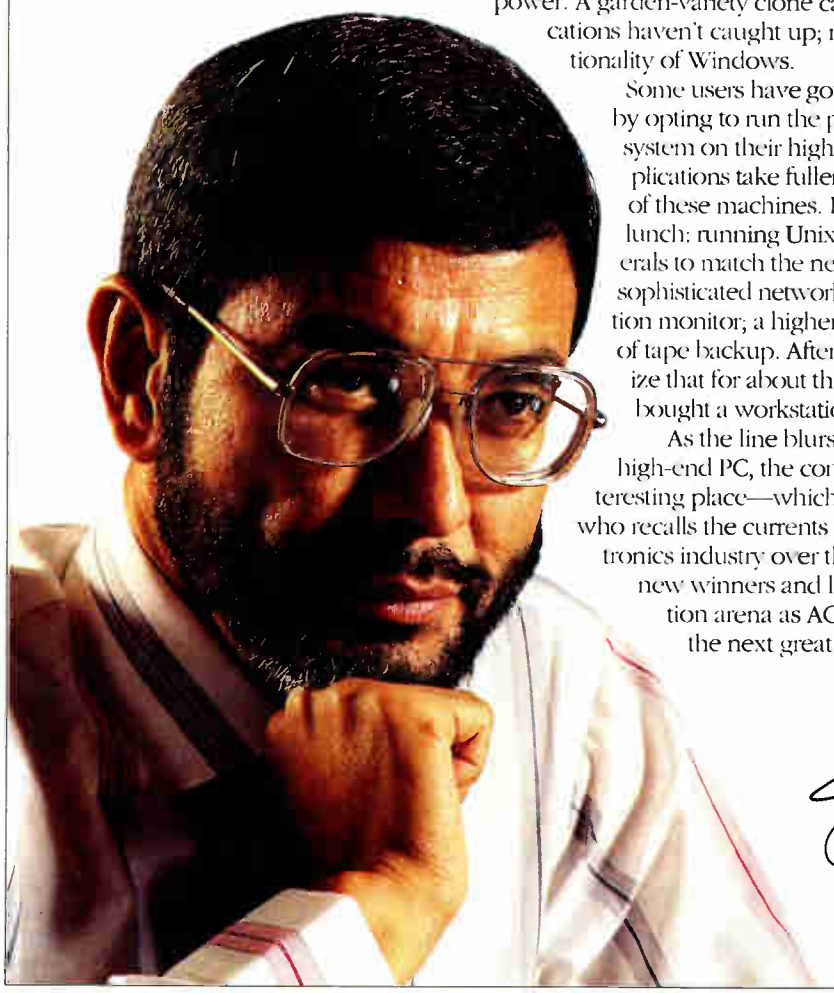
STATE OF SIEGE IN PC INDUSTRY

MS-DOS is under siege. The venerable operating system that has served as the backbone of the personal computer revolution now finds itself beleaguered by two factions eager to topple it from its desktop perch. The new Advanced Computing Environment consortium leads one flank of the attack, an aggressive group of workstation suppliers the other (see p. 41). What we are witnessing is a major shift in power from one form of computing to another.

ACE is playing both sides of the game, mustering a powerful group of industry movers and shakers in setting de facto standards for both high-end PCs based on Intel Corp. microprocessors and RISC workstations based on the MIPS Computer Inc. CPU. Both platforms will be offered with the OS/2 or Unix operating systems. The workstation vendors, meanwhile, keep cutting costs on their machines while adding processing punch, thus edging onto PC turf.

To understand ACE's strategy, consider the battle plan of one of its key members, Compaq Computer Corp. The Houston company made its mark building high-priced, cutting-edge systems as soon as the technology came available to do so. It was first with 386SX and 486-based PCs. But today this strategy has hit a wall, as evidenced, perhaps, by the company's slowed growth last quarter and its decision to slash prices on its machines. At the heart of Compaq's problem is the fact that the window on next-generation products, in which it had the market to itself, has closed. Compaq's PCs are more quickly being cloned and its margins eroded by aggressive competitors. What's more, users putting down hard cash for a premium PC are getting less for their money simply because the application programs are not taking advantage of the wider word widths and sophisticated architecture of these machines.

Microsoft Corp.'s vaunted Windows 3.0 gives Compaq and other suppliers of high-end systems something of a reprieve, since this graphical user interface demands large amounts of processing power. A garden-variety clone can't handle Windows. But the applications haven't caught up; most don't make full use of the functionality of Windows.



Some users have gotten around the applications problem by opting to run the powerful and flexible Unix operating system on their high-end PCs. Unix and its associated applications take fuller advantage of the processing punch of these machines. But there's no such thing as a free lunch: running Unix on a PC means upgrading its peripherals to match the needs of the operating system, adding sophisticated networking capability; a larger, higher-resolution monitor; a higher-capacity disk drive; and some form of tape backup. After tallying up the tab, some users realize that for about the same money, they could have bought a workstation with all that functionality built in.

As the line blurs between low-end workstation and high-end PC, the computer market becomes a pretty interesting place—which is no great revelation to anyone who recalls the currents of change that have swept the electronics industry over the past decade. Shifts in power bring new winners and losers. Watching the PC and workstation arena as ACE spreads its wings could become the next great spectator sport. ❑

Jonah McLeod

JONAH McLEOD
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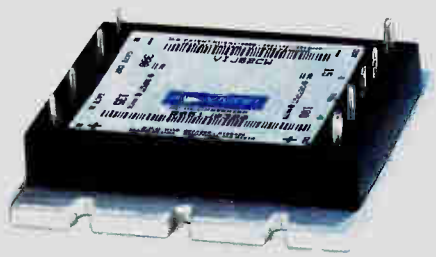

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CIRCLE 202

JUNE 1991 VOLUME 64, NO. 6

Electronics

60 YEARS OF GLOBAL LEADERSHIP.

COVER STORY PAGE 41

FEATURES

DEPARTMENTS

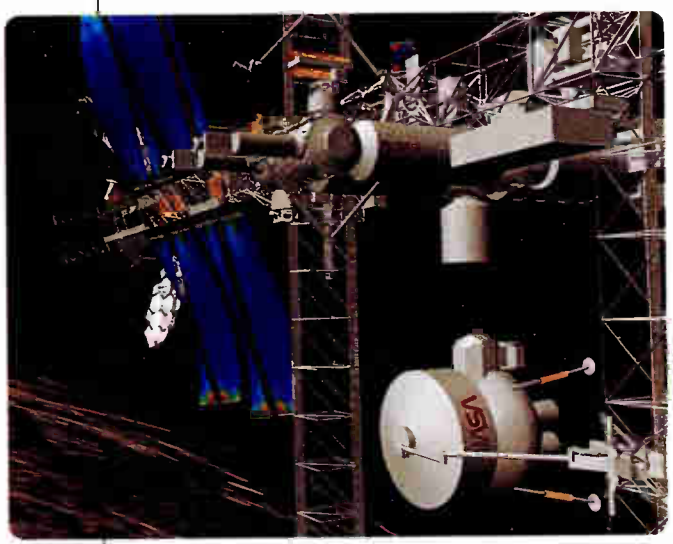
NEWS ROUNDUP

WORLDWIDE NEWS

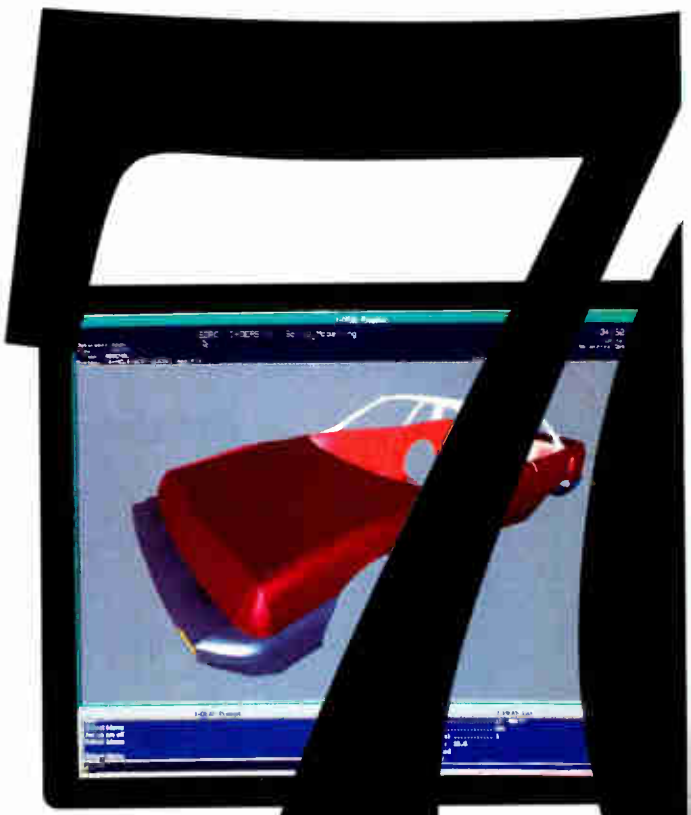
EXECUTIVE BRIEFING

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

*International only



CASE and AI solutions include HP's SoftBench; Interactive Development Environments; Intellicorp; Inference; and Neuron Data.



Mechanical CAD solutions include SDRC; HP ME 10 and 30; McDonnell Douglas; Parametric Technology; and PDA.

Move up the launch

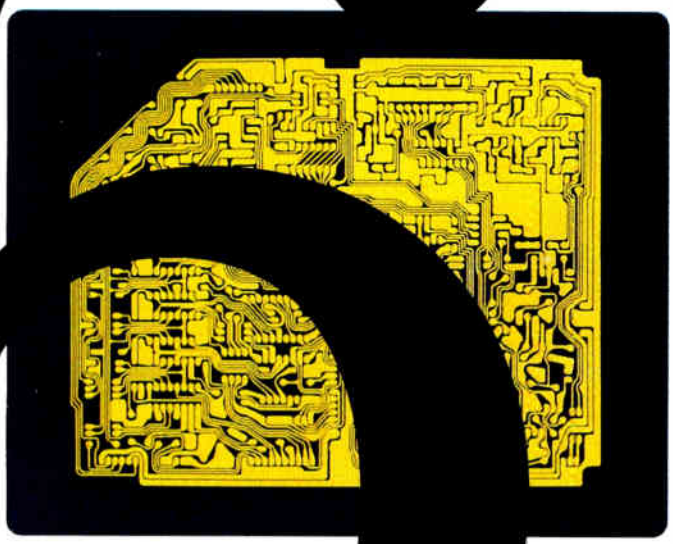
Whether you're launching a new car, a new chip, or a new magazine, you'll get it to market faster with a new HP Apollo RISC workstation.

And that speed won't cost you, either. Those 76 MIPS come for less than $20K for gray-scale; $27K for color. And, if 57 MIPS will launch you fast enough, you can get that for under $12K.

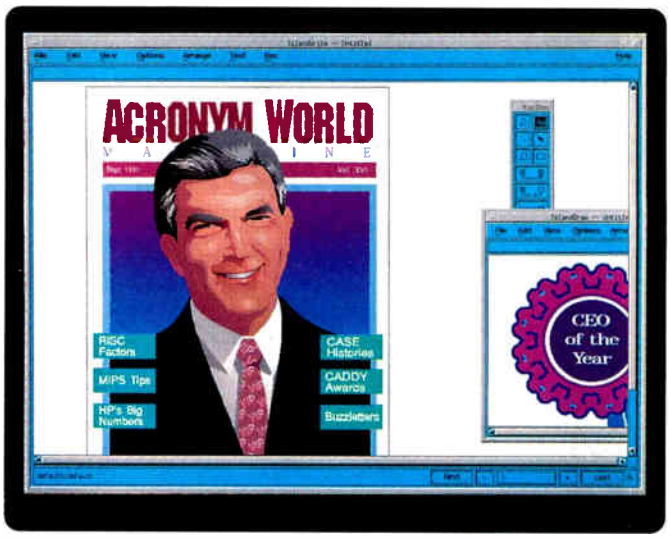
Of course, you'll go nowhere fast unless your applications run on our workstations. Chances are very good that they do. The top programs are already ported. And more than 3,600 applications are now available on PA-RISC.

HP's open design allows for an easy fit into your multivendor network. As well as for easy upgrades when you're ready to grow.

The sooner you get your hands on a new HP Apollo RISC workstation, the sooner you'll be launching new products. So



For electrical CAD, software is available from Cadence Design Systems; Mentor Graphics; Zuken; Racal-Redac; and VLSI, among others.



For Electronic Publishing, Desktop Productivity and Database, available software includes Informix; Oracle; ASK/Ingres; Interleaf; and Island Graphics.

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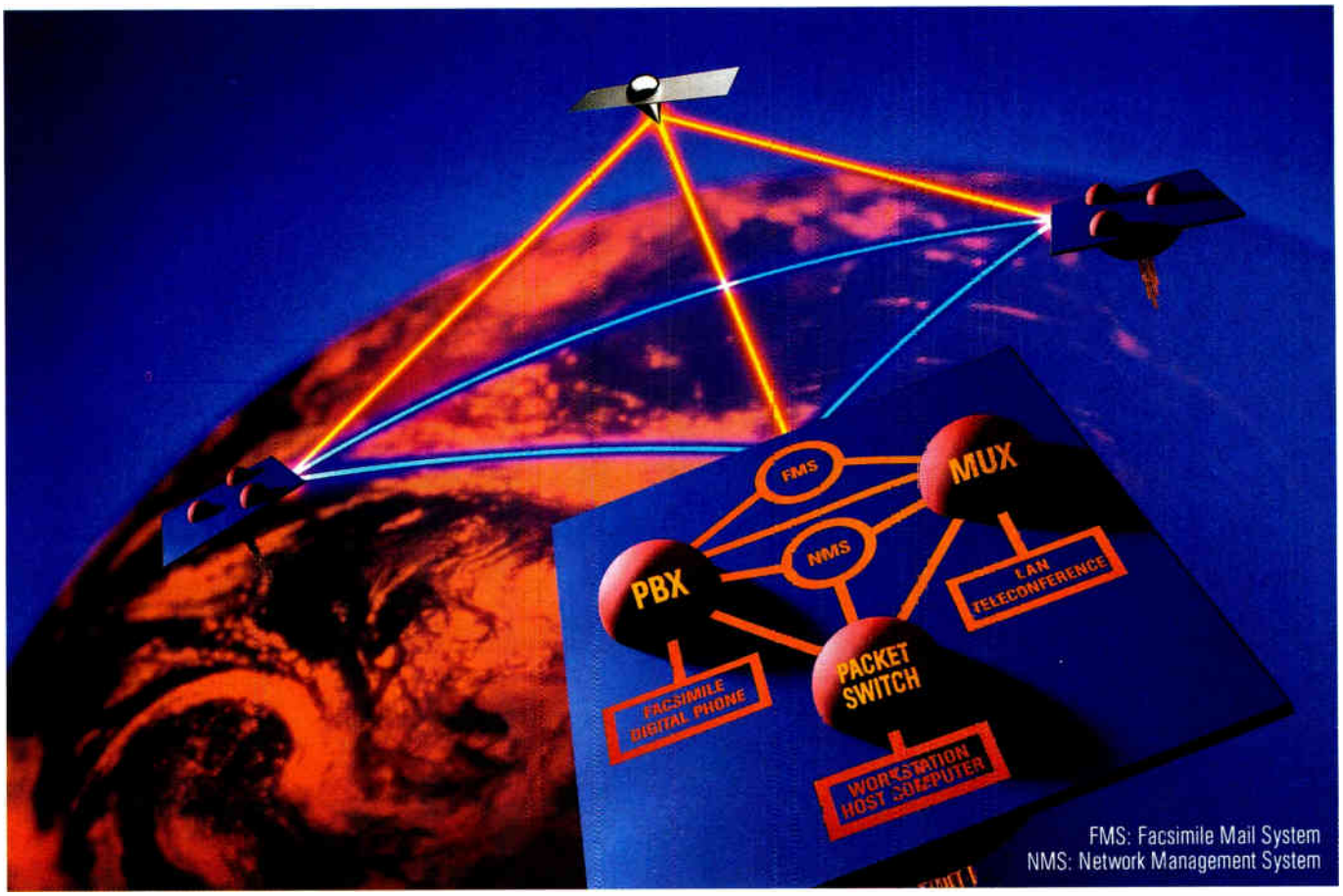


GLOBAL VISION: FOR INTERNATIONAL CORPORATE INFORMATION NETWORKS.

Today's multi-national corporations require an efficient network for international information exchange. NEC responds with Global VISION (Versatile Solution-Oriented Network), a sophisticated private network that can be tailored to specific corporate needs.

NEC provides total support for network construction. Our services range from problem analysis to system design, installation and maintenance. We even offer system operation and management.

Global VISION is a high-quality, multi-media network that integrates telephone/facsimile, data and images. For international networking, it leases cost-effective, high-speed digital circuits on satellites or submarine cables. Global VISION connects to domestic private networks and, where regulations permit, to public switched-telephone networks.

Global VISION opens the full range of advanced services. Facsimile and voice mail eliminate time zone problems. Distances disappear with international teleconferencing, remote CAD and high-speed file transfer.

High-quality NEC products form the heart of Global VISION systems. These include our advanced multi-media multiplexers, PBXs, packet switches and facsimile mail systems.

NEC invites consultation from corporations interested in Global VISION to reduce communications costs and improve productivity.

NUMBER 145

READY FOR SDH/SONET DIGITAL NETWORKS.

The goal of worldwide telecommunications is free exchange of information throughout the global community. But North America, Europe and Japan all have different digital communication standards, and the digital networks of the nations involved cannot freely interconnect.

The network node interface (NNI) operating in the synchronous digital hierarchy (SDH) offers a clear solution. SDH is recommended by CCITT/CCIR and sets an international standard for high-speed digital transmission. SDH is the key to flexible broadband networks that feature efficient operation, administration and maintenance.

NEC is prepared to enter the SDH arena with new fiber optic transmission systems (FOTS) and digital radio products. The primary multiplexer combines tributary signals of 1.5, 2, or 6.3Mbps to 51.84 or 155.52Mbps. The high-order multiplexer bundles these composite signals up to 2.4Gbps. Cross-connector functions are also offered. SDH digital radios include 4/6GHz–150Mbps systems for long-haul use and an 18GHz–150Mbps system for short-haul use.

FOTS and digital radios with NNI are already in commercial service in Japan. FOTS based on SONET (the U.S. version of NNI) have been on field trial in the U.S. since 1990. SONET digital radios will go on trial this year in Australia and the U.S.

LATEST SHOWCASE OF SKYSCRAPER INTELLIGENCE.

The NEC Super Tower, our new 180m, 43-story skyscraper in Tokyo, is a living model for next-generation smart buildings. The tower provides a comfortable environment for 6,000 headquarters personnel and supports them with integrated communications, information processing and television systems.

The Super Aladdin system supports 20-plus services including electronic processing of business forms, electronic mail and filing, electronic secretary, and a company-wide electronic cabinet. Super Aladdin links 7 distributed power servers with workstations or 2,000 PCs in a LAN.

Telephone Aladdin, designed for our Open Application Interface, is a completely new OA system that integrates a digital PBX and a computer. Utilizing a telephone terminal with liquid crystal display, users can take advantage of message/paging services and an on-line telephone directory for over 35,000 extensions.

TV Aladdin can broadcast strategic business information to 105 offices across the country. It also provides teleconferencing with three NEC subsidiaries in the U.S.

A super-large building automation system offers integrated control for all facilities and manages even such aspects as crime prevention and disaster preparedness. The sophisticated office and building automation systems in the tower are supported by a 622.08Mbps trunk fiber optic LAN, and a unique integrated voice and data LAN on each floor of the tower.

Super Aladdin: Available only in Japan.

NEW LD MODULE FOR CATV DISTRIBUTION.

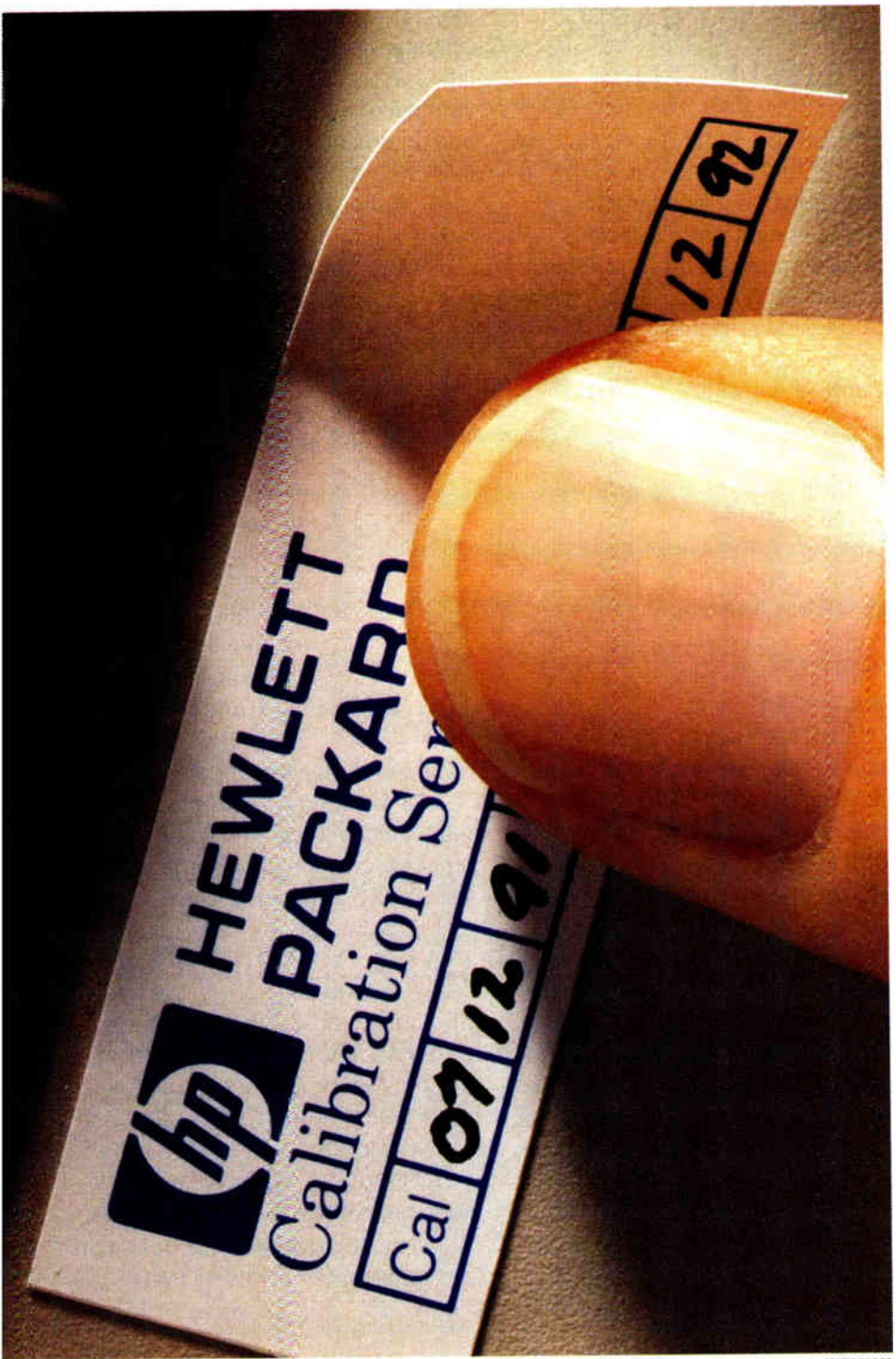
NEC's answer to the growing need for fiber optics in the CATV industry is a 1.3μm distributed-feedback, laser-diode module. The OD-8339 improves picture clarity by reducing noise and distortions in analog CATV distribution.

Higher performance comes from two internal isolators working in tandem. They deliver 50dB isolation—tops in the industry. In 40-channel AM/FDM CATV transmission with 4mW output power, our LD module offers: CSO≦–60dB, CTB≦–65dB, and RIN≦–150dB/Hz.

The OD-8339 comes with a single-mode fiber and a fine FC-PC or D4-PC connector. It provides stable operation over ambient temperatures from 0°C to 55°C.

NEC

We make it stick.



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CIRCLE 186

LETTER FROM

CAMBRIDGE

HARVARD BUSINESS SCHOOL TAILORS PROGRAM TO ENTREPRENEURS

A CRASH COURSE FOR CEOs

BY LAWRENCE CURRAN

You're owner and president of your own company, and you can't even get away for a week's vacation, much less go back to school. Nevertheless, maybe you should know about a program at the Harvard Business School in Cambridge, Mass., tailored expressly for managers like you.

And if you talk to some of the more than 1,800 graduates of the Owner/President Management Program, you may become convinced of the value of setting aside time to join a network of entrepreneurs who have found the program invaluable in making them better managers.

OPM consists of three intensive sessions of three weeks each in three consecutive years—nine weeks in all. Enrollment is restricted to executives who own and manage their own companies, usually as president and/or chief executive officer, and who have at least 10 years of managerial experience.

Take Dick Peisch. He has completed two OPM sessions and will go back next February for his third. In addition to becoming part of a vital network of colleagues, Peisch says the chief benefit he's deriving from OPM is obtaining "a very structured business education, which I never had as a liberal arts student in college. It's been a great experience already. I'd go every year." Peisch doesn't have an MBA. He has an undergraduate degree from Harvard, but felt he couldn't take two years off from running a company to get the graduate degree. He's president and owns 100% of the stock of Medical Data Processing Inc., a Brookline, Mass., company that handles billing for doctors and hospitals using personal-computer-based local-area networks. Peisch says his company is "at the lower end" of the $3 million to $100 million range of firms from which OPM students come.

For her part, Sandra Kurtzig, a 1979 OPM graduate who is president and chief executive officer of Ask Computer Systems Inc. in Mountain View, Calif., says she wouldn't change anything about the OPM structure, calling it "a great program." In her newly published book, entitled *CEO*, she says of OPM: "The first thing I learned was how little I knew about running a company. I hardly knew how to read a financial statement. I didn't know much about strategic planning. I didn't know how to leverage financials and borrow against them—or even that companies did so."

But the case-study method used at OPM reaffirmed for Kurtzig that her instinctive approach to business was usually well founded. "When it came time to solve a problem," she writes, "whether financial, dealing with people, marketing, whatever—nine times out of 10 my gut feel led me in the right direction. It was a great confidence builder."

Ask Computer develops and sells, among other software products, the Ingres relational data base and Manman and MaxCIM manufacturing-management application programs. The 1979 revenue goal Kurtzig set after returning from Cambridge was $2 million; today's revenues are close to $400 million.

At OPM, each three-week, six-days-a-week session has 100 to 120 students, who pay $9,875 for each session. The fee covers room, meals, classroom instruction, books and case materials, athletic activities, and health fees. The OPM day begins with 7 a.m. breakfast with colleagues and extends into small-group discussions long after dark. There's usually a break from 2:30 to 6 p.m. for study and preparation as well as physical activity.

The curriculum in each session repeatedly examines, in progressively greater detail, topics that owner-managers confront over and over in their companies. That includes planning, strategy, and tactics; profitability; marketing; ethical issues of business and management; making the transition from informal to formal methods of managing; cash management; dealing

with the financial community; interpersonal relationships; and providing for management succession.

Students are taught by seven members of the Harvard Business School faculty, who rely heavily on the school's famed case-study method. In fact, however, they learn a great deal from one another, says Martin Marshall, chairman of the OPM faculty and Harvard's Henry R. Byers Professor of Business Administration. "I tell them on the first Sunday night that while they don't know anyone else in the room then, within a week they'll be friends," says Marshall. "They become sounding boards for each other, developing into networks of bosom buddies. They actually have reunions."

Seven or eight students share a common living room adjacent to their private bedrooms, learning from one another in the living group as well as in three larger classroom discussion groups per day. The emphasis in small-group and classroom discussions is on case studies. Peisch says he's heard one professor liken the OPM curriculum to "the core of the apple of a Harvard MBA program" because students dissect some 250 case studies in nine weeks, against about 600 in a two-year Harvard MBA course.

A typical case study encompasses a 25-to-30-page documentary on a real company's experience that's based on careful field research. The case describes the company and its industry environment, providing all the facts leading to a decision management must make to achieve some corporate goal. Each case involves one or more of the subjects covered in the curriculum, and there is no single "right" decision.

For example, Marshall says that every class studies the marketing strategy of L. L. Bean, the renowned mail-order retailer in Freeport, Maine, whose only store is located there. And every class sees trouble ahead for the firm because of its narrow strategy. "But they're still going strong," Marshall says.

"Living and working with 120 others who have similar experience means that you get a tremendous amount of input from your classmates," says Peisch. "That's the heart and soul of the program. I can almost see my house from the OPM dorm because I live in Cambridge, but I live in the dorm at OPM. Some of the guys I've met here will be lifelong friends," he says.

Marshall points out that all three units in the program cover each of five basic concerns of owner-managers: marketing strategy, overall strategy and operations, financial policy, management control, and the human aspects of business. But there's also a great deal of flexibility. "Each student comes in with a personal agenda," Marshall says. "If you're not good at personnel relations, you may want to tailor the program to that agenda."

For example, by the time Kurtzig reached Unit III, the last session, she had decided to take Ask Computer public, "and she talked to everyone there about the pros and cons of an initial public offering," Marshall says.

Enrollment in OPM is carefully balanced so that students represent a

broad variety of disciplines and markets. And they come from everywhere. Mashall says U.S. business is somewhat parochial in its methods, "so we get people from all over the world" to get an international flavor. That flavor was particularly noticeable during the Gulf War, when there were two Kuwaitis, an Iraqi, and two Egyptians in the course.

Marshall says there are no more than 10 or 12 students who run electronics or computer companies, and a similar number from each of several other industries, so they can bring their varied backgrounds to bear on a given case.

The OPM faculty is available for individual consultation during each session, and may occasionally recommend a consultant on a given problem to an OPM graduate, but the usual experience is that OPM students call on each other as consultants. "While they're here, we offer a lot of free consulting," Marshall says, "but I know of only one faculty member who is on the board of [an OPM student's] company. The students get to know each other and get on each other's boards."

Another recent OPM graduate, Ivan Modrovich, attests to the ability to tap the experience of peers as probably the most valuable aspect of the program. Modrovich is president of Medical Analysis Systems Inc. in Camarillo, Calif., a $13 million manufacturer of chemicals used in automated medical diagnostic instrumentation. "It's a special kind of environment," he says. "You constantly do your own thinking but with people who have the same kinds of problems you have, without worrying about exposing weaknesses."

Modrovich hasn't yet called on many classmates to brainstorm a problem, but he's confident he can, if necessary, "because I met people who are in businesses complementary to my own, and some in businesses that I didn't know existed. I can probably find someone in the class who specializes in almost any kind of problem that comes up." The only suggestion Modrovich makes for improving the program would be for Harvard to consider extending each session to four weeks, although he sees a psychological obstacle to students committing to four weeks away from running a company. "They pack one hell of a lot into three weeks," he says.

Modrovich himself had reservations about being away from his firm even for three weeks, but concludes that "it was the most valuable investment of my time I've made in my life. I'm very high on the program."

Surprisingly, Marshall says student reservations about being away from their companies seldom come up. "I have encountered it only once in 12 years," he notes. That instance involved an executive from a Rhode Island firm who repeatedly postponed his enrollment because of the press of business. Marshall invited him to spend just a day in the program, which he did and then promptly enrolled for the full course.

Nor is there significant attrition between sessions, for the most part. Marshall says the record shows that 3% to 5% of the students may not come back after completing Unit I, "but there's zero loss between Units II and III." ❑

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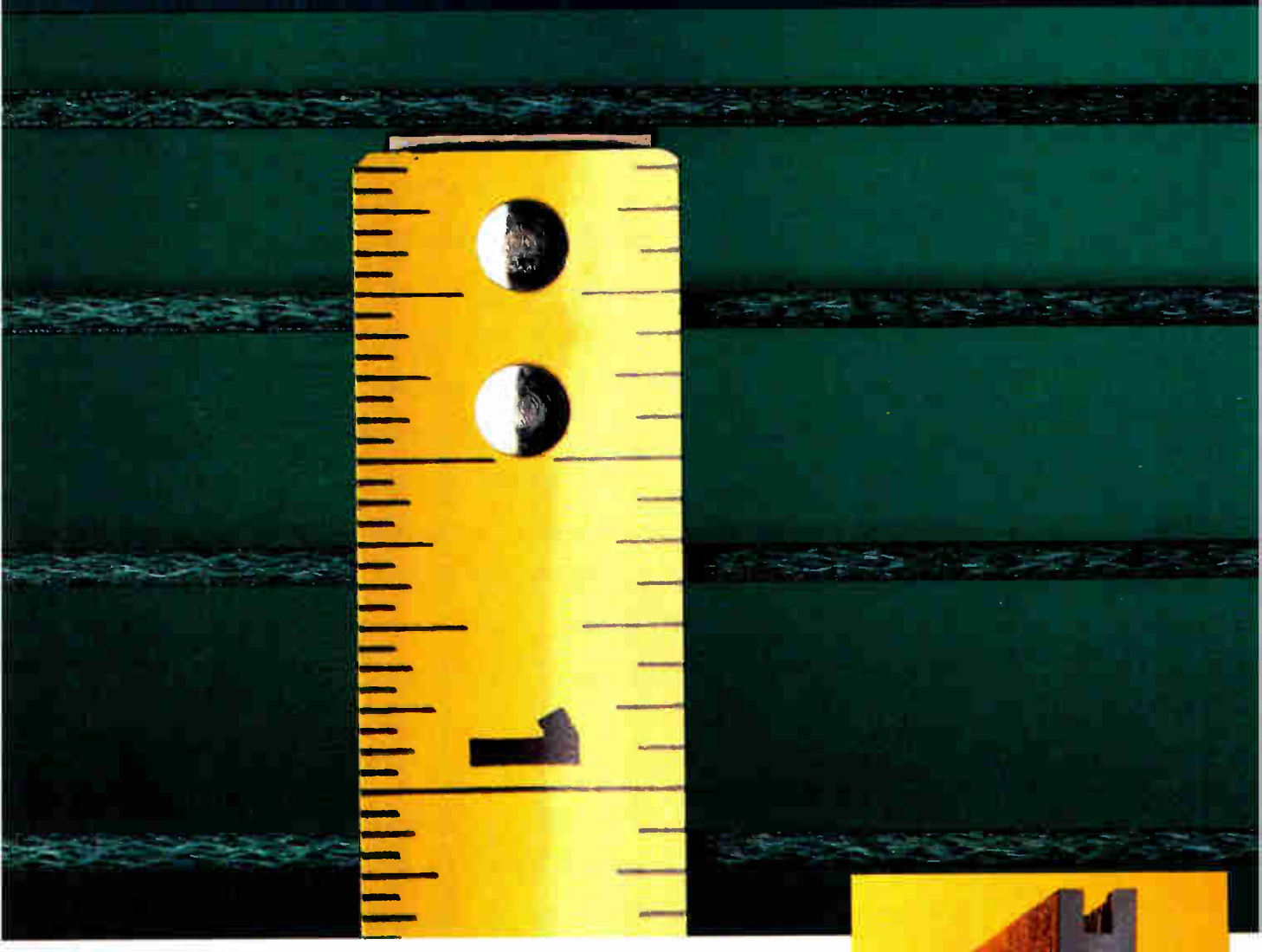

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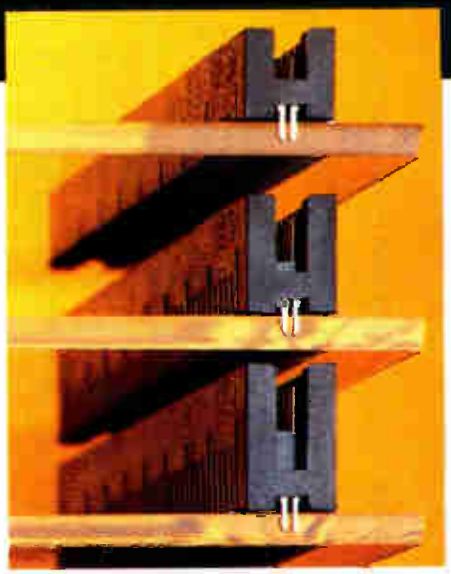

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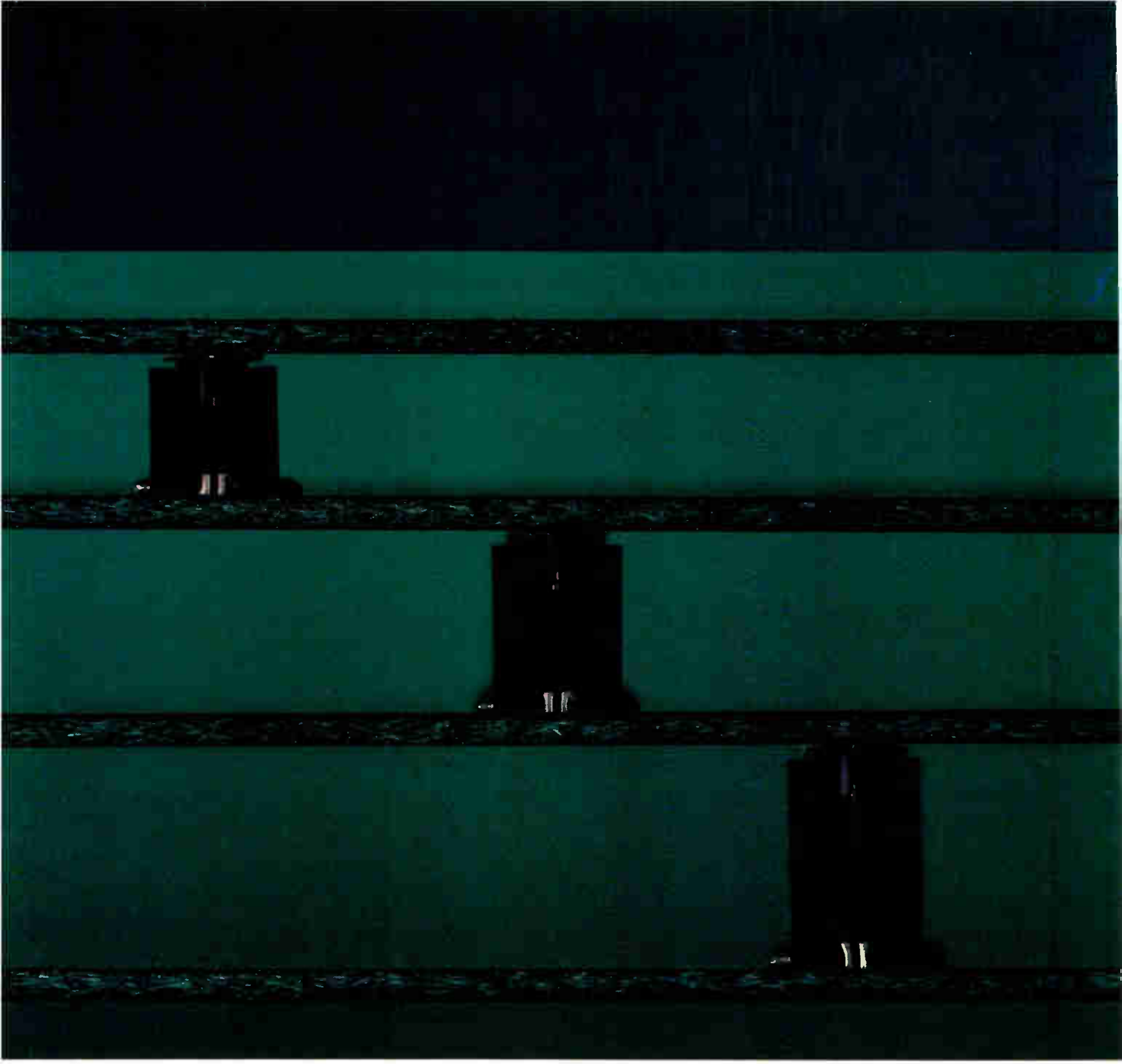

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CIRCLE 172

FRONT

DON'T COUNT US OUT, SAYS 88OPEN

Stung by the perception that the RISC 32-bit microprocessor race is over—and that they have lost—officials of 88open Consortium Ltd., the hardware and software vendors that support Motorola Inc.'s 88000, have mounted an aggressive campaign to show that the war has barely begun. Their message has two parts: first, time is on their side, and second, their "standards-based business-support model" strategy is a winner.

The 88open time line holds that although processors based on reduced-instruction-set technology capture barely 10% of today's market from their complex-instruction-set rivals, by 1995 the share will swell to 75%. "We're aiming at the long term," says Derek W. Meyer, marketing director for the San Jose, Calif., consortium.

Then there is the advantage that the group sees in what it calls its standards-based model, which can be defined by what it is not: a clone. That is, compatibility is guaranteed through standards even though there are differences in architecture or implementation—there is no reference platform or operating system. This leaves the vendor free to design for a particular market (as do 88open members Data General, Harris, and Unisys), offers tested and certified compatibility, and guarantees software availability. With a clone-based model, a reference platform and an operating system are included; all vendors build copies.

In any event, 88open's 1995-and-beyond plan is starting from a narrow base. Figures circulated by the 88open people indicate that outside of the Transputer—which is aimed at the embedded-processor niche—sales of Sparc processors led the pack in 1990, with 88000s ranking fourth. ❑

RIDING THE RISC WAVE

32-BIT UNITS SOLD, IN THOUSANDS

	1989	1990
Transputer	190	240
Sparc	93	185
MIPS R series	98	90
Motorola 88000	32	65
Intel i860	8	65

SOURCE: 88OPEN CONSORTIUM

SHORTER TIME TO MARKET: RACAL AND IKOS CUT AN EDA DEAL

Racal-Redac and Ikos Systems Inc. both want to get into the system-level design-tool market where the tool captures and simulates a design in high-level description language, preferably VHDL, the VHSIC hardware description language. Then the debugged design is synthesized into logic gates for back-end implementation (see p. 55). Racal has a simulator that has long been used in printed-circuit-board design, but not for ASICs, and a logic-synthesis tool that is able to synthesize behavior into gates. For its part, Ikos has an accelerator that is a simulator for gate-level simulation.

So the two companies struck a deal last month in which each gets co-ownership in the other's front-end design tools. "Ikos got access to our VHDL simulation and architectural synthesis technologies," says John O. Barr, vice president of marketing at Racal, based in Mahwah, N.J. It cost Sunnyvale, Calif.-based Ikos $2.1 million in cash and common stock—about 4% of the 11 million shares in circulation—and the cost of abandoning its own VHDL development effort, which comes to about $3 million in the current fiscal quarter. Racal also receives royalties of up to $4.6 million over the next few years on the future sales of Ikos products using the technology.

"What Racal gets is access to our ASIC libraries," says William B. Fazakerly, Ikos's president and chief operating officer, "and it will sell our products OEM in Europe." The plum for Racal is access to the ASIC libraries, saving months of negotiations with ASIC vendors to get them to produce the libraries for Racal's simulator. It gets Racal into the game against EDA heavy hitters Mentor, Cadence, and Valid that much sooner. ❑

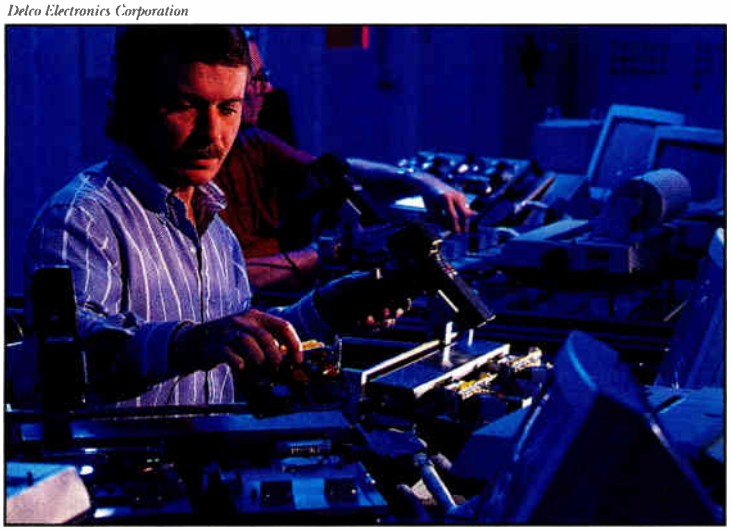
AT&T-NCR: A MASSIVE MERGER AND A MASSIVE PROCESSOR

NCR Corp. is bringing a potentially nice dowry to the marriage with AT&T Co., but it may be a while before the new couple can figure out how to use it. The Dayton, Ohio-based firm raised a lot of eyebrows by introducing a massively parallel processor on the heels of agreeing to be bought by AT&T for about $7.5 billion in Ma Bell stock.

The acquisition took five months to consummate, with NCR initially fighting the takeover until AT&T sweetened the price from $90 to $110 a share. And it will take much longer than that to integrate the two behemoths. The totals alone are daunting: AT&T's revenues last year topped $37 billion; NCR came in at almost $6.3 billion. Ironically, AT&T's computer operations, which have probably never been profitable, will become the reponsibility of NCR.

It isn't clear yet where the NCR 3600 massively parallel machine will fit in the market. It uses as many as 288 Intel 80486 processors and will sell in a range from $800,000 to $8 million. To date, massive parallelism has been employed on very large engineering and scientific problems—not for the kind of commercial applications where the NCR computers historically have been used. ❑

Delco Electronics Corporation



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CIRCLE 200

AUCTIONS: A SANER WAY...

On April 29, the Federal Communications Commission announced that two days later it would accept license applications for a group of newly allocated radio frequencies. With such short notice, a casual observer wouldn't have expected a very heavy response. Instead, by 7 a.m. more than 20,000 applications had been filed. By the end of the day, some 46,000 were in hand. The reason for this extraordinary flood of applications is the peculiar way in which the FCC will decide who gets the licenses. Instead of charging for these valuable spectrum rights, the agency will literally give them away at random through lotteries.

Such lotteries are fairly common at the FCC, which has assigned most of the contested cellular telephone licenses in the U.S. through lotteries that made a number of lucky applicants instant millionaires. In June 1990, for instance, a partnership known as the Rural Area Development Group won the lottery for a cellular license on Cape Cod, Massachusetts. Before the summer was over, the group agreed to transfer its rights to Southwestern Bell for a reported $30.5 million.

JAMES L. GATTUSO

In all, tens of billions of dollars worth of cellular frequencies have been given away through lotteries. Of this, the taxpayer has received nothing. Moreover, the lotteries attracted so many applications—almost 400,000 in all—that the assignment process has taken close to a decade and is not finished yet.

Lotteries are not the only way the FCC can award licenses (see p. 25). However, the other method—a comparative hearing on the merits of each applicant—is even worse, especially for nonbroadcast frequencies. It is often nearly impossible for the FCC to determine which applicant would provide the best service. For example, the winner of one Los Angeles cellular franchise was selected solely because it had proposed one more cell site than its competitor. Moreover, such determinations typically take years to make, depriving the public of service in the interim. And even if a "correct" decision is made, licensees often transfer their licenses to someone else in a fairly short time.

The Bush Administration has recently proposed that the FCC be given a third method of assigning frequencies: auctions. Under this plan, licenses would simply be awarded to the highest qualified bidder. The terms and conditions of those licenses would not change: the FCC would continue to define the scope and duration of each license. Such auctions could dramatically increase the efficiency of the assignment process.

Instead of spending years sorting through lottery applications or through a maze of litigation, the FCC could award licenses quickly. The main beneficiary would be the public, which could receive spectrum-based services months or years earlier than otherwise possible. At the same time, taxpayers would benefit from the assignment of this valuable resource. According to the Office of Management and Budget, taxpayers could receive about $4.5 billion from the auction of 30 MHz of licenses alone.

Despite this enormous revenue, auctions would not significantly raise costs for users. First, incumbent licensees would not be affected—only new licenses would be auctioned. Second, there is already a vigorous private market for the transfer of spectrum rights. The only difference between these "private auctions" and FCC auctions is that taxpayers, rather than lottery or hearing winners, would receive the revenue.

The two methods by which the FCC is permitted to assign spectrum licenses are inadequate. To resolve the problem, the FCC should be given a third option for assignments: auctions of spectrum licenses.—*JAMES L. GATTUSO, deputy chief, Office of Plans and Policy, Federal Communications Commission*

...OR JUST A QUICK FIX?

Getting broadcasters to go along with spectrum auctions is a bit like telling America the time has come to clear-cut the nation's last stand of giant redwoods. To broadcasters, proposals that would carve up America's airwaves and sell them off piece by piece to the highest bidder would amount to a clear-cutting of the nation's communications spectrum.

The airwaves, like the giant redwoods, are a public resource that should be managed wisely and protected from abuse. To some, however, selling unused spectrum means big dollars, a quick and easy hit under the shadowy guise of market economics. The federal government has proposed a $2 billion auction of the nation's remaining spectrum, an effort, boosters say, that will promote a greater use of unused spectrum, raise revenues for the Treasury, and lead to less government red tape for spectrum innovators. But these arguments lack foresight. Here's why.

JEFF BAUMANN

•The loss of available airwaves for potential services such as high-definition TV and CD-quality digital radio would deprive the U.S. public of services that will soon be available in other countries. These new services will be the benchmark for broadcasting in the next century.

•Auctions would lock out real spectrum innovators, such as the researchers and small businesses that typically develop promising new communications technologies but lack deep financial pockets. Any auction scheme would amount to a survival of the richest and stifle competition. Under this scenario, we'd likely see less innovation and more pay-to-use spectrum services.

•Auctions do not fairly test the fitness of applicants that want spectrum for a new service, nor do they properly balance the need to provide opportunities for minorities and others who lack the financial means to bid successfully. For minorities, spectrum auctions also seem to reverse federal policies that promote diversity in broadcasting.

•Spectrum auctions also would undermine the public-service obligations that broadcasters currently accept in exchange for their licenses. In addition to underwriting costly local news and information programming, broadcasters nationwide contribute more than $1.5 billion each year in air time for public-service programming.

Local communities enjoy other benefits, too. Broadcasting is free, except for the cost of a radio and TV—and the electricity to run them. In this regard, it differs significantly from telephone, cable, and many of the other pay-to-use spectrum services offered by the cellular phone industry and others.

What's more, broadcasting is competitive. Radio and TV produce more than $35 billion in revenues each year, and broadcast competition, unlike in most parts of the telecommunications industry, is fierce at both local and national levels. No one network or local station dominates year after year, whether it's in sports, news, or entertainment programming. Indeed, the business of broadcasting represents a stark contrast to the monopolistic tendencies of telephone and cable interests. You either buy cable or telephone service from these single outlets, or you don't get it.

These industries will likely be the high bidders for the nation's unused spectrum. In turn, the government, in its frenzy to collect money, may very likely begin to trade dollars for public-interest considerations. There is a strong consensus among broadcasters that the government should not abdicate its responsibility to manage the nation's radio spectrum. It's been shown time and again that "quick fixes" to complex problems can cause much more serious difficulties for future generations.—*JEFF BAUMANN, executive vice president, National Association of Broadcasters*

TO WATCH

SHARP SHOWS WALL-MOUNT COLOR TV

Sharp Corp. will begin delivery next month of a compact color TV tuner specifically designed for the company's wall-mountable, thin-film-transistor, active-matrix LCD displays.

Besides its UHF and VHF tuner functions, the TU-BS20E features remote controls and a speaker. Its 1.2-by-1.1-by-8.3-in dimensions allow it to be mounted on the back of some of Sharp's 9E-H Series monitors, says the Mahwah, N.J., company.

The monitors include the largest flat-panel, TFT, active-matrix displays available, with a screen size of 8.6-in. diagonal. The units deliver 456-by-960-pixel resolution, 60:1 contrast, and a double-speed scanning.

The maximum horizontal viewing angles are 120° horizontal and 60° vertical when the contrast ratio is greater than 10:1. The light source is a built-in, cold cathode fluorescent tube and the monitors use standard household voltage that is converted to 12 V dc.

Recognizing that the small screens make the monitors inappropriate for normal TV viewing, Sharp is marketing them as interior art. The "Objet" series, for example, was created by Japanese designer Naoki Sakai. ❑

Sharp's wall-mounted color TVs receive all VHF channels and UHF channels up to 62.

STARDENT LINKS i860 TO UNIX V.4 FOR LOW-END DESKTOP GRAPHICS

Stardent Computer Inc. has shrunk its so-called visualization technology down to "pizza box" size with the introduction of a family of low-end desktop graphics workstations. The new computers combine a 40-MHz Intel Corp. i860 reduced-instruction-set-computing (RISC) microprocessor, the Unix System V.4 operating system, and Stardent's proprietary Application Visualization System (AVS).

Stardent, which is based in Concord, Mass., claims AVS has become the industry-standard software environment for visualization applications, including computational chemistry and fluid dynamics as well as mechanical CAD.

An entry-level model in the Vistra 800 family outperforms its nearest RISC rivals in the IBM RS/6000 and Silicon Graphics 4D/35 series Stardent says. It sells for about $22,000 vs. $35,000 for the competing models.

And while the Hewlett-Packard 9000 series 700 models [*Electronics*, April 1991, p. 43] top the Vistra 800 in performance, the comparable HP unit also sells in the $35,000 range.

The entry-level and mid-range Stardent workstations are available now; a top-of-the-line model will be ready for volume shipments in September. ❑

MENTOR EASES MULTICHIP MODULE DESIGN

Concurrent engineering of modules with multiple-chip dies on a single substrate will be quicker and easier using Mentor Graphics Corp.'s MCM Station.

Integrated into Mentor's Falcon Framework for concurrent design, the package supports design, placement, routing, thermal analysis, and electrical analysis, says the Beaverton, Ore., company.

MCM Station accepts chip and ASIC designs from a number of sources. Simulation is supported by one or more of Mentor's digital and analog simulation tools. Other Mentor tools such as QuickFault, QuickGrade, and QuickPath can be called for test-development and critical-path analysis.

Priced at $128,900 for the physical layout, thermal analysis, and signal integrity tools, it is available now. ❑

DEC'S FIRST ACE IS UPGRADABLE

Digital Equipment Corp.'s first workstations to comply with the Advanced Computing Environment specification feature an upgradable 3-by-5-in. daughterboard.

The DECstation 5000/100 series model 120 has a 20-MHz MIPS Computer Systems Inc. R3000A RISC processor; model 125 offers a 25-MHz chip. The daughterboard can be replaced when faster CPUs come along.

Prices begin at $6,495. ❑

MEDIA-LINK BUS JOINS DSPs AND PCs

The Media-Link architecture from Spectrum Signal Processing Inc. gives system developers a well-defined technology for putting a digital-signal-processor chip on a PC motherboard.

Based on a custom chip, the bus technology now supports selected DSPs from Texas Instruments, Motorola, and Analog Devices, says the Vancouver, B.C., company. Its Media-Link Controller chip, which transfers data between processors at 66 Mbytes/s, will be available in the third quarter. ❑

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CIRCLE 219

THE SEARCH THIS TIME IS FOR RICHES IN THE NEW PERSONAL COMMUNICATIONS SPECTRUM

PANNING FOR GOLD

BY JACK SHANDLE

In the next few months, a modern-day gold rush will begin. But the "real estate" in this case is electromagnetic: broadcast spectrum for the lucrative personal communication services, or PCS, market.

Perhaps as early as July, and certainly by September, the Federal Communications Commission will release a Notice of Proposed Rulemaking for PCS. It will select a frequency band for the new service, provide general specifications such as emissions and interference criteria, and—the hottest potato of all—indicate a licensing procedure for PCS providers. The FCC will not specify a technology, letting free-market dynamics determine the winners.

PCS is an idea whose time is coming. It is likely to have as much, if not more, impact across the length and breadth of the electronics industries than any technology since the personal computer. One indication of its potential importance to the semiconductor, computer, and communications industries can be inferred from a short list of the companies that provided commentary following the FCC's Notice of Inquiry. They include computer companies such as Apple and IBM; Bell companies, including AT&T; TV networks; cellular operators; chip companies; and, of course, Motorola Inc., which qualifies in several of the categories.

COMMUNICATIONS

The stakes are high: 30 MHz of spectrum can be worth as much as $4.5 billion. As the economic implications of the FCC's decision sweep down the food chain, the impact will transcend mere dollars. For example, in its filing National Semiconductor Corp. urges the FCC to allocate PCS spectrum below 2.4 GHz so that CMOS technology can be employed instead of gallium arsenide. Besides that, spectrum in the 1.7-to-2.3-GHz band will track European PCS allocations, which in turn will make for a larger PCS semiconductor market. So by selecting the right spectrum, the FCC can allow U.S. chip makers to remain competitive globally.

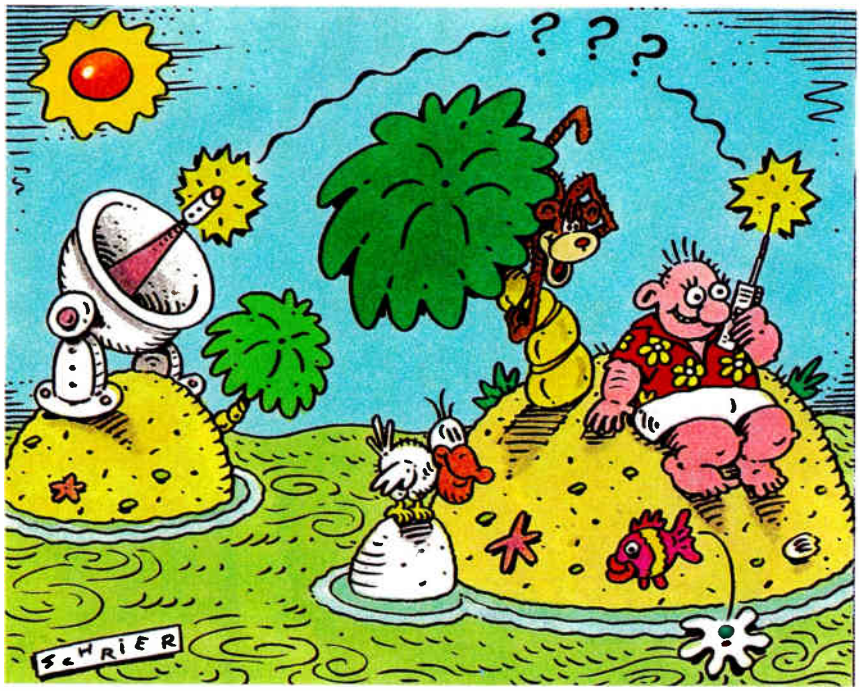
Initially, PCS operators can offer service in the 902-to-928-MHz band, which has already been set aside for unlicensed uses of any type, says Dale Hatfield, a communications consultant based in Boulder, Colo. But since that band by definition can be shared by many services, it does not offer a long-term, interference-free solution, he says. Most attention has focused on the 1.85-to-1.99-GHz band, but that is already occupied by fixed-site microwave users such as public utilities.

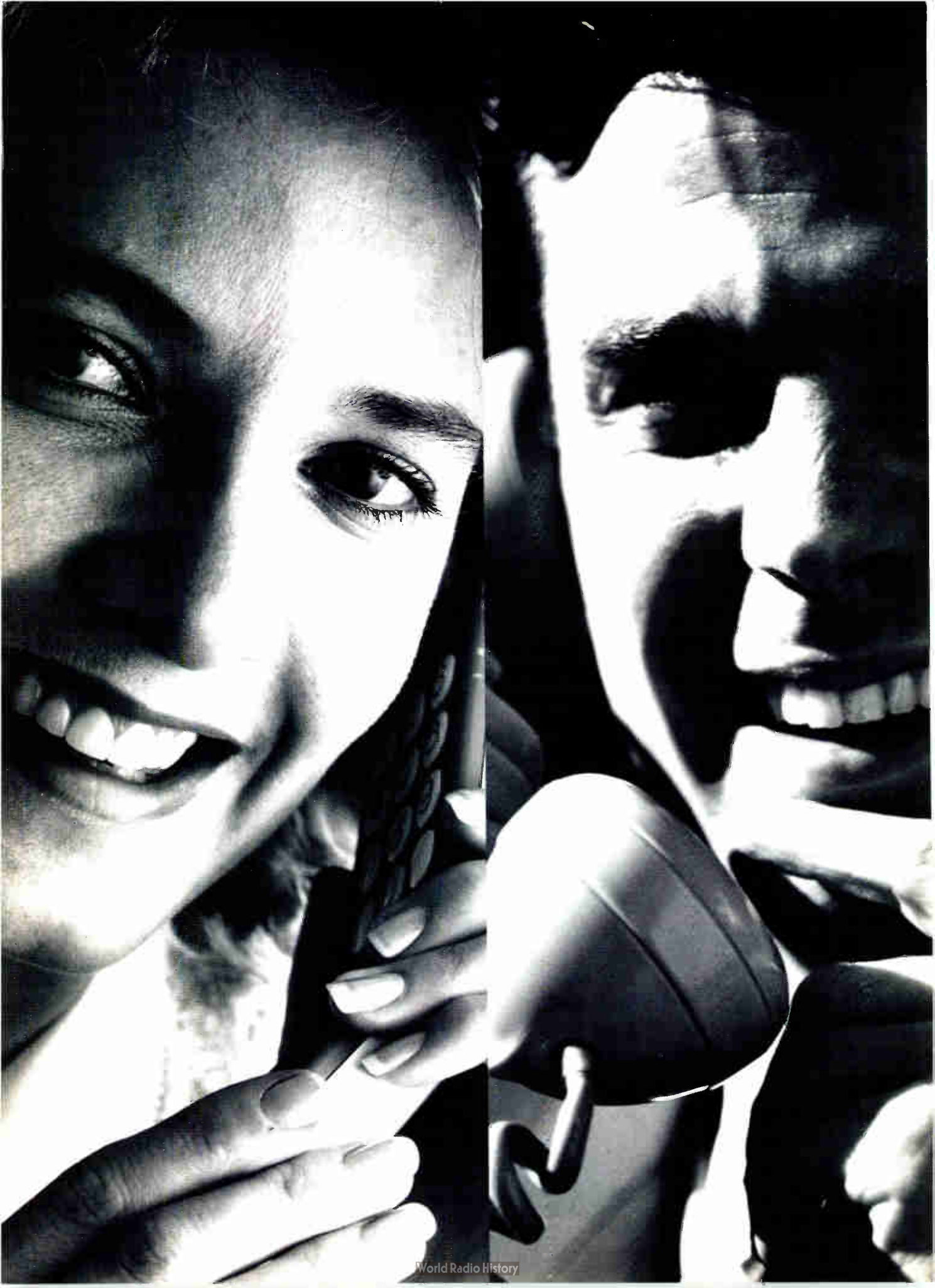
That raises the first specter for the FCC: reallocating an existing user into another band. "If they are forcibly evicted without compensation," says Hatfield, "they are sure to fight it." The net result would be a lengthy delay.

"Forced reallocation will take five years, at least," says Jack Taylor, director of regulatory affairs at Cylink Corp., a Sunnyvale, Calif., company specializing in wireless communications. Taylor suggests that the FCC might provide a regulatory means of "voluntary reallocation" of existing users by providing them with a band at a higher frequency and allowing PCS providers to move into the existing 1.85-to-1.99-GHz band only after they have compensated the fixed-microwave users.

That way, the fixed-microwave users will have a means of paying for the new equipment needed to move to a higher band. While the migration will take place over time, so will the ramp-up of PCS. Moreover, PCS will begin in major metropolitan areas, which provides geographic "breathing room" for the voluntary reallocation, says Taylor.

Spectrum allocation will prove to be less a problem for the FCC than licensing. Two approaches—comparative hearings and lotteries—have serious drawbacks (see p. 22). The sheer number of applications makes comparative hearings unmanageable, and "nobody was happy with lotteries except the winners," says George Calhoun, senior vice president of International Mobile Machines Inc., King of Prussia, Pa., another leading wireless communications company. And spectrum auctions, he says, "sound like a good idea until you take a closer look." Auctions favor large





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CIRCLE 181

players such as Bell regional holding companies and "squeeze the entrepreneur out."

A hybrid solution, which also addresses the spectrum-allocation issue, is called open entry. It is based on the assumption of using interference-tolerant spread-spectrum broadcasts by multiple PCS providers within the fixed-microwave band.

In its FCC filing, Cylink has already proposed a solution based on a spread-spectrum technology implemented within a channelization scheme. Each qualified PCS provider in an area would have its own 10-MHz channel and it would share other dynamically allocated channels with the other providers. To be qualified as a PCS provider, a company would have to meet criteria minimal enough to keep out speculators.

Sounds good, but Taylor is worried about open entry. In May, a court invalidated a similar process used for an air-to-ground phone service. "Open entry does not have a tradition, and the FCC may be hesitant to strike out in another innovative area," he says. ❑

SELLING COMPUTERS IN THE EC WILL BE EASIER—BUT IT'S ALSO GOING TO BE HARDER

EUROPE IS DIFFERENT

BY ANDREW ROSENBAUM

Selling computers in Europe should become much easier in 1992 when the European Community lowers its internal borders. But even when 12 markets become one, the technical problems that confront a U.S. computer manufacturer are considerably more complex than those it faces in its home market.

For starters, there are no true pan-European distributors; local dealers tend to be part of an old-boy network that shuts out new products; and making a product available in seven languages pushes up costs. Nevertheless, it is worth the effort because the demand for information technology in Europe is expected to be greater than that in the U.S.

The first problem is the lack of large dealers or distributors. Mass-market retailing has never really existed. "The home computer market is much smaller in Europe, although we expect it to grow rapidly in the coming five years," says Hugh Gibbs, an analyst with International Data Corp. in London. "As a result, there just aren't many outlets for street sales," he says. That leaves the computer manufacturer with a choice between traditional distributors and value-added resellers, or VARs.

In Europe, the traditional distributor is on the way out. "The pressure on profit margins for manufacturers has obliged them to go around the traditional distributor," says Dennis Exton, a Merrill Lynch analyst in London. "Large companies can still sell to them in bulk. But this pressure makes dealing with the few distributors left very difficult for small and middle-sized manufacturers. The distributor will squeeze them dry to keep his profit margin."

Hence the importance of European VARs: as in the U.S., about 80% of all computer sales are now made through them. But VARs in the EC are not like those in the U.S.: they're smaller and have a very local client base. "You don't just have VARs devoted to a particular product, as in the U.S.," says Jean-Carlo Bisone, vice president for marketing of Compaq Computer Corp. in Europe.

Of course, it's easy for a large company to hire salespeople in every country of Europe to hawk its products to VARs. But how does a small company with limited resources get to them?

When Poquet Computer Corp., the Sunnyvale, Calif.-based producer of a handheld personal computer, opened an office in France four years ago, getting distribution was one of the toughest challenges. "There really was no way for us to reach VARs," says Bruno Pagliuca, who runs Poquet's European operations. So Pagliuca wound up going to

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CIRCLE 188

When Smith Corona's production line went down, HP support was up and running.

It happened on a freezing Saturday in February.

Joe Reiley, a Hewlett-Packard test and measurement support engineer, was at a wedding in Pottstown, Pennsylvania. The office was the furthest thing from his mind, when suddenly his beeper went off.

In minutes, Joe was on the phone to Travis Field, the support engineer for Smith Corona in Cortland, New York. An HP test system crucial to Smith Corona's production line had gone down. Suddenly, Joe's thoughts turned to figuring out how to get Smith Corona's production line back up. Joe bid the other guests goodbye and ran to his car.

After driving through a blinding snow storm over icy mountain roads, Joe pulled into Smith Corona at 10:30 pm. A thorough analysis of the problem made it clear they needed extra parts, so Joe called another HP support engineer, Pete Nahrgang, in Valley Forge. Working through the early morning, Pete took parts from a back-up HP system, then flew them to Cortland by special courier. By Sunday afternoon, just 24 hours after Joe's beeper first went off, Smith Corona's production line was up again.

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CIRCLE 173

trade shows, where he met VARs.

For high-end systems, of course, direct sales are still the rule. IBM, Bull, Siemens, and ICL have all beefed up their sales force to improve marketing. But even for these systems, the VAR has become a competitor.

"Although you're not going to find new VARs who use proprietary systems," says John McGlone, vice president for distribution channels for Groupe Bull in Paris, "there are a considerable number of VARs who sell high-end proprietary equipment and have been doing it for years." McGlone says that Bull now sells about 10% of its big systems through such VARs.

With 1992 approaching, some European VARs are taking the hint and beginning to look for mergers and alliances to broaden their market. The UK is the center of most of this activity, since the high level of competition encourages every player there to expand. "At least two of the UK VARs have succeeded in expanding into Europe," according to Merrill Lynch's Exton.

Poquet's Pagliuca agrees about the need to get local VARs to expand. "Some of these dealers are mom-and-pop shops, who work with a local banker. They get very choosy about who they work with, and they're not easy to sell."

To make matters more complicated, the system differs from country to country. "France's VARs and those in the UK are growing very much along American lines," says IDC analyst Gibbs. "But Italy remains a sadly underdeveloped market, with very small dealers. Denmark is similar. This makes developing a global marketing strategy very complicated."

In order to encourage these local VARs to expand into new markets, some of the big European computer companies are helping them move around. "In the past we'd just try to sell a local VAR a hot product," says Bull's McGlone. "Now we try to form a joint marketing relationship." When Bull finds a VAR that has an exploitable application, the company puts up the money to help him go to another country and find a partner."

The EC has made the process of bringing small firms into cross-border alliances much easier with its program for "economic interest groups," which provides big tax breaks for making the jump. "We've been helping small VARs to make use of the program," adds McGlone, "and we help rewrite software, make translations, etc. But you have to be cautious," McGlone says. "You can't get one of these small VARs into a relationship he can't afford."

Faced with this diversity, the large European computer manufacturers are all actively working to recruit VARs. But each has worked out a radically different kind of distribution strategy to cope with the problems of the EC.

Ing. C. Olivetti & Co. has always followed an original-distribution strategy. While trying to bring in independent VARs, the Ivrea, Italy-based company has maintained a group of independent dealers that push its products. "This network of independent dealers is one of the most valued assets the company has," says analyst Giorgio Petitbon, with SRI Inc. in London.

Olivetti Office Systems has worked hard to educate its dealers. "We are trying to qualify our dealer channels," says Arnaldo Bonetti, marketing manager, "to make them capable of selling the most updated product and technology." Bonetti says that Olivetti is gearing these dealers to serve the needs of small and medium-size European companies. For example, they are expected to be able to provide an accounting system for an average company having three or four accountants—someone who needs three or four workstations with a server. "What they should be, in fact, is a local VAR," Bonetti explains.

Compaq—Olivetti's major competitor in the EC—has concentrated almost its entire distribution strategy on indirect channels. Analysts say that it has been successful, pointing to the fact that Compaq now has a larger European PC market share than the Italian company.

Britain's ICL has an approach that is closer to Compaq's. It has reorganized its distribution system, creating a Third Party Trading Division, devoted to recruiting VARs. According to ICL's UK director, Ken Wallace, the division will provide discounts and incentives.

Zenith Data Systems Corp., on the other hand, disagrees with ICL and Compaq about the best European strategy. It is betting on VARs that already have a presence in several nations. ❑

DEC TRIES AGAIN IN THE PC BUSINESS

WILL IT WORK THIS TIME?

BY LAWRENCE CURRAN

COMPUTERS

Digital Equipment Corp.'s newest foray into the personal computer market has the industry wondering what's next—after all, it's not as if the Maynard, Mass., computer giant hasn't tried before to claim a piece of the desktop.

Last month's introduction of an Intel Corp. 80486-based PC and server, along with two portable PCs manufactured by Italy's Ing. C. Olivetti & Co., was DEC's third move in the last few years. The others: a 1989 deal with Tandy Corp. of Fort Worth, Texas, to supply PCs that DEC sells, and the marketing of DEC's Pathworks PC-integration software, which links PCs to networks. And that follows the failure in the early 1980s of its proprietary Professional and Rainbow lines.

But the new PC gives DEC an industry-standard weapon that embodies more of its own contribution, portending increased profits. Called the DECpc 433, the unit is the fruit of a collaboration with Intel. DEC contributed expertise in systems, graphics, application software, and networking; Intel, chip- and board-partitioning experience.

The $5,999 low-end price for the 26-million-instructions/s PC puts it in a class with earlier 386- and 486-based PCs that offer less performance, especially in graphics. That's well below the prices of comparable PCs from IBM Corp. and Compaq Computer Corp.

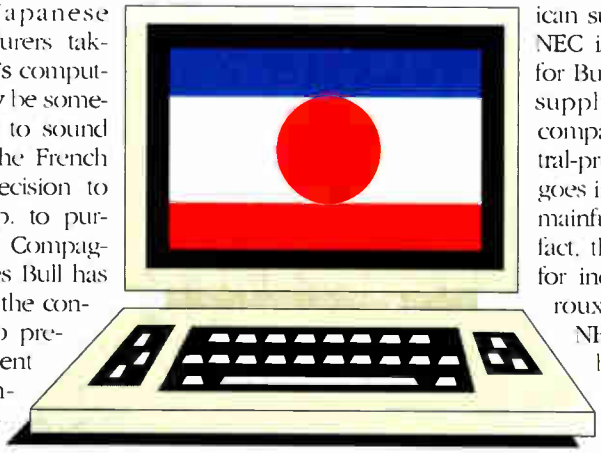
The new computer has attributes that blur the line between CISC PCs and RISC workstations. For example, a custom video controller provides both industry-standard full-screen VGA and workstation-quality graphics of 1,280-by-1,024-pixel resolution.

In fact, the combination of the 33-MHz 486 processor with advanced graphics and networking make the DECpc 433 a formidable competitor with some of DEC's own reduced-instruction-set-computing workstations, raising the specter of a clash between the company's Personal Computing Systems and Peripherals Group, where these new PCs reside, and its Unix-RISC workstation operation. But Bert Elchinger, product marketing manager for the DECpc 433, says it won't compete with workstations "because it is a PC. We're positioning it to run PC operating systems, especially Windows under DOS."

John Logan, vice president at the Aberdeen Group, a Boston market research-organization, sees the PC as an essential alternative to DEC's VAX minicomputers. "Users are demanding high-performance MS-DOS systems where they once needed a higher-priced VAX," he says. "We've seen applications run faster on a 386-based PC with a Fortran compiler than on a VAX." ❑

OBSERVER

WHAT NEXT IN COMPUTERS?



Are the Japanese manufacturers taking over Europe's computer market? It may be somewhat premature to sound the alarm, but the French government's decision to allow NEC Corp. to purchase a stake in Compagnie des Machines Bull has analysts all over the continent rushing to predict the imminent end of all computer manufacturing within the European Community.

The move by the Tokyo-based NEC is probably only the beginning of a strong current toward a much larger Japanese presence in European electronics. At a recent Paris conference on the subject of Japanese investment, a spokesman for Japan's Ministry of International Trade and Industry said that Europe would be the choice of many Japanese investors in the coming years—and that is particularly the case in electronics.

The NEC deal, following last year's purchase by Fujitsu Ltd. of a controlling stake in Britain's ICL Ltd., is widely regarded as a sign of the inability of European producers to compete effectively in today's markets. "It's only a matter of time till the other [Japanese computer makers] follow," says Dorian Foyle, an analyst with UBS-Philips and Drew in London.

NEC winds up with only 5% of the French company, trading for it the 15% interest that NEC had in Bull's American subsidiary, Bull HN. NEC is a logical partner for Bull; it has long been supplying the French company with the central-processing unit that goes into its highest-level mainframe computer. In fact, the French minister for industry, Roger Fauroux, says he hopes NEC will be willing to buy even more. Bull lost more than $1.2 billion last year, and the government has warned that it would not continue its subsidies forever.

The European Commission is also investigating French state aid to the computer maker. France put up $1 billion to prop up its state-owned electronics producers Thomson and Bull. While most observers don't believe the government will be obliged to take all the money back, the obligation to return even part of the aid would leave Bull in an awkward position. ❑

FRANCE TELECOM HANGS OUT THE 'PARTNERS WANTED' SIGN

France Telecom, which in January ceased being a government agency and became an independent public company, is beating the bushes for business partners to help nurture its global telecommunications business. Under its new look, the company will retain its protected monopoly status in basic telephone service and telex. However, new tiers of service have been converted to competitive markets, says Paul Quilès, France's minister of posts, telecommunications, and space.

Under the new regulations, companies wishing to provide services such as mobile telephony, data communications, cable TV, and very-small-aperture satellites (VSATs) will require a license but the companies will be open to competition. On the other hand, value-added network services will not require licensing. The new law also liberalizes the equipment market in France by laying out concrete specifications on how manufacturers can seek type approval for equipment that can be connected to the French public network.

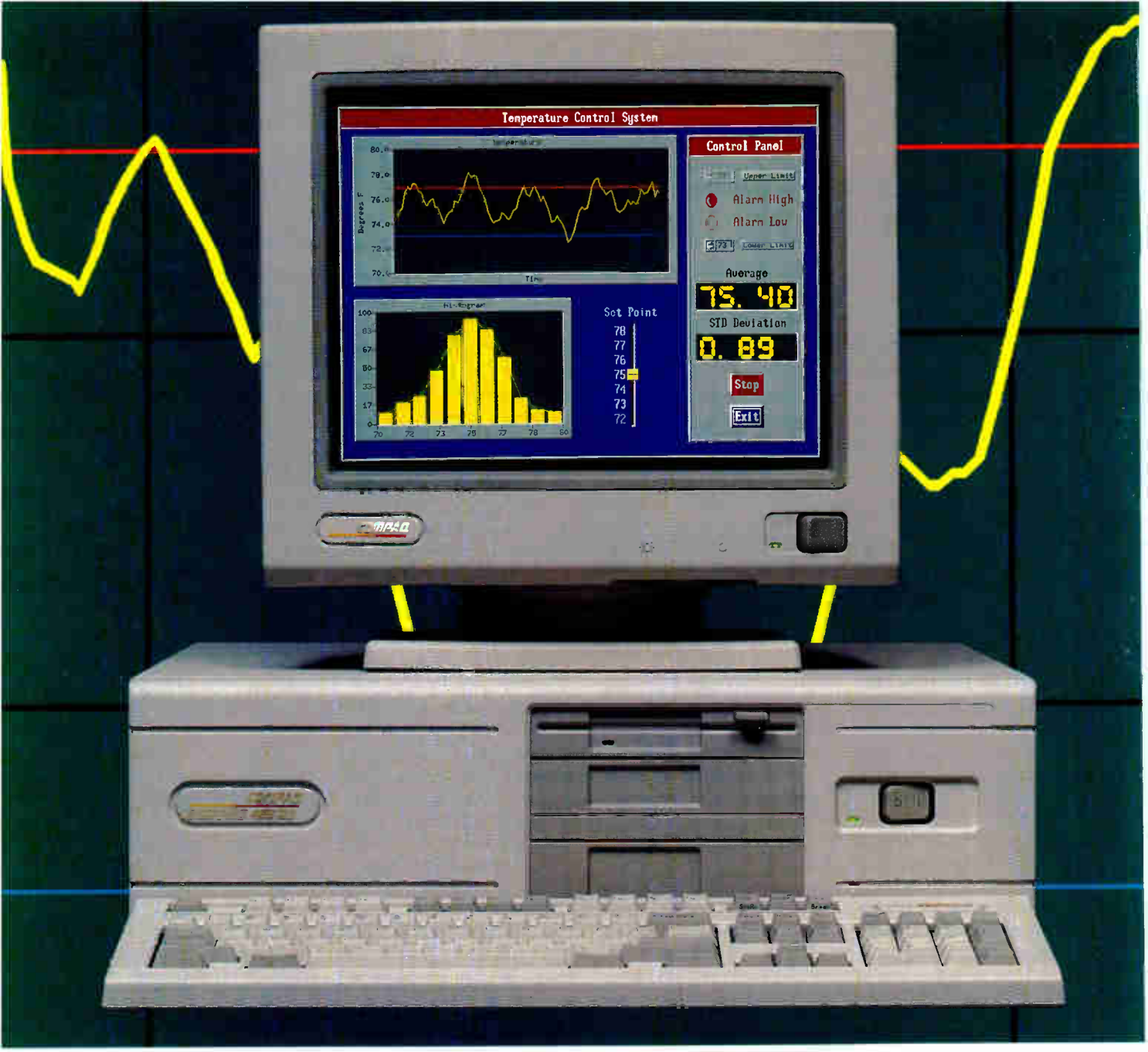
Meanwhile, France Telecom has had some success in its search for partners. So far this year, the company has concluded 57 partnership agreements and is processing 23 applications, says France Telecom Chairman Marcel Roulet. Many of these are with foreign telco service providers such as AT&T, Ameritech, Nynex, and U.S. West. However, one of the shining entrepreneurial stars with a deal is Cisco Systems Inc. of Menlo Park, Calif., which specializes in the interconnection of disparate local-area networks. ❑

EC REACHES DUMPING ACCORD WITH JAPANESE

The European Community and Japan have reached an antidumping agreement that covers erasable programmable read-only memories, much like the one arrived at two years ago for dynamic random-access memories. A regular duty will be imposed on the chips brought into Europe from Fujitsu, Hitachi, Mitsubishi, Texas Instruments Japan, and Toshiba. Under the terms of the agreement, a "reference price" will be established for the chips, which is below the production cost of Japanese producers. It will be reviewed quarterly to ensure that it doesn't fall below changing prices.

SGS-Thomson, the only producer of EPROMs in Europe, will profit the most from the agreement, benefiting from a 9.4% duty on the chips imported from Japan. It shares a market worth $469 million with Japanese and U.S. producers.

European semiconductor makers remain concerned that low-cost EPROMs will make their way into their markets from other sources. But according to the European Electronic Component Manufacturers Association, the Japanese companies have the lowest cost of production due to the learning-curve effect and economies of scale. It will be difficult for third-country companies to dump the chips at lower prices. The accord will give the EC Commission the right to impound products that are being sold below the reference price. ❑



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CIRCLE 194

TIME-TO-MARKET FEVER MAKES PROGRAMMABLE LOGIC A BIGGER FISH IN ASIC POND

WATCH OUT, GATE ARRAYS

BY JONAH MCLEOD
AND JACQUELINE DAMIAN

If you buy into the business postulate that being late to market is a greater sin than overrunning a budget, then programmable logic devices are a godsend. Time-to-market fever is the big reason why PLDs are steadily nibbling away at the market share of their less flexible big brothers, the gate arrays.

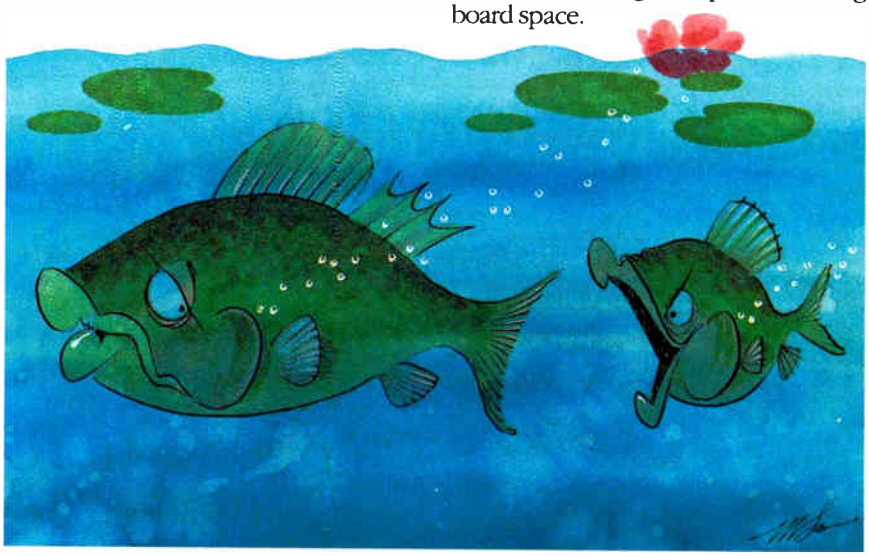
These ubiquitous devices, once relegated to lowly glue-logic duty, are also taking on more important system roles as they gain in speed, density, and functionality, and drop in price. As a result, the CMOS version—today the PLD of choice—is racing ahead at a 42% compound annual growth rate through 1994, says research house Dataquest Inc., San Jose, Calif. The market should hit $1.5 billion that year—or some $2 billion if the older bipolar segment is taken into account.

SEMICONDUCTORS

PLD is the generic term for several subclasses of products, including programmable logic arrays (PLAs), the simplest type of PLD; the high-end field-programmable gate arrays (FPGAs), which analysts say have the largest market potential; and the newest category, programmable multilevel devices (PMDs), a fast-growing derivative of PLAs that, unlike most PLDs, boast predictable timing.

What they all have in common is flexibility: PLDs are by nature friendly to use, easy to program and reprogram. This is a boon to companies tweaking systems or boards that are just going onto the market. A mistake in a gate array means a three-to-six-week delay while a new part is being designed and manufactured. A mistake in a PLD can be fixed pretty much instantaneously.

In recent months, PLDs have gotten technologically feistier, aiding their incursion into the huge market for gate arrays, which today make up 42% of the $9.3 billion overall market for application-specific integrated circuits. PLDs account for only 9% of that total, says Dataquest analyst Patricia Galligan. But survey figures show that starting last year, PLDs began taking a significant share of design starts away from gate arrays at 5,000 gates and below, she says.



Density and speed are on the upswing, with some PLDs boasting 8,000 usable gates or more and others blazing away at 7.5 ns, for performance in systems of 100 MHz. The speed gains mean PLDs can keep pace with the most rapid microprocessors in the current crop of workstations and high-end personal computers, ousting gate arrays from those sockets as well.

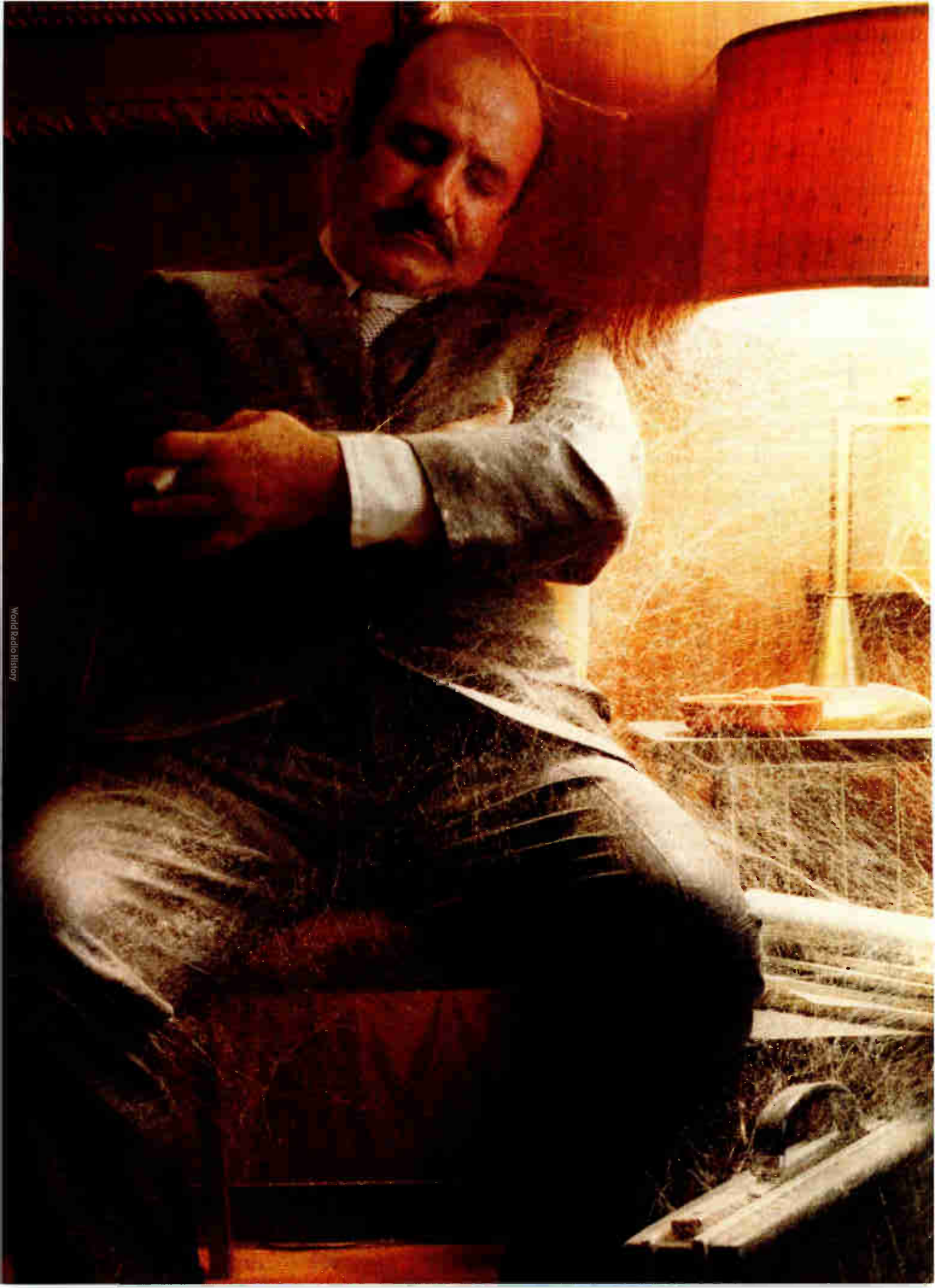
What's more, high-end PLDs are starting to break the price barrier that has kept them out of volume applications. Typically, a systems house uses PLDs to get a machine to market but switches to lower-cost gate arrays as soon as the design is cast in stone and the sales volume hits 10,000 units or so a year. Now PLD vendors are introducing devices that can be programmed at the mask level, reducing unit cost.

Finally, PLD vendors are adding some interesting new wrinkles that suit the devices for more sophisticated uses. For example, Altera Corp. has just come out with the first application-specific PLD, tailored for imaging, and Plus Logic Inc. offers PLDs that take on particular system functions, eliminating the need for additional logic chips and saving board space.

The PLD market splits two ways, says Larry Palley, product marketing manager for programmable logic at Intel Corp. in Folsom, Calif. "The complex logic market represents replacements for gate arrays," he says. "Here, combinatorial logic and state machines perform sophisticated logic operations, and the main requirement is for large gate counts." The other market, he says, is in simpler PLDs used for glue logic. "This glue logic ties together memory, central processing unit, and other system components. The main requirement here is for fast performance to keep up with fast CPU and memory."

Indeed, the speed of today's CPUs—33 MHz is fast becoming the workstation norm—poses a tough challenge for PLD vendors, since the logic surrounding a processor must be twice as fast as the processor itself. Intel, Cypress Semiconductor Corp., and Lattice Semiconductor Corp. are among the vendors addressing the speed issue. Where Cypress's biCMOS PAL22V10C accesses in 7.5 ns, Lattice has just introduced the GAL16V8B-7, a 7.5-ns device in CMOS, which boasts lower power consumption than biCMOS.

Also grappling with speed in FPGAs



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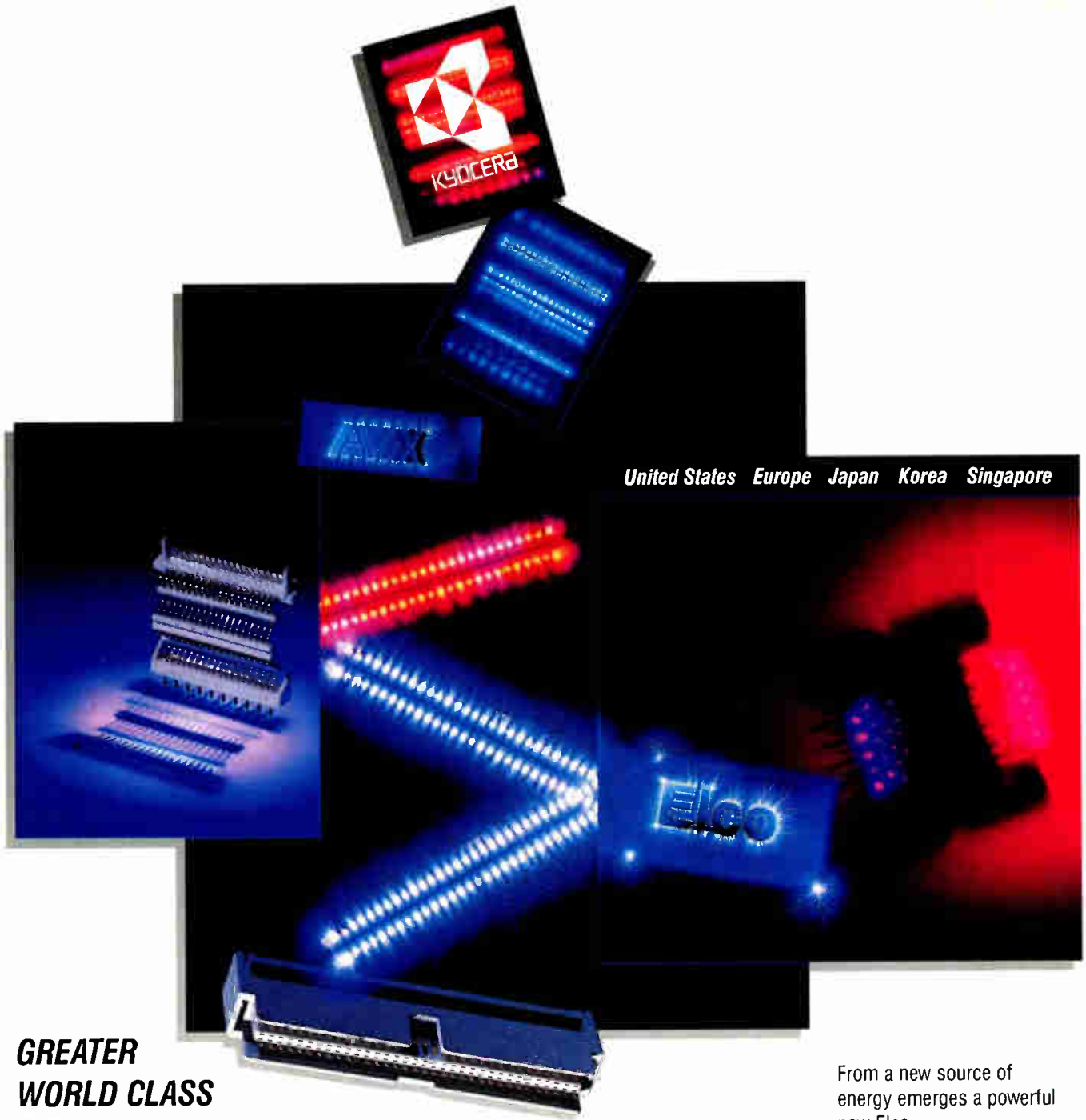

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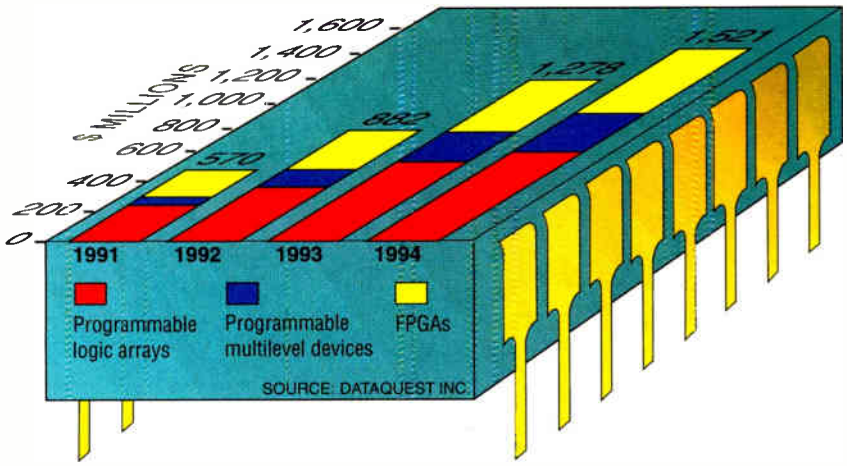
CIRCLE 183

CMOS PLDs ON THE RISE



is Quick Logic Corp. The Santa Clara, Calif., startup's VGT350 zips along at 100 MHz and sports 1,000 to 4,000 gates, says David Laws, president and chief executive officer. Quick Logic uses an antifuse technology for programming connections, an approach that cuts capacitance and resistance, thus enhancing speed, says Laws.

Besides speed and density, pricing has long been a hurdle for high-end PLDs, which can cost several hundred dollars apiece. Now FPGA market leader Xilinx Inc. of San Jose and PLD heavyweight Advanced Micro Devices Inc. of Sunnyvale, Calif., have found a way to trim costs and ease or eliminate the sometimes bumpy transition from PLD to gate array in a system. Both use a masked layer of factory-programmed interconnection instead of user-programmable cells in their products, which are essentially hardwired PLDs.

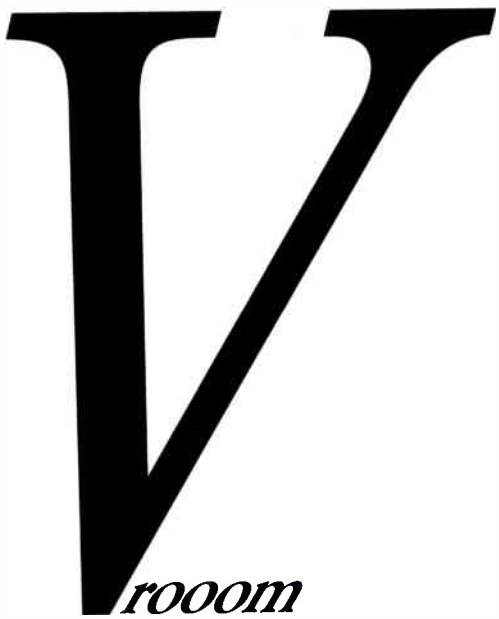
The Xilinx solution is the XC3300 family. Using the same FPGA configuration that the customer devised for its prototype, Xilinx automatically generates an architecturally identical hardwired version in XC3300 parts ranging from 3,000 to 9,000 gates, says Charles A. Fox, manager of IC product marketing. Prices are $9, $13, and $25, depending on gate count. By comparison, a 2,000-gate array can cost $50, including nonrecurring engineering costs.

AMD's solution is the MASC family, metal-masked versions of the chip maker's MACH series PLDs, at 900 to 3,600 gates. No reengineering is needed—OEMs simply drop the MASC unit into the MACH socket. The cost is 0.3 cents per gate, which is comparable with gate-array pricing. The metal-mask approach has been a success with AMD's simpler, low-density GAL devices, says Andy Robin, director of PLD marketing, and he anticipates similar enthusiasm for the MASC parts.

Two PLD players, meanwhile, offer up some interesting new twists. San Jose-based Altera's application-specific PLD is the first such device designed for a particular industry. The EPS464 Synchronous Timing Generator, a 50-MHz part jointly developed with Japan's Fuji Films, takes aim at VCRs, camcorders, laser-disc players, and the like. The critical need in imaging is synchronous timing, says Sandeep Vij, strategic marketing engineer. Besides neatly handling the timing problem, the EPS464 contributes to system integration, Vij says. Instead of a gate array or PLD to perform the core function "and several discrete logic devices surrounding it to customize it," the new device integrates all those logic functions on one chip, says Vij.

Plus Logic, meanwhile, offers up its Hiper family. "Hiper" is an acronym for a mouthful: hierarchically interconnected programmable efficient resources. What it means is a mix-and-match approach based on resource-rich building blocks, says Gary Banta, vice president of marketing at the San Jose firm. Each of three product groups contains blocks for particular functions—control in the 2000 series, data-path tasks in the 4000, and data storage in the 5000. Systems houses can thus customize a PLD depending on how they want to use it.

"All [systems makers] have access to the same CPUs," says Banta. "All use commonly available memory. Thus, the way to differentiate a product is in the programmable logic used to build additional features." ❑



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CIRCLE 195

A BATTLE IS BREWING ON THE DESKTOP

ACE INITIATIVE, INTEL X86 PLANS, WINDOWS, AND DEC'S NEW PUSH ALL STIR THE PC BUSINESS

BY LAWRENCE CURRAN

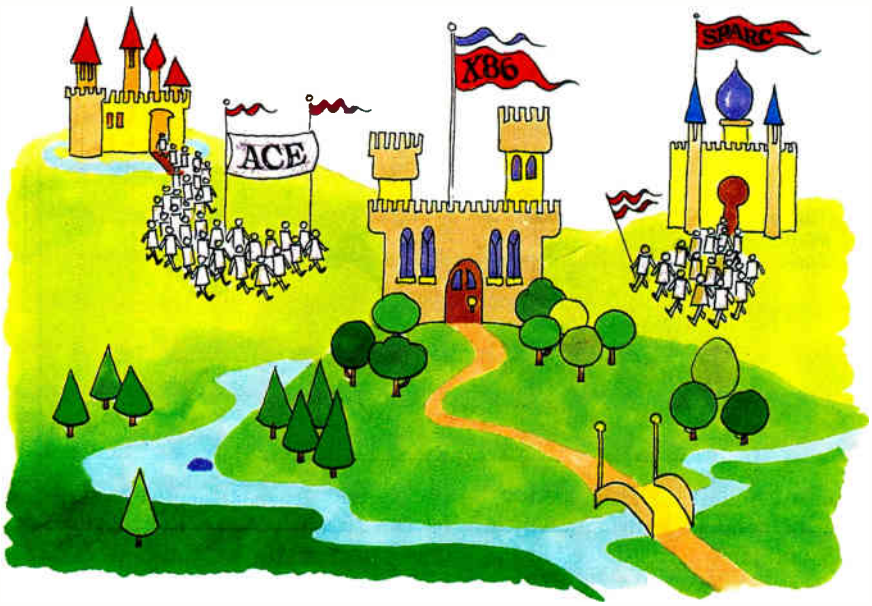
COMPUTING

Just when it looked as if the Intel 80386 microprocessor had run its course as a major stimulant to the personal computer market, a raft of new developments heralds a battle for control of the desktop and renewed vigor in PC sales. Managers pondering when to replace their older desktop machines will get more bang for their bucks in the wake of key market moves, not the least of which is Intel Corp.'s aggressive plan to extend the architecture and performance of the industry-standard x86 microprocessor family.

Some of the other forces that will breathe new life onto the desktop include the advent of the Advanced Computing Environment consortium, the runaway success of Microsoft Corp.'s Windows 3.0 graphical user interface, and Digital Equipment Corp.'s bold venture to get back into the PC business, piggybacking on an Intel-built 486-based platform.

But the initiative of the 21-member ACE consortium, if it succeeds, will also boost sales of the PC's big brother, the workstation. That will sharpen the competition between vendors of x86 PCs, which have slumped to a 5% annual growth rate, and Unix-based RISC workstations, which are charging along at 24% growth, for desktop space historically conceded to venerable DOS machines [*Electronics*, May 1991, p. 27].

In the ACE camp, vendors like Digital, battle-hardended from the workstation wars, see the initiative as a way to extend their sphere of influence to PC users frustrated with the limitations of the DOS operating system. The Maynard, Mass., computer giant struck out in the PC market in the early 1980s because its proprietary Professional and Rainbow machines were incompatible with the IBM Corp. PC standard. It's too early to tell if Digital's 486 computers, unveiled just last month, will be a hit, but the initial reaction of many analysts is positive (see p. 32).



Another major mover in the ACE camp is Compaq Computer Corp., the Houston-based PC powerhouse whose high-end machines, built around the x86 complex-instruction-set computing architecture, are already facing competition from low-end reduced-instruction-set workstations. Compaq is positioning itself to take advantage of whichever way the ACE winds blow—RISC or CISC. With no RISC architecture to offer, Compaq in April spent $135 million to get one: the company invested in Silicon Graphics Inc., the Mountain View, Calif., vendor of three-dimensional graphic workstations, which will manufacture ACE-compliant RISC machines for Compaq once the consortium irons out product details.

In backing Silicon Graphics, Compaq has given notice to Intel that the Santa Clara, Calif., microprocessor giant no longer has an exclusive franchise at Compaq—that Compaq will play both ends of the field and let customers decide what they want. Silicon Graphics uses the MIPS Computer Systems Inc. RISC microprocessor family, for which the ACE consortium has opted in a move to try to block the skyrocketing success of the Sparc RISC architecture pioneered by workstation leader Sun Microsystems Inc. of Mountain View.

Aside from moves by any of its individual members, the very formation of the ACE consortium throws down the gauntlet in the desktop duel. It establishes a third major camp of de facto standards for small systems, sharpening competition among providers of x86-, Sparc, and ACE-compliant hardware and software.

It's too soon after ACE's formation in April to predict how successful the initiative will be. With or without it, though, there are powerful new forces at work that are revitalizing the sagging

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PC industry. And the industry needs it.

"The tremendous earlier growth in the U.S. and Europe has slowed to single-digit growth in what has become a replacement market," says John Logan, vice president at the Aberdeen Group, a Boston-based market research organization. "Users aren't upgrading because there haven't been new application programs that require them to upgrade. They're looking for greater functionality before they consider trashing their 386 or older systems."

Now Intel, ACE, and Windows are changing that picture. Logan says that 95% of the desktops today are populated by PCs offering 20-MHz 386 performance or less. That's not good enough for Microsoft's so-called New Technology OS/2 3.0 operating system with Windows, which is one of the two operating-system paths to the future espoused by ACE. (The other is the Santa Cruz Operation's Open Desktop version of shrink-wrapped Unix.)

In fact, Logan believes the ACE initiative is an open attack on Intel by a group of companies that had tired of the chip maker's restricting the supply of microprocessors to computer builders. "The industry has now ganged up on Intel to make sure they don't have a stranglehold on the microprocessor market," he contends.

The move has already forced Intel to be more forthcoming about its plans for the x86 family and to accelerate development of the next-generation 586 and 686 central processing units. Now, higher-performance x86 processors will mean a shot in the arm for the PC business, because system builders can proceed with new designs knowing what tomorrow's mainstay CPUs will bring, and when.

Intel will more quickly make the 386 obsolete because of ACE, Logan believes. "This is why they've introduced the 486SX," he says, a slimmed-down 20-MHz version of the 80486 CPU. It also explains why Intel has clarified its plans for follow-on processors, Logan believes. "Plans for the 586 had been unclear as to the delivery date of systems that use it," he says. Those systems had been expected in 1993, and "Intel is now saying they'll be available in 1992." A 686 is in the works, too, and "that hadn't been confirmed" before ACE came along, Logan says.

Intel denies that ACE forced a speedup of its x86 plans, but Dana Krelle, Intel's marketing manager for high-end microprocessors, does concede that "we've got to do a better job of getting the word out about what's coming. We have a very good set of products coming in the next several years that will be competitive with anything out there," he says. "The market isn't comprehending as well as we'd like what will go into the x86 family, which was one of the motives behind [the formation of] ACE."

For example, Krelle says that there seems to be an impression that "RISC is something wonderful and revolutionary. In fact, RISC is a set of design techniques that are used in the 386 and 486. And some of the architectural innovations of RISC [that are] talked about for the future may appear sooner" in the x86 family than in any RISC CPU, he asserts. "The Intel processor product line is as robust an architecture as any," Krelle says.

Though RISC is certainly differentiated from CISC by design techniques that result in faster performance, as Krelle says, another strategic plus for the RISC camp is that the technology has become synonymous with open systems. It's linked with the Unix operating system and multiple sources of chip supply. The x86, by contrast, carries connotations of an older era characterized by a single-sourced, proprietary approach.

Krelle won't acknowledge that the successor to the 486 will be called a 586, but he points out that "the ACE products won't be on the market until next year at the earliest, and next year is also the year the next Intel generation comes to market." It's clear, then, that Intel has a long-term strategy for the x86 family, and that's good news for PC vendors, software developers, and users alike. It assures continued growth in a market that has the long-term backing of IBM, Compaq, and now Digital.

Krelle points out that two important elements that have been absorbed into ACE were in place well before the consortium's founding—OS/2 3.0 and Windows. "The market has been waiting several years for an operating system that will take full advantage of the 386, 486, and future processors," Krelle says. "[Microsoft's] OS/2 3.0 looks like a positive development for the Intel architecture, and the 32-bit applications-programming interface of Windows has the possibility of finally taking full advan-

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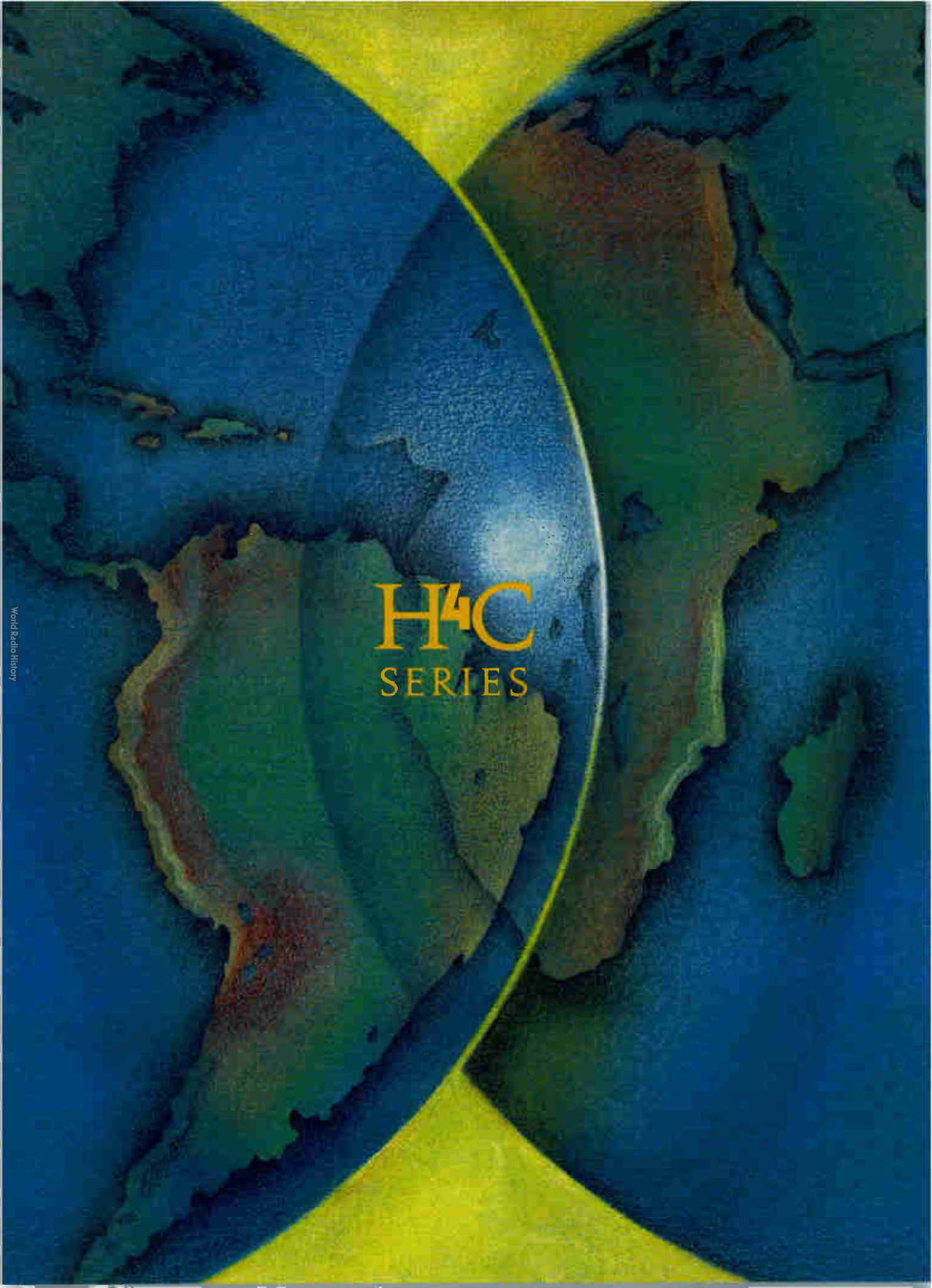

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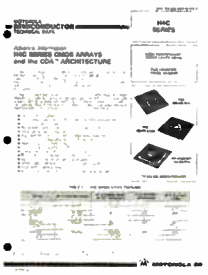

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tage" of the advanced x86 architecture, he says. "But these activities were well under way independently of ACE."

Intel hasn't joined the consortium, but Microsoft's Carl Stork expects the chip maker to be a major beneficiary, with "the lion's share of ACE systems to be based on Intel's architecture." Stork is advanced-development business manager at the Redmond, Wash., software giant, one of the prime movers behind ACE. He says it's an explicit goal of ACE "to fully include the 386, 486, and follow-ons in its provisions, and I expect Intel to continue to push the x86 to higher performance and value levels."

That will protect users' vast investment in DOS application programs, which will run on ACE-compliant CISC machines, says Keiichiro Kagiyama, president of NEC System Laboratories in Boxborough, Mass., a member of the consortium. "I think ACE is a good stimulant for Intel to promise fast enough and competitive enough chips in the x86 line that will allow customers to amortize their investments in [existing] PC software," he says.

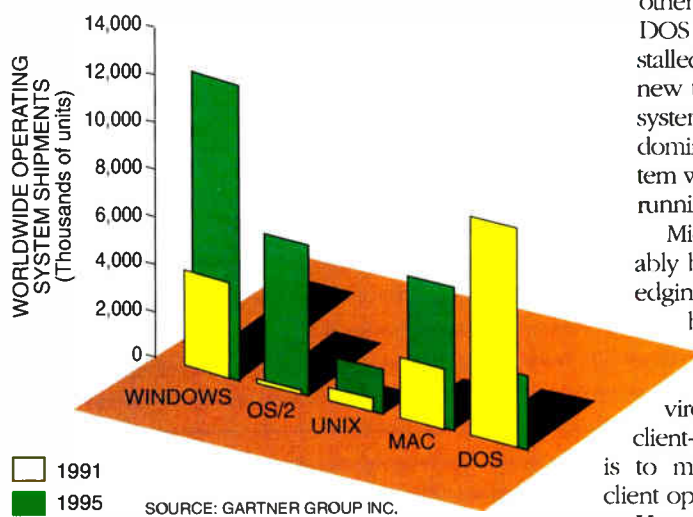
Besides boosting x86 development, ACE revitalizes the PC in yet another way, says Lori Strong, vice president for product marketing at Compaq. "A key consideration behind ACE," says Strong, is a growing interest by networked computer users to run applications on PCs that heretofore have been reserved for corporate mainframes or departmental minicomputers. This movement will mean "long-term growth for microprocessor-based systems," Strong says.

Also stirring growth in microprocessor-based systems is the fact that PC users will need new and faster machines to run Windows. And Windows will continue to take the industry by storm, says Jonathan Yarmis, vice president for personal computing at the Gartner Group, the Stamford, Conn., market research firm. Gartner predicts that Windows will be the dominant PC operating environment by 1995, when it will account for 41% of all new installations, up from just 12% last year.

Yarmis contends that the success of Windows is wresting control of the desktop from IBM, showing that "users will flock to an application-rich platform like Windows and bypass an application-poor platform like [IBM's] OS/2." He maintains that although Big Blue's OS/2 2.0 is technically stronger than Windows, "OS/2 lacks third-party appeal. Without that, it doesn't matter how well OS/2 performs. Users buy applications, not operating systems."

While developers are busy writing programs to run under Windows, "IBM has only a so-so strategy" to get them producing applications for the 32-bit extended OS/2 2.0, Yarmis says. Like its predecessor, OS/2 2.0 is a joint Microsoft-IBM development, but IBM has primary responsibility and is pushing hard to win favor for it, he adds. "I may have to revise the forecast if IBM can deliver on its promises, but it's still an open question as to whether they can."

WINDOWS TAKES OFF



SOURCE: GARTNER GROUP INC.

Gartner's forecast has OS/2 getting a 21% market share of new PC installations in 1995, mostly in large corporations, where IBM has been historically strong with larger systems. Apple Computer Inc.'s Macintosh OS will double in new PC sales by 1995, growing to 20% from 10% last year. DOS is slated for a steep plunge in the Gartner forecast—from 69% of new installations last year to 10% in 1995. Unix won't do well on the desktop either, the Gartner Group believes, accounting for just 6% of new sales vs. 3% last year.

Not everyone in the PC industry is convinced that the Gartner scenario will play out as forecast. "We don't disagree that Windows will be a pervasive environment well into the '90s, either under DOS or OS/2 3.0," says Compaq's Strong, "and we'll make sure that we're there with both of those." But she doesn't agree that PC hardware has become a commodity that's almost a trivial consideration for buyers, as the Gartner scenario implies. "Customers have always been driven primarily by the applications they're trying to run, but once they've chosen the applications, they're still very much interested in having the right hardware platform, too," she says.

Intel's Krelle is also keen on Windows—"We absolutely believe that PC users have wanted a graphical user interface rather than a DOS prompt"—but he doesn't believe it spells the death of DOS. Rather, Krelle sees Windows running more on DOS than on any other operating system: "Given that DOS has 75 million PC units installed, and that OS/2 3.0 is brand-new technology and will be a large system when it comes, by 1995 the dominant [desktop] operating system will still be DOS, with Windows running on top of it," he says.

Microsoft's Stork is understandably bullish on Windows, acknowledging that "even we were surprised by [its] runaway success." Stork says Microsoft plans to push Windows as the operating environment of choice for desktop client-server networks: "Our strategy is to make Windows the pervasive client operating environment."

He stresses, however, that as codesigner of IBM's OS/2 2.0, Microsoft will supply and support that operating system to its OEM customers. "We and IBM have somewhat different visions of the relative role of the two," Stork says. "IBM looks for OS/2 2.0 to play a large role on the desktop. But our long-term strategies are more aligned than different, and the customer will ultimately decide which way to go." Stork notes that IBM is not blind to Windows' success "and is strengthening its support for Windows in OS/2 2.0."

The historic PC market leader, IBM is characteristically mum about specific plans in its own family of x86-based PCs. But the biggest computer company in the world isn't about to give up control of the desktop without a fight. It's wise to keep one eye on Big Blue to see if the PC magician will pull any rabbits out of its hat, infusing the desktop market with even further energy. ❑

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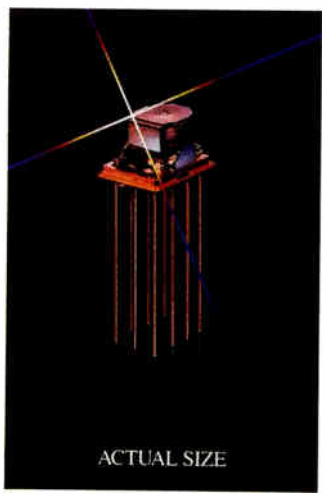

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CIRCLE 225

MULTIMEDIA COMPUTING HITS A SOUR NOTE

A COPYRIGHT BATTLE MAY BE BREWING AS THE FLEDGLING INDUSTRY BUMPS INTO ARTISTS' RIGHTS

BY JACK SHANDLE

COMPUTING

The PC industry's dream is slowly coming true. Personal computers are becoming as entertaining as TV, as utilitarian as washing machines, and as ubiquitous as telephones. But by boldly marching beyond the land of bits and bytes into markets where no machine has gone before, desktop computing has stumbled into a flesh-and-blood kingdom filled with problems that could turn the dream into a litigation nightmare. Artists' royalties—if, when, and how much to pay for them—are one of these problems. It won't be long before acronyms such as ASCAP and BMI are as familiar to the PC professional as BIOS and SCSI.

With the dawning of the multimedia PC, many industry watchers say, new business structures addressing compensation for the images and sounds used in this new medium must be created. If some observers are to be believed, a battle royal could be shaping up between a "royalties" industry steeped in the history—and rate structures—of vaudeville, film, and broadcasting vs. a computer industry where the "audience" could be a solitary person in front of a PC or a half dozen customers viewing a multimedia sales pitch on a Sony DataDiscMan.

In a perverse way, the fledgling multimedia industry can take some pride in uncovering the artists'-rights issue. As long as computer executives talked about "a PC in every home" but encountered none of the problems that broadcasters and phone companies deal with daily, their dream of everyman's PC was just that: a dream. But now digitizing hardware for audio and video is relatively inexpensive, and some companies are marketing snappy multimedia software tools. The technology is here and now, and it works. Musicians, photographers, and other creative artists are taking notice. And they want a piece of the action.

Case in point: at the Multimedia and CD-ROM Conference held in San Jose, Calif., in March, exhibitors claim they were put on notice by the American Society of Composers, Authors, and Publishers (ASCAP) that "spotters" would be at the show listening for copyrighted music in multimedia presentations. This raised hackles on the show floor, because it seemed that ASCAP was raising its involvement to a new level. It is already a well-established procedure for trade-show managers to secure a blanket license for all copyrighted music played on the show floor. What else does ASCAP want?

"ASCAP is very aggressive," says copyright attorney Bruce Lehman. "It may attempt to segment out multimedia PCs and make them a separate revenue stream." As the largest agency collecting licensing fees for artists, ASCAP, head-

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CIRCLE 224

quartered in New York, collected $358 million last year. Managing director Laura Messinger says ASCAP's presence at the conference was only to inform potential organizers of other shows of their responsibility to license music. Multimedia is both a new area and a gray one, she says. Attorney Lehman, who represents the Software Publishers Association for the Washington law firm Swidler and Berlin, agrees it is gray. But he cautions in-house corporate multimedia developers, in particular, against swallowing ASCAP's legal arguments hook, line, and sinker. By signing an agreement with a royalties agency, he says, the user is acknowledging that agency's legal right to collect a fee for PC-based presentations.

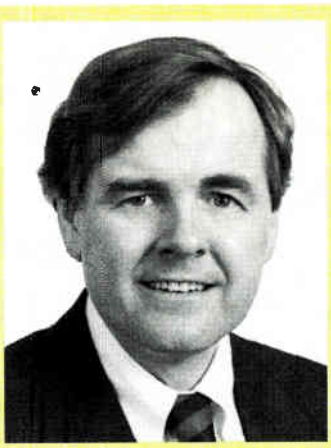
The world of royalties is many-tiered and involves dealings with different organizations and individuals for music, images, and even text when it is copyrighted. In the music realm, performance fees are paid to ASCAP and/or BMI (Broadcast Music Inc.) for public performances of copyrighted music.

The definition of "public performance" is one of the gray areas. If music is being integrated into a purely audio presentation, such as a compact disc, cassette, or record, a mechanical license is required from the music publisher. If it is being integrated into a visual presentation, synchronization licenses are required. These are handled by the National Music Publishers Association through its subsidiary, the Harry Fox Agency Inc. (HFA), New York. There may also be obligations to record companies and individual performers.

Few multimedia developers are out to pirate copyrighted material. "From a moralistic point of view, the songwriter deserves compensation," says Carmine Bonanno, president of Voyetra Technologies Inc., a Pelham, N.Y., creator of computer-music files. And from a business point of view, he adds, "If a songwriter is not paid for his work, he probably will not produce more." But developers are discovering that the cumulative cost of art and music royalties for a large data-storage medium such as a CD-ROM disc can be heavy. Some CD-ROM titles never see the light of day because the per-disc royalties add up to hundreds of dollars, sinking the project before it is launched.

One example: when a well-known CD-ROM developer was approached by the *Sporting News* with the idea of publishing a disc of baseball cards, the denouement was almost ludicrous. It seemed simple enough at first, says Mark Engelhardt, president of Wayzata Technology Inc. in Grand Rapids, Mich. Wayzata would purchase the rights from the Topps Co., a well-established purveyor of the cards.

But Topps's contract with the ball players restricted use of the photos to its trademark bubblegum packages. "So they [the *Sporting News*] had 500 to 1,000 players' lawyers to negotiate with," says Engelhardt. "The size of that agenda made the project unmanageable, and besides, no lawyer is going to talk to you for one eighth of a percent royalty, which is what was needed to make the project viable."



"ASCAP is very aggressive. It may attempt to segment out multimedia PCs and make them a separate revenue stream."

BRUCE LEHMAN

Nearly everyone, in fact, has a royalties anecdote to tell. Take the case of IBM and Pluto. Ron Palmich, international director of IBM Corp.'s Multimedia Market Support Group in Atlanta, was creating a presentation for the president of Disney Studios Inc. The IBM developers thought it would be fun to digitize a rendition of Disney dog Pluto and import it into the PC for playback, says Palmich. But to obtain the rights from Disney, which jealously guards its cartoon creations, Palmich had to sign a release that limited IBM's use of the pooch to the 24-hour period during which the presentation to Disney's president would be made.

It is not hard to find doomsayers who predict the intellectual-property issue will keep multimedia from taking off. But clearer heads tend toward optimism, because mutual benefits can accrue to both sides. Tim Mott, president of MacroMind Inc., a leading developer of multimedia software tools based in San Francisco, says he has heard of multimedia productions in which royalties exceed total production costs. But Mott sees those cases as symptomatic of an industry in its early growth stages.

Over the long haul, says Mott, it is in the interest of artists—and the organizations that represent them—to come to some sort of accommodation with the computer industry, which represents a vast, untapped revenue stream. Clearly, new business arrangements will be required to accomplish this.

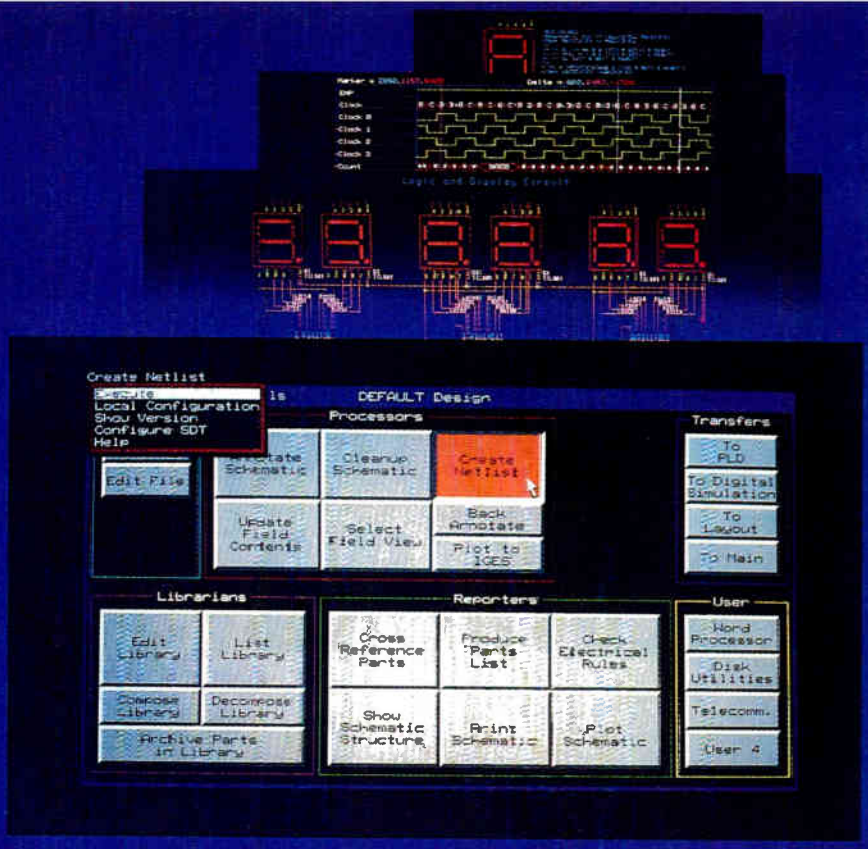
The paradigm of the cassette or CD does not quite fit multimedia, which generally uses snippets of an artist's work—10 seconds of a soundtrack, for example—and often changes the material in some way through the magic of digitization. Moreover, since the artist's work is often embedded in a large data base and accessed through a user-interactive environment—as opposed to the serial access of a record or CD—there is no guarantee the user will access it at all.

The most likely forum for an industry-wide approach is the Interactive Multimedia Association, a trade group for developers. "There is no question that the IMA will delve into this," says Philip Dodds, director of the group's compatibility project. "I would be very surprised if this time next year we are not deeply involved in addressing the copyright issue," says Dodds, who is also president of Randall House Associates in Annapolis, Md.

But, Dodds says, hardware portability is first on IMA's agenda, and until the compatibility issue is settled, multimedia will probably not be large enough for copyrights to be very important. Once that happens, the IMA might be able to strike an industry-wide deal like to the one that will save TV broadcasters $40 million in royalties in 1991. The All-Industry Television Station Music License Committee in New York administers the broadcasters' plan, which involves blanket and per-program protocols. "The broadcasters banded together to fight ASCAP and BMI," says attorney Lehman.

On the other hand, ASCAP's Mes-

OrCAD presents Release IV



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CIRCLE 189

PENTON CONTINUES COMMITMENT TO RECYCLING

Penton Publishing's Camera Department started recycling chemicals from film wastewater 25 years ago... long before the ecologically-smart idea was widely recognized.

For almost as many years, the Penton Press Division has been recycling scrap paper, obsolete inventory, and printing press waste materials. In 1991, Penton Press will recycle some 5500 tons of paper, 9 tons of aluminum plates, and 3 tons of scrap film negatives. Furthermore, the Press Division has invested $500,000 in air pollution control equipment.

Company-wide, the recycling spirit has spread from Cleveland headquarters to offices throughout the country. Penton employees are enthusiastic participants in expanding programs to re-use paper, aluminum cans, and other waste materials.

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Penton Publishing

singer says blanket licensing is practically a tradition if the user industry is large enough. "ASCAP will quote a fee and if the user is not pleased, he can go to the rate court [an administrtive law judge in New York] for relief," she says.

Lehman does not recommend a similar course for the computer industry until some basic issues are sorted out, however. "With the broadcasters, there was no question that these are public performances," he says, but the use of music on an individual workstation or in front of a few employees should not be conceded to be a public performance. ASCAP's Messinger responds: "Playback takes many forms. There is not much doubt that a single PC in an individual's home is not a public performance. But when the use enters the realm of a commercial enterprise and the work is put on a local-area network or on satellite, then it is definitely a public performance."

Some arrangement will undoubtedly be worked out, but for the interim, any developers smaller than IBM, Microsoft, and Apple may have to settle for artistic material they create themselves, find in the public domain, or buy from a company that has already cleared the rights.

In the graphic arts, magnetic and optical disks containing clip art have been popular since the advent of desktop publishing. The Topps baseball card experience clearly signals that there are problems even there. But music and video are an even tougher nut to crack. Much of the public-domain material is either dated—copyrights run for 75 years—or falls into rigid categories like patriotic or Christmas music.

Organizations like ASCAP and HFA control most of the rest, but they are not set up to handle requests from multimedia developers and frequently ignore them. "If I want to use 10 seconds of *Dick Tracy* video or 15 seconds of Madonna," says Wayzata's Engelhardt, "I call these people and first off it's hard even to get to them. When I do, they want 6% of the price of the disc. There is a whole string of people who have to be educated when you do any kind of multimedia."

People are building companies to help developers avoid these hassles. One such is Bonanno's Voyetra, which publishes a song library called MusiClips in the MIDI electronic-music format. This is a collection of multitrack MIDI sequences that direct specific instruments to play specific sounds in a wide variety of styles. Some of the songs on MusiClips are over 75 years old and in the public domain. The rest, which are produced and owned by Voyetra, fall into 14 familiar categories such as jazz, country, blues, and reggae.

MusiClips contains all the parts of a performance, including drums, bass, piano, etc., so it is easy to customize a song from the files. Developers are free to use the music generated by a MusiClip, but the files themselves are copyright-protected software. Developers cannot put a MusicClip MIDI file in their software and resell it, says Bonanno.

For those willing to venture onto copyrighted turf, the logistics could be made easier, says Bonanno. "Given that we are in a computer age, there could be an on-line clearing agency," he suggests. Developers could dial into a data base and find out if material is protected, and perhaps even the appropriate licensing fee. At least two might be required: from ASCAP and/or BMI for performance rights; and from HFA for synchronization rights.

Even the legal issues involved in multimedia have a different twist. Attorneys like Lehman contend that the definition of a public performance might very well exclude PC presentations. He finds a precedent in the exemptions courts have made for "home use and small-scale commercial establishments." Significantly, the courts have hinged these decisions on the size and power of the sound-amplifying equipment being used, he says.

In addition to the public-performance issue, the advent of multimedia could lead to reassessments of the definition of "fair use" and a tiered approach to duration of a copyright, says Miles Gilburne, managing partner of the Cole Gilburne venture capital firm in Manhattan Beach, Calif., which specializes in multimedia companies. Current exceptions to royalty payments under fair use include educational and other nonprofit enterprises. Gilburne, who is also an attorney and editor of the *Computer Lauyer* newsletter, sees both practical and a public-policy reasons bolstering the need for a reassessment.

A LITIGATION NIGHTMARE?

Multiple agencies make getting copyright clearance virtually impossible for multimedia producers.

There is no definition of "public performance" in the context of PCs.

Changes in the copyright laws may be in store to fine-tune the provisions governing "fair use."

Since multimedia uses "snippets of a work and juxtaposes them with other cultural icons," the production is much different than a work on stage, he says. As long as a developer takes reasonably defined excerpts and integrates them into a much larger work that is fundamentally different than the original, he argues, the law is dealing with quite a different animal than in the past.

This argument leads directly to the public-policy issue. "People often lose sight of the fact that laws are a reflection of public policy," Gilburne says. One public-policy issue is the deplorable state of education in the U.S. Corporations spend billions of dollars each year teaching new employees to read and write. "If you accept the premise that interactive multimedia products are the best source of education that we are likely to come across in our lifetimes, then all of a sudden very rich multimedia products acquire a very high societal priority," Gilburne says.

ASCAP's Messinger says the fair-use agrument goes beyond the criteria Gilburne mentions. "Other considerations are whether it is being used in a commerical venture or for nonprofit," she says, "or whether it is criticism or educational; and its effect on the potential market." ASCAP has little interest in seeing the term of a copyright shortened, she adds.

Gilburne acknowledges that in the long view, multimedia may end up as just a hiccup in the history of copyright, and that market dynamics may solve the problem. In any event, he does not expect action from Congress any time soon. "Legislatures are prone to let the courts work on it first," he says. "They want to see issues percolate a little bit."

Stand by for further developments. In the meantime, the electronics industry will have to decide if it will remain on the legal sidelines or take an active—albeit unfamiliar—role in formulating public policy. ❑

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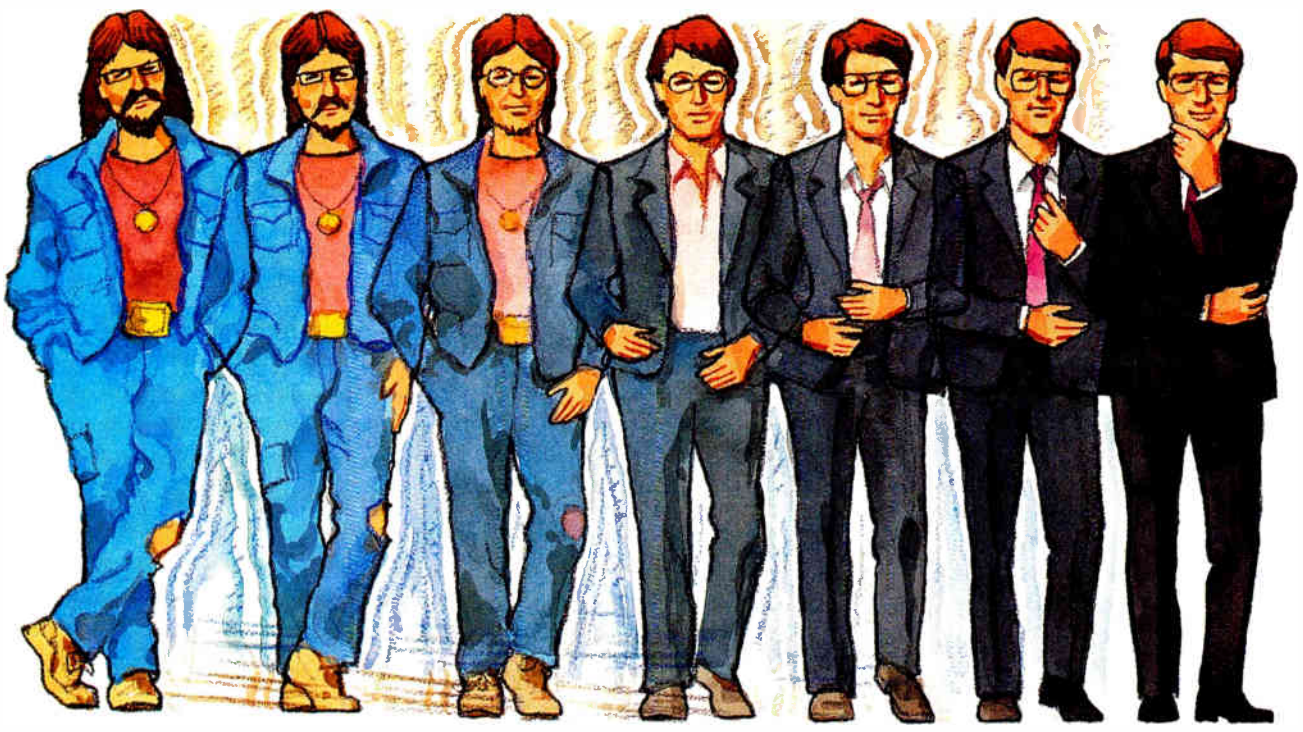

ALL TALK, NO ACTION

THE CAE INDUSTRY GROWS UP, BUT CAN IT GIVE THE MARKET WHAT IT WANTS?

BY JONAH McLEOD

CAD/CAE

The heady growth in computer-aided design and engineering during the 1980s has left many suppliers with a bad hangover and a much more sober view of the future. The industry has matured from a ragtag group of nerdy entrepreneurs starting companies based on new CAE tools into one of buttoned-down businessmen worrying about market share and operating expenses.

The fundamental success of the design-automation industry assures a continuous influx of new technology to handle the next generation of application-specific integrated circuits and printed-circuit boards. But the new technology the market is demanding is system-level or top-down design, and the CAE vendors, long the *wunderkinder* of the electronics industry, are having trouble giving the market what it wants.

Since last year, the flow of new technology has slowed. Industry leader Mentor Graphics Corp. choked trying to roll out its System 8.0. Top rival Cadence Design Systems Inc. suffered from its lack of a complete system-level solution. Valid Logic Systems Inc. was busy making financial ends meet, while Dazix was fending off bankruptcy. Meanwhile, Racal-Redac Inc. was buying and integrating system-level technology, while synthesis leader Synopsys Inc. remained a one-trick pony.

An old concept, system-level design has yet to be successfully implemented. Scientific and Engineering Software in Austin, Texas, comes the closest with a tool that lets design-team managers analyze a system before they ever create hardware or software. But most so-called top-down tools are actually simulators that handle behavioral and gate-level descriptions simultaneously. Ultimately, the language for these systems will be the VHSIC hardware description language, or VHDL, a memento of the Pentagon's Very High- Speed Integrated Circuits program.

For system-level simulations to occur within a reasonable amount of time—hours, instead of days or weeks—has meant a resurgence in simulation accelerators. Zycad Corp. of Menlo Park, Calif., has rolled out a new offering as has Cadence, based in San Jose, Calif. In addition, faster hardware models are needed to facilitate such large simulations, and these are now available from Logic Modeling Systems Inc. of Milpitas, Calif.

But despite the patchwork of available tools, the industry overall can be seen as suffering from all talk, no action. "The design-automation industry has a supply-side problem," says Ron Collett, industry analyst at the San Jose-based market research firm Dataquest Inc. The customer base is waiting for high-level system-design solutions that CAE vendors have promised but are not yet shipping in volume, he says.

High-level system design has come to mean top-down design, in which a

design is captured at a system level—the motherboard of a workstation containing both ASICs and standard components, for example. Once captured, the design is analyzed to see if it meets system specifications. This methodology is followed in the design of ASICs, too. The designer creates a high-level device description and simulates it extensively before creating actual circuit-level descriptions. Integral to system-level design is a logic-synthesis tool that automatically converts a high-level description into a highly optimized gate-level description.

The lack of system-level solutions has slowed the spectacular growth of the 1980s to a more modest 20% in recent years. Dataquest says revenue from IC layout tools grew 23% in 1990 to $1.79 billion and will rise another 23% this year to $2.2 billion. Board-layout tools are slower: Dataquest says sales increased only 7% in 1990 to $545 million, but should rebound to 17% growth this year, hitting $637 million.

There's a simple explanation for the slowed growth: market leaders such as Mentor, which is based in Beaverton, Ore., don't have products ready. "System 8.0 from Mentor is not shipping, but Mentor has strong account control," Collett says. "That means Mentor customer can't switch CAE vendors, but they aren't buying Mentor's older tools either."

Mentor's problem is executing the vision it has described to the industry, says Peter Schleider, a partner at the Minneapolis investment firm of Wessels, Arnold & Henderson. Part of Schleider's skepticism revolves around technical risks Mentor has taken on. "They have undertaken a complete implementation of their software in C++ and object-oriented constructs," he says. "Both are immature and unproven technologies."

David Chen, vice president of marketing at Mentor, says the company has rotated about two thirds of its tools into C++, the largest C++ application yet achieved, the company claims. The promise of C++ and object-oriented technology is to simplify ports to various hardware platforms, speed upgrades and extensions to existing tools, and accommodate the emerging industry framework standards.

Mentor may be occupied with its development problems, but major rival Cadence is having a hard time taking advantage of its vulnerability. "Cadence is only now starting to ship Amadeus," that company's system-level design offering, says Dataquest's Collett. Moreover, "previously, Cadence had only IC layout," Schleider adds. "The board-layout tools it acquired from Automated Systems Inc. of San Diego have only recently been integrated into Amadeus."

Another major player, San Jose-based Valid Logic, is in no position to unseat Mentor either. Even though it has a system-level offering in the Rapid-sim simulator and associated back-end chip and board design tools, Valid has been hamstrung by business concerns.

"Valid is in transition from a hardware to a software business," says Collett, a fact that George Klaus, president and chief operating officer at Valid, concedes. Klaus says he made the decision to focus on software last October and it has taken two quarters to make it happen. But he says the company's positive cash position—the highest since 1988—testifies to the wisdom of the move.

Besides the change in its business model, another plus for Valid that could one day spell trouble for Mentor is a $150 million investment from IBM Corp. Klaus says Big Blue evaluated the available tools and determined that Valid's was the one it wanted ported to its fast-growing RS/6000 workstation platform. Schleider speculates that IBM wanted to attack Sun Microsystems Inc. in the EDA market and bought into Valid, with its large Sun installed base, to do so.

Another player is much-beleaguered Dazix. The company clung tenaciously to life after it was formed by the 1989 merger of Daisy Systems and Cadnetix, only to be devoured in December 1990 by Intergraph Corp., the Huntsville, Ala., workstation giant. "Intergraph bought Dazix to get firmly into design automation," Schleider says. "But it will be 1993 before they regain market share."

Racal-Redac, meanwhile, has been on an acquisition spree of its own. It acquired HHB Systems and Thom T6 in 1989 and Silc Technologies in 1990, in the process investing $71 million to create a system-design solution, says John O. Barr, vice president of marketing. Now, with its top-down design system set to roll out of the lab in upcoming months, Racal has an offering to play in this new market.

Racal's Achilles' heel was its lack of support from ASIC suppliers. "To play in the ASIC arena a tool vendor has to have ASIC vendors provide design kits for its tools," says Schleider. So in May, the Mahwah, N.J., firm announced a joint venture with Ikos Systems Inc. in Sunnyvale, Calif. Ikos got co-ownership of portions of Racal's VHDL simulation and architectural-synthesis technologies and Racal got co-ownership of Ikos's ASIC libraries and tool technology (see p. 18).

Finally, upstart Synopsys, based in Mountain View, Calif., purchased VHDL simulation capability from Zycad with the intent of tightly integrating the simulator with its ground-breaking logic-synthesis product. Thus the company will be able to participate in the market for top-down design by providing a VHDL simulation/logic synthesis package.

Besides the slow pace of getting solutions to market, EDA suppliers are simply not offering the kinds of top-down tools that have been preached about in technical seminars. "System-level design is not a new concept; it has been around for some time but no one has implemented it yet," says Daniel Gajski, a computer-science professor at the University of California in Irvine. "Designers design largely from the bottom up, and tool suppliers built tools to cater to this approach. Now there is so much investment that people are not willing to switch to a true top-down methodology."

One problem is defining "top." To most CAE vendors it means an electron-

IS GROWTH SLOWING?

IC LAYOUT

Revenue ($ Millions)	1989	1990	1991	1992
SOFTWARE	1,061	1,278	1,608	1,988
SERVICE	436	511	608	726
TOTAL	**1,497**	**1,789**	**2,216**	**2,714**
CAGR		19%	23%	23%

BOARD LAYOUT

SOFTWARE	313	344	410	486
SERVICE	197	201	227	260
TOTAL	**510**	**545**	**637**	**746**
CAGR		7%	17%	17%

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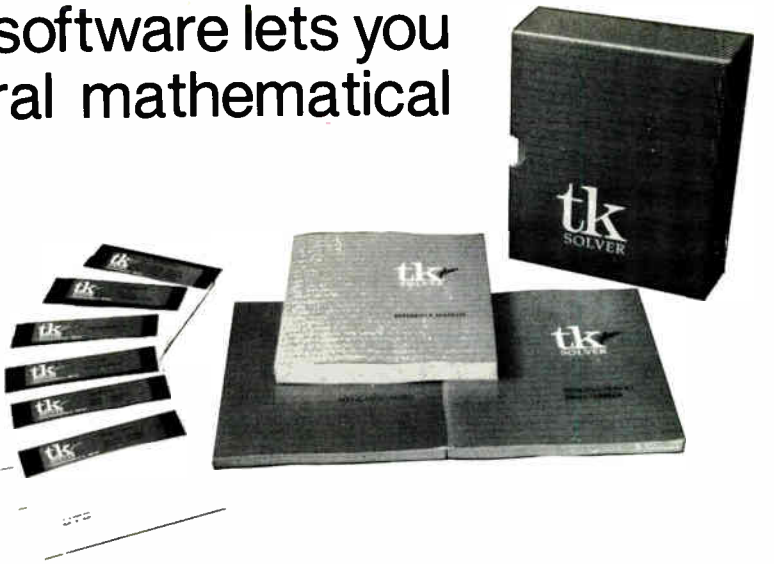

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ic circuit on a board or on a chip. But J.C. Browne, founder and chief scientist at Scientific and Engineering Software, believes "top" starts well above that level. In hardware design, he says, a team leader determines the system requirements, creates an architecture that meets them, and defines the behavior of the system elements built in this architecture. Then the design team creates the logic and gates that implement this behavioral description. There are five analogous steps in software design.

To simulate a system at the initial stage when hardware and software engineering teams are determining requirements and building an architecture, Browne's company offers the SES/Workbench. With it, a design group can describe a system such as a VLSI pipelined central processing unit at an architectural level. They create a model of the CPU and submodels of elements it contains: cache, instruction unit, pipeline, and so on. Next, using the Workbench language, they describe the behavior of models and associated submodels, and then simulate operation. Exactly the same analysis can be carried out for the software portion. SES plans to put in place a tool that will translate from Workbench to VHDL.

Elsewhere, what has been shipping as top-down solutions are tool sets such as Amadeus from Cadence. At its core is the Verilog simulator, which supports high-level design descriptions and performs multilevel simulations. Rapidsim from Valid, Quicksim II from Mentor, System HILO 4 from GenRad, and Cadat 2000 from Racal-Redac are competitive offerings.

Currently, the Department of Defense is requiring all its vendors to provide their system descriptions in VHDL. Thus, all CAE vendors will ultimately offer VHDL in addition to their proprietary high-level description languages. Even personal computer-based simulators are offering VHDL capability, as in Susie version 6.0 from Aldec Co. of Newbury Park, Calif.

But some customers say today's VHDL simulators are much too slow to be useful. Nick English, director of design systems at Harris Semiconductor in Melbourne, Fla., says his staff evaluated four commercially available units and found that all took two to three hours to perform a behavioral simulation of a 40,000-gate design. None could simulate the behavior of a multi-ASIC circuit board with 500,000-gate complexity, he says.

Indeed, "As design sizes and complexity increase and as designers begin to tackle the problem of simulating multiple ASICs in a system, the need for acceleration becomes imperative," says Pamela Mayer Bernal, vice president of marketing at Zycad. So in April, Zycad introduced its XP-140 Design Team Accelerator, which performs logic simulations for circuit designs of 256,000 to 1 million gates in complexity.

Acceleration also makes sense to Cadence. In May the company announced its own hardware accelerator, the XL-Processor, a pair of VME cards plugged into the back of a Sun compute server. The coprocessors work in unison with the Verilog simulator, which performs behavioral-level simulations while the coprocessors accelerate gate- and switch-level simulation, much like a math coprocessor in a PC. The system achieves a 15-times performance gain over software simulation on a workstation, says Prabu Goel, president of Cadence's Systems Division.

Another requirement for system-level design is models. If a design team expects to simulate a complete system, it needs accurate models of all standard components, such as microprocessors and the like. Logic Automation Inc. in Beaverton, Ore., has long offered a large number of software models. But hardware models are in demand for parts with no software versions. Logic Modeling Systems has stepped into the breach with two offerings, the LM-1200 and LM-500 hardware modelers. ❑

WHO NEEDS COMMERCIAL TOOLS?

Ten years ago, CAE vendors were preaching that the semiconductor industry should stop spending R&D dollars developing its own design tools and use commercially available products instead. Two chip makers that have ignored this advice—VLSI Technology Inc. of San Jose, Calif., and Cirrus Logic Inc. of Fremont, Calif.—have some interesting perspectives on flouting the conventional wisdom.

ASIC maker VLSI Technology recently spun out Compass Design Automation, the company's in-house EDA team, as a separate company. Inside VLSI Technology, the group developed a number of leading-edge products, including a data-path compiler, logic synthesizer, and a new product the company is calling an ASIC synthesizer.

Contrary to what the design-tool industry says, a chip maker like VLSI Technology must develop its own tools to suit its own design needs, says Taylor Scanlon, vice president of North American and Asia/Pacific Operations. "We have fabricated ASICs with 250,000 gates—that's over a million transistors—and they worked first time," he says. Tools able to achieve the density, performance, and power requirements an ASIC vendor must provide cannot be bought off the shelf, in Scanlon's view.

"In launching Compass, we will not compete with other CAE tool vendors," Scanlon says. "Our solution will be for the designer who needs to design a state-of-the-art chip."

Suhash Patil, chairman and executive vice president at Cirrus Logic, is a potential user of such a tool. However, Cirrus is another ASIC maker that has distinguished itself from its competitors through its own innovative design tools, developed internally.

Cirrus's SLA Design System consists of a proprietary simulator and back-end layout tools. "Our system has its own data structure that was designed to easily interface with other design tools," says Patil. "We need a high degree of timing-simulation accuracy to determine where a design fails. This capability is not available from commercial simulators." The back-end layout tools give Cirrus's system designers the ability to produce commercial-grade ICs without having to know chip layout. "This allows us to turn around high-quality ICs very fast," Patil says.

But quick turnaround is not the only consideration. Patil says the SLA tool ensures that the device is manufacturable as well. It also allows Cirrus to squeeze the most out of a given process technology. Getting this kind of competitive advantage out of commercial tools, which are available to every Tom, Dick, and Harry in the ASIC business, is not likely.—*J.McL.*

LOOK FOR AN END TO THE RECESSION BY AUTUMN

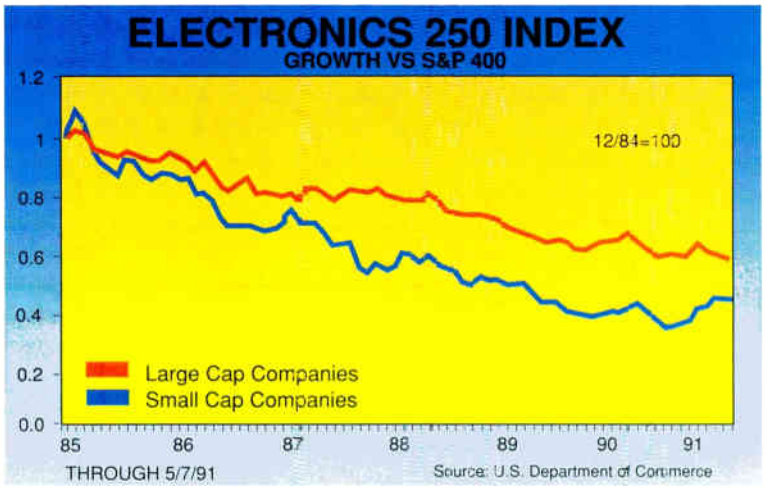
If industrial production stays flat for the next six months, the recession will bottom in September-October, allowing earnings to rise for the industrial sector in the first half of 1992. But for now, order patterns in April and early May offered little evidence that the recession has ended.

Meanwhile, the computer price war is the final page in the industry's transition to a normal capital-goods market. Even though demand for palmtop and laptop computers remains robust, the installed base of desktop PCs, minicomputers, and mainframes is underutilized due to lack of adequate software. So to maintain unit volume, manufacturers must offer improved performance at a significantly lower price. The recession has intensified this trend, and pricing wars are permanently lowering the customer's perception of what hardware should cost—not to mention vendors' profit margins.

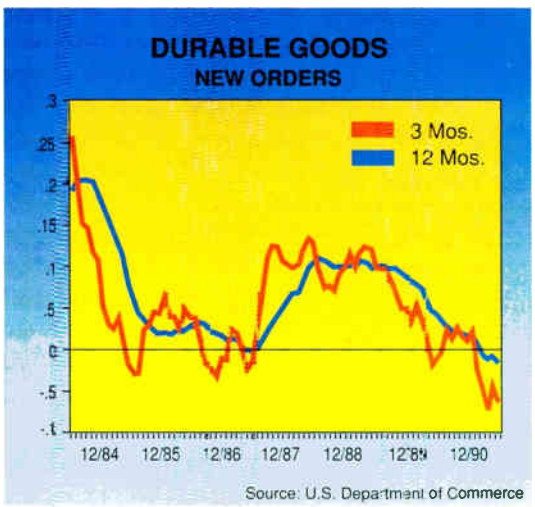
Component demand continues to hold up better than finished-goods categories, in line with normal seasonal inventory building. If the computer price war increases volume, look for improved component demand despite weaker revenues for computer manufacturers. Also, auto production is likely to remain weak at least through the third quarter.

Communications demand is being held down by the weakness in new business formations and slower capital-spending trends. The aerospace industry continues to work through the enormous backlogs accumulated over the past several years, but the depressed state of the commercial airline industry implies stretchouts of shipments continuing for at least the next several months. Defense demand may improve to replenish inventories depleted by the war, but overall trends suggest a flat demand for the forseeable future. ❑

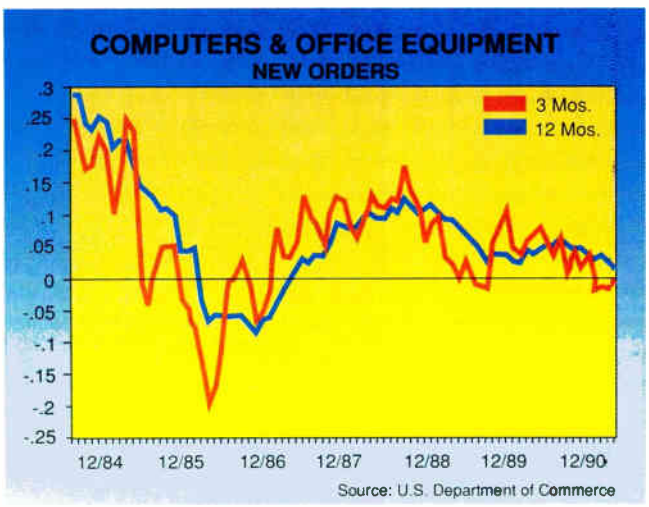
By Mark Parr, McDonald Securities Inc., Cleveland (216-443-2379)



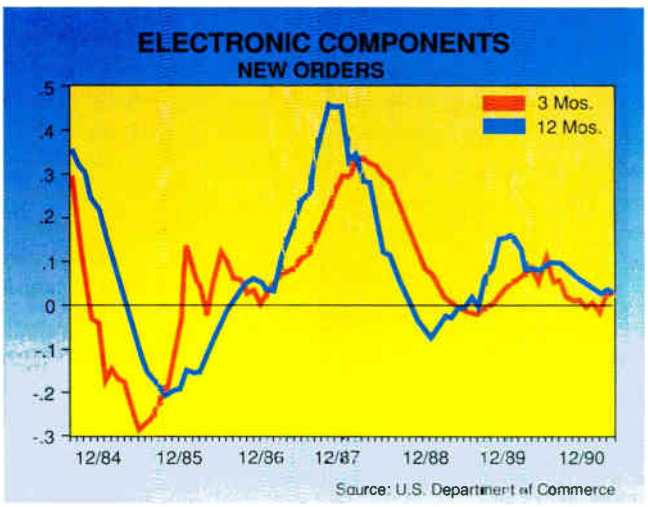
If the recession reaches its nadir this fall, as predicted, then look for earnings to turn up in the first half of 1992.



Demand for durable goods, as reflected in the order rate, continues to be weak.



With adequate software lacking, manufacturers must offer improved performance at a significantly lower price.



Demand for components is continuing to hold up, in line with normal seasonal inventory building.

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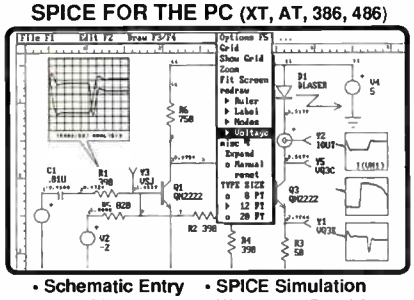

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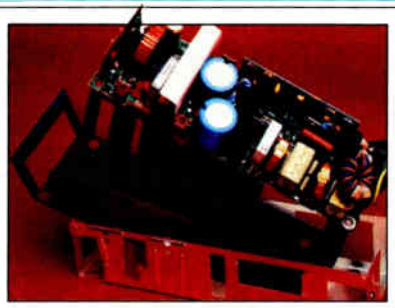

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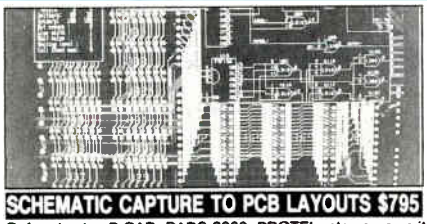

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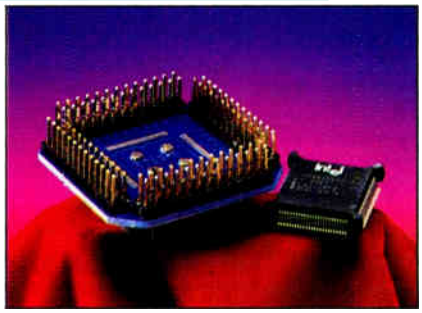

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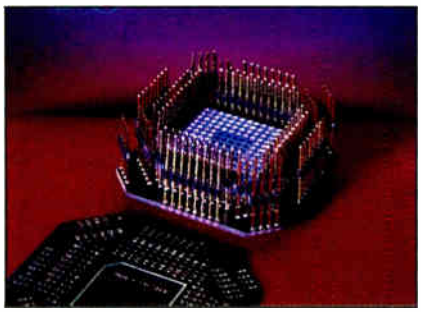

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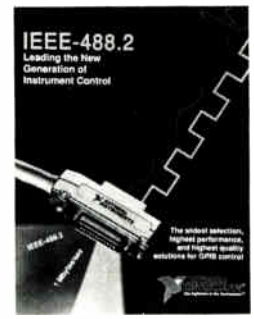

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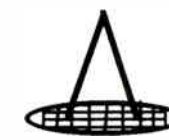

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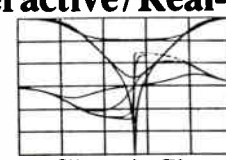

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2	22	42	62	82	102	122	142	162	182	202	222	242	262	282	302	322	807
3	23	43	63	83	103	123	143	163	183	203	223	243	263	283	303	323	808
4	24	44	64	84	104	124	144	164	184	204	224	244	264	284	304	324	809
5	25	45	65	85	105	125	145	165	185	205	225	245	265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

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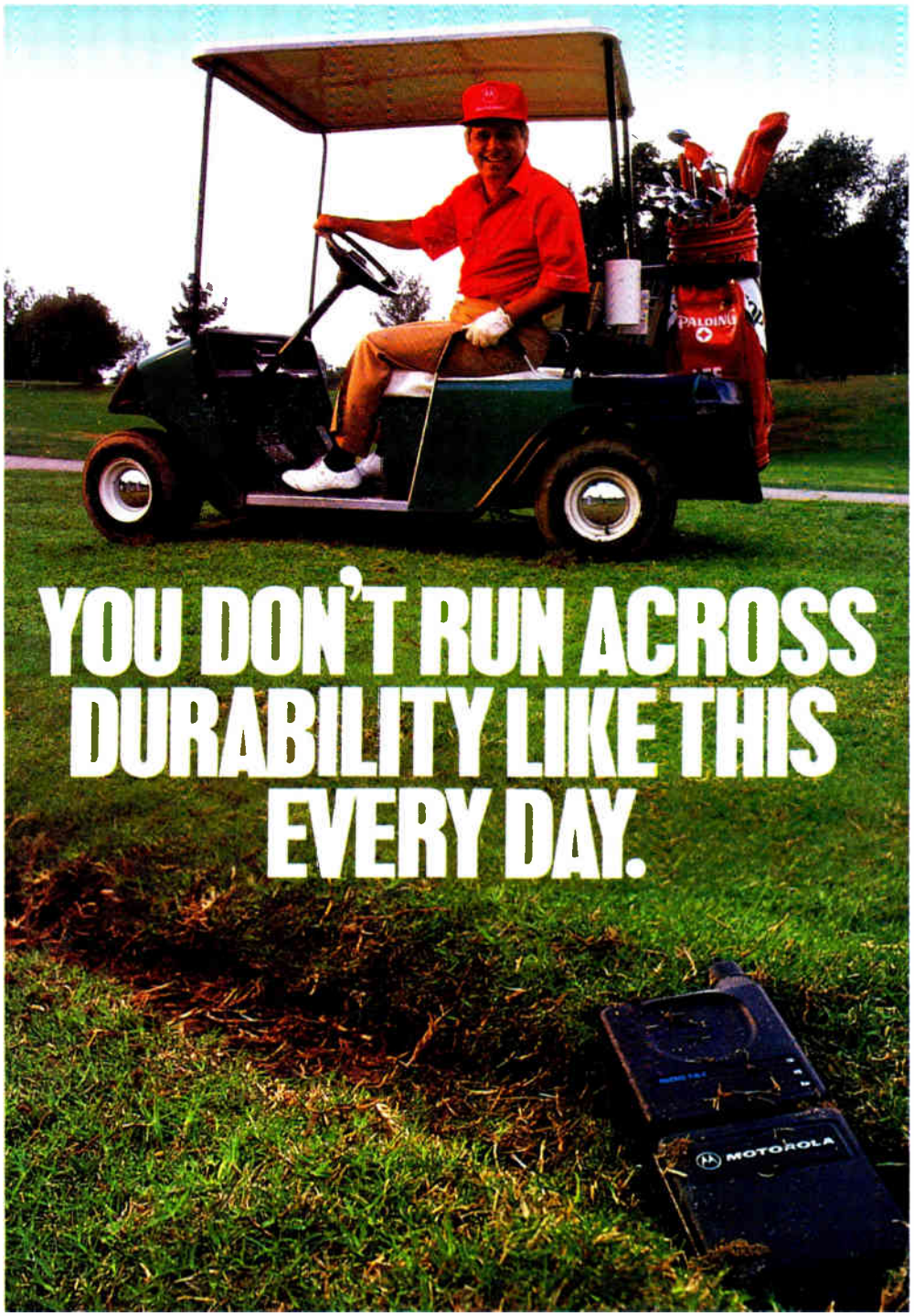

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