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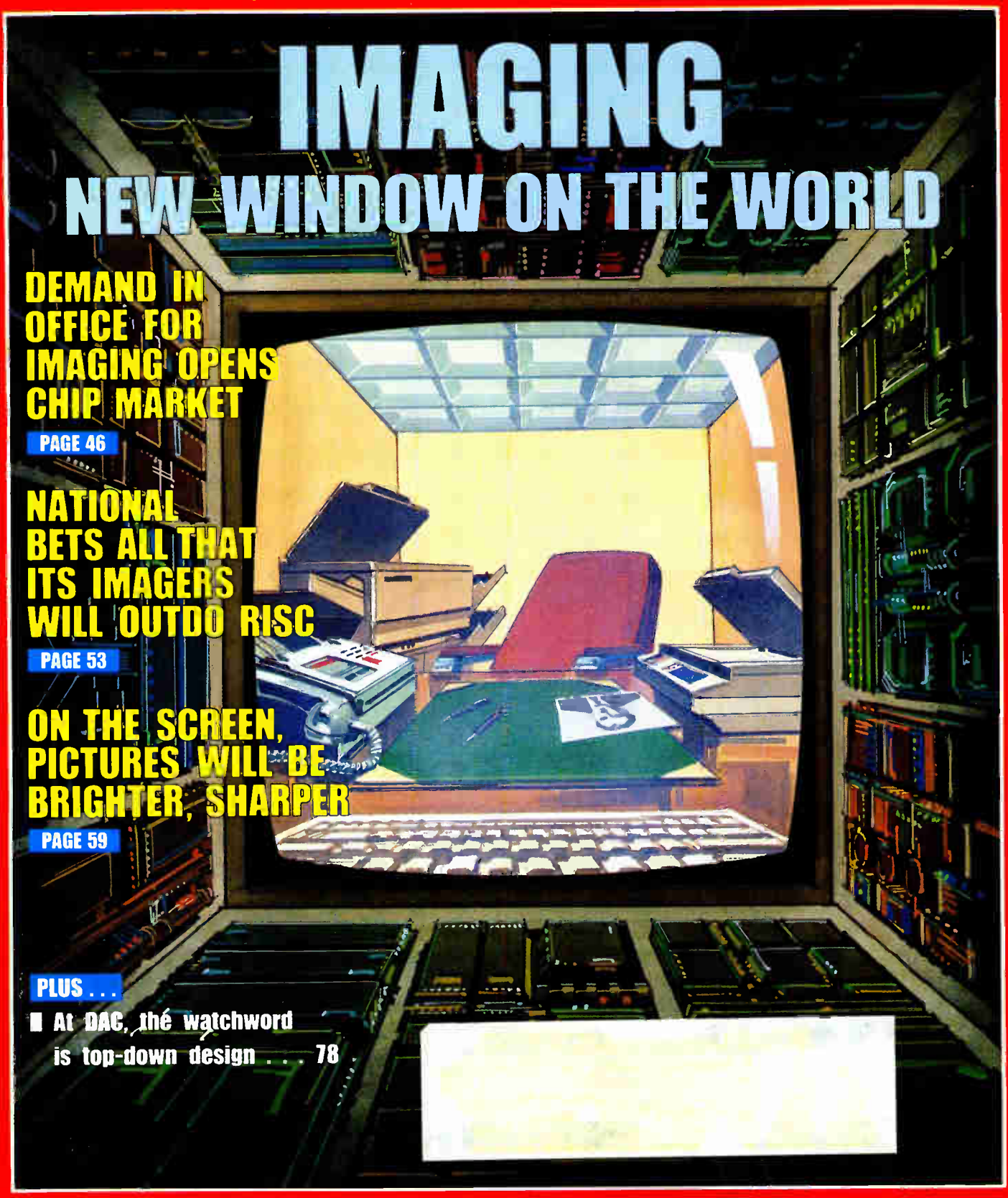
JUNE 1990

Electronics

FIRST MAGAZINE OF GLOBAL ELECTRONICS MANAGEMENT



IMAGING

NEW WINDOW ON THE WORLD

DEMAND IN OFFICE FOR IMAGING OPENS CHIP MARKET

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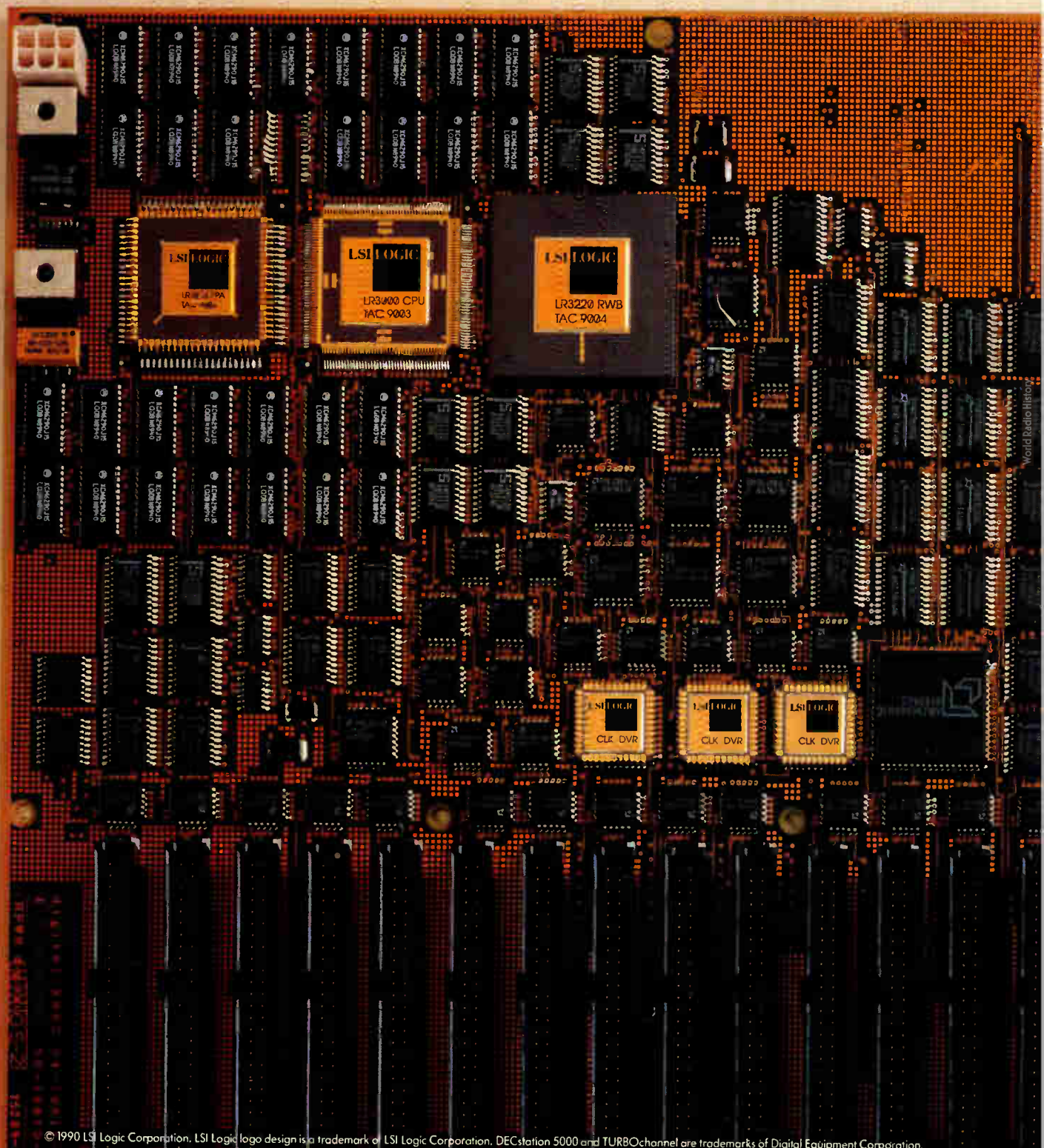

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Electronics

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CIRCLE 175

DARPA RIPPLES SPREAD

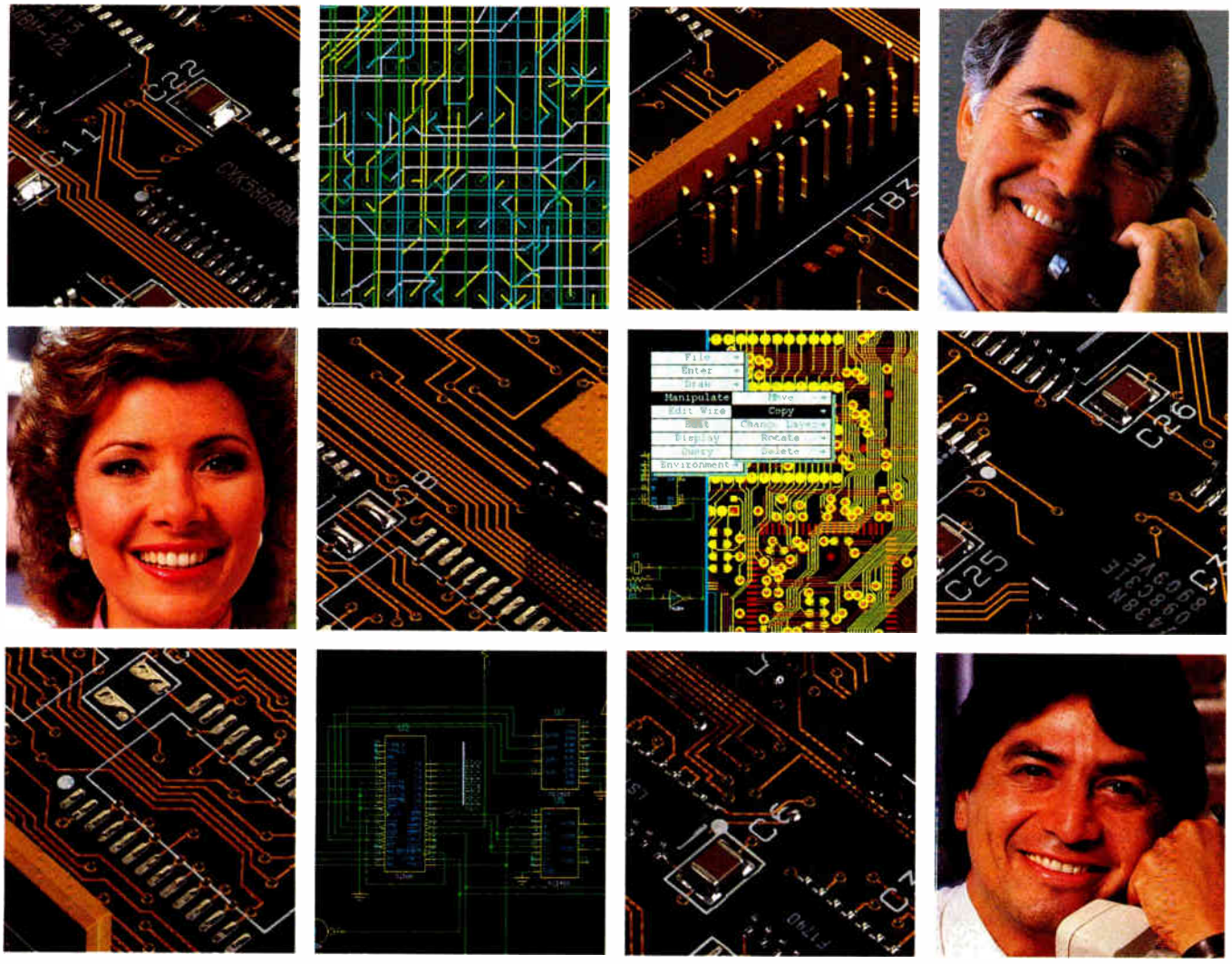
Recently, the Bush administration fired Craig Fields, the director of the Pentagon's Defense Advanced Research Projects Agency. Though not turned out on the street, Fields was given the much less significant job of studying the Department of Defense labs. Both Congress and the electronics industry saw Fields as the brightest light in the government. "His dismissal shows that the administration did not like what he was doing," says Richard Iverson, president of the American Electronics Association. Anyone with any political sense was given a clear, unmistakable message: taking risks can be hazardous to your career.

Under Fields, Darpa had become much more aggressive in its R&D investments than apparently was comfortable for the laissez-faire Bush administration. And what may have been the straw that broke Darpa's back was the $4 million it awarded Gazelle Microcircuits Inc. of Santa Clara, Calif., to develop 1-Gbit/s gallium arsenide data-communications chips and subsystems. By itself, a grant to Gazelle would have raised no eyebrows. But this one was different: it would make money for the government by allowing Darpa to receive a return on its investment, much like a venture capitalist. Though no one in the administration is saying so, this novel funding approach appears to be poison to the powers that be in the White House.

In its 30 years of existence, Darpa has always walked a thin line, moving much more quickly than other governmental agencies in supporting new, emerging technologies. It's been a staunch backer of the electronics industry, says Iverson, providing a multiplier on every investment it made: for each dollar Darpa plowed into research, another $10 was contributed by commercial investment. Darpa has nurtured technology to advance national security. But in the process, it has had far-reaching commercial import. MIPS Computer Systems, Silicon Graphics, and Sun Microsystems were outgrowths of Darpa-funded research. So was the concept of standard hardware platforms and operating systems. In recent years the organization has fostered parallel processing, and the commerical fallout included such companies as Convex and Sequent. Another cause dear to Darpa's heart is high-definition TV. And by default the agency has championed the renovation of the decimated domestic consumer electronics industry. Fields's departure brings all of this into question, and the industry now fears the loss of other government efforts, such as Sematech, says Iverson.

With the Republican administration turning a deaf ear, it remains for Congress, working with the U. S. industry, to take the initiative on industrial policy. *Electronics* applauds one such effort now under way. Called the Advanced Technology Program and administered by the Undersecretary of Technology in the Commerce Department, it has been given a modest $10 million to spend on emerging technologies, with another $30 million to come from industry. House bill HR4329, now pending, will expand the funding to $100 million in 1991, $200 million in 1992, and eventually up to $500 million annually. We suggest a letter to your congressman urging support for this legislation. E

JONAH McLEOD
EDITOR



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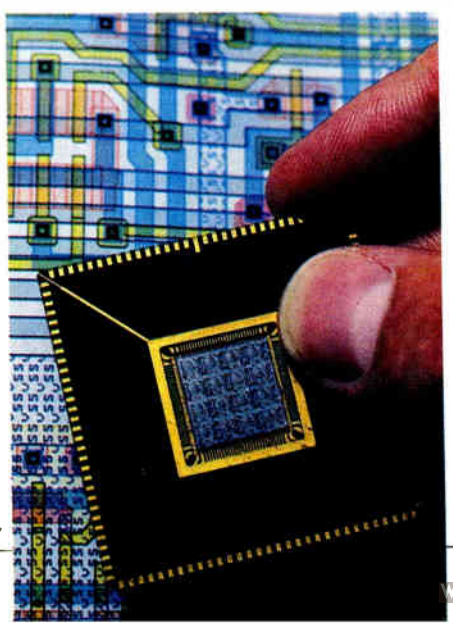

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LETTER FROM

THE PENTAGON

AS DEFENSE COSTS FACE THE AX, THE SCENARIOS FLY THICK AND FAST

HOW TO GET BY IN HARD TIMES

BY HOWARD WOLFF

THESE ARE NOT THE BEST of times for defense contractors. For many, the so-called peace dividend that is coming due as a result of the dismantling of the Soviet empire and the resulting decrease in arms investment by the U.S. and its allies means program cancellations and stretch-outs. The scenario today is in perpetual flux even as it plays itself out, with companies nervously trying to spot portents and trends.

The result is that all eyes are on northern Virginia, in the highway-crossed federal reserve just over the Potomac from Washington. That's where the Department of Defense's headquarters monolith, the Pentagon, hunkers down amid tract houses, apartments, and suburban greenery. The basic message from the Pentagon is that while there are going to be some losers, there also is room for a few smart winners.

That message was delivered at a spring conference of contractors convened by the Electronic Industries Association and featuring updates and pep talks from defense and company officials. The tone was set by one of the vendors, Malcolm R. Currie, chairman and chief executive officer of Hughes Aircraft Co. in Los Angeles, who examined both sides of the coin.

On one side, Currie sees a declining defense budget as the threat changes. Thus, he reasons, technology takes on greater importance as a means of delivering more capability for less cash. At the same time, he says, "we have strengthened the industrial capabilities of our allies" so that individual U.S. companies find themselves competing against foreign governments. Currie wants the industry and federal government together to "protect America's technology leadership." On the plus side, he says, "the U.S. defense industry is the best in the world, the Department of Defense is still a prime force in R&D and procurement, and the DOD will continue to develop large, complex systems."

Adding to the anxiety in the defense industry is a collection of nine arms-control negotiations ranging from discussions about a nuclear test-ban treaty and an open-skies aerial inspection accord to a ban on chemical weapons. "They all promise to come to fruition in the next year or two," says Assistant Secretary of State Richard A. Clarke, "and they will mean budget cuts."

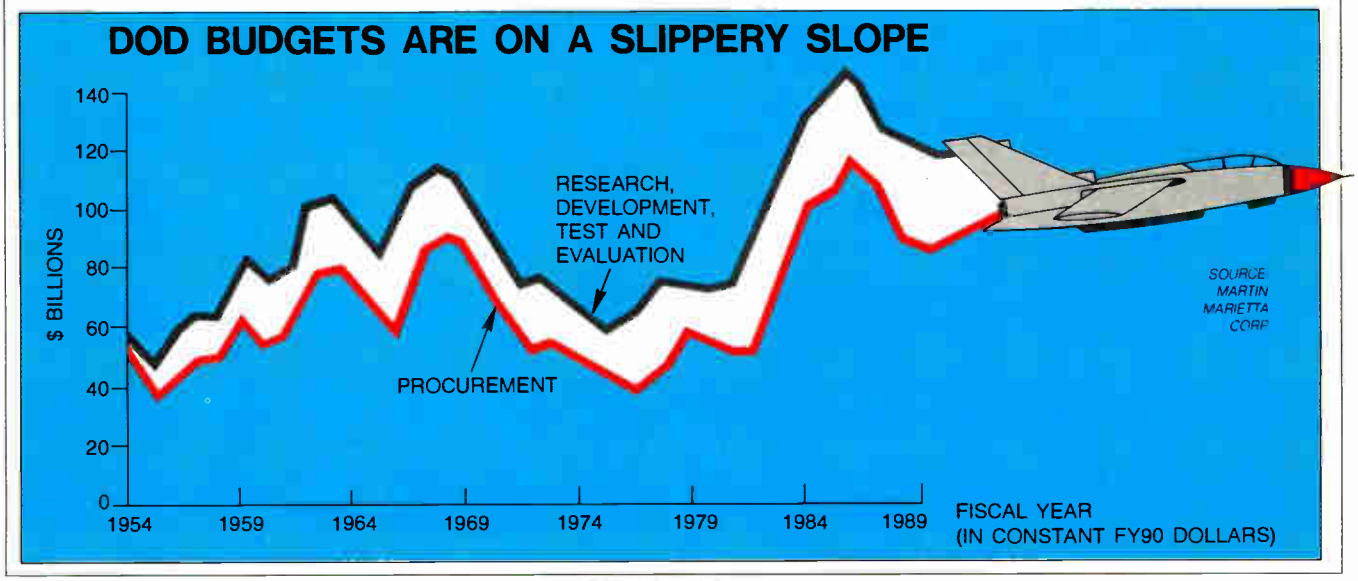
One possible result of all this contraction will be a concomitant shrinkage in the number of companies doing business with the government. That means mergers and acquisitions, a scenario put forth by Joseph F. Campbell Jr., a vice president at PaineWebber Research Inc. in New York. Campbell's watchwords for executives of companies that are hunting or being hunted:

- Be opportunistic.
- Be proactive.
- Be ready with a short list of companies that you could not live without or lose to competitors.
- Be aware of your ranking on other companies' lists.

Short of closing the doors, or becoming part of a merger, what is a company to do? "There are as many scenarios as there are analysts," notes James Tegnelia, vice president of Martin Marietta Corp. of Bethesda, Md.

Nevertheless, some of the advice from those close to or part of the establishment makes good sense. One of those insiders is Brig. Gen. Harold B. Adams, deputy director for force structure on the Joint Chiefs of Staff. Adams recommends that in scanning the list of opportunities, avoid programs that do not meet performance requirements of a newly straitened military. Also, he says, steer clear of high-cost programs; these are the ones that the budget-cutters' ax will find first.

Adams sees opportunities opening with the lean, mean armed forces of the future. The emphasis will be on



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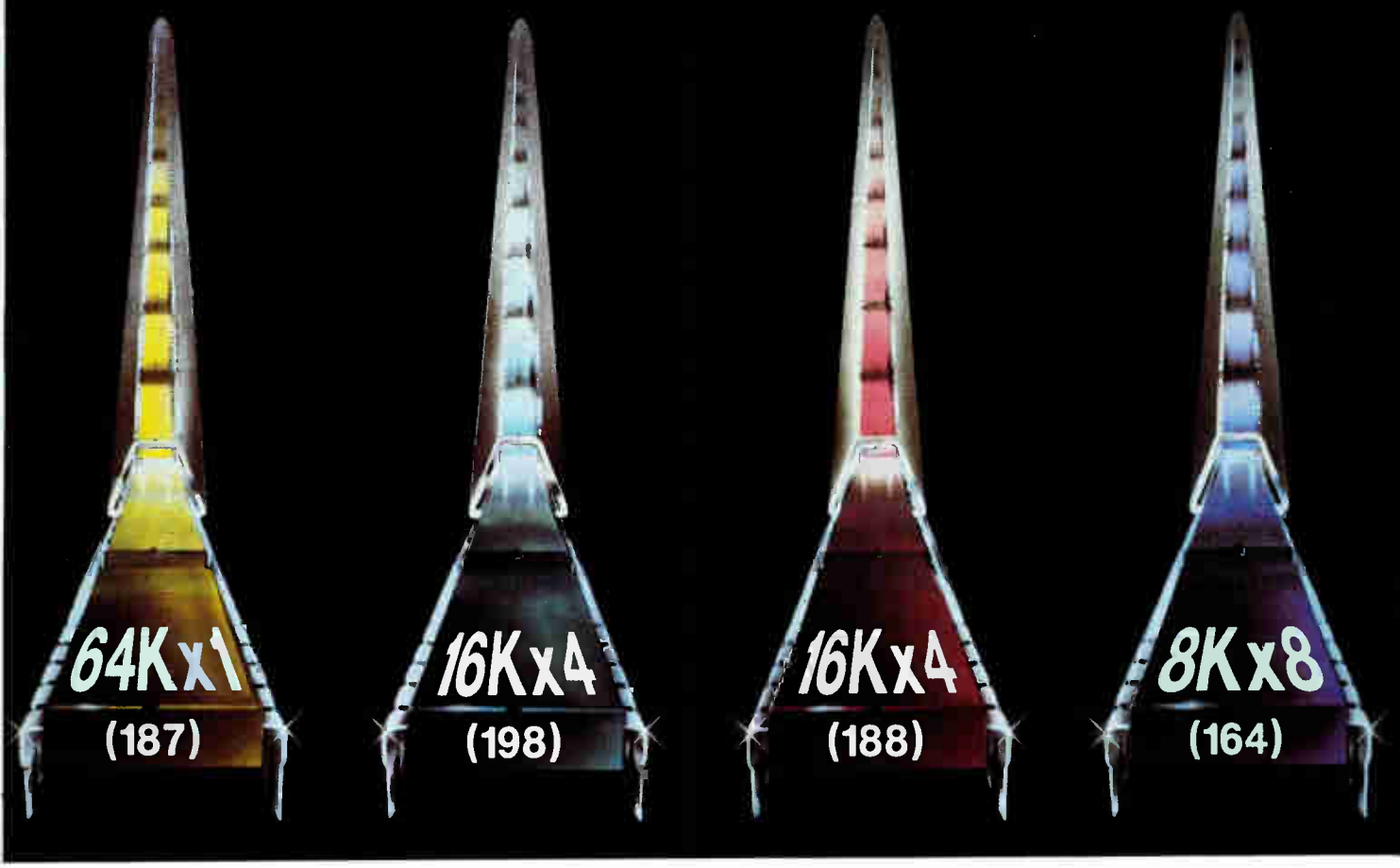

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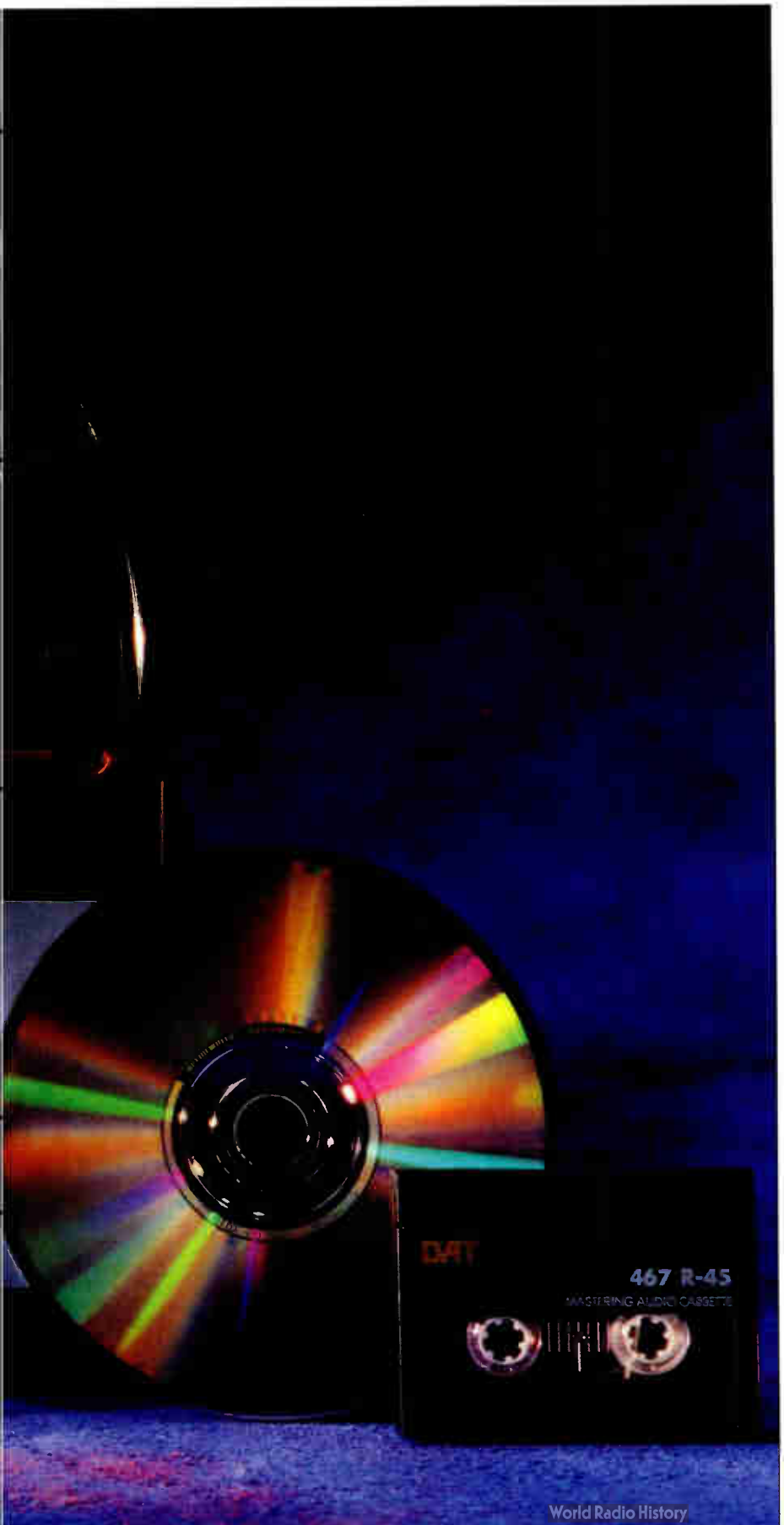
CIRCLE 186

What happens when the market

turns faster than your product?



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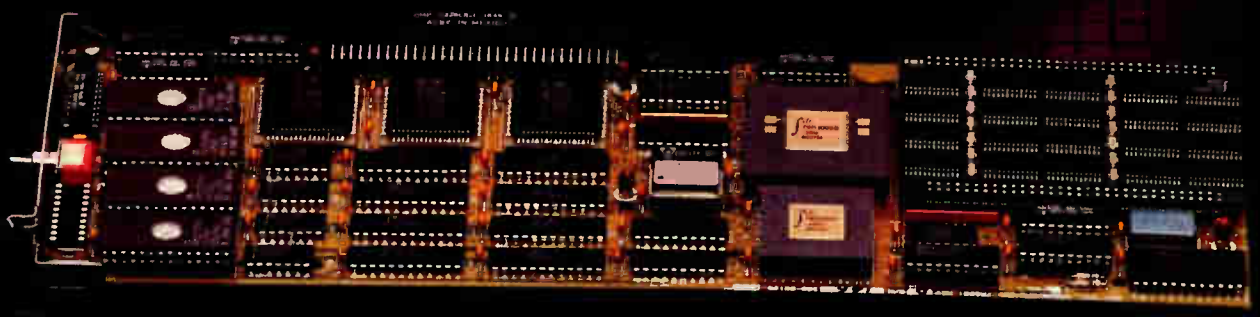
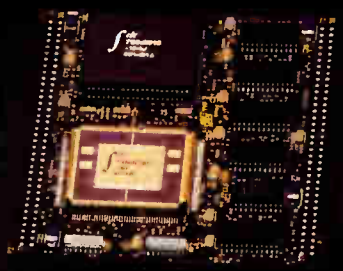
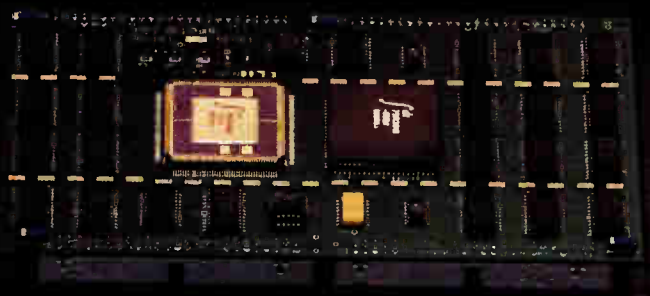


■ Development ■ Prototyping ■ Production





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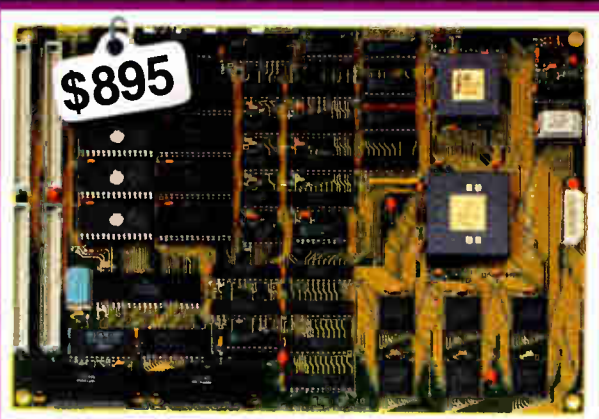

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AHIP
M-88A2 Improved Recovery Vehicle
Apache Helicopter
M-1 Tank
Non-Los Missile
Chaparral Missile
MK-19 Grenade Launcher
OV-1D ACFT Mod Program

Savings ($Millions)

Fiscal Year 1991	$1,982
Fiscal Years 1991-1994	$18,563

Navy/Marines

F-14D Aircraft
Phoenix Missile
Sea Lance ASW Weapon

Savings ($Millions)

Fiscal Year 1991	$156
Fiscal Years 1991-1994	$3,580

Total Savings ($Millions)

Fiscal Year 1991	$2,976
Fiscal Years 1991-1994	$28,267

Air Force

F-15E Aircraft
Maverick Missile
ASPJ
Combined Effects Munition
ASRAAM
Follow-On Wild Weasel
Airbase Survivability
Autonomous Precision-Guided Munition

Savings ($Millions)

Fiscal Year 1991	$838
Fiscal Years 1991-1994	$6,124

SOURCE: DEPARTMENT OF DEFENSE

mobility—that is, lighter equipment—sustainability, strategic defense, special operations capability, intelligence capability, extended-range weapons, and strong R&D.

Adhering to his one-man, one-scenario rule, Martin Marietta's Tegnelia has a set of solutions for the company facing a pinch. Pursue commercial diversification, he says, with dual-use technology. At the same time, he says, look into other government markets, among them space initiatives and drug interdiction. When it comes to R&D, says Tegnelia, do the work and "then put it on the shelf," so that when those fixed-price development contracts come along, you will be ready.

The idea of looking at civilian markets is strongly backed by Jacques S. Gansler, president of Analytic Sciences Corp. of Arlington, Va. "Competitiveness could be improved by a conscious DOD effort to integrate the military and commercial sectors," he says. "For the DOD, this would mean lower costs, increased competition, and a way to gain surge capability. For the commercial sector, it would mean government dollars and increased R&D skills."

To accomplish such a marriage, says Gansler, defense would have to be "less different." The Defense Department would have to move toward the civilian sector in three areas:

- The government should sponsor dual-use technology, not just fallout.
- Plants should be integrated.
- The government should use commercial specifications and standards, as well as buying practices.

As an example, Gansler says that in electronics, "the government pays 10 times the civilian cost and gets inferior product. Take the integrated circuits in a car: they're better than the mil specs, between two and 10 times cheaper [than military versions], five times faster to acquire, and more reliable. The DOD must make cost an engineering challenge and turn to concurrent engineering, with the process and the product being designed at the same time."

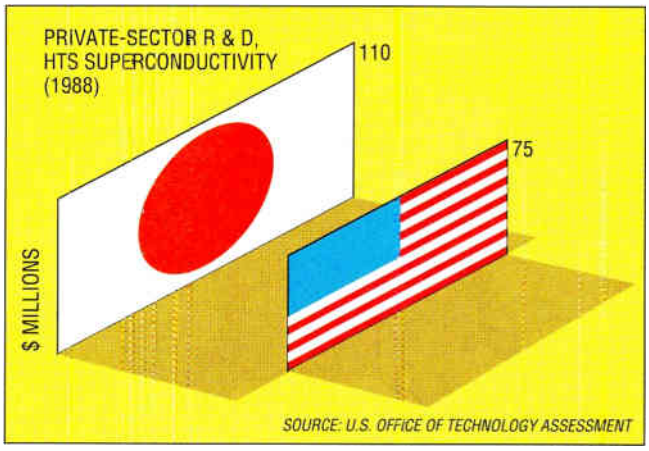
If nothing else, the sudden budget squeeze seems to have helped the electronics industry get the government's attention and appreciation. Officials are unanimous in espousing their dedication to maintaining a strong electronics industry, even promising to press for eased export restrictions [*Electronics*, May 1990, p. 23].

As Assistant Secretary of State Clarke puts it, "The State Department will remove mindless impediments in the licensing process—the Center for Defense Trade has increased its licensing rate by 64%." Also, says Clarke, "We will get items off the munitions control list to make it clear and close to the international list." And the State Department will be more active in approving and promoting defense exports. "Where the U. S. approves, the U. S. will promote," he says.

Clarke provides a final bit of advice about where business will be found: "There is clearly money to be made in inspection technologies [for conforming to provisions of arms-control treaties]. The on-site inspection agency could become one of the largest." E

SUPERCONDUCTOR R&D LAGS, SAYS OTA

Still another voice in Washington is calling for the investment community to take a long-term perspective regarding research and development. This time the technology at risk is high-temperature superconductivity, and the voice is that of a report from the congressional Office of Technology Assessment.



The OTA found that while the U. S. government provided more money—$130 million in 1989—for high-temperature superconductivity research than any other country, Japan was providing the most from private sources. Japanese companies invested $110 million in HTS research in 1988, compared with $75 million for U. S. companies, and Japan's investment in low-temperature superconductivity research was three times that of the U. S. If the U. S. does not shape up, "we will turn into the perennial loser in the high-tech marketplace," says Rep. Robert Torricelli, chairman of the House Transportation, Aviation, and Materials Subcommittee.

WEST GERMAN FIBER CABLE-TV CONTRACT GOES TO RAYNET

A U. S. company has nabbed a $14 million contract to install a fiber-optic cable-TV system in rural West Germany. That nation's Ministry for Post and Telecommunications (the Bundespost) last month chose Raynet Corp. of Menlo Park, Calif., to install the turnkey optical system in the area of Lippetal, providing cable to some 4,500 rural subscribers.

Raynet will begin setting up the system—which will offer 36 broadband AM video channels, 30 FM audio channels, and 16 digital-audio channels—in the fall of next year. "It will help to serve the German households in rural areas that until now were denied CATV because of the high cost of copper-based systems," says Edward Davis, president and CEO of Raynet. A fiber-optic solution is more reliable than coaxial cable in supporting high-frequency cable-TV transmissions over long distances, he says.

Raynet has also mounted a trial in Cologne of a combined CATV and telephone fiber-optic system, again under the auspices of the Bundespost. The trial system is now entering service.

IBM BUYS A STAKE IN NO. 2 CAD-TOOLS VENDOR, VALID LOGIC...

IBM Corp. is doing its part to keep the computer-aided-design tools business competitive. Big Blue's agreement last month to take an $11 million preferred-stock equity stake in Valid Logic Systems Inc. weighs in as a big plus for the San Jose, Calif., CAD-tool vendor's long-term stability.

The price, which is bounded on both the up side and the down side, was to be finalized May 30.

The investment in Valid will also speed the delivery of design tools for IBM's RISC System/6000 workstations [*Electronics*, April 1990, p. 32], says Edward Kfoury, president of IBM's Industrial Sector Division, Kingston, N. Y. Valid has scheduled delivery of its tools for the second half of this year.

Depending on Valid's performance in marketing its tools on the System/6000, IBM could invest up to an additional $90 million by the end of 1994. Since these opportunities to purchase are seen as a means of raising investment capital, they are at Valid's option. The initial investment will be in the vicinity of 5% to 8% of Valid's stock, and IBM has the option to buy up to 5% more this year.

Market-research house Dataquest Inc. ranks Valid No. 2 after Mentor Graphics Corp. in design automation for total hardware and software sales. Valid posted $174 million in revenues in 1989.

...AS HP GETS SET TO MARKET MENTOR'S BOARD-TEST PRODUCTS

Late this year, Hewlett-Packard Co., Palo Alto, Calif., will begin selling design and analysis software for board testing from Mentor Graphics Corp., Beaverton, Ore.

Under terms of a marketing agreement between the two firms announced last month, HP will integrate future entries in its HP 307X series of board-test systems with Mentor products and resell them.

Included are Mentor's Design Station (actually an HP-Apollo workstation) and two software programs: QuickFault, a deterministic fault simulator, and QuickGrade, a high-speed fault grader.

Both software packages are aimed at the increasing need to design and test board-level products concurrently. For customers that do not perform simulation during design or those that have no access to the design team—as in depot repair centers—HP will offer a test package that includes model libraries and Mentor's Schematic Generator, which provides schematic synthesis from net lists.

Pricing, delivery, and product descriptions for all the HP-Mentor software packages are expected to come late this year.

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

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

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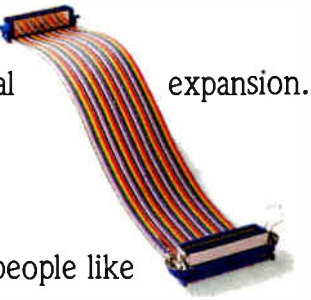
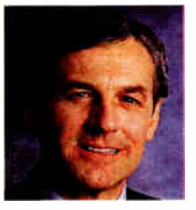
Multi-National Account Executive

Some big names in electronics are  making big plans for global  expansion.

But even the international date line can't stop Amphenol people like Antonia, Donna and  Dennis from speaking your language when it comes to on-time delivery and zero defects. Now Amphenol has  new facilities in Scotland, Mexico, Spain, and  soon in Thailand, Korea and Australia. 

In most cases, we're right next door to major customers. So no matter how far away you go,  people like Efrain and Normand won't be  far away. That's what makes us a world class connector  manufacturer, and second to none when it comes to customer service.

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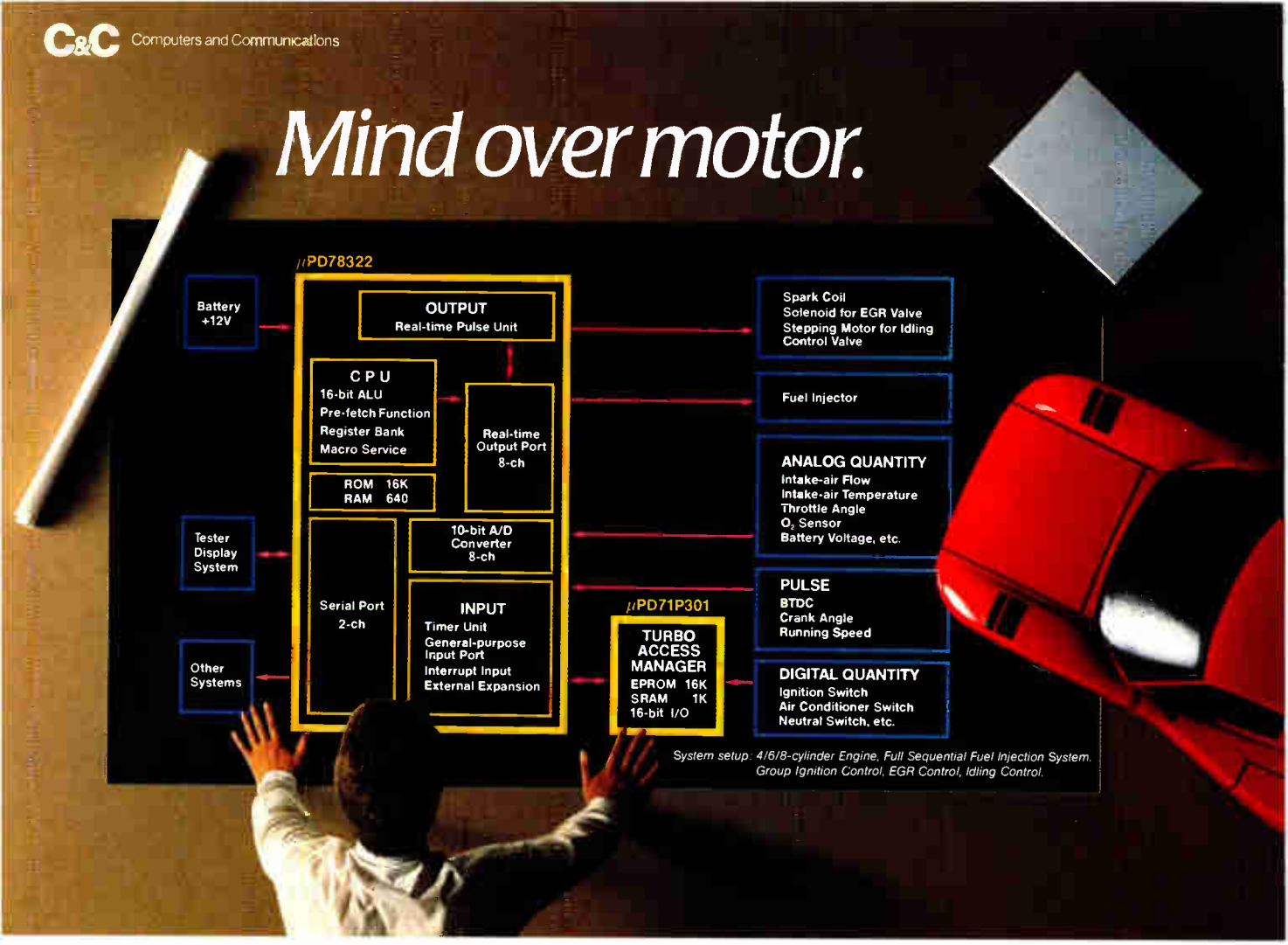

New 16-bit microcontroller offers integrated electronic control for the engines of the 90's.

New cars need smart engines to pull away from the pack in the 90's. The intelligent solution is integrated electronic engine control.

NEC's new 16-bit microcontroller (8-bit external) gives you higher speed, more memory and improved interrupt handling. That translates into better fuel economy, more horsepower and cleaner exhaust for your engine.

Turbo speed and lots of memory.

The μPD78322 runs fast. Minimum instruction cycle is 250ns with 8MHz system clock. You also get faster access to more memory. We provide 16k-byte ROM and 640-byte RAM on-chip.

And an exclusive Turbo Access Manager (TAM) lets you access 16k-byte EPROM and 1k-byte SRAM with all the speed of on-chip memories.

Enhanced interrupt response.

For fast, efficient interrupt handling, the μPD78322 is in a class by itself. It offers two exclusive hardware features that reduce CPU overhead:

☐ Macro Service speeds data transfer between memory and a special function register. No software intervention required.

☐ Context Switching automatically selects a new register bank for each interrupt request and saves current register contents without additional software.

Precise real-time control.

The μPD78322 delivers optimum timing control with its real-time pulse unit, consisting of an 18/16-bit free-running timer, a 16-bit timer/event counter and multiple registers. An 8-channel real-time output port is provided for per-bit set/reset.

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CIRCLE 235

NEC

CAE Technology Report

Vol. 2, No. 6 June 1990

DAC Conference Will Be the Largest Display of Design Tools

The 27th DAC Conference (June 24-27, Orlando, Florida) will be the biggest showdown of design automation tools. To get good and timely press coverage, most of the vendors have preannounced their products in April, 1990. Vantage Analysis Systems, Inc. announced version 2.0 of its Design Spreadsheet which has doubled its speed. Cadence Design Systems, Inc. announced their VHDL-XL simulator, claiming three to ten times greater speed than other simulators. Valid Logic Systems, Inc. introduced RapidSim for high resolution submicron simulation. Performance was the main theme in most of the announcements.

Will Concurrent Design Tools Dominate the EDA Industry?

At the top of the news is Mentor Graphics, Inc.'s announcement of Concurrent Design Environment Release 8.0 which allows for concurrent design and simulation, doing away with lengthy batch compilations. Concurrent design is not new. It was first introduced by ALDEC, Inc., which holds several key patents on this technology. However, for the first time concurrent design has been confirmed by the industry leader, forcing other CAE vendors either to follow suit or play a secondary role. The entire project took 2 years and 75 million dollars. Very seldom a clear industry leader innovates to such an extent as did Mentor. However, their vision may pay back with even stronger market dominance within the next few years.

Who Will Gain Most From Mentor's Announcement?

The PC-based CAE vendors have already been reselling concurrent design tools for over a year. Almost all of them have standardized on the real-time *SUSIE™ simulator which allows concurrent design changes and simulation (ALDEC: 805-499-9105). Since Mentor's move confirms viability of this technology, it helps P-CAD, Racal-Redac, CAD Software and many other resellers of SUSIE to better compete for the market share. With the new power of 386 and 486 PCs, the price/performance of their tools is superior to workstation-based products, and this can make a major difference, particularly in a tight economy. **CIRCLE 101**

Is ALDEC a Dark Horse of DAC Conference?

In response to the rumors about Mentor's Release 8.0, the six-year-old ALDEC has incorporated into its new SUSIE 6.0 some of the most advanced features like software acceleration that speeds logic simulation by orders of magnitude. ALDEC claims that simulators without a software accelerator will soon be considered dinosaurs and will eventually disappear. The new VHDL-based SUSIE 6.0 to be announced at the DAC show (Booth 3808) handles unlimited design size, provides automatic design error reporting and is expected to be vastly superior to other products. With Mentor's endorsement of the underlying technology and strong support from its OEMs, the low cost-high performance SUSIE may dominate many segments of the market. **CIRCLE 102**

VHDL Source Code for IC Models Are Free

To stimulate the IC model development, ALDEC has decided to release the VHDL source code of its key IC libraries. This will allow designers to learn and write their own IC models more efficiently. The source codes will be available by third quarter, 1990 from ITEX Corp (805-499-6860) which licenses ALDEC VHDL tools. **CIRCLE 105**

*SUSIE is a trademark of ALDEC, Inc. **(805) 499-9105; FAX (805) 498-7945** .

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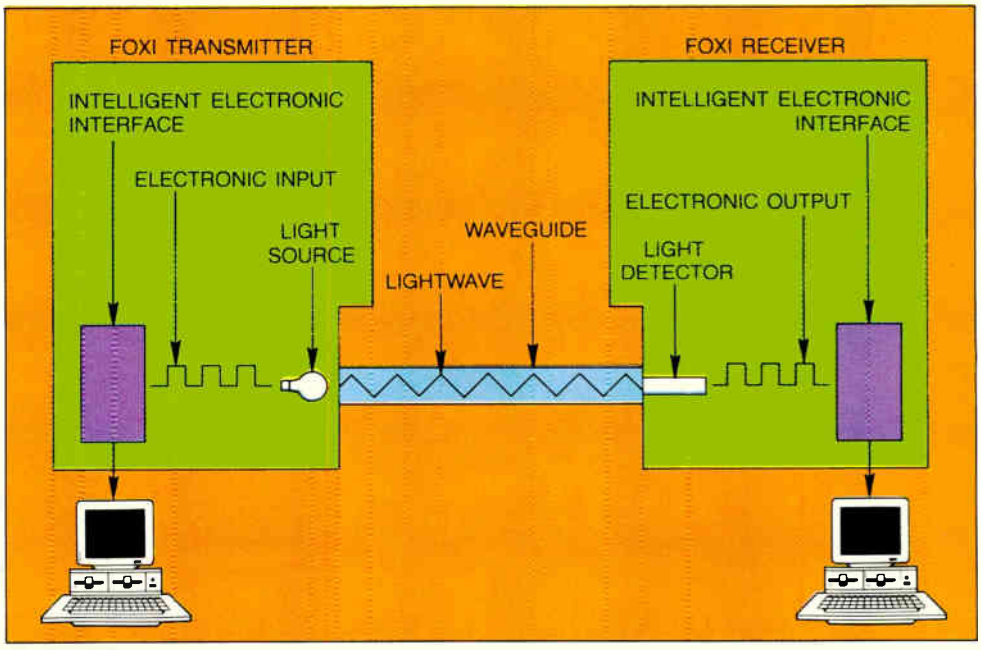
AMD SIMPLIFIES OPTICAL LAN DESIGN

A 125-MHz transmitter/receiver chip set from Advanced Micro Devices Inc. promises to speed the adoption of optics-based networks such as the Fiber Distributed Data Interface by eliminating many technical problems associated with optical connections.

The FOXI chips convert light to electronic data and vice versa using a 1,300-nm light-emitting diode. They occupy about the same board space as a 28-pin IC and are about 30% less expensive than electronic and optical components packaged separately.

Available now, the Sunnyvale, Calif., company's Am79h1068/69 set is priced at $295 in 1,000-unit lots.



The FOXI chip set simplifies optical connections in local-area networks, but promises to be just as useful in telecom private-branch exchanges.

READY SYSTEMS EXPANDS THE LIMITS OF REAL-TIME SOLUTIONS ON PCs

The migration of IBM Corp. personal computers into real-time, embedded-processor markets such as industrial control and communications will be speeded by the latest release of Ready Systems Corp.'s VRTX32 real-time operating system.

The biggest advantage that VRTX-PC/386 offers is its ability to let developers write programs of up to 4 Gbytes. Until now, the 640-Kbyte limit of standard DOS was a major impediment to developers of real-time software. The Sunnyvale, Calif., company enlarged the memory space available simply by supporting the protected mode of Intel Corp.'s 80386 microprocessor.

As its name implies, VRTX-PC386 runs on 80386-based computers. It lets the user develop real-time software using DOS-based development software. Once the application is ready, it can run under VRTX. To make software development easier, VRTX includes a windowing environment and debugger that can run in a window.

VRTX-PC386 is available now for $9,880 for the first license. Substantial discounts kick in for extra development and run-time licenses.

MOTOROLA REVS ITS 'MEDIA ENGINE' DSP

Motorola Inc. has targeted multimedia computing as a primary market for its 96002 "Media-Engine" digital-signal processing chip. The 32-bit floating-point DSP packs enough power to create full-color graphics and stereo sound simultaneously, says the Austin, Texas, company. A dual-port device, it is designed for multiprocessor systems. Multiple 90002s can supplement microprocessors such as Motorola's 68040 or Intel Corp.'s 80486.

Capable of full-motion video compression, the 96002 also addresses the knotty problem of debugging DSP software. Debugging can be accomplished with the help of an on-chip emulation facility. Called OnCe, this is a silicon module that lets engineers look at the registers, memory locations, buses, and the last five instructions executed. It eliminates the need for traditional high-speed, multiconnector cabling to an external emulator to the target system.

Samples of the 90002 are available for $750.

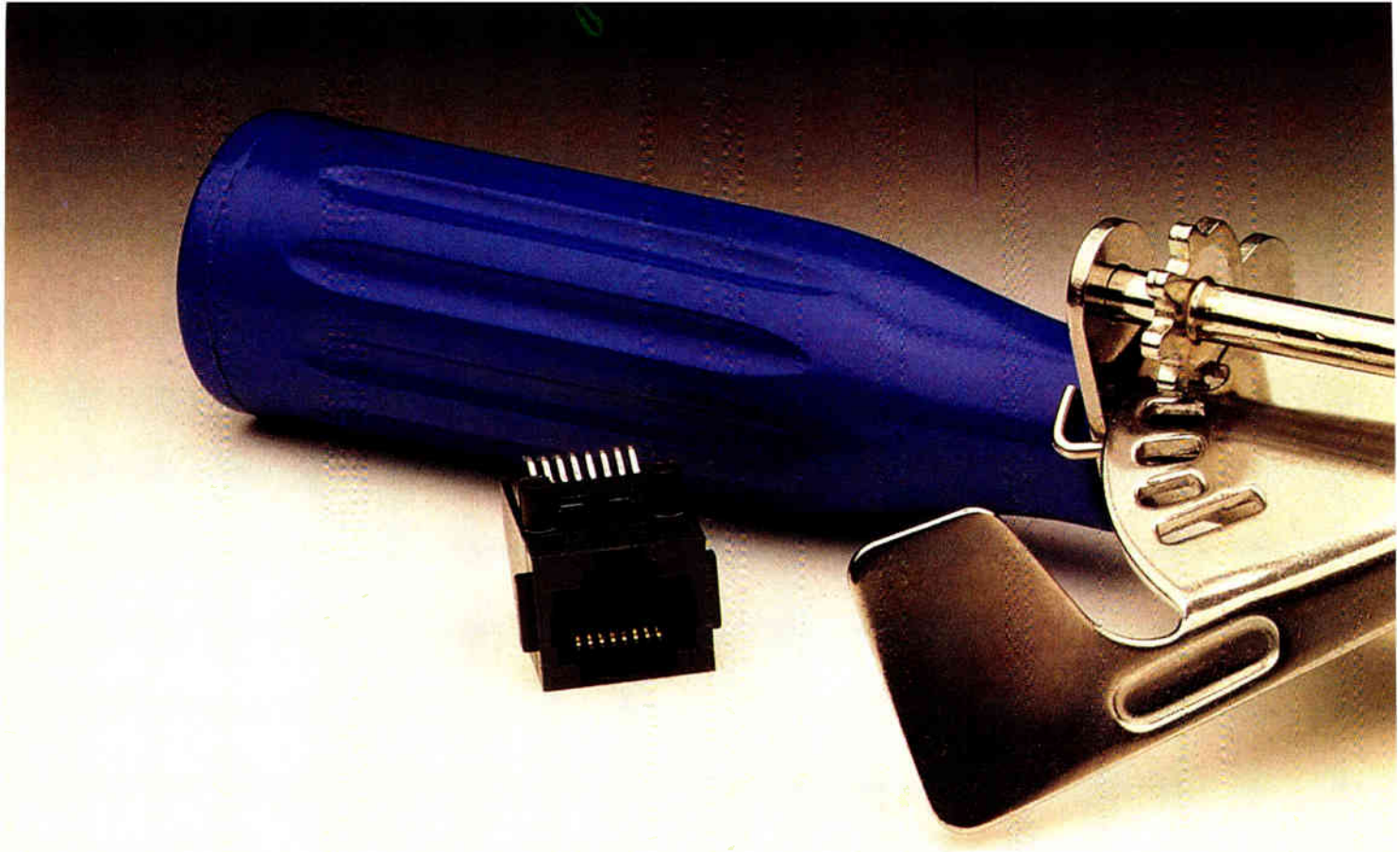
ETHERNET-MONITORING CONSOLE INTEGRATES COMPLETE SOLUTION

The ProbeView console for monitoring Ethernet networks is Hewlett-Packard Co.'s answer to customer requests for more simplicity.

The HP 4993 ProbeView is a fully configured workstation that taps into a LAN using the HP LanProbe segment monitor and analyzes traffic with HP's ProbeView software. Formerly, customers had to configure their own systems for this function.

The LanProbe monitor simply attaches to an Ethernet segment and monitors the traffic. Data can be transferred over an RS-232-C port—or over a modem for remote monitoring—to the ProbeView Console.

Unit pricing for the entire package is $25,750.



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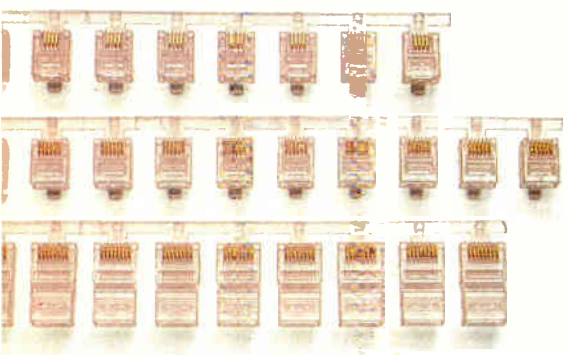

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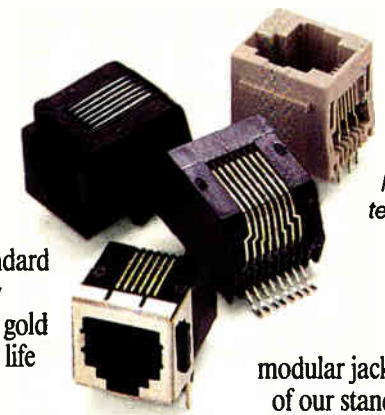

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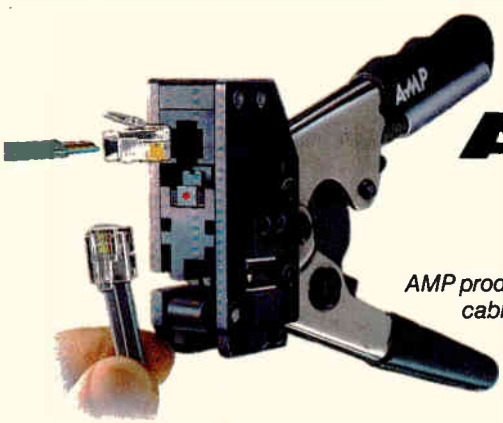

AMP production hand tool cuts cable, strips cable jacket, and mass terminates loose-piece plugs.

AMP Interconnecting ideas

CIRCLE 173

NATIONAL INSTRUMENTS SQUEEZES A HARD-DISK PC INTO VXI SLOT

Leading the new line of National Instruments Corp. embedded PC-compatible VXI controllers is the VXIpc-386, the industry's first complete 386 PC/AT in a one-slot C-size package. Also available is a two-slot version of the 386 PC/AT that includes a floppy disk and additional hard-disk options, and the VXIpc-030, a 68030-based controller fully compatible with Apple Computer Inc.'s Macintosh line.

The computers exercise direct control of VXI registers, memory, and triggers. They use slim hard drives from JVC Corp. that conform to the 0.75-in. height requirements of VXI. Only 20- and 40-Mbyte versions are available now, but JVC plans to have an 80-Mbyte version later this year and a 200-Mbyte unit within a year, National says.

The VXIpc-386 starts at $9,000; the VXIpc-030 starts at $14,800 and includes National's LabView software. E

HERE'S AN ISDN TERMINAL ADAPTER THAT HANDLES MULTITASKING

A joint product development that teamed Natural Microsystems Corp. and NCR Corp. has yielded an integrated services digital network terminal adapter enabling personal computers running under Microsoft Corp.'s OS/2 to accommodate simultaneous voice and data.

Using advanced telecommunications software, the PC-AT-compatible adapter is a board that connects a standard telephone and PC to the ISDN. The unit permits PC users who have access to an ISDN line and an OS/2 multitasking operating system to manage different aspects of voice and data calls via screen windows while running other application programs in the foreground.

Although ISDN will not be widely available until the mid-1990s, devices such as terminal adapters will let users access ISDN-like services being offered by the telcos.

NCR prices its PCTA board at $1,695 and its ISDN Voice Data Manager application software at $195. The Dayton, Ohio, firm will begin shipping this month.

Natural Microsystems, a Natick, Mass., firm specializing in voice technology for computers, will sell the unit through original-equipment manufacturers beginning late this year. Prices have not yet been set. The adapter supports the 2500 phone-set standard, transmission of screen images during a conversation, call merging, and incoming call identification, as well as customized voice mail. E

THIS RAM-DAC VIDEO IC FEATURES LOW-POWER MODE

A random-access memory, digital-to-analog converter chip from International Microelectronic Products Inc. boasts a standby mode that cuts power consumption to one-tenth that of the competition's standby power.

Aimed at laptop computers, the IMP41C171L has three 6-bit DACs for controlling the mix of red, green, and blue on the computer display. It can display up to 262,144 colors. Its 80-MHz pixel rate means it can change color combinations 80 million times/s. In 1,000-unit quantities, the chip is priced at $5.73 each. The IMP41c171A version, which does not have a standby mode, costs $4.98 in 1,000-unit purchases. E

WEITEK CUTS PRINTER-CONTROLLER COSTS WITH A PAGE-PROCESSOR IC

Boards for page-printer controllers that use advanced page-description languages such as Adobe Systems Inc.'s PostScript will be faster and less expensive using Weitek Corp.'s XL-8220, claims the Sunnyvale, Calif., company.

Nicknamed the HyperScript Processor, the XL-8220 runs at 16 or 25 MHz. By integrating a dynamic random-access memory controller, a code cache, interlock queues, printer registers, and printer control logic on-chip, the XL-8220 allows designers to save about one-third the space normally used on a page-printer controller board such as Apple Computer Inc.'s LaserWriter IINTX.

A controller based on the XL-8220 provides up to eight times the PostScript processing performance of existing boards, Weitek says. The chip is built around Weitek's 32-bit RISC architecture, which executes more than one instruction per cycle.

Available now in samples, it will sell in volume during the third quarter for $99 each in the 16-MHz version and $149 each at 25-MHz. E

COMMODORE NETWORKS MULTIMEDIA

Commodore Business Machines Inc. hopes to crack the business personal computer market in a big way by leveraging its head start in multimedia computing.

Its new Amiga 3000 handles the hardware performance challenge very nicely with a Motorola 68030 microprocessor, a true 32-bit architecture, and the West Chester, Pa., company's proprietary gate arrays to handle audio and video. Software includes a multitasking operating system and AmigaVision, an easy-to-use multimedia authoring system. Commodore is also addressing its primary current shortcoming with networking products.

The Amiga 3000's pricing is aggressive, starting at $3,299 retail for a 16-MHz version. E

The design tool *ISS* uses to design its design tools

At ISS we base our IC design system on a radical concept. We listen to our customers.

What we heard from customers like you helped us create an IC environment for people who make their living using CAD systems. The result was IC design tools to solve your toughest design challenges, including **Layout, DRCs, PG fracturing,** and **Plotting.**

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We listened to your ideas about user interface. With our X-window support, you can configure the user environment to your own style. Our open system accepts EDIF-standard schematics, and our C Programming Interface allows easy access to our database.

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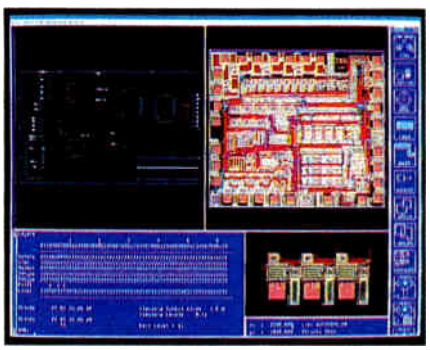
We listened to our competition, too. We've tested our design system side-by-side with competitors' in real engineering environments and our products outperformed them in speed, ease-of-use and functionality. At a lower price.

Now that we've listened to you, why not listen to us? **Try our IC CAD tools free for 30 days** – Install them on the workstation of your choice, or visit our sales offices for a demonstration. And see for yourself how well we listen.



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CIRCLE 185

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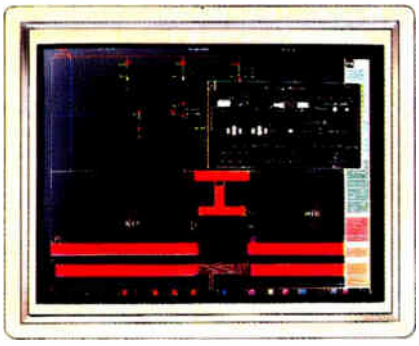

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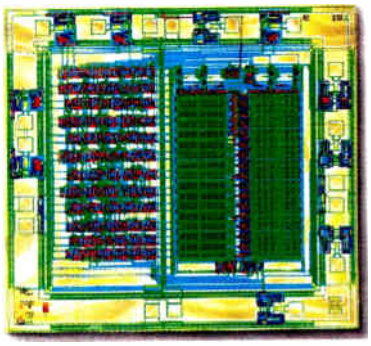

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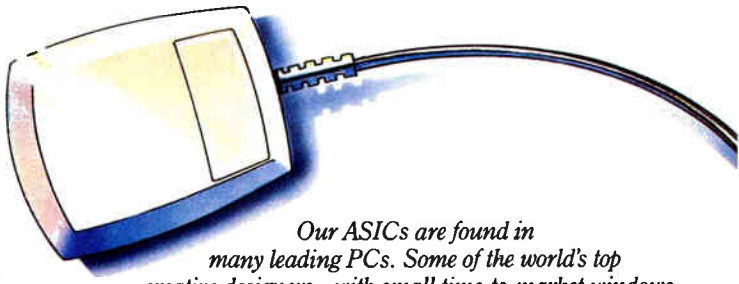

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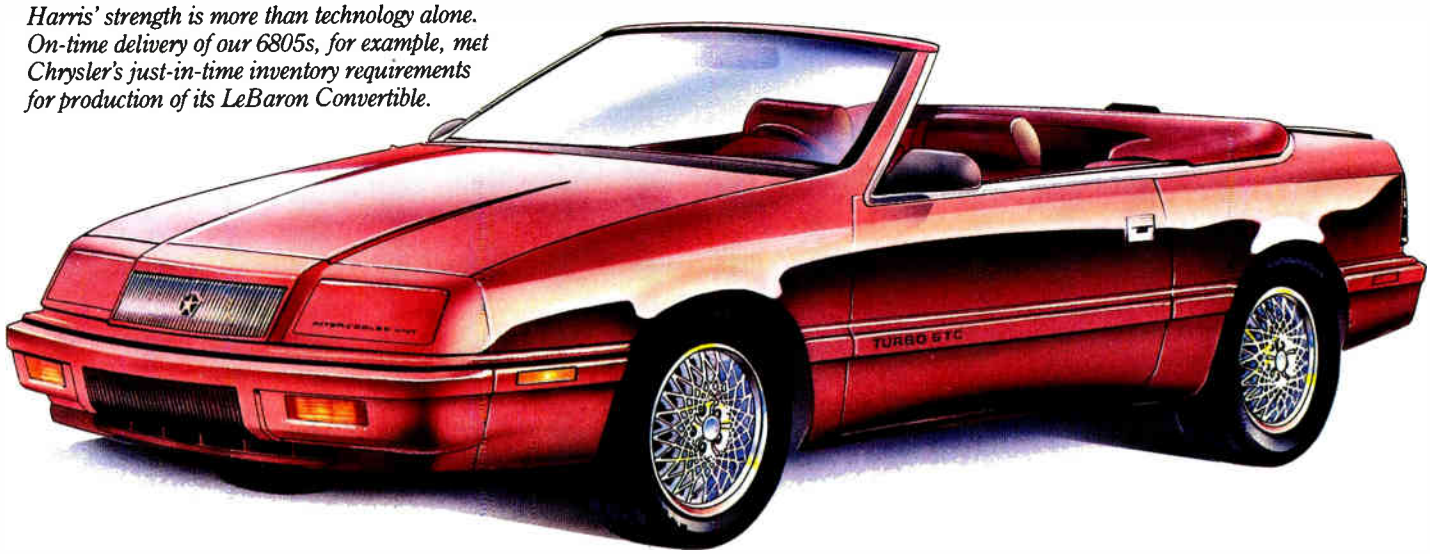

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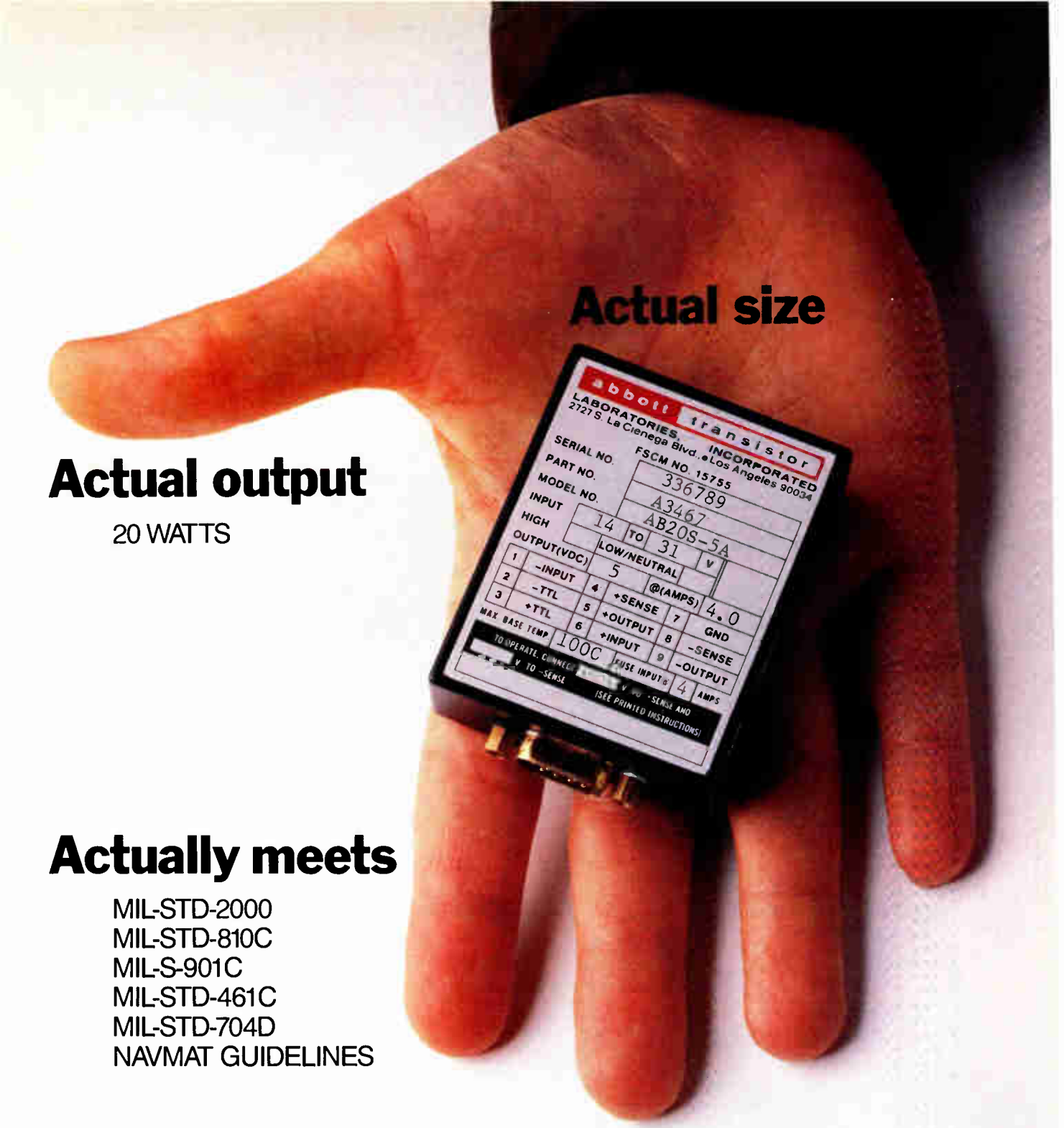
CIRCLE 177



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CIRCLE 208

CONGRESSIONAL INITIATIVES FLY FAST AND FURIOUS, BUT THEY MAY NOT BE ENOUGH

THE CASH CRUNCH

BY JACK SHANDLE

THE SCARCITY, HIGH COST, and impatience of investment dollars in the U. S. must be reaching crisis proportions, because Congress is abuzz with legislative hearings addressing the problem from any number of directions. Legislation alone may not be enough, however.

Since seed capital for research and development programs is particularly scarce, Sen. John Glenn (D., Ohio) has proposed a bill to create a civilian counterpart to the Defense Advanced Research Projects Agency. Hearings before the Subcommittee on Trade and Technology are scheduled to begin June 12.

Antitrust laws have been identified by numerous industry groups, including the American Electronics Association, as inhibiting capital funding because they keep competing companies from sharing risk by forming manufacturing consortia. On that issue, hearings on a bill to extend the National Cooperative Research Act to cover production ended in April. The bill, introduced by Rep. Jack Brooks (D., Texas), was expected to be voted on by the House in late May. A companion bill in the Senate sponsored by Sen. Patrick Leahy (D., Vt.) is still wending its way through the process.

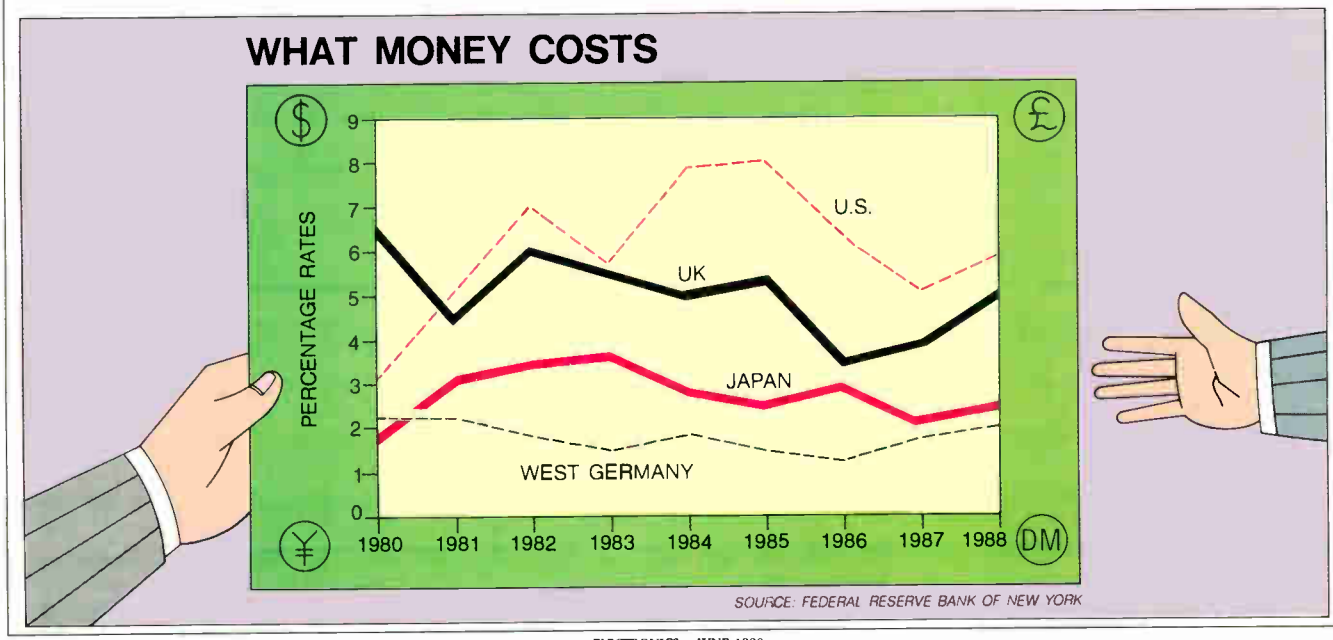
Brooks's bill "removes some of the chilling effects that antitrust laws have on joint ventures, particularly the liability to treble damages," says Maryann Karinch, spokeswoman for the Computer and Business Equipment Manufacturers Association. Although manufacturing joint ventures are legal now, they run the risk of a suit filed by a private party claiming the venture is anticompetitive. If the venture loses, it stands to be fined three times the amount of its profits.

The bill offers antitrust protection to the public by requiring that a prospective joint venture notify the Justice Department of its intent and provide details on its business plans. Although the Justice Department reviews the proposal to determine if it would be anticompetitive, there is no formal certification. Nevertheless, after passing a Justice Department review, the consortium is no longer haunted by the specter of treble damages.

Although it is generally accepted that legislation such as Glenn's "civilian Darpa" bill and Brooks's bill has a role to play, many observers think that changes in tax policy and the internal operations of corporate America offer the best chance of a long-range solution. The real, after-tax interest rate of investment capital in the U. S. was almost 6% in 1988, compared with 2% in Japan and West Germany, according to the Federal Reserve Bank of New York.

AT A RECENT AEA-SPONsored meeting on the cost of capital, Robert Glauber, Undersecretary of Finance for the U. S. Treasury, pointed out that pension funds should be a good source of investment capital that does not dart about the market following the latest quarterly reports. Pension funds that do not have a lot of churn, in fact, have historically outperformed those that do, he says.

The funds have not been patient in recent years, he says, but that situation could be solved by cooler heads on the board of directors. "We have to make the board of directors a more effective means of corporate governance," he says. One way would be to have the corporation's pension-fund manager represented on the board of



SOURCE: FEDERAL RESERVE BANK OF NEW YORK

directors. Glauber acknowledges, however, that the government is not doing all it can to keep capital costs under control. Referring to aspects of the tax law such as the capital-gains tax, Glauber says that "it makes no sense to have a taxation system that makes it much more attractive to finance with debt instead of equity, but it would be expensive [for the government] to change that."

Reforming the financial services industry is another policy direction that would "make money available on better terms," he says. A Treasury Department report on the deposit industry will be completed soon, and proposed reform legislation will follow. "This will be a major focus in 1991," he says.

Prospects for legislation this year that would affect the cost of capital are not as bleak as in the past. Rep. William Frenzel (R., Minn.) of the House Ways and Means Committee thinks that the R&D tax credit, which has been burdened by year-to-year extension in recent years, will probably be enacted for more than one year. "It has support and can be passed; it can be funded and should be no problem if there is a comprehensive fiscal bill," he says. Similarly, a favorable revision in the capital-gains tax has majorities supporting it in both houses. But "since the President seems to want it, there is a feeling that Congress should extract something from the administration of it," says Frenzel.

Despite the recent sacking of Darpa chief Craig Fields (see p. 4), Frenzel believes that the agency is still a viable source of R&D funding. "What has gone before is not in jeopardy," he says, "but what will be considered add-ons will be difficult to achieve."

The overriding problem with legislating taxes today—whether it be something as perfunctory as the R&D tax credit or as far-reaching as reducing the capital-gains tax—lies in the budget deficit. "Prior to 1981," says Frenzel, "we drew up tax bills on what we thought was real tax policy. Since 1981 [the year of rapid deficit growth], the tax laws have been driven almost solely by the budget problem."

"There have to be outside forces working on members of Congress to accept a deficit-reduction package," says Jim Jones, chairman of the American Stock Exchange in New York.

At the same time, Jones acknowledges that the politically charged atmosphere surrounding the budget dilemma must be dampened. The same lobbying effort that calls on the members to vote on deficit reduction must also lobby the leadership in each party "to hold each other harmless politically—to hash it out away from the TV cameras."

An economic summit is certain to take place, says Frenzel. "The question is whether it will be soon enough. If we don't have some sort of resolution this year, we will have another two- or three-year wait, because we will then be into presidential politics."

TELECOM

A NEW INTERNATIONAL ARM UNDERSCORES THE PUSH TO BECOME A MAJOR TELECOM FORCE

SPRINT GOES GLOBAL

BY PETER FLETCHER

WITH A NEWFOUND AGgression, US Sprint is setting out to become one of the largest telecommunications network operators in the world. Already, parent United Telecommunications Corp. of Kansas City, Mo., provides local telephone services in 19 U. S. states. Now its new international arm, International Sprint Corp., is organizing a series of joint ventures and other deals to recoup major investments Sprint made in building global networks over the last four years—investments that almost broke the company under the ownership of GTE Corp., from which United Telecom purchased a majority share in 1988.

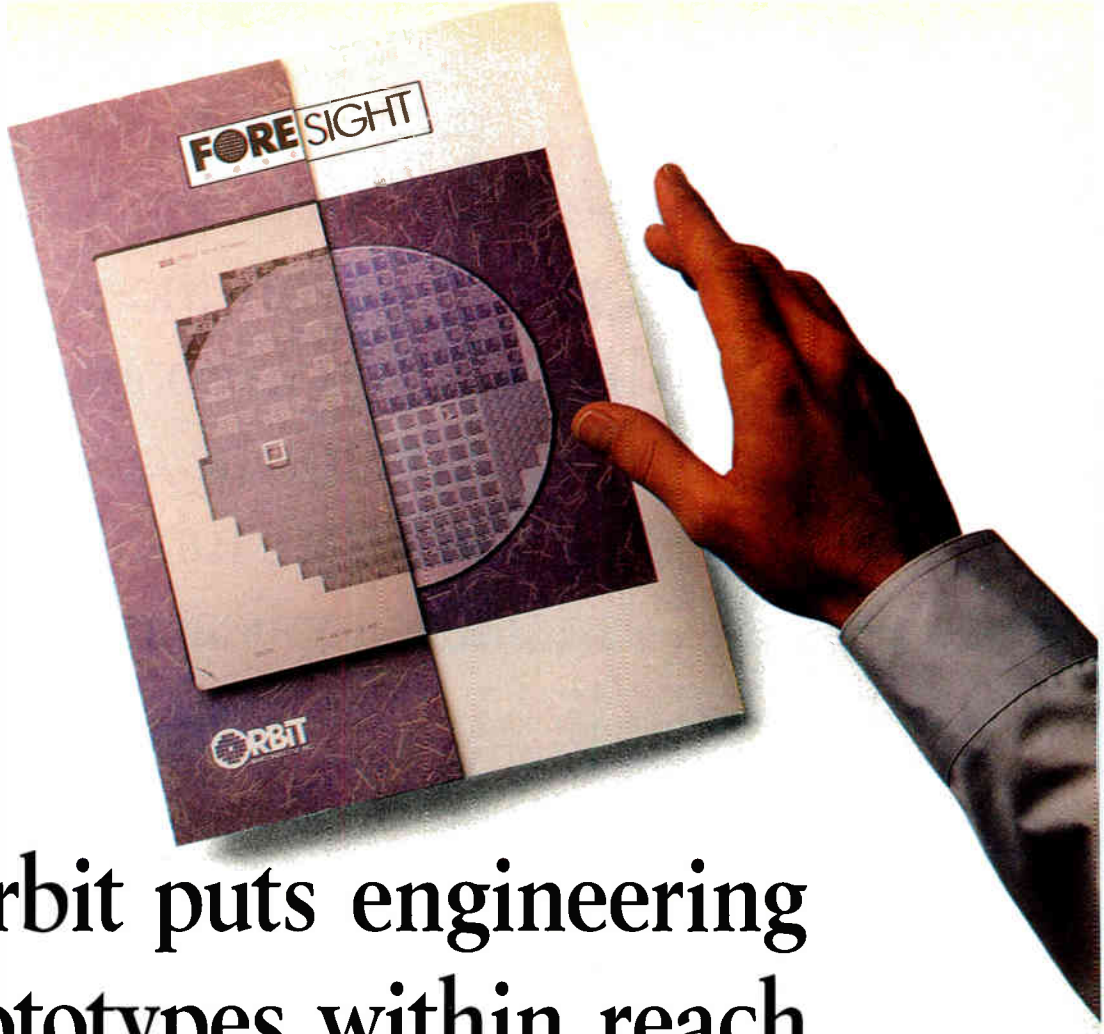
International Sprint, headquartered in Reston, Va., was formed in January from a combination of US Sprint's International Voice Division and Telenet Corp. of Reston. Together, that duo boasts part ownership in the transatlantic PTAT-1 underseas optical-fiber cable, direct-dial voice services to 156 countries, packet-switched data links to 94 international locations, and video-conference services to 680 locations in 25 nations, says Chris Rooney, vice president for operations. This gives the company an estimated 9% share of all international telecommunications traffic originating in the U. S., Rooney claims.

Rooney's objective is to establish International Sprint as a major carrier of international voice, data, and video communications traffic. Rooney is aiming at creating a "seamless" global network with continuous 64-Kbit/s connections. He says that in the U. S., Sprint currently has 23,000 miles of fiber-optic cable in service. Add that to the 4,600-mile PTAT-1 transatlantic fiber cable that Sprint owns jointly with the UK's Cable & Wireless plc, and the planned Pacific and Sea East Asia undersea cables that Sprint is to partner, and Rooney claims to have the world all but encircled—and total traffic capacity about half that of AT&T Co.

Now Rooney needs to find customers to make it all pay for itself. First off, he has set his sights on Eastern European ventures and on winning a major share of European international traffic revenues that he estimates will add up to $5 billion a year by 1995. His first move is to consolidate Sprint's European activities with the formation of a new Northern Europe Division, based in London, to complement existing South and Central Europe arms. "Within 18 months, all three divisions are likely to be merged into one," Rooney says.

FOR SPRINT'S BRIDGEhead in East Europe, Rooney has signed preliminary agreements with two Soviet organizations—the Central Telegraph Agency of the Soviet Ministry of Posts and Telegraphs and the Institute of Electronics and Computer Science of the Latvian Academy of Sciences. The aim is to form Telenet USSR, a jointly owned company that will build and operate a major communications switching center in Moscow, Rooney says. Details should be finalized by the middle of the year.

The new venture will also form the base for a Sprint foray into East European markets. "Moscow will become our Eastern-bloc headquarters," Rooney says. "We have started discussions with the authorities in Poland and Hungary" for similar services there.



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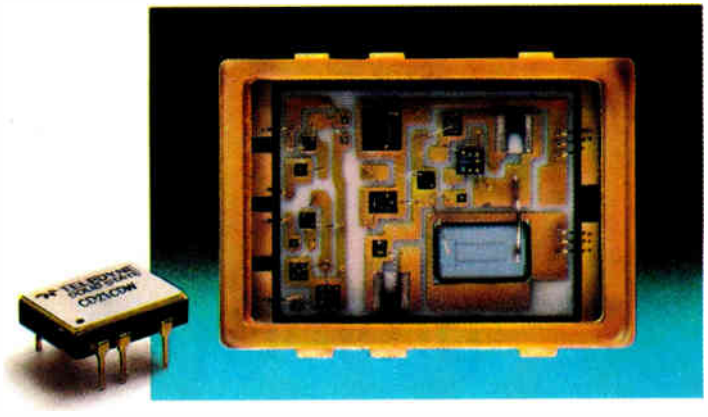


ACTUAL SIZE
CERAMIC PACKAGE

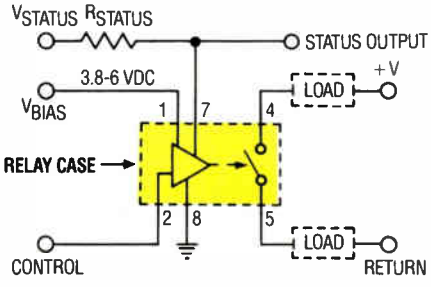
PART # CD21CDW

Review the electrical characteristics and call us for immediate application assistance.*

ELECTRICAL CHARACTERISTICS (–55°C to +105°C unless otherwise noted)				
	Min	Max	Units	
Bias Voltage (V_{BIAS})	3.8	6.0	V_{DC}	See Note 1
Bias Current (I_{BIAS})		15.0	mA	V_{BIAS} = 5 V_{DC}
Control Voltage (V_{IN})	0	18.0	V_{DC}	
Control Current (I_{IN})		250	µA	V_{IN} = 5 V_{DC}
Turn-Off Voltage $V_{IN\ (OFF)}$	3.2		V_{DC}	
Turn-On Voltage $V_{IN\ (ON)}$		0.3	V_{DC}	
Continuous Load Current		1.2	A	–55°C to +25°C
I_{LOAD} @ 60 VDC		0.7	A	+85°C
Output Trip Current (I_{TRIP})	2.4 (Typ.)		A	+25°C, 100ms
On-Resistance (R_{ON})		0.65	Ohms	
Turn-On Time (T_{ON})		1.5	ms	
Turn-Off Time (T_{OFF})		0.25	ms	
Status Voltage (V_{STATUS})	1	18	V_{DC}	
Status Current (I_{STATUS})		2	mA	$V_{SAT} \leq 0.3\ V_{DC}$ See Note 2

Notes:
1. Series resistor is required for bias voltages above 6V_{DC}. RS = (V_{BIAS} – 6 V_{DC})/15 mA
2. A pull up resistor is required for the status output. R_{STATUS} = (V_{STATUS} – 0.3)/I_{STATUS}
3. Output will drive loads connected to either terminal (sink or source).
4. Status circuit is a built-in test feature checking the input circuitry of the relay. Status output is low (on) when the input is on.

All power FET relays may drive loads connected to either positive or negative referenced power supply lines (source or sink modes).



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CIRCLE 230

APPLE-DIGITAL AGREEMENT YIELDS SOFTWARE TYING THE MACINTOSH TO VAX NETWORKS

LINKING MACs AND VAX

BY LAWRENCE CURRAN

Tying Macs into corporate VAX-based networks is now possible, thanks to the new Apple-Digital software.

IF THERE'S A Macintosh on the desktop, why not link it with the VAX system in the MIS department? That's the corporate reality that Apple Computer Inc. and Digital Equipment Corp. acknowledged in early 1988, when they joined forces to develop software that would connect Macs with VAXs and AppleTalk networks with DECnet/Open-System Interconnection links [*Electronics*, Feb. 4, 1988, p. 47].

That software became a reality with last month's joint introduction by the two companies of DEC LanWorks and SQL/Services for the Macintosh. Those two umbrella products actually encompass about 15 software components (see p. 36) that make possible:

- simple links between Macintosh computers and VAX machines;
- use of VAXs as servers for Macintosh clients in a local-area network;
- direct connection of Macintoshes into DECnet networks;
- use of DECnet wide-area networks to interconnect multiple AppleTalk local-area nets.

The new software supports the client-server model of computing, in which users run application programs on desktop client computers that are, in turn, connected to midrange departmental or corporate computers providing the facilities for services such as electronic mail, data storage, printing, and network management.

Digital, the Maynard, Mass., giant of the midrange computer and workstation worlds, hasn't made much of a dent in the personal computer marketplace. For its part, Apple, based in Cupertino, Calif., has flooded the PC world with Macs, but doesn't manufacture midrange systems. Thus, the 1988 joint-development agreement between the two was a natural match.

The new products fit into Network Application Support services, Digital's environment to foster corporate-wide open integration of multivendor computer systems. NAS provides standards-based software to help developers design application programs that are easily portable across such networks.

Tom Willmott, vice president of the Aberdeen Group, a Boston market research organization, sees the NAS con-

text of the new software as "one of the interesting angles" of the Apple-Digital linkup—especially in Digital's competition with IBM Corp.'s Systems Application Architecture approach to enterprise-wide interconnection of multivendor computing resources. Willmott says that NAS, with its ability now to link the Macintosh to its earlier support of MS-DOS, OS/2, Ultrix (Unix), and VMS operating systems, "is gaining momentum at Digital at the same time that IBM is deemed by most analysts to be late" with its SAA solution.

Willmott is enthusiastic about the breadth and depth of the software encompassed in the announcement. "This hasn't been a slapdash approach," he says. The product managers from Digital and Apple seem to know each other well, Wilmott says, and the two companies "have spent a tremendous amount of time trying to build a synergistic connection between their two environments. They haven't just slapped together some kind of file-transfer capability." E

UNDER TWO UMBRELLAS, 15 SOFTWARE COMPONENTS

THE FIRST OF THE TWO classes of software stemming from the Apple-Digital agreement is called DEC LanWorks for the Macintosh, which will be sold and serviced worldwide by Digital. The umbrella product is shipping to application software developers now, and will be generally available in September.

LanWorks' 15 or so individual components provide file sharing via VAXshare VAX-resident file services; printing on both Macs and VAXs via VAXshare print services; electronic mail that allows Mac users to communicate using Digtital's All-in-1 mail or PCmail; and access to applications anywhere on a wide-area network via software that makes Macs look like Digital VT320 terminals.

Another component called MacX lets Mac users display DECwindows applications running remotely on a VAX. There's also a network-interconnectivity component, which includes AppleTalk for systems using Digital's VMS operating system and provides tools to connect Macs to a DECnet.

An additional element provides interoperability in multivendor networks, allowing users to share information and resources with MS-DOS, OS/2, VMS, Unix, and terminal-based servers on the same network.

The data-base portion of DEC LanWorks for the Macintosh permits access to departmental and corporate data stored in VAX Rdb/VMS relational data bases using Apple's Data Access Language (included in LanWorks) or Digital's SQL/Services. The latter is included with the VAX Rdb/VMS release.

Each Macintosh that will access services on a VAX and/or use client application programs requires a $295 client license for DEC LanWorks for the Mac.

The second major umbrella product to come from the Apple-Digital connection is VAX Rdb/VMS with SQL/Services. It provides remote access to VAX Rdb/VMS data bases from desktop application programs running on Macintosh, OS/2, Ultrix (Digital's Unix), and MS-DOS computers.

SQL/Services allows users to easily connect Digital and third-party desktop application programs with Digital's Rdb and IBM Corp. DB2 data bases on larger machines.

SQL/Server is actually a protocol based on the client-server computing model. The Rdb data-base server resides on the VAX computer; the client segment is embedded in the user's desktop application program.

VAX Rdb/VMS with SQL/Services for the Macintosh and OS/2 will begin shipping in September, with prices ranging from $3,348 to more than $200,000.—*L. C.*

AT 4 GIGA-OPS, ITT'S VIDEO SIGNAL PROCESSOR PACKS A LOT OF POWER INTO THE HUMBLE TV SET

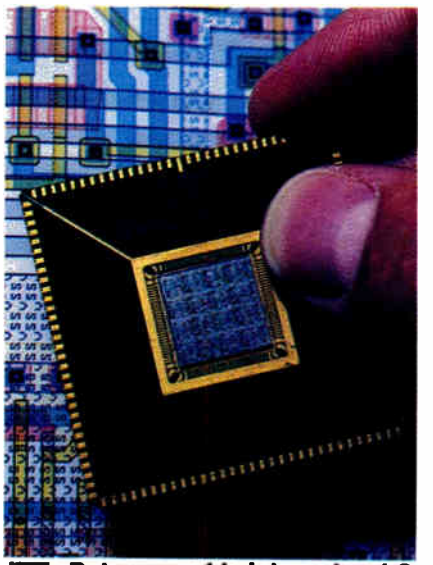
A SUPERCOMPUTING TV?

BY JOHN GOSCH

REVOLUTIONARY IS A TALL word and not often merited in electronics equipment design. But engineers at the ITT Semiconductors Group think they've taken nothing less than a revolutionary step in consumer electronics by applying the highly parallel architecture and the enormous computing power typical of a supercomputer to as humble a system as a TV set.

These advanced computer features are incorporated in a programmable single-chip video signal processor in development at Intermetall GmbH, lead house of the ITT group in Freiburg, West Germany. Integrating some 1.2 million transistors on a 150-mm² chip, the processor is as complex as Intel Corp.'s i860. The ITT device boasts a peak computing power of 4 billion operations/s and a sustained throughput of 750 Mbytes/s.

Packing so much performance into a TV receiver instead of a computer seems like a case of design overkill. That may be true for today's sets with their fairly low sampling frequencies of around 13.5 MHz. "But consider what's ahead for TV and other video-signal-processing systems," says Ulrich Schmidt, who heads the development project. Future equipment, Schmidt points out, will need much more processing power than today's sets. Some high-definition TV standards will have sampling frequencies well above 100 MHz and data rates as high as 288 Mbytes/s (in the case of a 1,250-line, 1,440-pixel/line, 100-Hz-interlace standard and a 16:9 picture ratio). Gate arrays or sea-of-gates circuits are neither area-efficient nor fast enough for HDTV applications.



ITT's Datawave chip integrates 1.2 million transistors on 150 mm².

This is where ITT's processor comes in. Its high computing power and data rate will also suit the needs of video systems other than TV sets. Among alternative applications are real-time image processing in robot vision systems, multimedia equipment integrating computer graphics and video signals, and real-time frame-rate converters.

Being programmable, the Datawave processor—it takes this name from the data-flow principles on which it is based—breaks with conventional TV signal-processor designs based on dedicated, hardwired data-path architectures. Although a programmable chip means more overhead than a dedicated one, this overhead is more than offset by the speed and the ease with which the processor can be reprogrammed for different functions.

Programmability is a decided advantage in a TV set. Consider, for example, a multistandard receiver in which NTSC-, PAL-, and Secam-standard signals, as well as satellite-TV signals, are processed within the same hardware. Rather than dedicating silicon area to

each signal standard, the ITT processor uses the same silicon area for all standards. Simply by loading new software, the device can be configured as an NTSC, PAL, Secam, or satellite-TV signal processor.

As Schmidt sees it, Datawave ushers in the third-generation era in TV design. The first generation was marked by purely analog circuits and the second by the dedicated digital circuits that ITT pioneered in the early 1980s and which are now used in more than 80 TV brands from 70 set makers around the world.

Engineers at Intermetall had predicted years ago that TV circuit design would take the programmable-chip route to provide the flexibility needed for the sets of the 1990s. But only now, with submicron technologies available, can highly complex and programmable chips be made in volume for consumer applications. By the end of this decade, ITT figures, virtually all sets will use high-performance programmable processor chips.

The man behind ITT's push into this new era is Yugoslav-born Lubo Micic, general manager of ITT Semiconductors Worldwide, who is also considered the "father of digital TV." Both Sönke Mehrgardt, the group's technical director, and project leader Schmidt implemented the programmable chip concept, with Schmidt the chief architect.

A particular challenge for the Intermetall developers was to come up with a professional device at a price that the consumer electronics industry is willing to pay. Low cost was achieved by a single-chip design using submicron features. What also counted was ITT's know-how in implementing full-custom circuit designs on a minimum of silicon. (An example of this capability is a satellite-TV signal decoder on a single chip—competitive decoders come on a number of chips.) All told, the Datawave processor, to be ready as samples by year's end, will sell for $30 to $40 apiece in large quantities.

THE ITT DEVICE IS A multiprocessor on a chip designed for "fine-grained" parallel processing of digitized video signals. It consists of 16 identical cells arranged in a 4-by-4 array. Each cell is a superscalar reduced-instruction-set processor with a deeply pipelined 12-bit architecture featuring a multiplier-accumulator, an arithmetic logic unit, 16 registers, and a programmed store with 64 instructions. A cell's peak performance is 250 million operations/s.

Key to the processor's performance is a combination of 0.8-μm CMOS technology, a 125-MHz clock rate, and the 16 pipelined RISC processor cells, all working in parallel. Any number of Datawave chips can be cascaded in one or two dimensions to increase computational power and realize different topologies.

The cells in the 4-by-4 array are individually software-programmed to meet the demands for high functionality in video applications. Such programmability enables the user to employ the same resources in time-division multi-

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CIRCLE 296

plex for the most varied functions. The decision as to which part of the processor should perform which function at which time is made at the time of execution through the software.

The ITT processor uses data-flow principles. This means that the parallel program runs are controlled by local data streams, not by global clock timing. Such data-driven architecture is considered the best means to cope with the complexity of a highly parallel system. The data transmission through the processor resembles the propagation of a wave: the computational wavefronts, which may originate at one corner of the array, are pipelined through the array to the opposite corner, which is like the propagation of electromagnetic wavefronts.

Schmidt sees the power of a single processor chip one day going from the current 4 giga-ops to 32. This performance can be attained by 1993 or so when 0.4-μm technology becomes available. By halving the feature size, the number of cells per unit area quadruples, in this case from 16 to 64. At the same time the clock frequency increases approximately linearly, to 250 MHz. Since both the cell number and the frequency affect computing power, an eightfold rise in specific computing power, to 32 giga-ops, is achieved.

PERSONAL COMPUTERS

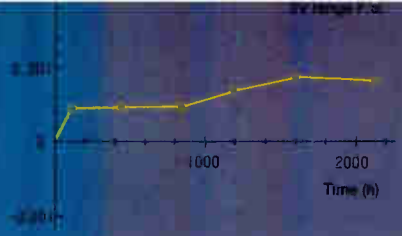
EDGING INTO '92
IBM NO. 1 IN EUROPE

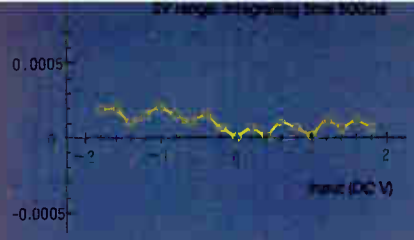
BY ANDREW ROSENBAUM

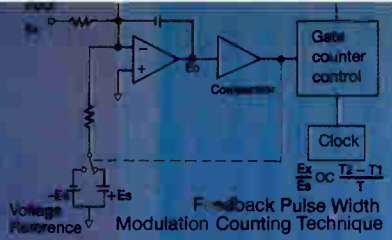
DESPITE THE INCREASING competition from U. S. personal computer makers and the new threat from ever larger, better-organized European manufacturers, IBM Corp. can expect to continue to dominate the high end of the European computer industry right through 1992. Analysts say that the changes in the European hardware market—which is growing 13% to 15% a year—should give Big Blue real advantages over local competition.

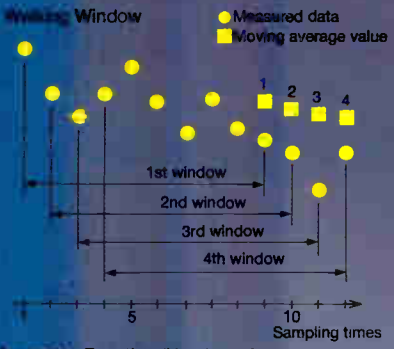
IBM has always enjoyed bigger profit margins in Europe than in the U. S., analysts say. "Here in Europe, IBM competes with the relatively weak 'national champions,'" says Dennis Exton, an analyst with Merrill Lynch in London. "The national champions can count on government contracts, local alliances, etc. That means their prices are kept high, regardless of demand."

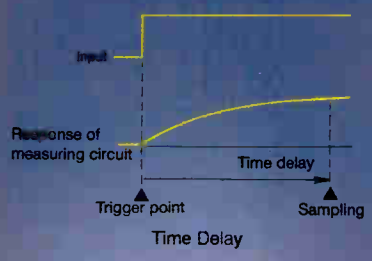
IBM is in a position to take advantage of a booming European economy. "As companies prepare for 1992," says consultant Dan Newman of Ernst and Young in Brussels, "they are investing heavily in the computing they will need to make them pan-European. All of this creates a demand for mainframes, and IBM profits thanks to its image as the surest mainframe maker."

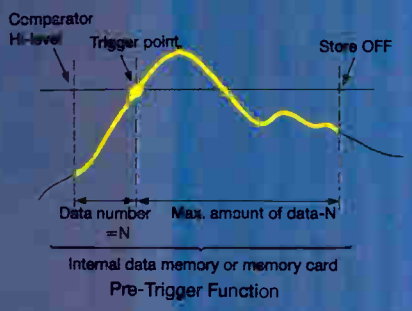












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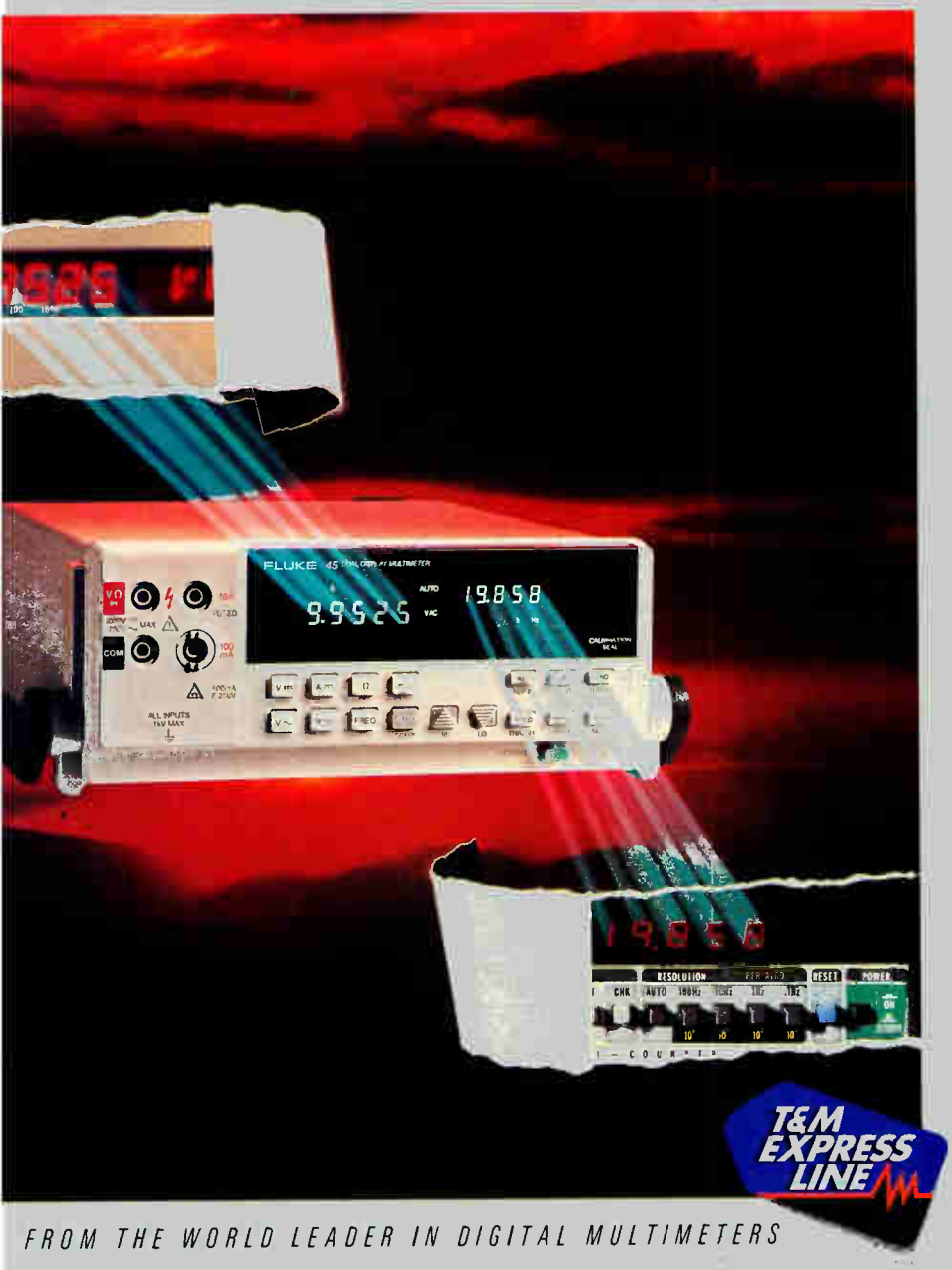

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The Fluke 45 has the specs to get the job done right.

0.02% basic dc voltage accuracy and 100,000 count resolution on both displays. Basic dc current accuracy is 0.05%, making the 45 ideal for servicing 4-20 mA current loops. The Fluke 45 measures true-rms voltage and current, including ac + dc. Closed-case calibration simplifies the calibration process and increases uptime.

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The 5-digit, 100,000 count dual display give you more information in less time - and with less effort. For example, measure the VDC output of a power supply while measuring the VAC ripple. Or check the amplitude and frequency of an AC signal. From a single test connection!

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With the Fluke 45 complex measurements become simple, with standard features like a 1 MHz frequency counter, Min Max, limits testing (Hi/Lo/Pass). Touch Hold® and Relative modes. There are 21 different reference impedances for dB measurements; in the 2Ω to 16Ω ranges, audio power can be automatically displayed in watts. The variety of electrical parameters, measurement functions and display combinations is incredible.

Even an RS-232 interface is standard.

Connecting the Fluke 45 to PCs, RS-232 printers and modems is as easy as attaching the cable. An IEEE-488.2 interface and internal, rechargeable lead-acid batteries are available as options.

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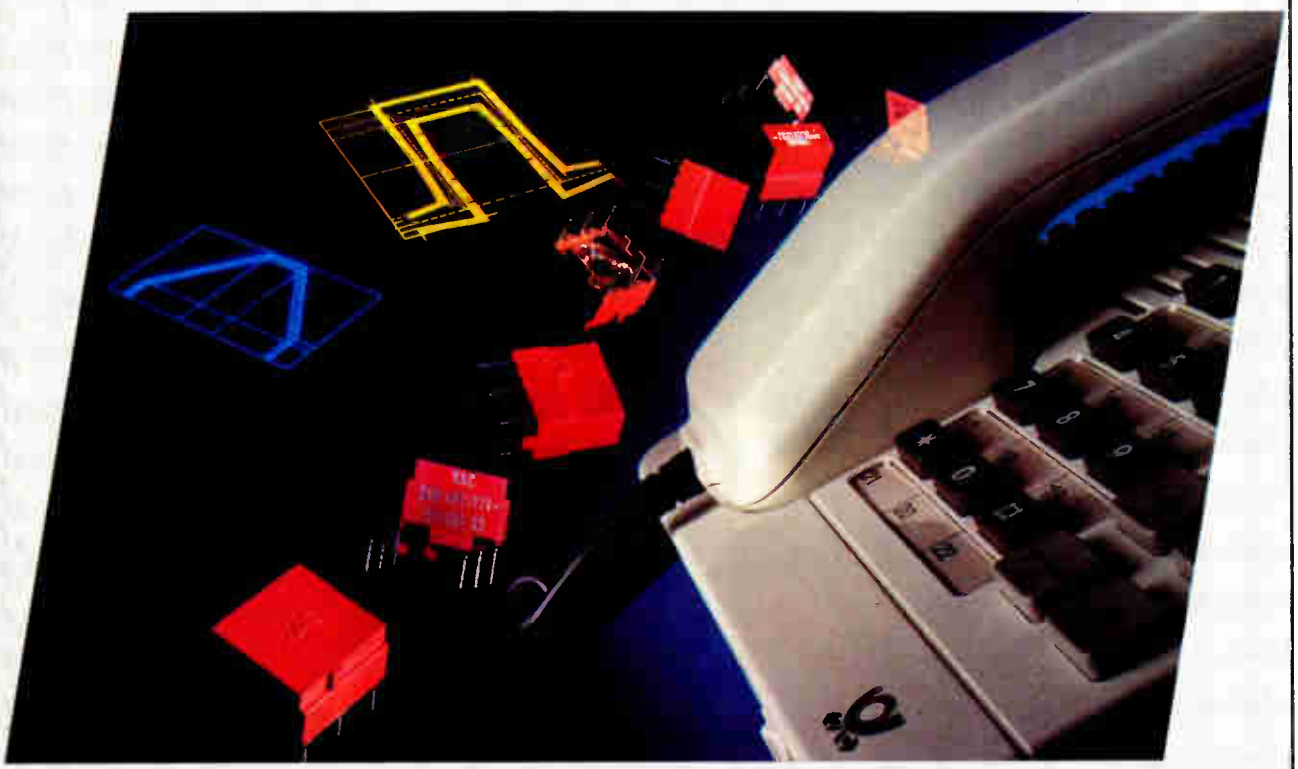

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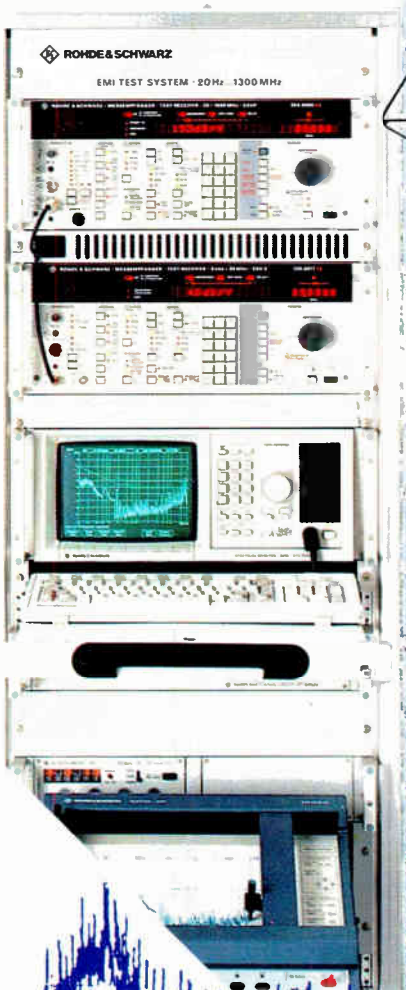

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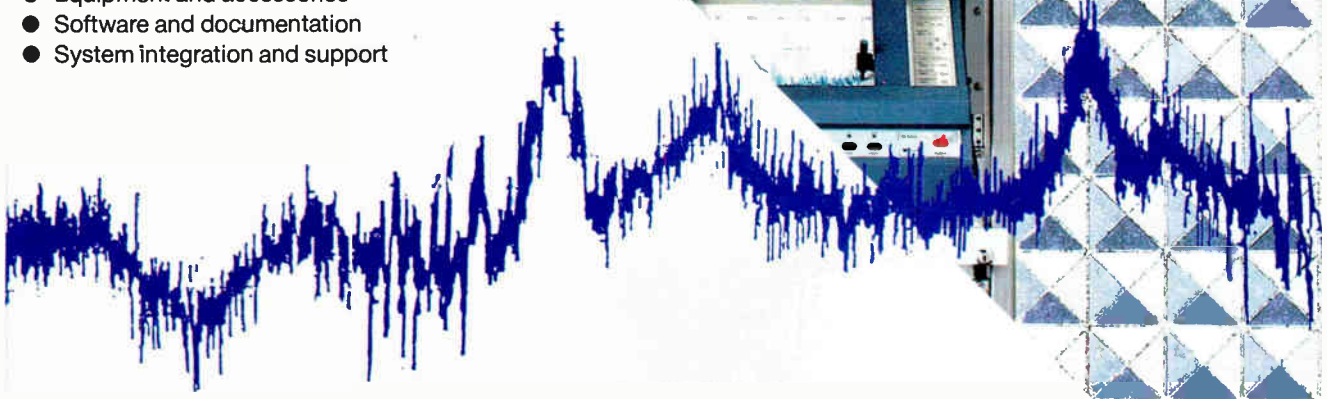

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If you're ready for another laser trim system and want to increase productivity and decrease problems, the system to add is the CLS-37S. Built for high-volume, high throughput demands, the CLS-37S is more affordable to purchase and more cost-effective to operate.

Even if you currently operate another manufacturer's trimmers, adding a CLS-37S can help you trim costs and enhance capabilities. Its many benefits can be applied to passive trims, or active trimming to ac and dc voltage or time parameters. It can even handle capacitance trimming; and an IEEE-488 bus interface module is available. An air-bearing step and repeat handler and a new cartridge feed stack loader are also optional.

In addition, the CLS-37S is trimmer in size than other systems, Its advanced design has made it smaller and less complex than the older generation of trim systems sold by others.

Designed as "the smart laser trim system," the CLS-37S is backed by the industry's most intelligent software operating system. So easy to use, unskilled workers can learn to program the system in just days.

For lower operating costs, Chicago Laser has taken extensive measures to minimize the chance of downtime. That process begins with well-proven designs and rigid quality-control standards. Chances of downtime are further reduced by the system's modular construction and advanced diagnostic programs.

For a detailed appraisal of how the CLS-37S can fill your needs, contact Chicago Laser Systems.

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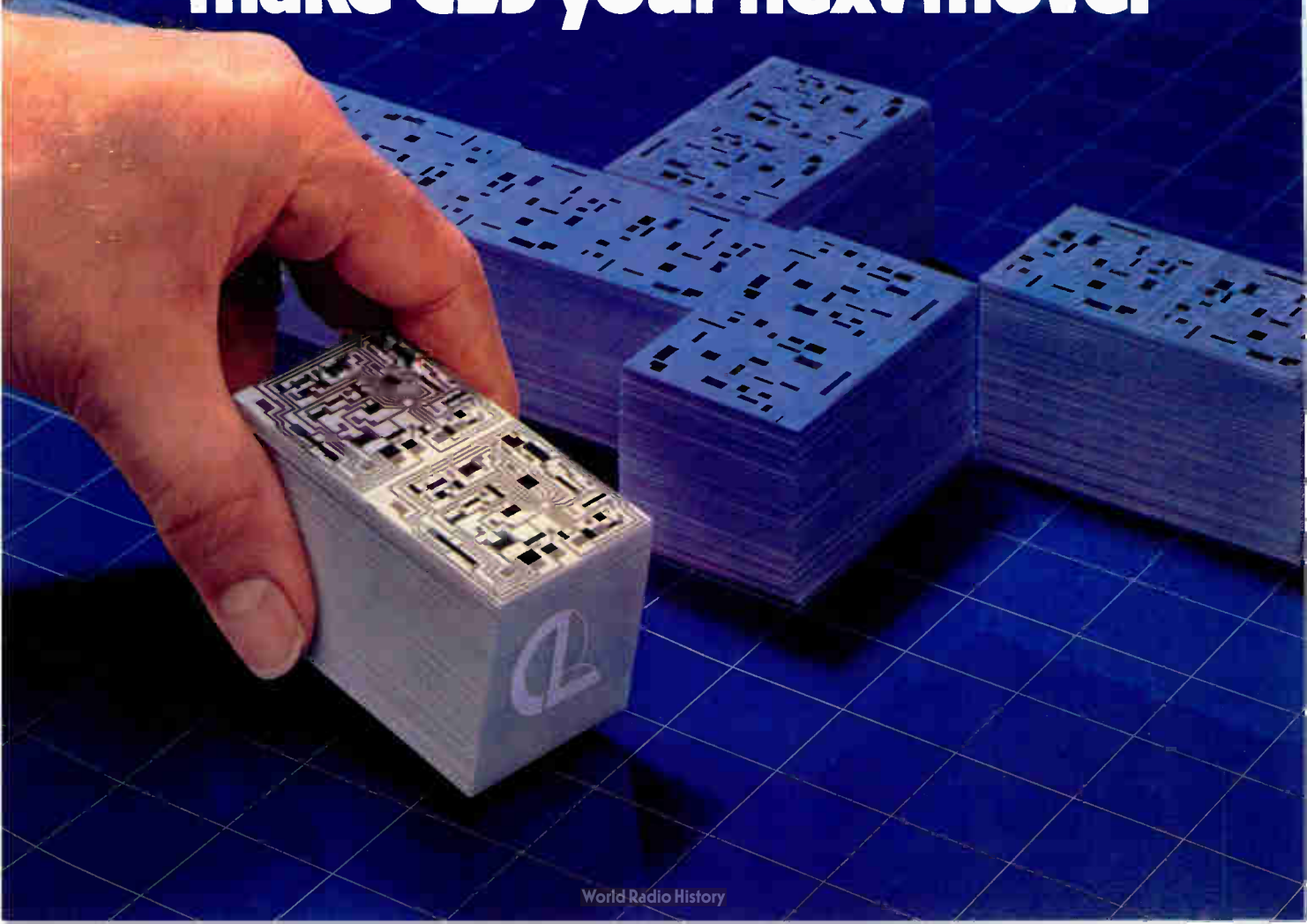
For lower-cost laser trimming, make CLS your next move.



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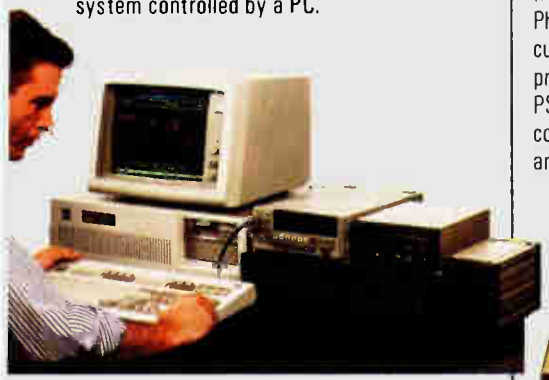
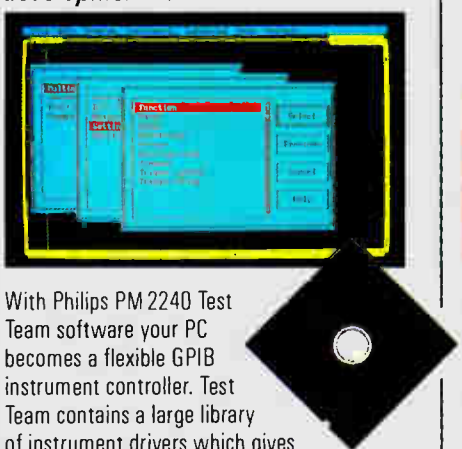
Alliance system speeds Laser Vision testing

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



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

Software to cut development times



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

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

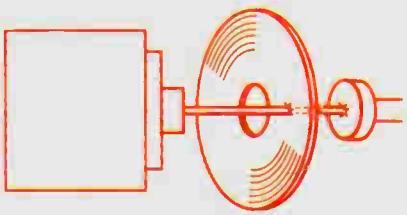
GPIB interfaces for PC and PS/2

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

Spotlight on timer/counter

Timer/counters from Philips are the ideal solution to time measurements in many applications from R&D to field service. With a frequency range of 0.1 Hz to 120 MHz and an option up to 1.3 GHz, the PM 6660 Series offers an unrivalled price/performance package for PC-based GPIB systems. Measurement function include FREQUENCY, PERIOD, FREQ RATIO, TOTALISE PULSES, TIME INTERVAL, RPM and VOLT peaks values. With a resolution down to 20 ps and temperature stability that is only found on more expensive models, the PM 6660 Series represents excellent value for money. The GPIB option gives programmability of settings and high speed output of unformatted data over 100 measurements.

Laser Vision tester



A Belgian company is using a PC-based GPIB test system for functional tests on PCBs used in Laser Vision equipment. The system performs tests on five different PCBs at one time and employs a timer/counter as one of its elements.

The PM 6660 Series used in this instance to perform various frequency and time measurements, has been selected because of its temperature stability, measurement accuracy, versatility and ease of programming.

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

For further information, call your local supplier:
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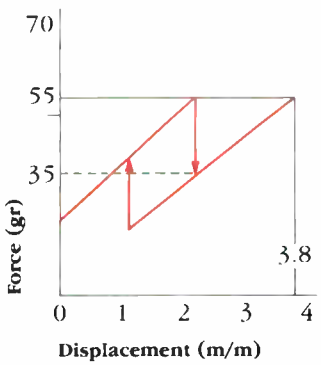

Operating Force and Travel Characteristics **FKB4700 Series (Sharp)**

Fujitsu gives you a choice of tactile keyboards

Before customers buy computers, they like to try them out. They run a few programs, compare response times, compare displays, compare keyboards. Often the way a keyboard feels helps to determine whether a product becomes a fast seller or excess inventory.

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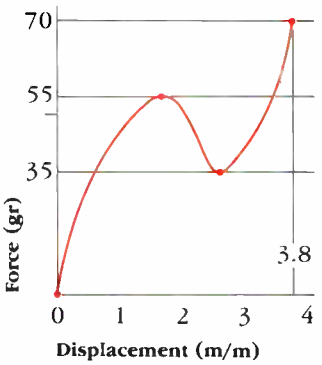
For complete information and specifications, call Fujitsu today.



Operating Force and Travel Characteristics **FKB4800 Series (Smooth)**

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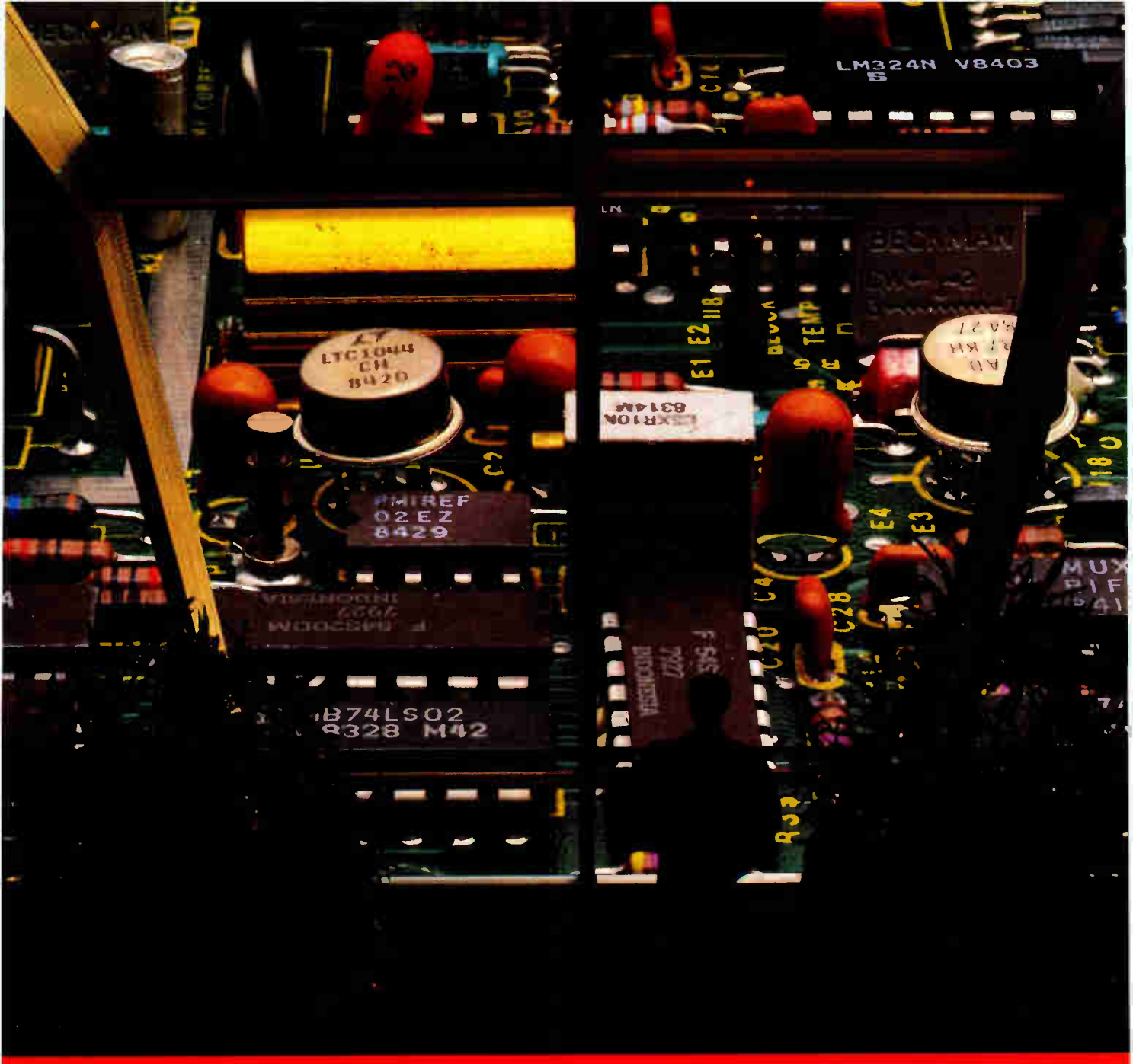

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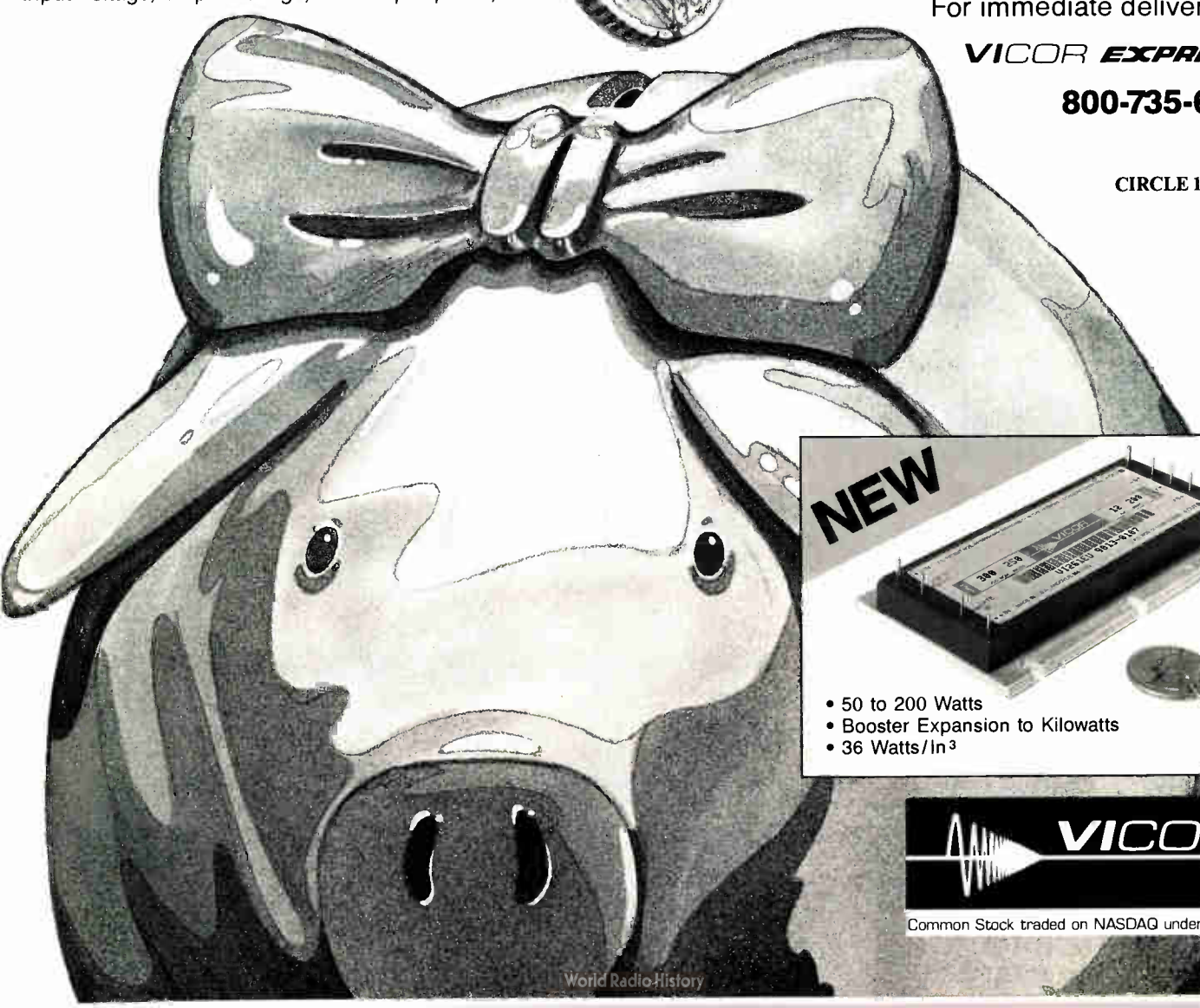

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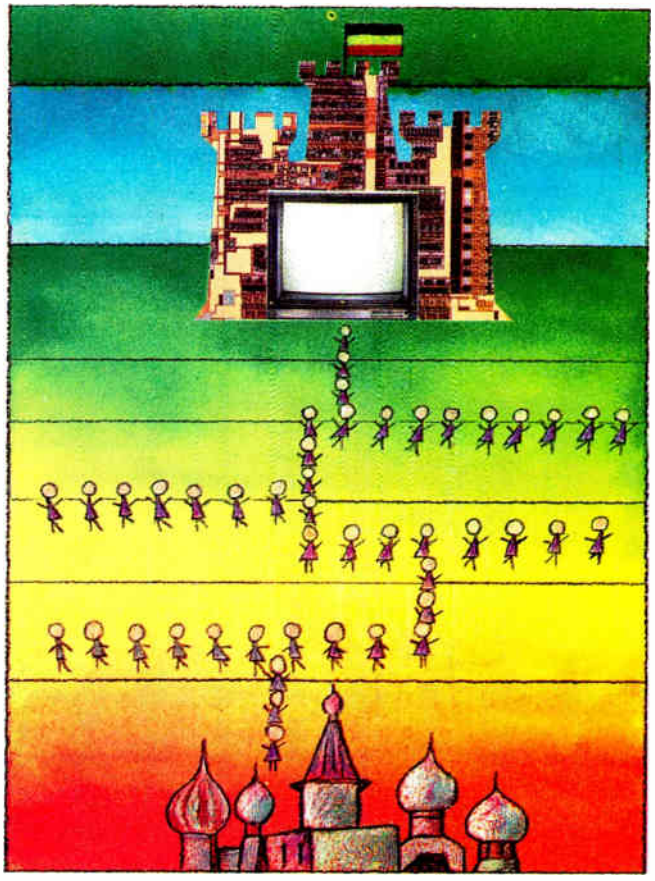
EAST EUROPEANS WANT DIGITAL TV



Delegation after delegation from East European countries are knocking on the doors of the ITT Semiconductors Group eager to buy chips for implementing digital TV. After a team from Bulgaria had visited the group's lead house, Intermetall GmbH, in late April, by mid-May three delegations from the Soviet Union had come to see the company in Freiburg, West Germany. In fact, during the first four months of this year, representatives from all East European countries except Romania and Czechoslovakia had visited this digital-TV mecca.

What's attracting the experts from the East is the chance to leapfrog from conventional receiver design right into the digital-TV age. ITT's Digit 2000 circuits also help lower production costs and replace bags full of discrete components. Moreover, digital text processors can easily handle the Cyrillic characters used in the Soviet Union and Bulgaria.

After a slow start in the early 1980s when ITT brought them to market, the Digit 2000 chips have gained rapidly in popularity. They are now found in more than 80 TV receiver brands made by 70 set makers worldwide.

SOVIET SHOW IN THE WEST WAS A $30 MILLION HIT

Score another coup for glasnost: Conversion 90, the Soviet military equipment show held in Munich, West Germany, in late April, was so successful that its sponsors expect the Russians to step up their presence with formerly secret products at future trade shows in the West. The show's purpose was to get Western firms interested in buying or building Soviet equipment for civilian uses [*Electronics*, April 1990, p. 112]. And in this it succeeded admirably.

Conversion 90 drew some 8,000 experts from companies and research organizations in the West, including the U. S. and Japan, who negotiated contracts worth about $30 million with Soviet partners. Roughly 300 military equipment production centers in the Soviet Union displayed about 1,200 products. Even while Conversion 90 was still in progress, the Soviets made about 50 deals, and many more are now in the making, says the show's organizer, the Munich Fair Co. Attracting much of the attention were Soviet laser technology, holography, medical electronics, communications gear, and aerospace engineering. In the fields of lasers, diagnostic equipment, and tools for crude-oil exploration alone, 20 Western firms negotiated cooperative and joint-venture deals with the Russians.

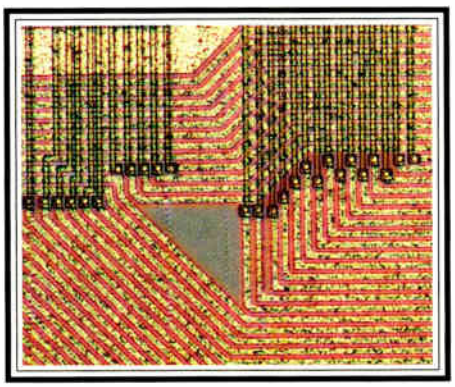
SIEMENS TO DOUBLE 1-MBIT DRAM PRODUCTION

Look for West Germany's Siemens AG to double its output of 1-Mbit dynamic random-access memories—to around 40 million units—this year. At the beginning of 1990, the company's two memory production centers in Regensburg and Munich had reached a level of 1 million such chips a week. So the goal to double last year's production of 20 million units is a realistic one for 1990, Siemens says. So far the company has invested some $350 million in its 1,000-person Regensburg plant, and for this year another $35 million has been earmarked to ramp up 4-Mbit DRAM production.

PHILIPS AND THOMSON INTENSIFY HDTV TALKS

Although they are fierce competitors in consumer electronics, Philips NV of the Netherlands and France's Thomson SA are chums in consumer-equipment-related research and development. The two companies are now discussing various R&D subjects in high-definition TV that could lead to close cooperation in key HDTV components. Philips and Thomson are already working together in Europe's Eureka EU95 HDTV project and in Jessi, the Joint European Submicron Silicon Initiative. In the U. S., the two firms are in an alliance with NBC and the Sarnoff Labs on a terrestrial advanced-TV system.

THIN LINES.



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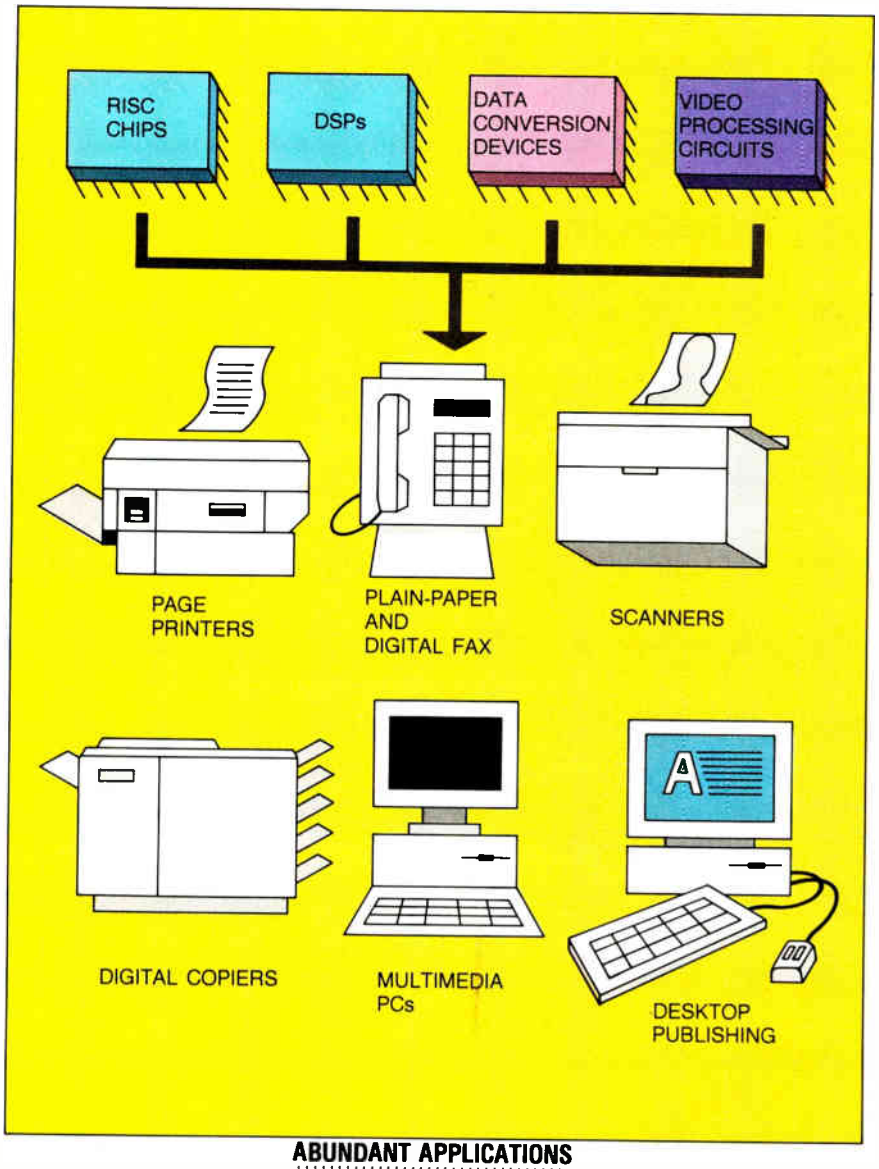
CIRCLE 215

IMAGING: THE NEXT BIG BONANZA IN CHIPS?

SEMICONDUCTOR MAKERS, ESPECIALLY VENDORS OF EMBEDDED CPUs, TURN TO A MARKET THAT'S SET TO EXPLODE

BY BERNARD C. COLE



ABUNDANT APPLICATIONS

Imaging is especially important to vendors of embedded RISC processors, who are being squeezed out of the workstation battle by the standardization of processor architectures.

IMAGE PROCESSING, PREVIously the domain of supercomputers, is making its way to the desktop. This once arcane art form is stretching beyond the traditional scientific and medical applications and shedding its reliance on proprietary hardware. And as it gravitates down to 32-bit personal computers and workstations, imaging may become the chip industry's next boom market.

Desktop machines have become sophisticated enough to handle imaging. They can now display not just numerical and graphical representations of the "real" world, but actual images as well, says Stephen R. Silver, president of Imaging Technology Inc., a board-level imaging company in Woburn, Mass. Largely accounting for this power are new types of analog and digital integrated circuits for data compression and expansion, character recognition, and image enhancement, Silver says. Also contributing is the new breed of high-density and video memories, high-performance 32-bit microprocessors, and new bus concepts and systems architectures that handle coprocessing and multiprocessing. Another part of the mix is standards that support high-resolution monitors and terminals.

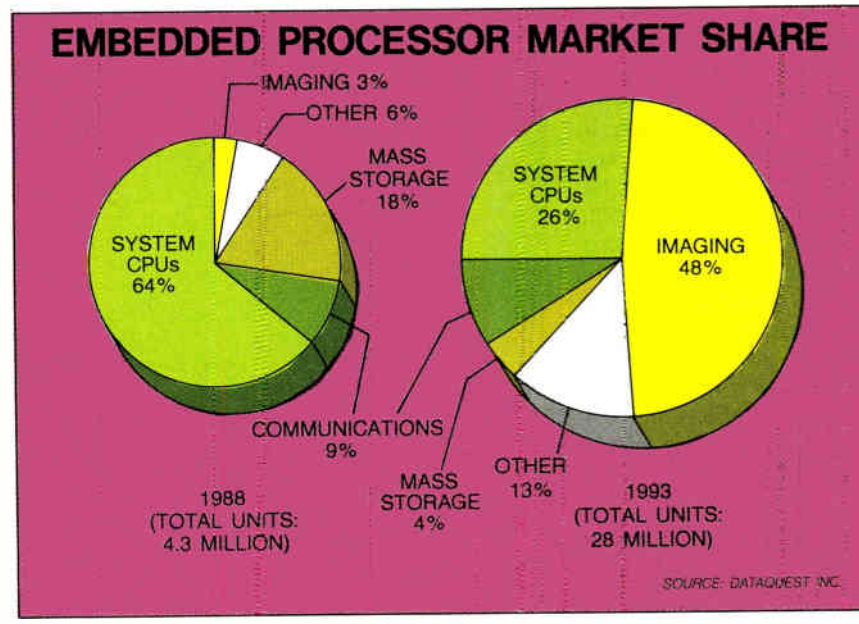
IMAGING

The upshot is an industry poised for explosive growth, says Roger Sullivan, vice president of image-management systems at market research house BIS CAP International in Newtonville, Mass. Demand is growing in the office environment for all sorts of image-processing functions, he says: page printing, digital copying, plain-paper and digital facsimile, and document scanning and

conversion—all using the PC or workstation as the platform. According to BIS CAP, the market for imaging peripherals or servers will grow from about 500,000 units in 1989 to some 4.5 million by 1993.

But that's not the whole story. To get an idea of the full potential of the imaging market, desktop publishing and multimedia must be factored in. Desktop publishing last year topped $3.8 billion and is headed for $10 billion by 1993, says Dataquest Inc. of San Jose, Calif. And the still nascent multimedia PC will be a $2.4 billion industry by 1994 in business and professional—nonconsumer—markets alone, says the Information Workstation Group of Alexandria, Va. [*Electronics*, February 1990, p. 48].

Cumulatively, this all adds up to a big opportunity for chip makers, as well as for the board and systems manufacturers that build products with their offerings. Looking to take advantage of the growth are vendors of reduced-instruction-set processors, digital signal processors, high-performance data-conversion circuits, and specialized circuits for video processing, such as data compression and expansion.



THE NEED FOR IMAGE processing, manipulation, and management in the office comes none too soon for the many manufacturers of embedded RISC processors. PCs are standardized on mature processor architectures—Intel Corp.'s iAPX86 series and Motorola Inc.'s 68000 family—and workstations are heading for standardization, too. As a result, many RISC-chip makers are looking for new markets to conquer. Among them are Advanced Micro Devices with its 29000, Intel with its 80960 and 80860, VLSI Technology with its ARM series, and the various manufacturers of Sun Microsystems' Sparc chip sets, including Cypress Semiconductor and LSI Logic.

They may find one in image processing, says Lewis R. Pacely, product marketing manager at Intel in Hillsboro, Ore. "Digital image processing is a market whose basic existence is predicated upon the widespread availability of 32-bit processors," he says. And image processing will one day dwarf sales of host central processing units, now the bulk of the embedded processor market. In 1988, image processing accounted for no more than 3% of embedded processor unit sales, compared with 64% for CPUs, says Dataquest. By 1993, this ratio will reverse: image processing will then account for 48% of the 32-bit processors sold and CPUs, 26%.

To address this market, embedded-processor makers have adopted a variety of strategies. Some, such as Cirrus Logic Inc. of Milpitas, Calif., have developed specialized coprocessors dedicated to laser-printer applications. Others concentrate on page printing, like Weitek Corp. of Sunnyvale, Calif., with its XL6200 RISC family. With its 80960 as the starting point, Intel is developing a series of application-specific processors targeting particular imaging applications.

Another major player—though not a RISC-chip maker—is National Semiconductor Corp. of Santa Clara, Calif., which has reoriented its NS32000 family of processors toward embedded applications, starting with page printers. The company has broadened its horizons to embrace all of image processing with its newest introductions this month (see p. 53).

"All applications of imaging technology—whether scanning, printing, facsimile, or character recognition and conversion—use basically the same set of bit-map-manipulation algorithms to capture, draw, store, and transmit the digital representation of an image," says Russell Johnsen, director of National's imaging group. "That is what we are taking advantage of."

To date, the fastest-growing segment of the business/office imaging market has been nonimpact laser and inkjet printers, which use specialized page-description languages to translate the ordinary text on a page into a bit-mapped digital image that is then enlarged, compressed, and modified before printing [*Electronics*, March 1990, p. 58]. This market has tripled since 1987 to 4.1 million units and is expected to hit 6 million by 1991.

Previously dominated by mature processors such as Motorola's 68000 and Intel's 80186, both complex-instruction-set architectures, this market—with more than 100 vendors—is turning to more powerful embedded RISC solutions. At the chip level the playing field is crowded with almost a dozen contestants: AMD, Cirrus Logic, Cypress Semiconductor, Integrated Device Technology, Intel, LSI Logic, Motorola, National, Texas Instruments, VLSI Technology, and Weitek.

Since many of the bit-map-manipulation algorithms required for page printing are the same as those needed in a variety of other imaging functions, many companies, like National, have begun to segue into market segments where there is less competition.

One still fledgling—but fast-growing—image processing market is PC- and workstation-based document scanning and conversion [*Electronics*, July 1989, p. 60]. Since 1987 this market has doubled in U. S. sales to almost 1.4 million units; by 1991, analysts say, it will reach 2.5 million units. Until recently, the most important function of scanners has been optical character recognition (OCR), in which the machines simply read words from a page and translate them into a form computers can use. However, now scanners are being used to capture graphic, photographic, and video images

as well as words—a particularly important requirement in desktop publishing.

The all-in-one, stand-alone scanner has the smarts to perform both text and graphic functions. But at the PC and office workstation, the scanner function is separate from that of OCR. The scanner mechanics are less intelligent, with only enough processing power, in controller form, to handle the real-time-event control of the actual scanning of the image into bit-mapped form. The conversion back into text is then done in one of two ways: in software, under the control of the main CPU, or in combination with a special accelerator board containing a 32-bit processor that operates independently of the main CPU.

The OCR platform side is a relatively uncrowded segment, with Xerox Imaging Systems and Calera Recognition Systems dividing about 80% of the market. Caere Corp. is a distant third, with about 10%. Competing for the remaining 10% are such players as OCR Systems, Recognition Equipment, and TDC.

At the chip level, there is virtually no competition: the Motorola 68000 or one of its follow-ons is the processor of choice in most stand-alone units and add-in OCR boards. But this may be changing, says Barney Dewey, vice president of product marketing at Calera Recognition Systems of Dallas. "We have been evaluating a number of the competitive CISC and RISC processors, especially for the high end," he says.

One new player in the OCR/scanner controller arena is Toshiba Corp., which is developing a 29000-based PC add-in board. The Tokyo company says its board will offer the performance and conversion accuracy of a high-end $10,000-to-$20,000 unit, but at a third to a quarter the cost.

Another lively market for imaging chips—facsimile—is currently undergoing rapid changes [*Electronics*, April 1990, p. 72]. Stand-alone fax and add-in boards have long used 8- and 16-bit controllers combined with customized DSPs to perform most of the digital functions. But Intel's alternative approach—a PC fax board built around its 80186 embedded processor—has made board designers sit up and take notice.

Now both National Semiconductor and Gammalink Inc. of Palo Alto, Calif., are looking at significantly upgrading the processing capability of fax boards. National has entered the market with a line of fax boards, and Gammalink manufactures a high-end facsimile board that uses a Postscript library similar to that used in laser printers to improve the quality of the messages.

MOVING TO PC PLATFORMS

Image-processing chips are going into systems like Univision Technologies' VGA/frame-grabber board.

In most PC-based imaging applications, be they facsimile, scanning, page printing, desktop publishing, or multimedia video capture, the bit-mapped image of just a few pages of text can strech the storage and transmission limits of existing tecchnology. For example, a single page of text, which takes about 2 Kbytes of storage in ASCII form, needs anywhere from 20 to 100 Kbytes in standard fax format. In scan form, it needs 500 Kbytes to 2 Mbytes. A scanned image of a photograph can require as much as 8 Mbytes.

Another problem area is transmission speed. Using the standard run-length-limited encoding algorithm of most fax and document-storage systems, transmitting a single page with a resolution of 200 to 400 dots per inch can take two to three times longer than sending ASCII text over a modem—even though, at 9,600 bits/s, the transmission rate is anywhere from three to 40 times higher than standard modem speeds.

To address these critical bottlenecks, chip makers have developed a variety of compression/expansion circuits, some general-purpose and others specific to particular image-processing applications. For example, Advanced Micro Devices Inc. in Sunnyvale, Calif., aims its Am95C71 at document storage and retrieval. This chip codes and compresses images, eliminating white space and redundancy and often reducing documents to one twentieth of the original uncoded file size. The 95C71 compresses Group 3 and 4 facsimile documents at rates up to 85 Mbits/s; that means PC-based systems can browse documents at over seven pages per second, AMD says.

Targeting similar applications is the uPD72185 from NEC Electronics Inc. of Mountain View, Calif. It can code and decode a typical page of ASCII characters in less than a second.

More specifically targeting the requirements of desktop publishing is Zoran Corp. of Santa Clara, with a family of 32-bit vector-signal-processing circuits for compression and expansion of color and monochrome video images. For example, using the Zoran approach, a compressed VGA color image from a hard disk can be reconstructed in only 3.5 s, compared with several minutes using traditional solutions.

For video and still-image compression, LSI Logic Corp. of Milpitas, Calif., this summer will offer a three-chip set: the L64720 motion-estimation processor, the L64730 transform processor, and the L64740 quantization processor.

And going after multimedia PC applications as well as more traditional fax and scanning applications is C-Cube Microsystems Inc. of San Jose [*Electronics*, April 1990, p. 95]. Its CL550 can compress or decompress a full-page, 24-color, 300-dpi image in less than a second, reducing the 25 Mbytes of original bit map to under 1 Mbyte, with no visible image degradation.

INTO THE MAINSTREAM

Desktop machines built around 32-bit processors now handle imaging, once the domain of supercomputers.

That opens vast new markets for makers of embedded processors, DSPs, data-conversion and video ICs.

These parts will go into PC- and workstation-based fax, scanning, printing, and multimedia systems.

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CIRCLE 300

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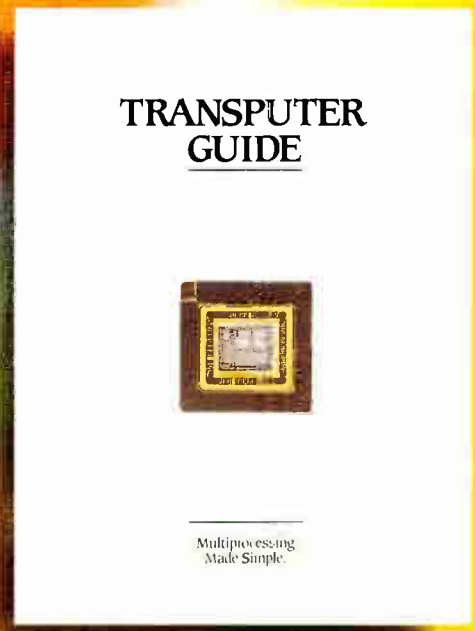

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NUMBER 11 IN A SERIES

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As semiconductor technologies run out of steam and become more expensive, manufacturers are turning to architectural improvements. The RISC movement is an example.

However, the inadequacies of sequential RISC architectures — increased size, parts count, power consumption, time to market — have necessitated costly remedies, including large register banks, deep pipelines, specialized memory, dual data buses and complex compilers.

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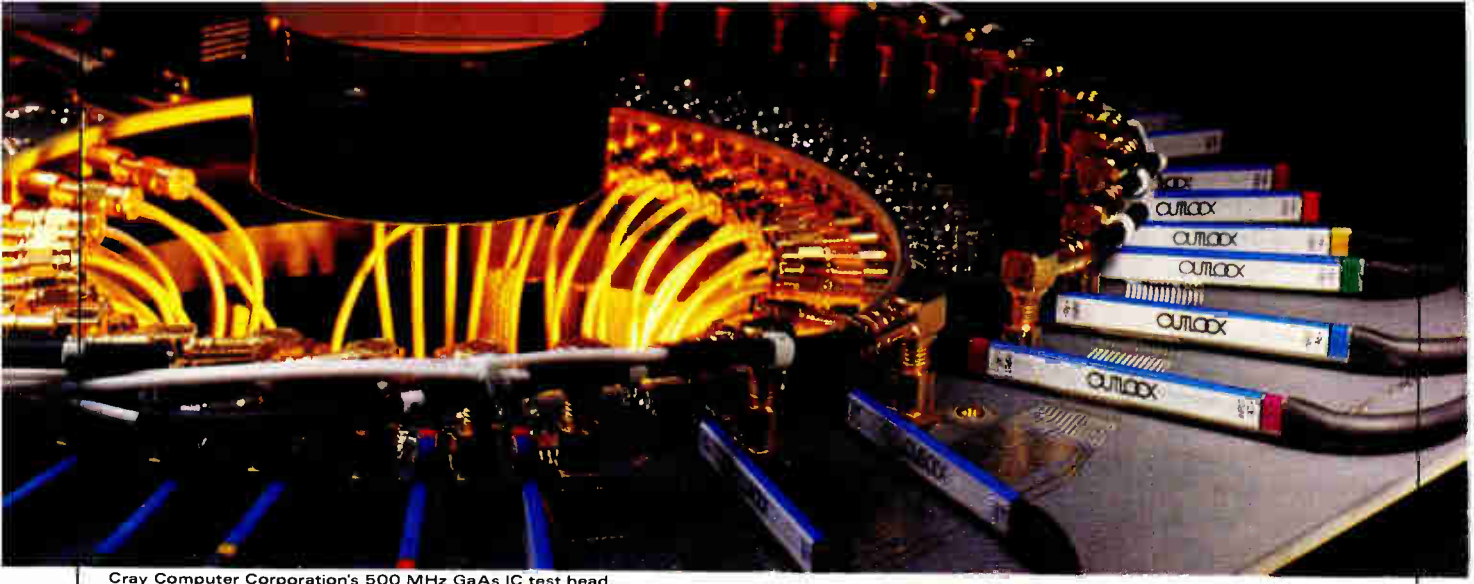
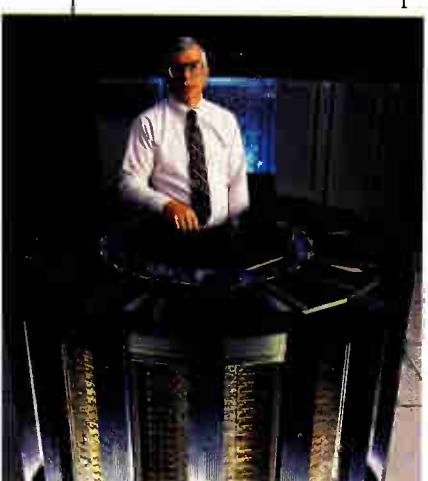


Cray Computer Corporation's 500 MHz GaAs IC test head.

How do you test a 500 MHz Cray3 in a 100 MHz world?

The Cray3's GaAs ICs were too fast for any commercially available testing equipment. Except Outlook's.

The 480 different GaAs ICs used in the Cray3 needed to be tested at speed. There were too many things — backgating effects, latching problems — that wouldn't show up at lower speeds, but caused failures at full-out.



"We couldn't have tested the Cray3's GaAs ICs without it." — Doug Wheeland, V.P., Hardware Development, Cray Computer Corporation.

Trouble was, the speed at which they needed to be tested at was about five times faster than commercially available test equipment.

"Always before," Cray Computer Corporation's VP Doug Wheeland explains, "we used parts off the shelf. But the Cray3 is the first time Seymour has designed his own ICs. For awhile it looked like that would mean designing our own test equipment, too."

Until they took a look at Outlook.

The Functional At Speed Test (FAST) system you see here became possible with Outlook Technology's high performance logic timing analyzers and pattern generators.

"It's made at-speed testing of high speed ICs possible," adds Doug. "We couldn't have tested the Cray3's GaAs ICs without it."

Outlook products include very high performance logic timing analyzers, and a family of digital word generators that reach a 2 GHz data rate.

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CIRCLE 176

NATIONAL BETS THE FARM ON IMAGING PROCESSORS

THREE NEW CPUs BUILT IN A HYBRID ARCHITECTURE AIM TO KNOCK THE RISC MACHINES OUT OF THE RUNNING

BY BERNARD C. COLE

IN THE MANNER OF A HIGH-stakes gambler betting everything on what he believes is a winning hand, National Semiconductor Corp. this month significantly enhanced its family of specialized 32-bit central processing units, targeting the largest and fastest-growing segment of the embedded CPU market: image processing. In a major expansion of its so-called CRISP processors, National unveiled three offerings that it hopes will give it the lion's share of imaging applications in the office.

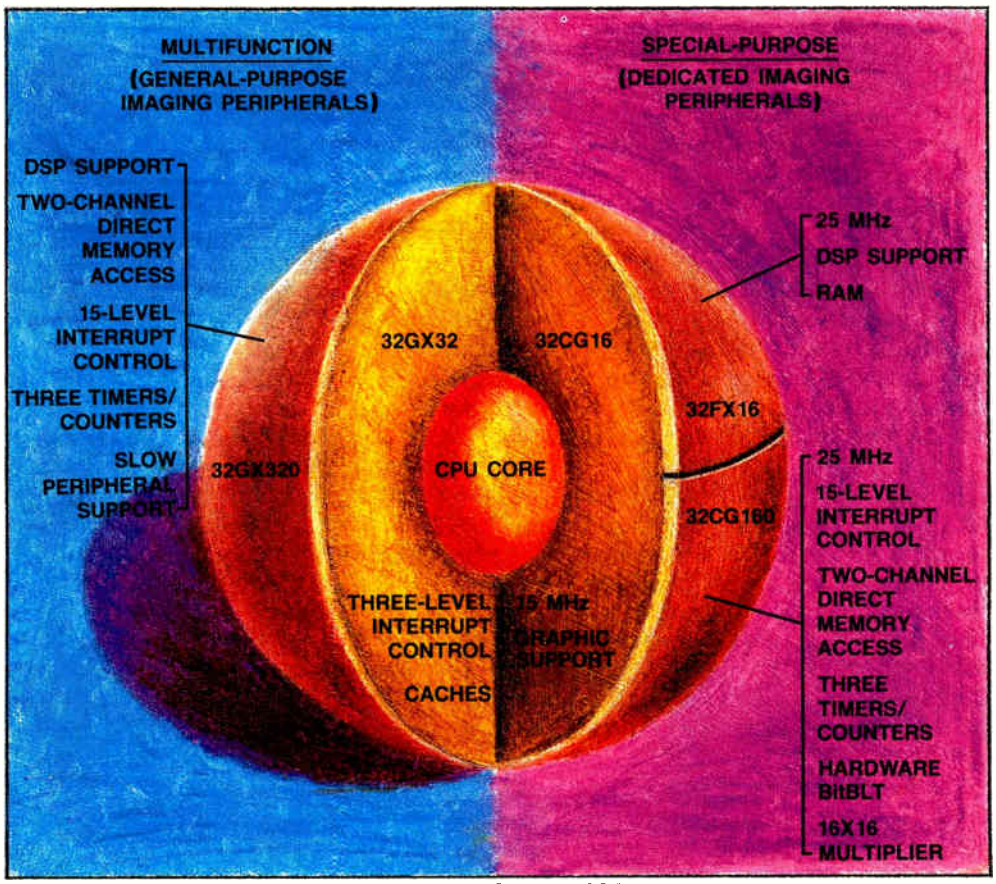
The three new chips are the NS32CG160 integrated system processor, the NS32FX16 imaging/signal processor, and the NS32GX320 high-performance integrated system processor. All are fabricated with the company's 0.8-μm CMOS process and boast clock rates up to 25 MHz.

Image processing in the PC and office environment appears poised for strong growth with use in such applications as digital copiers, page printers, optical character recognition, scanners, and X-window terminals (see p. 46). National, which lost out in the first-round PC processor sweepstakes to Intel Corp. and Motorola Inc., sees imaging as giving it a new lease on life. The Santa Clara, Calif., company is betting that its CRISP architecture, a hybrid that mates complex- and reduced-instruction-set processing, will beat out the RISC machines in this burgeoning market.

IMAGING

The company's advantage is overcoming the limitations of the two current approaches to embedded processing, says Russell Johnsen, director of National's electronic imaging group. One involves using a general-purpose processor—either RISC or CISC—to perform specialized algorithms. The more recent alternative is a processor designed expressly for a particular imaging application, such as page printers.

However, says Johnsen, "With such



BUILDING AROUND A CORE

National's three new devices start where its two original processors (center) leave off. The top-of-the-line 32GX320 can perform several imaging functions at once.

traditional solutions, the user has got to make some tough choices." In other market segments, there is usually a well-defined dividing line between users' requirements—high performance, low cost, low component count, or quick turnaround to meet time-critical market windows. By contrast, he says, the embedded imaging processing market is unique in that all four of these elements are equally important.

Using a generalized solution achieves the goals of low cost and fast turnaround, Johnsen says. Also, no specialized circuitry is required on-chip, and application-specific algorithms can be performed in software. But what the user sacrifices is performance and low component count. Alternatively, although more algorithmic-specific solutions offer higher performance and lower component count, they are, he says, only appropriate for particular applications—say, page printing. Other applications require different hardware solutions, leading to higher cost and slower time to market.

BUT NATIONAL SAYS IT has found a way to satisfy all of these conflicting user requirements. The solution is a family of processors that are targeted at imaging applications. They are built around a common processor core and instruction set to which application-specific functional blocks can be added, says John Vidal, director of product marketing for the imaging group.

Adding to its existing repertoire of CRISP processors, the company is building up its offerings in two directions around the cores of the 16-bit 32CG16 and the 32-bit 32GX32. In the first category are the 32FX16 and the 32CG160, which move beyond the page printer applications of the original 32CG16. The 32FX16 is a relatively straightforward extension of the architecture, to which a digital-signal-processing module and 384-byte memory array for storage of DSP coefficients have been added. The DSP functions are optimized for applications such as 9,600-bit-per-second facsimile and data modems as well as voice mail.

The module boosts the performance of the complex vector operations required in such applications by fetching operands using its own address generator, storing filter coefficients in the internal memory array. The improved performance comes from overlapping data fetches and internal multiply and accumulate operations, says Vidal.

And where conventional stand-alone DSPs process data streams serially through a sequence of noncomplex operations, the logic contained in the FX16's DSP module does a real-time transformation of the original incoming digital signal stream. The stream is divided into two—one in phase and the other shifted in phase by 90°—allowing both to be processed in parallel. In this way, throughput is effectively doubled.

Designed as a direct plug replacement for the 32CG16, the FX16 lets a designer easily upgrade a page printer to a relatively low-cost plain-paper fax/printer combination, using his original board design, Vidal says. If further integration is necessary, National has also developed an analog front-end chip, the NS32FX210, as the interface to the telephone line, and the DS32FX211 for real-time clock generation. And to simplify and speed up system development for standard fax modem, data compression, and protocol implementation, he says, National will provide a software library of algorithms that implement Group 3 fax functions.

BRANCHING OUT

The 32FX16 and the 32CG160 move beyond the page printer applications of the original 32CG16.

Replacing National's high-end 32GX32, the 32GX320 does everything the other new chips can do and then some; it also handles a number of imaging functions simultaneously.

The second device that builds on the same 32CG16 core is the 32CG160. Another plug-in replacement, it handles not only the original page-printer functions but also X-window terminal graphics and document scanning. As in the FX16, it expands the original 16-bit bus to a full 32 bits, but incorporates such functions as the bus interface, direct memory access, interrupt control, a 16-by-16 multiplier, three 16-bit timers, and a bit-aligned block-transfer processing unit.

As far as the additional image-processing functions, says Vidal, the DMA capability enables high-speed transfer of data or images between laser or ink-jet printers or image scanners. The 15-level interrupt controller, when combined with an improved response mechanism, allows the CG160 to respond more quickly to real-time external events, he says.

Replacing the original 32GX32 at the top of the line in National's imaging processor family is the 32GX320. Where the other new processors are configured so that they can be used in a number of imaging applications, the GX320 can perform several different imaging functions simultaneously. For example, says Johnsen, it can conduct all of the graphics and page-printer control functions of the CG16 and the high-speed DMA transfers of the CG160. Also, it has the graphics-terminal capabilities of the 32GX32 and the 9,600-b/s Group 3 fax and modem capability of the FX16.

BUT THE GX320 GOES BEyond the other two devices, says Vidal. It supports the emerging Group 4 digital fax ISDN standard as well as electronic voice recording and playback. In addition to the special graphics and DSP instructions of the other devices, the GX320 also contains special instructions for efficient one- and two-dimensional data-compression algorithms and four new instruction primitives for performing fast Fourier transforms and real or complex finite impulse response filters.

This device will not be used to replace earlier chips, says Vidal. Instead, it will be used as the core of a whole new generation of multimedia image-processing peripherals and add-in boards. "I would not be too surprised if we see some relatively low-cost units begin to appear on the market within a few months that can switch functions on the fly, depending on the application at hand," he says. Those applications might be page printing, facsimile, scanning, voice mail, voice recognition, and image compression and expansion.

Because the same basic hardware implementation and the same process are used across all members of the family, economies of scale are possible, resulting in lower costs, says Johnsen. In quantities of 1,000, the cost of these new processors approaches that of general-purpose RISC designs: the 320 is about $135 each, the 160 about $37, and the FX16 about $31.

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

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

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

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

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

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

NUMBER 143

CHILE AIMS FOR NATIONWIDE DIGITAL NETWORK.

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

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

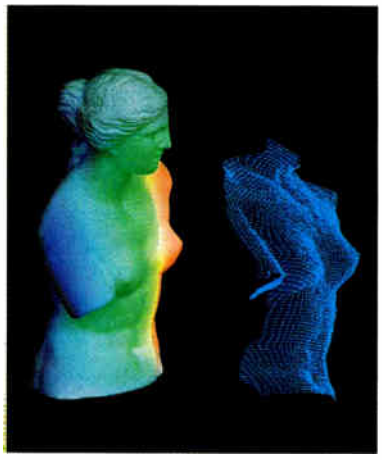
NEAX61 switches in other Chilean cities will be networked with 2GHz–8MB, 6GHz–140MB, and 8GHz–34MB digital microwave systems.

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

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

REAL-TIME, 3-DIMENSIONAL MEASUREMENTS.

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



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

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

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

PASOLINK: SHORT-HAUL MICROWAVE RADIO.

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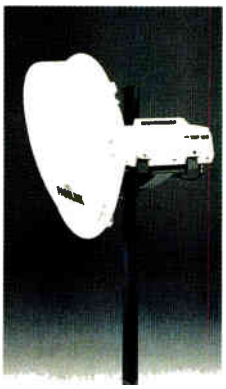


PASOLINK is an advanced point-to-point microwave radio operating in frequency bands from 13GHz to 50GHz. Coverage extends about 20km for data, voice and video links. Transmission capacity is from 2.048 to 34.368Mbps*, providing up to three service channels, or one video plus two sound channels.

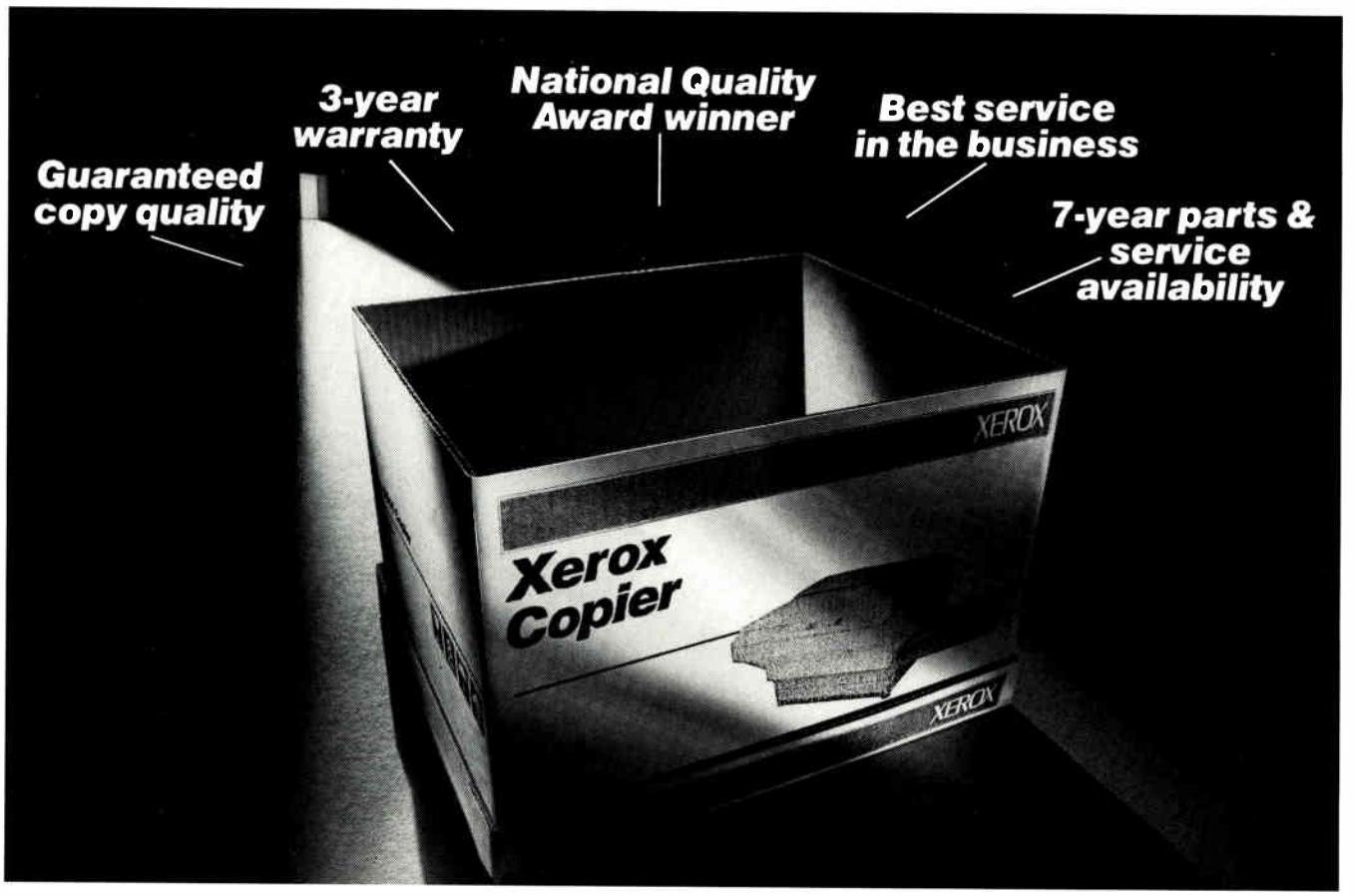
PASOLINK is easily transported and simply consists of a compact outdoor transceiver with antenna, and indoor modulator/demodulator unit.**

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

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

NEC

XEROX



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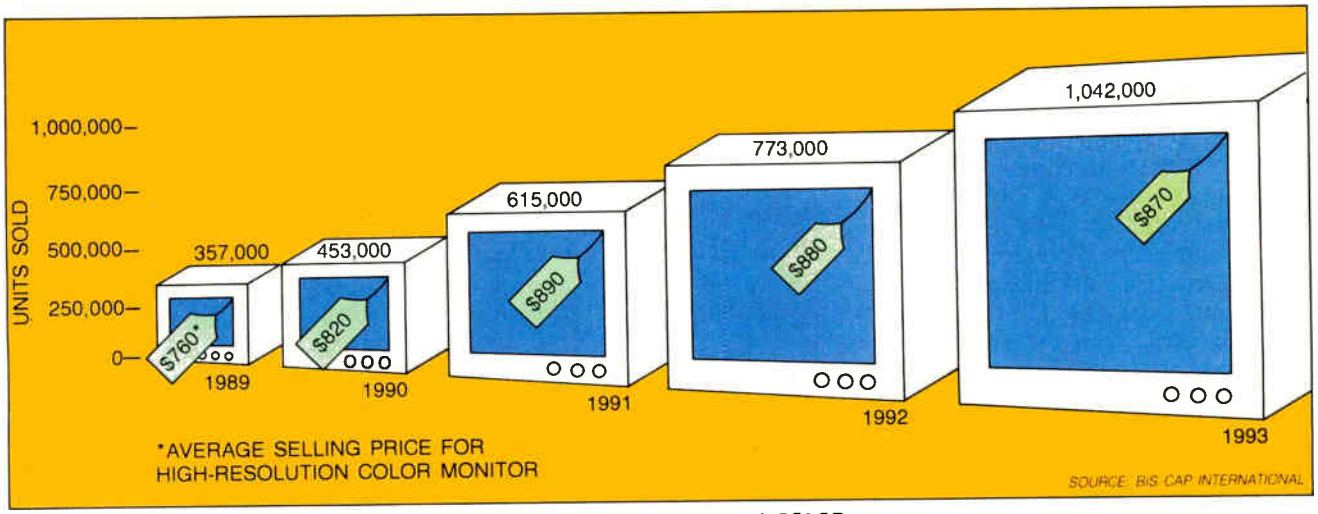
Malcolm Baldrige National Quality Award 1989 Winner

Xerox

CIRCLE 2



STABLE PRICES FOR HI-RES COLOR

While the number of high-resolution color displays sold will nearly triple by 1993—rising to 1,042,000 units from 357,000 in 1989—the average price per unit will be remarkably stable.

SHARPER, PURER IMAGES BRIGHTEN DISPLAYS

COLOR MONITORS SEEK BETTER RENDITION WHILE MONOCHROME CHASES LASER-PRINTER QUALITY

BY JACK SHANDLE

IN IMAGING APPLICATIONS, the buck truly stops at the display screen. Without cutting-ede technology in the monitor—whether it be 24-bit color, one-bit monochrome, or gray-scale—all the magnificent pixel manipulations of chips and boards can fall on uncomprehending, weary eyes.

Crisp images, true color rendition, and flickerless performance continue to be the Holy Grails of display engineers and manufacturers, and as advanced chips and algorithms enhance the quality of electronic imaging, the displays—chiefly the venerable cathode-ray tube—are finding new ways to deliver the corresponding optical image.

Technology innovations in color displays are numerous and range from Sony Corp. of America's giant 20-by-20-in. color monitor to a number of calibration schemes aimed at achieving true color. In the monochrome world, MegaScan Technology Inc. has built a video amplifier that delivers an 800-MHz bandwidth—eight times what is needed on a typical workstation—to feed its 300 dots-per-in. display.

DISPLAYS

Imaging applications run the scale from document imaging, where monochrome will do quite nicely, up to full-color design graphics and prepress applications in the publishing industry, where the computer display must compete with photographic film for color integrity, says Bob Murray, a market analyst with BIS CAP International, Norwood, Mass. Color is clearly the technology path of the future, even in the world of medical imaging, where black-and-white images are very often displayed on a color screen, except in cases such as X-ray diagnosis where extremely high resolution is required.

Joseph Castellano, president of Stanford Resources Inc. in San Jose, Calif., estimates that 75% to 80% of the displays built today with 1,280-by-1,040-pixel resolution or better are color. "And the percentage will keep increasing," he says, "until by 1995, it will be 95% color in that market."

The market for high-resolution color displays will do more than just grow at a healthy pace through 1993, says BIS CAP's Murray. It will also exhibit relatively stable pricing. While the number of high-resolution color monitors sold will nearly triple between 1989 and 1993, the average selling price will rise 14%—from $760 in 1989 to $870 in 1993—which is an average annual growth rate of about 4%. Economies of scale will contribute to the price stability, but competition will play a big role too, says Murray. "Forecast numbers are dynamic and the price may drop faster," he says.

Murray sees the market arranged in

three broad segments: business graphics, which includes desktop publishing and document archival technologies; engineering, medical, and scientific applications; and graphic arts. In each area, users begin to enter the high-resolution market when "VGA [for IBM machines] and standard Apple resolution are not enough." In publishing prepress, for example, "the minimum you could stand would be 1,024 by 768 pixels," he says, "and the next level people look at is 1,280 by 1,024."

Other strong market trends include a move to monitors with 72-Hz frame rates instead of 60 Hz, and to monitors that can easily handle different graphics standards, such as NEC Corp.'s MultiSync products. "It is an important capability when you upgrade, because you need only to change the controller card," says Murray. "NEC started it and now all the major companies are either offering it or investigating it."

The application that is driving the technology for color monitors is relatively unfamiliar to the broad base of companies in the computer and electronics industries. "Graphic arts and prepress have special needs," says Murray.

These include color-description words 24 bits long, which can display 6 million colors, 100-dpi resolution, and color-calibration schemes. "Colors have to be as close to the printed copy as possible," he says, "and an inherent problem is that displays are put together using an RGB [red, green, blue] additive system, while printers use a subtractive system of yellow, magenta, and cyan."

Companies can address the color calibration from a number of angles. Radius

A LOT OF DOCTORS ARE SO USED TO LOOKING AT BLACK-AND-WHITE PICTURES THAT THEY DON'T WANT COLOR MONITORS

Inc. of San Jose, for example, measures the color output on the screen and indexes the results to Pantone Inc.'s standard color-selection charts, which are used by printers to mix inks. Radius uses Sony's Trinitron monitors in its displays. It addresses the desktop publishing market with both Apple Computer Inc. Macintosh-compatible and IBM Corp. PC-compatible products.

Radius does not claim to have a 100% solution. It can handle only spot color—that is, situations where a graphic artist doing a page layout states what the colors of the various illustrations should be. "We cannot help people who work with scanned images," says Andrew Singer, Radius's vice president of engineering. "That is the next generation. But 85% of printed color is spot color. We are solving 85% of the problem first."

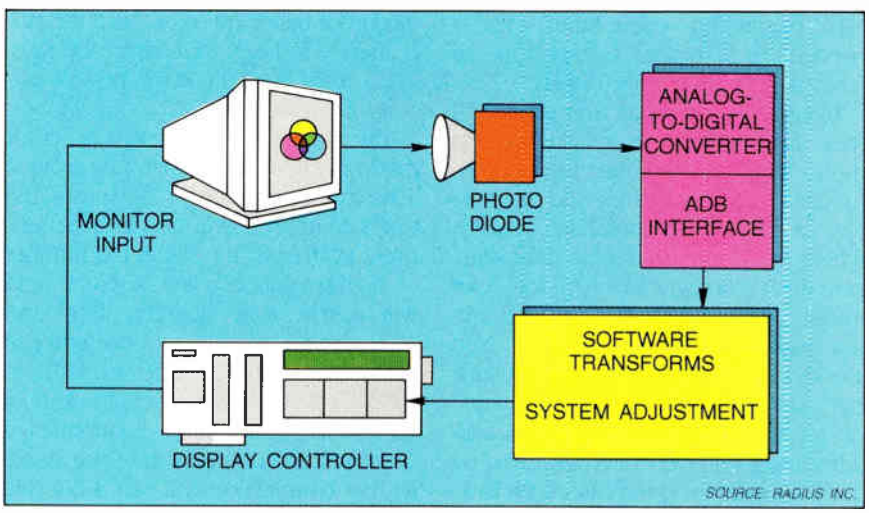
Another shortcoming is that the full spectrum of thousands of Pantone colors cannot be displayed on the screen. About 10% are too highly saturated to be duplicated by screen phosphors. Radius is consulting with monitor manufacturers to "see if we can get better phosphors," says Singer. Even this limitation does not inhibit the market potential. Newspapers, for example, use only 80 colors and Radius has sold its equipment to several of them, including the *Los Angeles Times*.

Knowing that the colors on the screen are true is more important in most instances than offering the full Pantone set. But left to their own devices, displays can drift significantly in color rendition over time. The key to Radius's calibration system is to close the feedback loop around the entire system instead of just the CRT.

THE TECHNIQUE RELIES on the fact that the latest phosphors do not exhibit color drift with age. They can be counted upon to deliver the same wavelength year after year. "What changes is the brightness and the brightness characteristic—the mapping between the digital brightness supplied and the one displayed," says Singer. This comes about for three reasons: as phosphors age, they lose emissivity; the cathodes in the CRT exhibit nonlinear responses; and the parameters of analog-to-digital converters, high-voltage power supplies, and video amplifiers also drift with age.

Radius's calibrator measures pixel brightness with a sensor that attaches to the screen and uses lookup tables to map the brightness that is being called for by the display controller. An ADC communicates the results from the photodiode over the Apple Desktop Bus interface. Software transforms running in the Macintosh subsequently adjust the display controller. "The calibrator has an Intel microprocessor in its base that runs the firmware," Singer says, "but the actual calibration is done by software on the Mac."

Barco Inc., Kennesaw, Ga., takes a different calibration approach. Long a leader in producing displays of TV-studio quality, Barco wants to pick up the pace in high-end businesses such as prepress and textile applications, says Piet Lesage, product-line manager. Barco uses shadow-mask CRTs instead



CALIBRATING COLOR

A color-calibration system employed by Radius Inc. uses screen brightness and lookup tables to modulate signals from the controller.

of Trinitron technology, and its products are generally workstation-based. An important specification in the prepress and textile industries, says Lesage, is to be sure that information downloaded from one display will create the same color on another monitor. This has led Barco to characterize the nonlinearities of each monitor in the factory and store that information in each monitor as firmware in tables known as gamma curves.

"The gamma curves for every monitor are different," he says. When a system integrator bundles Barco's monitor with a computer-based prepress, textile, or other workstation, the gamma tables are downloaded from the monitor over an RS-232-C interface to the computer, which builds the lookup table for internally adjusting that particular monitor.

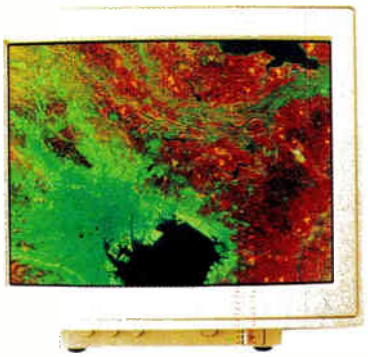
The best technology strategy for color calibration can be controversial, depending as it does on the application's requirements. Radius and Barco are a good example. "Radius's color matching does what it claims, but it does not address other issues [such as monitor-to-monitor color rendition]," says BIS CAP's Murray.

Radius's Singer, on the other hand, points out that at least some of the difference in approach stems from the fact that Barco sells monitors for the most part and Radius sells systems—monitor and controller boards for Macs and PCs. "The bottom line is what the user experiences, and in that regard there is no significant difference between Barco and our system," he says. "Barco closes the loop around the monitor and we close it around the system."

Although color rendition is of growing importance, the resolution of color screens is even more critical in some applications. In those instances, Sony's 20-by-20-in. screen with 2,048-by-2,048-pixel resolution stands alone. "The fact that it is so very large—28 inches in diameter—makes an impact on the viewer, especially where more than one person has to view it at the same time, such as in air-traffic control," says Stanford Resources' Castellano. "The only other color monitor on the market that can give you 4 million pixels is Hitachi's, and that is a 19-in. diagonal."

DOUBLING UP IN RGB DISPLAYS

At 28 in., Sony's 20/20 color monitor for air-traffic control dwarfs the 19-in. screen of conventional CAD displays.



In fact, when Sony started research on its 20/20 DDM-2802C five years ago, it had air-traffic control in mind. "We developed it on a bet and we won," says Gary Romans, marketing manager at the company's Precision Graphics Systems Division in San Diego. Officially introduced in March at the National Computer Graphics Association show in Anaheim, Calif., the display has so far attracted most of its serious interest from command-and-control systems integrators.

TWO JAPANESE COMPANIES "are developing mechancial CAD systems with it," says Romans, "but so far there has been no penetration in the U. S." For the most part, computer-aided design and manufacturing companies balk at the monitor's $40,000 price tag, but the prepress industry has expressed interest too, and did not find the price inhibiting, according to Romans.

"Like any other monitor," he says, "it is very sensitive to volume shipped. If we can find a market for 10,000 to 20,000 monitors, the price will come down into the $20,000 range." Controller boards for the monitor are available from UniVision, Burlington, Mass.; Metheus, Beaverton, Ore.; TechSource, Altamonte Springs, Fla.; and Chromatics, Tucker, Ga. "Some of the boards will give up to 24 bits, double-buffered," says Romans.

Sony's engineers came up with still another scheme for color calibration. It is accomplished internally by measuring current in the high-voltage power supply and correlating brightness levels with the current. The tables that define the correlations are kept in microcode, says Dave Eccles, staff engineer. Scanning such a large screen with 2,048-by-2,048 resolution and 4 million pixels created a couple of other challenges, says Eccles. The horizontal scan rate of the electron beam is 127 KHz, about twice the 65-KHz scan rate of high-resolution workstation displays. Sony handled that by redesigning the yoke. A technical paper on the redesign, which is based on a slit-core yoke, was presented at 1989's Society of Information Displays Conference.

Moreover, throwing 4 million pixels on the screen requires a pixel rate of 357 MHz, compared with 110 MHz for a 1,000-line display, says Eccles. To solve that problem, Sony jointly developed a 400-MHz video channel with Tektronix Inc. of Beaverton, Ore.

Gray scale—the ability to display multiple shades of gray by varying beam intensity—falls between 100-dpi color and 300-dpi, one-bit monochrome in the spectrum of display technologies. Its niche is supposedly in color emulation, but Stanford Resources' Castellano sees this as almost irrelevant. "People talk about gray scale emulating color, but I personally do not think it is true," he says. "I see people relaxing their resolution requirements just to get color."

As a case in point, Barco has been somewhat surprised to see a market for its color monitors "emulating" gray scale, says Lesage. The cause of the confusion is perceptional. "A lot of doctors are so used to looking at black-

and-white pictures that they say they don't want color," says Castellano. Color monitors achieve gray scale the same way they handle any color—by combining red, green, and blue into the proper tint. In medical applications Barco is seeing its 1,280-by-1,024-pixel color monitors used to show relatively static images—such as a heart and its valves—in gray scale, he says, and moving images—such as blood—in color. Just exactly what color is arbitrary, says Lesage, since it is differentiated and identified by the computer because of its motion. Any color can be assigned. "The fact that we are using color is due to the market's demand," says Lesage. "We did not intend to be in the black-and-white market, but people are using it that way."

Companies such as MegaScan Technology in Hopkinton, Mass., and Alacrity Inc. of Flanders, N. J., on the other hand, are actively pursuing the monochrome market with displays capable of laser-printer-quality resolution.

MegaScan's product line for the gray-scale market offers 200-dpi resolution, 2,000 scan lines, and 4,000 levels of gray scale. It is used primarily by physicians for X-ray diagnosis and by the intelligence community for analysis of satellite data, says Stan Kriz, vice president of engineering. The 4,000 levels of gray scale are obtained using a controller card capable of handling 12-bit-deep pixels.

MegaScan recently reached a new technology plateau for high resolution with a one-bit monochrome display that offers 300-dpi resolution on a 21-in. diagonal screen. To avoid flicker, the DDS-301 has selectable refresh rates of 72 and 76 Hz. It is aimed at three markets: document imaging, CAD, and electronic publishing, says Kriz. MegaScan's design team vaulted two major technology hurdles in the DDS-301: a video amplifier capable of a rise-and-fall time of 300 ps (compared with 3 ns for a typical 1,000-line CAD display) and a shift-register cascade to handle the flow of pixels out of video random-access memory to the electron gun.

In order to achieve a 300-ps rise-and-fall time in the video amplifier, says Kriz, MegaScan had to fall back on microwave techniques to design the amplifier itself and to model the electron gun's effect on the amplifier. "A conventional amplifier looks at the gun as purely capacitive load," he says, but "we had to take into account the physical length of the gun components. We compensate with proprietry circuits."

Moving the picture to be displayed out of VRAM and onto the screen presented speed probems of another type. "A 250-bit, high-speed shift register would have been too expensive," he says, "so we used a combination of technologies and multiplexing." Using TTL circuits running at 24 MHz, the bits are transferred out of VRAM in 64-bit words. The next step—still using TTL components—is to multiplex the bits into two 32-bit shift registers running at 50 MHz. The last two steps require emitter-coupled-logic circuits. First the bits are multiplexed into 16 ECL shift registers running at 375 MHz. Then they are transferred into the coaxial cable to the electron gun one at a time at 1.5 GHz. The 1.5-GHz pixel rate creates a problem of excessive heat in the yoke, which MegaScan solved with a patented cooling system, says Kriz.

In addition to its innovations in hardware, MegaScan has also paid plenty of attention to the software side of high-resolution displays. "One of the big flaws in the past has been that special drivers had to be written to run standard software packages," says Andrew Davis, vice president of marketing. The solution is software drivers that are resolution-independent, he says, and the bridge to that goal lies in standard user interfaces such as Microsoft Windows, X Window, and Presentation Manager.

"We've announced drivers that are compatible with Microsoft and X Window," he says. As software companies with standard graphics and paint programs go through their next revision and include hooks to the windowing environments, customers will be able to buy shrink-wrapped packages that run on MegaScan's displays.

The trend has already begun. The Xcalibur image-processing software from BDS Systems Inc. of Sterling, Va., for example, is compatible with the X-Window user interface and geared toward original-equipment manufacturers and value-added resellers that are developing products aimed at image processing and visualization.

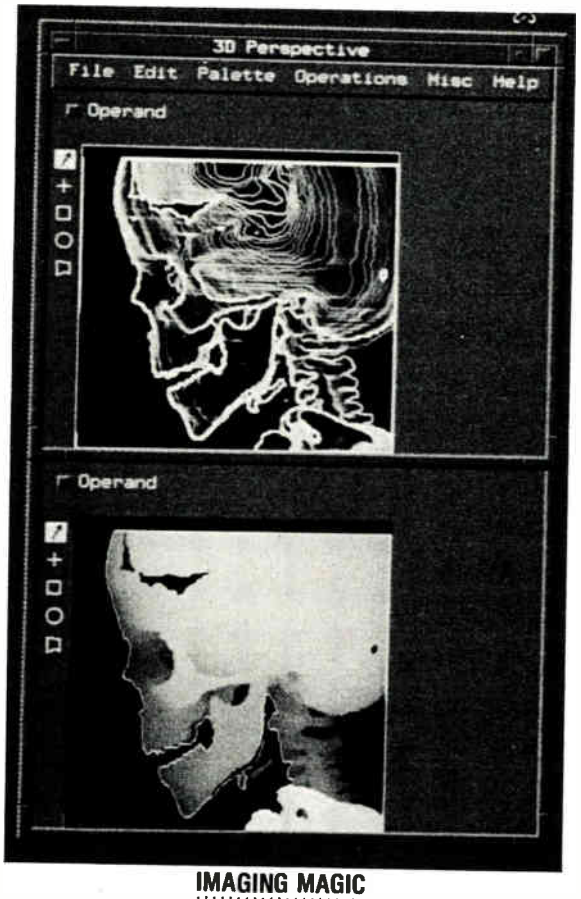
Applications that are ideal for Xcalibur include medical imaging, satellite and aerial reconnaissance, undersea imagery, and geosciences, says Gary Brown, BDS Systems' marketing manager. Written in C and running under Unix, Xcalibur offers a comprehensive suite of image-processing tools.

NEW-LOOK DISPLAYS

Color displays, armed with precision calibration, seek high-end markets such as prepress publishing.

Bigger is probably better, as CRT displays advance in both resolution and screen size.

Monochrome settles into a very-high-resolution niche with displays that rival laser-printer quality.



IMAGING MAGIC

Some software packages, like BDS Systems' Xcalibur, use the X-Window interface.

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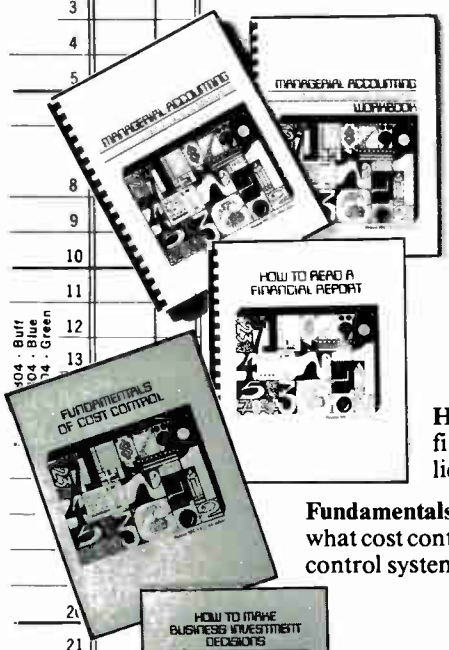

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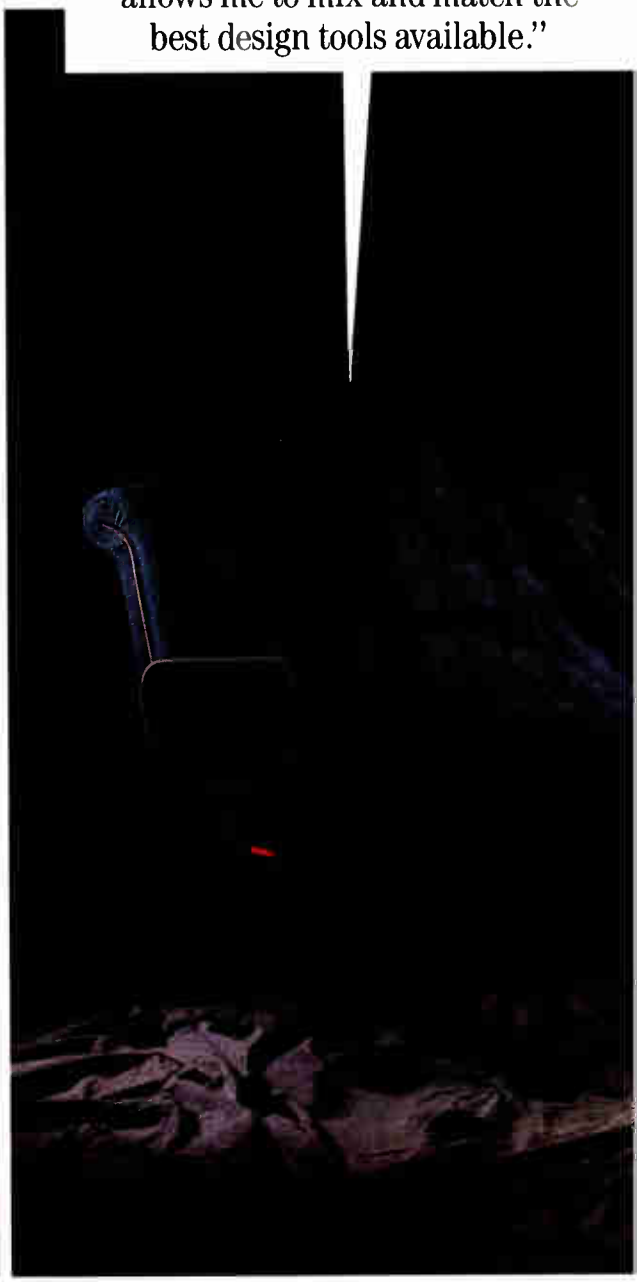

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CIRCLE 199

JUST HOW MUCH WILL HDTV CONVERSION COST?

FROM $4 MILLION TO $40 MILLION PER LOCAL TV STATION, SAYS ONE STUDY, AND PRODUCTS ARE NEEDED NOW

BY JACK SHANDLE

THE ECONOMIC REALITIES of high-definition TV are slowly becoming discernible as the storm of hyperbole passes and committee reports roll in. And while the latest National Association of Broadcasters' estimate of the cost of converting local stations is hardly rock solid—$4 million to $40 million, depending on many variables—it clearly points up the growing sense of the inevitability of HDTV and, with it, a mother lode of silicon for chip and systems houses with the right stuff.

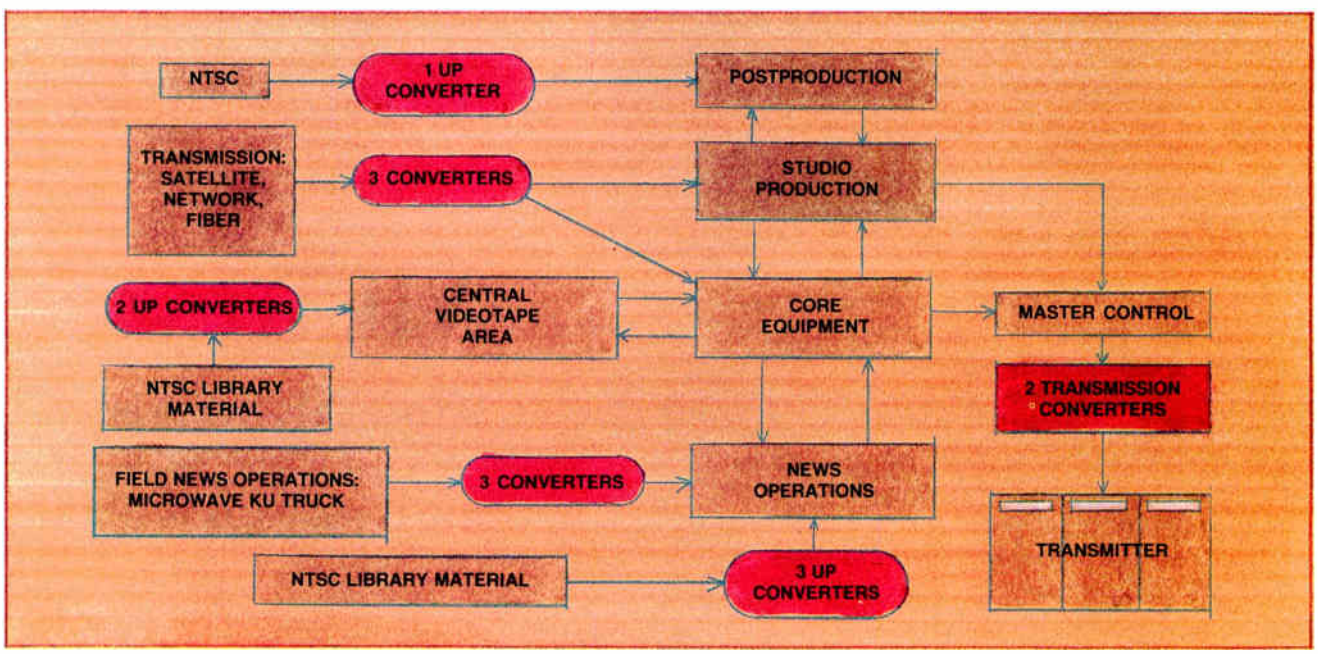
In the U. S. alone, converting signals from existing National Television Systems Committee standards to advanced TV and ultimately HDTV will mean the gradual replacement of most—if not all—of the local TV station's gear. Some local stations will be looking for products sooner than many chip makers believe.

HDTV

"There is a ton of NTSC material [on videotape] that is going to be up-converted, as well as live news that might initially originate in the studio in NTSC but be converted to a high-definition standard for transmission," says Bob Ross, chairman of the NAB Engineering Conference working group that produced the study.

HDTV sets in the home are not a prerequisite. Viewers will receive what amounts to a very high-quality NTSC picture, says Ross, who is also director of broadcast operations for KYW-TV in Philadelphia. "Even a small station is going to need seven, eight, or nine converters inside its plant and two converters to transmit," he says.

One high-end up converter will serve the postproduction studio, which requires a very high-quality signal. One or two up converters will transform NTSC videotape from the station's tape library, and another three will link the library to the local news operation. And three additional converters—one each for the red, green, and blue signals—will go into two fur-



MOTHER LODE OF SILICON

Chip vendors will find an expanding market as the 1,500 U. S. local TV stations begin moving to ATV and HDTV. Even a small station will need seven to 11 converters to make the switch.

ther applications: network feeds and the local news operation's remote equipment.

At last count, there were 1,446 TV stations in the U. S. with another 200 or so construction permits outstanding. A single TV studio camera can cost as much as $1 million. Present-day boxes that convert European standards such as PAL (Phase Alternate Line) or Secam (Sequential Couleur avec Memorie) to NTSC address problems that "are not all that different" from the ones presented by HDTV, Ross says. Generic requirements include "a lot of memory and very-high-bandwidth analog-to-digital and digital-to-analog conversion," Ross says.

Conversion Cost	Enhanced-Definition TV		High-Definition TV	
Large station (Three studios)	Up to $6M	Up to $20M	Up to $32M	Up to $40M
Small station (One studio)	Up to $4M	Up to $5M	Up to $10M	Up to $13M
Modifications, additions, and other costs	• Modify cameras, tape equipment, and transmitter exciter • No modification to core plant equipment that processes TV signal	• New 1,050-line cameras, tape equipment, etc. • No modification to core equipment	• New cameras, tape equipment, etc. • New plant core equipment • Convert signal for broadcast from existing tower	• New cameras etc. • New plant core • Install second transmitter and tower • Acquire land • Lawyers
Technology proposal	Sarnoff Labs' 525-line EDTV	Faroudja Inc.'s 1,050-line camera, 525-line EDTV transmission	NHK Ltd. simulcast HDTV	HDTV
	Group 2	Group 3	Group 4	Group 5

Since Ross and his working group approached their cost estimates from a broad perspective—and without much baseline data—the results range widely. The working group was consistent, however, in assuming that at least some ATV production would originate in the local station. This approach omits the lowest-cost solution, says Ross, in which local stations simply build in the capability to "pass the network" feed. Broadcasters used this scheme to make the transition from black and white to color, and it is most likely to be the first step of a phased conversion for many stations.

THE MINIMUM EQUIPment necessary to pass a network signal is based on a number of assumptions: that a second signal is delivered to the studio from the network; that there is a minimum of videotape and switching between ATV systems and NTSC; delivery to the transmitter site; transmission over the air; and minimum monitoring. ATV—either in the pass-the-network scheme or as enhanced-definition TV—will deliver a signal that is noticeably inferior to pure HDTV, Ross says.

Nevertheless, the working group's formal report presupposes a phased transition. Its first two estimates (Groups 2 and 3 in the chart) reflect the costs of competing EDTV systems, one from Sarnoff Laboratories in Princeton, N. J., and the other from Faroudja Inc. The next two (Groups 4 and 5) address the still-to-be-decided HDTV standard.

Separate estimates were prepared for large and small stations. The small stations have less equipment, but also less latitude in devising options, says Ross. A large station can, for example, choose at first to convert just one of its three or more studios and associated equipment; a small station will be working with just one studio.

At the high end, it could cost as much as $40 million for a large station to convert, and that doesn't make HDTV proponents happy. "We have our concerns about the $40 million figure," says Wayne C. Luplow, executive director of Zenith Electronics Corp.'s Electronic Systems Research and Development Division in Glenview, Ill. Cost estimates made today involve "a lot of 'Kentucky windage,' " he says, adding that other industry associations are in the process of generating data similar to—but not necessarily concurring with—the NAB's.

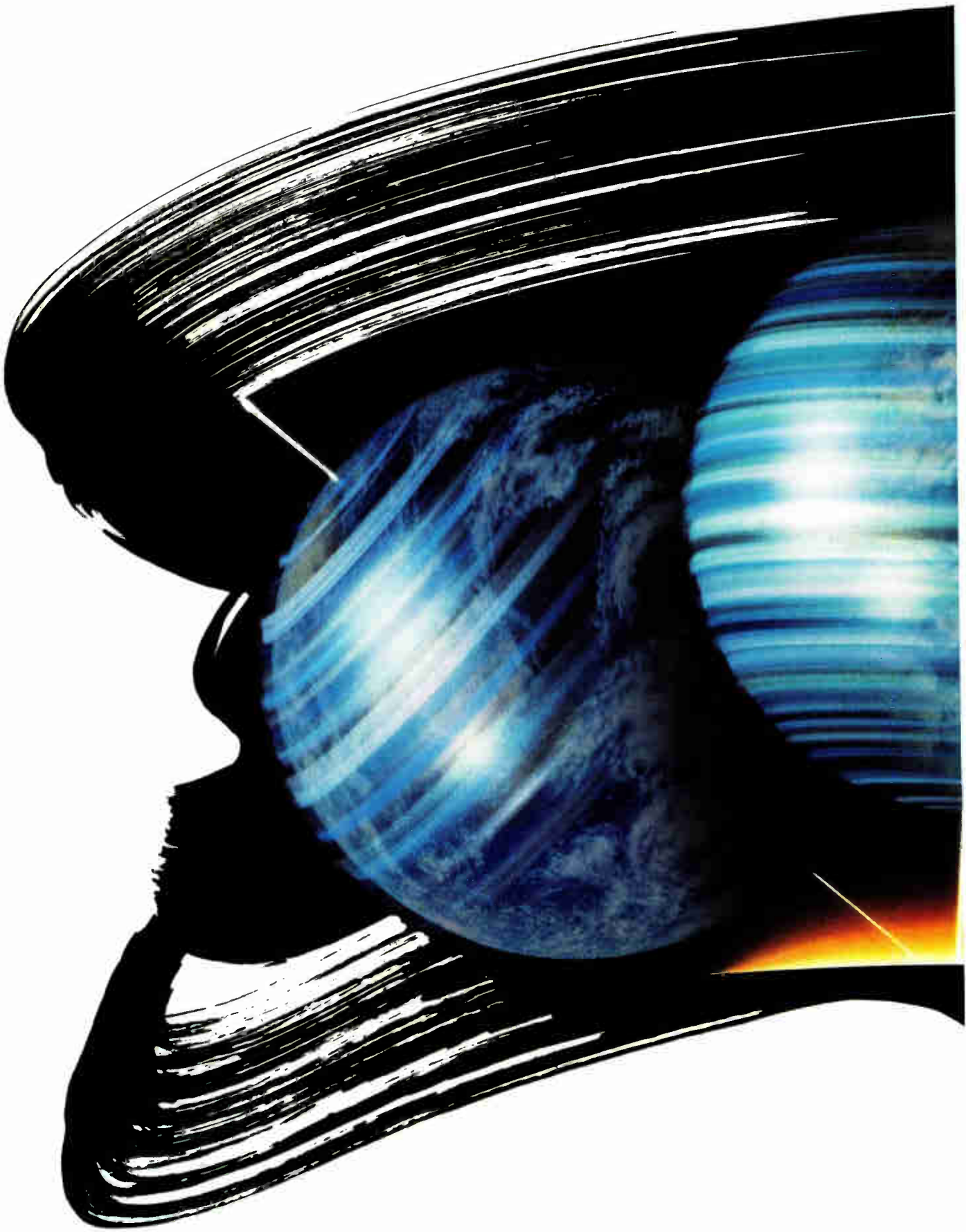
In particular, Luplow contends that few stations need to build an additional tower and antenna. Zenith and the developers of many other HDTV proposals have all taken power requirements into account and have projected relatively low-power solutions. "We think the likelihood of a second tower is small," he says. "It will happen, but not very often."

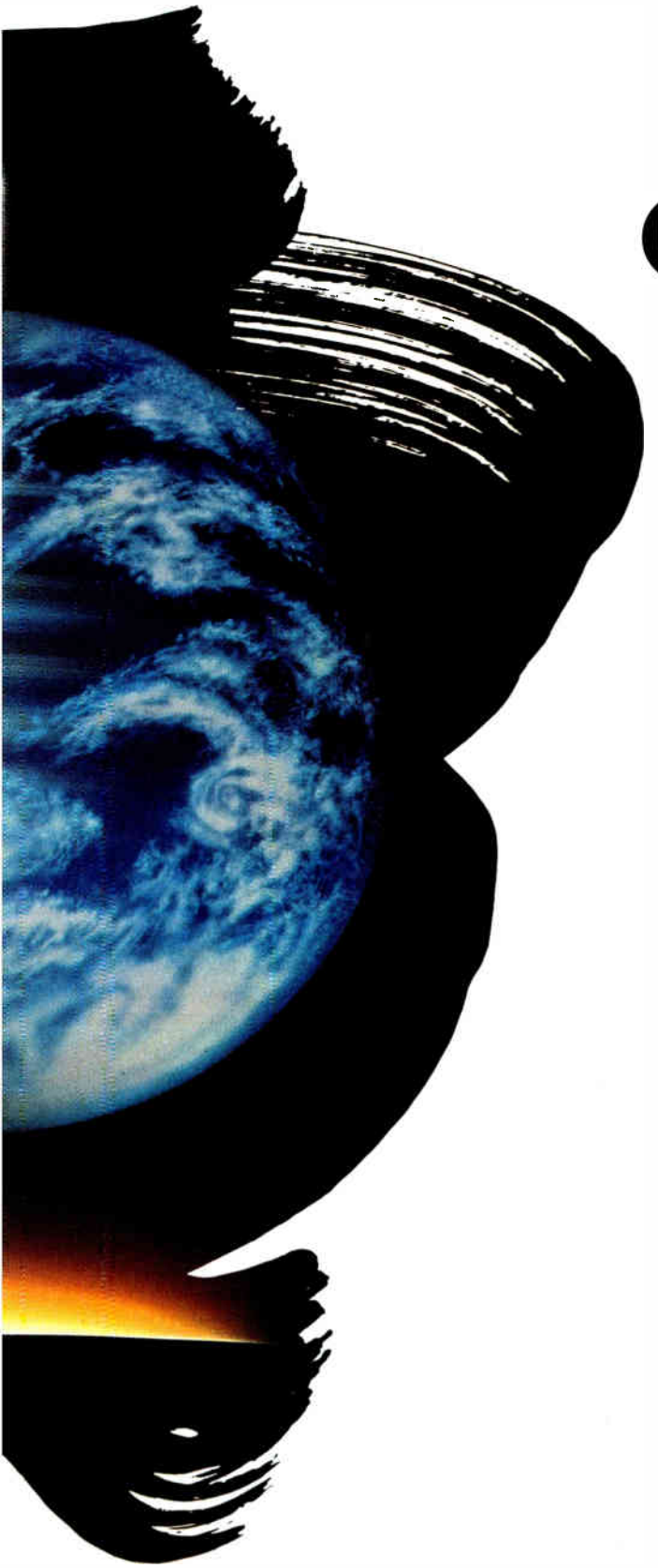
Ross frankly acknowledges that the working group's estimates are imprecise. In some instances, the group had to estimate a price for equipment that does not now exist. In other cases, it was stuck with using the single-unit price because volume pricing is not available. The important questions of volume pricing and better "fudge factors" will occupy the working group through most of the coming year, he says.

In the working group's scenarios, Group 1, which is not shown on the chart, represents NTSC technology. Group 2 stations are presumed to have adopted the Sarnoff EDTV system, which uses a 525-line camera but widens the signal bandwidth to 8 MHz. This requires the modification of cameras, tape equipment, and the transmitter exciter, but not the core equipment, because the 8-MHz signal will pass through the conventional 10-MHz plant. The core equipment area contains the central signal router and its associated equipment.

Group 3 stations follow Faroudja's approach of a 1,050-line camera and the replacement of concomitant equipment, but not the core plant. Groups 4 and 5 represent conversion to the terrestrial broadcast of HDTV signals, which requires new cameras, tape equipment, and associated equipment. Since the existing core equipment does not have sufficient bandwidth to handle the HDTV signal, however, it will have to be replaced as well.

The primary difference between Groups 4 and 5 lies in the transmitter, tower, and antenna. Group 4 stations are presumed to be using NHK Ltd.'s system, in which the production signal is an HDTV signal that can be converted to fit into a modified transmitter. Group 5 stations are also presumed to have an HDTV production signal, which requires a second transmitter for either the proposed augmentation or simulcast broadcast technologies.





Tiny Glitches Lead to Giant Wobbles

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

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

Hipparchus

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

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CIRCLE 279

HDTV: LOOKING GOOD AS A CAD/CAM STANDARD

ZENITH'S RETOOLED SPECS PAVE THE WAY FOR A STANDARDIZATION OF DISPLAY TECHNOLOGY

BY JACK SHANDLE

SLOWLY BUT SURELY, HIGH-definition TV is winning its battle for a piece of RGB turf in the world's technology future, and the latest trends toward standards should warm the cockles of U. S. computer makers' hearts.

Zenith Electronics Corp.'s decision to alter two key specifications for its proposed HDTV production standard helps open the door for the direct adoption of HDTV into the computer world, especially in high-resolution applications such as computer-aided design. Zenith demonstrated its "new and improved" production standard for the first time at the recent National Association of Broadcasters' Conference.

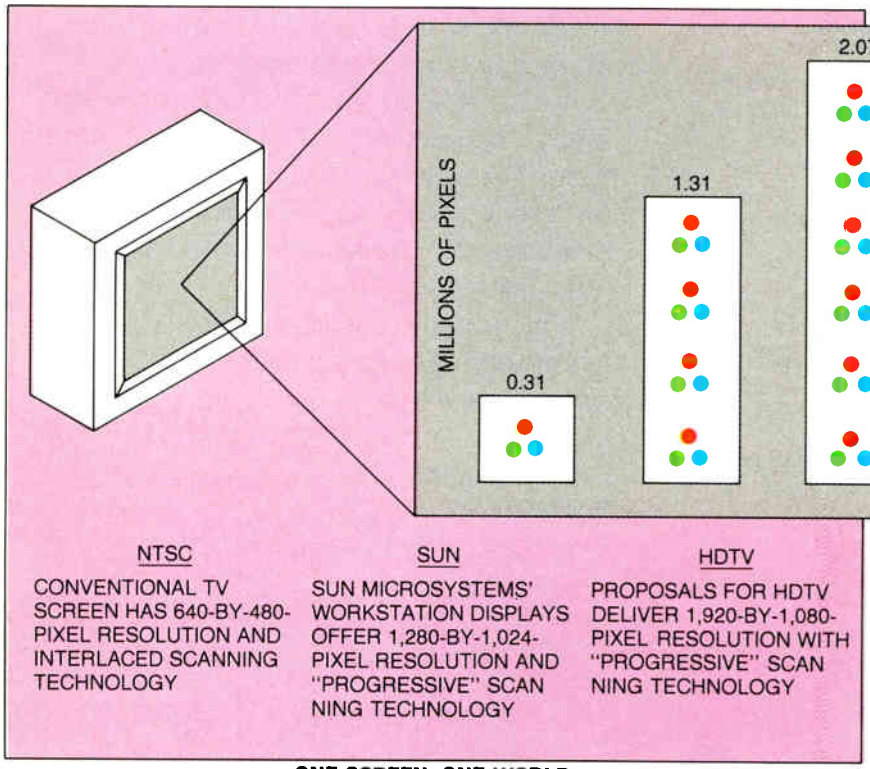
Meanwhile, the International Radio Consultative Committee (CCIR) met in Dusseldorf, West Germany, last month to endorse 30 recommendations of it technical experts on all essential elements of an HDTV display—except the ultraimportant standards for resolution and frame-repetition rate. CCIR's next decisional meeting on HDTV will convene in the fall of 1991.

HDTV

For the computer industry, HDTV represents an opportunity to standardize on a display technology superior to what is currently available—even in CAD systems—while at the same time relieving itself of the economic burden associated with multiple display standards, says Charles Poynton, a staff engineer at Sun Microsystems Inc.'s Graphics Products Division in Mountain View, Calif. Computer users have been plagued by a wide variety of incompatible monitor interface standards for years, he says. HDTV will offer a common scanning and interface standard for the next generation of workstations. It will simplify the interfacing of workstations to monitors, down converters, film recorders, and other peripherals.

But so far, computer manufacturers have, for the most part, been asleep at the HDTV switch. Most of the participation in standards has been directed by broadcasters and consumer electronics manufacturers. Nevertheless, Zenith's decision to offer a production standard compatible with the U. S. Advanced TV Systems Committee's proposed Common Image Format (CIF) is good news for the computer industry because it implements a so-called "square-pixel" display characteristic in which the spacing between pixels is equal along both axes.

Unequal vertical and horizontal spacing is very inconvenient for computer users, says Sun's Poynton. Visual information scanned into electronic format



ONE SCREEN, ONE WORLD

Some say that HDTV will offer a common scanning and interface standard for the next generation of workstations.

using a sampling scheme based on unequal horizontal and vertical spacing must be rescanned or subjected to substantial computation to display it on a non-square-pixel screen. Both of these algorithmic techniques tend to impair picture quality.

The CIF calls for a screen aspect ratio of 16 : 9 and for a resolution of 1,080 lines with 1,920 pixels per line. Zenith's proposed production standard adheres exactly on screen aspect ratio. Its field-refresh rate is 59.94 Hz. And its resolution is 720 active lines on the screen by 1,280 pixels per line. "The 720 lines is exactly two-thirds of [the CIF's] 1,080, and the 1,280 pixels is exactly two-thirds of 1,920—which makes them nicely and evenly convertible to the Common Image Format," says Wayne Luplow, Zenith's executive director for research and development.

ZENITH'S PROPOSED PRODUCTION standard actually has 787.5 total lines in each field, but 67.5 lines are in the vertical blanking interval and do not appear on the screen. This seeming anomaly comes about to keep HDTV easily down-convertible to conventional NTSC TV. The total lines in an NTSC field is 262.5—exactly one-third of 787.5.

NTSC uses a 2 : 1 interlaced scanning technique, in which every other line is scanned. Zenith's proposed standard offers "progressive" scanning, in which each line is scanned. The relative merits of progressive versus interlaced scanning are, in fact, the hurdle that Zenith must leap in order to have its standard adopted by U. S. and international bodies.

Zenith's switch from its originally proposed 5 : 3 aspect ratio to 16 : 9—and from oblong to square pixels—has paid dividends in other ways. It allows Zenith's proposed Spectrum-Compatible HDTV transmission system to compress the information contained in 37 MHz of a production signal into the 6-MHz bands allocated for terrestrial broadcasts by the Federal Communications Commission, says Zenith spokesman John Taylor. The initial proposal could only compress 30 MHz into the standard FCC band.

Zenith's production standard is being reviewed by the Society of Motion Picture and Television Engineers (SMPTE). So far, the only HDTV production standard to be approved by any group is Sony Corp.'s 1,125-line system with a 2 : 1 interlaced scan technique and 60-Hz refresh rate. That got SMPTE's seal of approval last year, but when SMPTE passed it on to the American National Standards Institute for routine approval, ABC Television Inc. launched a legal challenge that resulted in ANSI rejecting it. So now the ball is in Zenith's court.

SQUARE PIXELS

Zenith's new HDTV production standard implements a so-called "square-pixel" display, with equal horizontal and vertical spacing.

That's good news for computer makers; non-square pixels require conversion to a square-pixel format for use by graphics software. Moreover, the compute-intensive conversion adversely affects picture quality.

The match-up pretty much ignores the square-pixel issue. It is being fought on picture quality. "A superficial comparison could lead to the conclusion that 787.5 lines is not as good as 1,125," Zenith staff engineer Wayne Bretl told the NAB conference. "But this overlooks the mode of scanning." Bretl contends that the Zenith production standard delivers pictures on a par with the 1125/60/2 : 1 system because it uses a progressive instead of interlaced scanning mode.

"The 1125/60 standard has a certain amount of inertia, 99% of it out of Japan, because that is where current production equipment is manufactured," says Zenith's Luplow. "The problem is that no one has figured out a way to deliver 1125/60 through the terrestrial broadcasting system in the U. S. To do so, you have to have something that is friendly with the 525-line NTSC standard."

The battle for a production standard has importance across the board, says Bob Ross, director of broadcast operations for KYW-TV, Philadelphia, and chairman of an NAB committee developing figures on the cost of HDTV conversion (see p. 66). "No station wants to buy and maintain converters to convert to and from a production standard to a transmission standard," he says. "The production equipment makers will build to the new transmission standard set by the FCC."

Judging from the progress of the CCIR, the world seems to be drifting toward a global HDTV standard. A standard resolution could be adequately addressed by the CIF, but frame rate—Europe supports 50 Hz and the U. S. and Japan opt for 60 Hz—is a daunting hurdle. "Given the FCC schedule and the CCIR schedule, it would appear that all the pieces of the HDTV puzzle will come together in the 1992–1993 time frame," says James C. McKinney, chairman of the Advanced Television Systems Committee. "The remaining issues—scanning parameters—are clearly the most difficult."

Sun Microsystems' Poynton acknowledges that frame rate is a critical issue, but proposes still another option besides 50 and 60 Hz. Computer users are not entirely comfortable with 60 Hz because many people can detect flicker at that frame rate. A 72-Hz rate is more appealing, and Poynton argues it should be given attention by the broadcast industry.

ABOUT 80% OF PRIME-time TV in the U. S. originates on film, which has a 24-Hz frame rate, which is then converted to 60 Hz. Therefore, a 24-Hz production standard using progressive scan would fit neatly into the broadcasters' plans. More important to computer manufacturers, however, is that a 24-Hz production standard would be easily convertible for display at three times that rate—that is, 72 Hz. Workstation monitors shipping today in high volume use 72 Hz. The proposal, Poynton says, offers broadcasters the ability to down-convert using exactly the same techniques they use for 24-Hz film.

While there has been plenty of hoopla about HDTV rejuvenating the U. S. consumer electronics industry, not much has been said so far about the economic potential for HDTV in the computer industry. "The computer industry itself is sufficient to sustain a very healthy display industry," says Poynton. At the moment, however, virtually all color displays used in U. S.-manufactured workstations are imported, due to the unavailability of domestically manufactured displays.

"If the computer graphics community participates sufficiently in HDTV standards efforts," says Poynton, "the computer display standard could be identical to a single worldwide HDTV production standard."

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RISC STATION REDEFINES COST PER SEAT IN CAD

AIMED AT SCHEMATIC CAPTURE AND SIMULATION, SUN'S SLC SELLS FOR LESS THAN $5,000

BY LAWRENCE CURRAN

COST PER SEAT IS A MAJOR concern for managers seeking the right tools for their design teams, and a mid-May introduction from Sun Microsystems Inc. has stirred the market by redefining the low-end per-seat cost for reduced-instruction-set-computing workstations.

The Sparcstation SLC from the Mountain View, Calif., leader in the workstation market sells for $4,995: that's the lowest price to date for a RISC workstation. Since the SLC delivers 12.5 million instructions/s (1.2 million floating-point operations/s), that works out to less than $400 per mips. The closest competing RISC and CISC workstations weigh in at about $760 to $1,150 per mips.

Developers at Sun maintain that the SLC's price and performance will prompt economy-minded users, who may have been leaning toward networked personal computers or X terminals, to opt instead for the more attractive price/performance ratio of a true workstation.

Combined with a new low-priced server introduced a few weeks earlier, the SLC helps rewrite the server-to-seat price ratio in design automation. The Sparcserver 1+, which succeeds the Sparcserver 1, has an entry-level price of $13,900. That compares with $18,900 for its predecessor.

The SLC and the server are powered by different versions of the Sun-designed Sparc processor. The SLC uses a 20-MHz device, the server a 25-MHz Sparc chip. The latter is also the processor employed in the Sparcstation 1+, which made its debut with the new server in late April.

The Sparcstation 1+ and the 1+ server provide a 20% performance improvement over their predecessors. Their 25-MHz processor enables 15.8 mips, 1.7 megaflops, and 10 SPECmarks, versus 12.5 mips, 1.4 megaflops, and 8.4 SPECmarks for the preceding machines.

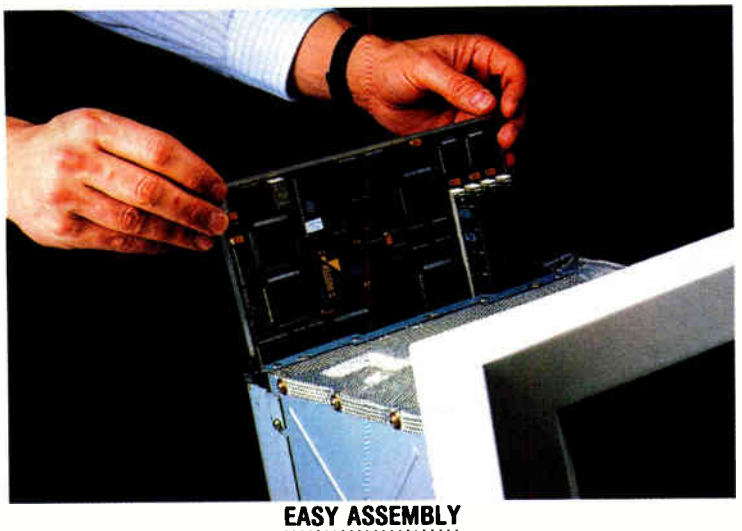
Sun says the original Sparcstation 1 is the leading seller among RISC workstations, and International Data Corp., the Framingham, Mass., market research organization, agrees. The machine accounted for 42% of all workstations shipped worldwide last year, says Vicki Brown, vice president for systems research at IDC, in a recent workstation-market report (see p. 76).

EDA

As for the SLC, Brown acknowledges that at less than $5,000, Sun "certainly has the industry's price/performance leadership, but I thought they'd offer more mips on the desktop." She adds, however, that the aggressive pricing will make the SLC competitive with high-end 32-bit PCs. "It seems reasonable to expect that PC CAD [software] vendors should be interested in porting to the SLC," she says.

Sun was able to price the SLC low by going with the 20-MHz processor in a diskless configuration that requires just one power supply shared by the single processor board and 17-in. monochrome monitor. In fact, the innovative packaging of the fanless SLC is a major contributor to manufacturing economy and low price. The processor board slides into a convection-cooled rack behind the monitor.

The use of low-power CMOS circuitry and the ability to have a single 80-W power supply drive both the system board and the monitor eliminates the need for a second power supply and cooling fan. The circuit board is smaller than the one used in the SRARCsta-



EASY ASSEMBLY

The SLC's innovative packaging contributes to its low price; the single processor board slides into a convection-cooled rack.

IN WORKSTATIONS, RISC IS OVERTAKING CISC

QUESTION: HOW PERVASIVE has reduced-instruction-set-computing become? Answer: so pervasive that RISC processors will soon dominate the workstation market, the fastest-growing segment of the computer industry. That's the central conclusion of a recent report from International Data Corp., the Framingham, Mass., market research firm.

The IDC report, "RISC Workstation Market," concludes, among other things, that RISC processors last year accounted for 37% or about $2.2 billion of the $5.9 billion in worldwide workstation/server revenues derived by U.S.-based workstation vendors. That was an improvement from the 23.2%—some $900 million—attributable to RISC processors for 1988, estimated by IDC at $3.9 billion.

And the beat goes on. By 1994, a whopping 90% of all workstations shipped will be RISC-based, says Vicki Brown, IDC's vice president for systems research. Brown, who follows workstations closely, wrote the IDC report, which was released in late May. Among its other conclusions are:

- The Scalable Processor Architecture (Sparc) pioneered by Sun Microsystems Inc. is now and will continue to be the leading RISC architecture;
- Sun displaced Intergraph Corp. as the RISC workstation/server market-share leader in 1989, and will remain the leader for the next few years;
- Digital Equipment Corp. and IBM Corp. will both gain momentum in RISC workstations through 1994, with Digital achieving double-digit market share this year;
- The RISC workstation/server segment will again see triple-digit growth in 1990, as it did last year.

Technical computing, including electronic design automation, continues to demand the high performance of RISC processors. The forecast section of the IDC report assumes that the trend will continue toward the use of RISC desktop systems—primarily for technical and later for commercial use.

As for the Sparc architecture, IDC estimates that almost 55% of 1989 worldwide RISC unit shipments by U.S. vendors were Sparc processors. IDC expects the Sparc dominance to continue, forecasting that 61% of all RISC units shipped this year will have Sparc processors.

The report shows that Sun, of Mountain View, Calif., vaulted over Intergraph, Huntsville, Ala., last year to become the leading supplier of RISC workstations and servers. Sun had 54.8% of worldwide unit shipments and 44.5% of equipment revenues to Intergraph's 15.6% of units and 19.2% share of revenues worldwide. IDC's 1988 tabulations put Intergraph in the top spot, with 38.1% of unit shipments, while Sun came in second at 27.3%.

And while Sun's fortunes should continue to soar, the leader should also see the beginnings of some market-share erosion, perhaps next year, as new products from Digital and IBM begin to take hold.

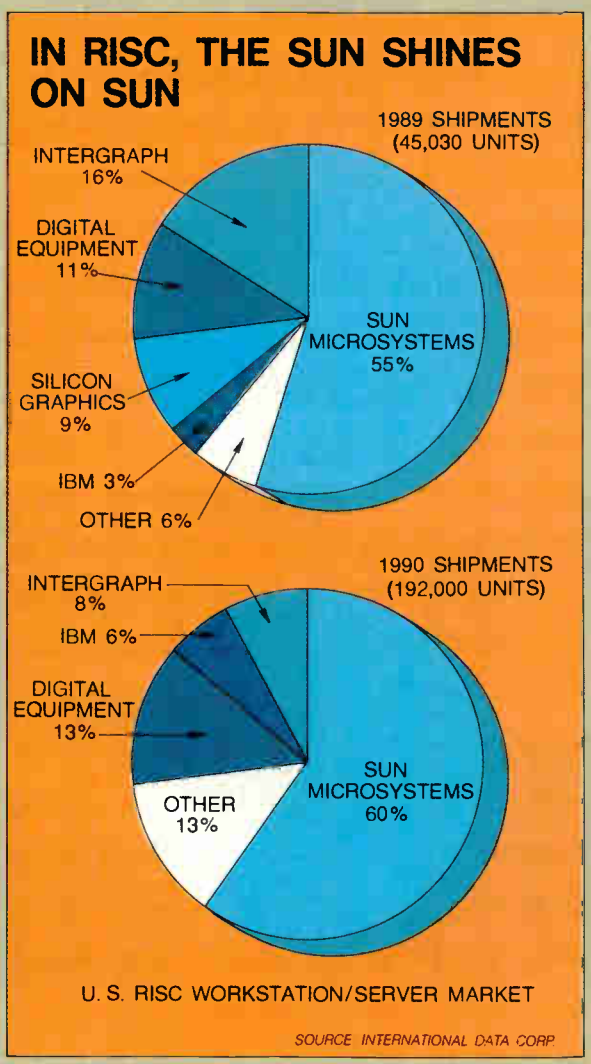
Digital's sales of DECstations were hampered last year because not enough application software was available for its platforms, says Brown in the IDC report. But with 854 packages ported as of two months ago, "Digital is close enough to a critical mass to more than triple its unit shipments during 1990, to 25,000 worldwide," she projects. Achieving those numbers would give Digital 13% of this year's shipments, enabling the company to edge Intergraph out of second place.

As for IBM, despite its formidable reentry into the market with the RISC System/6000 family [*Electronics*, April 1990, p. 32], it still must counteract the false start it made with the unsuccessful RT platform. "IBM has to overcome the negative momentum of the RT," Brown says, "but they've tried to do it all right" with the 6000 family.

IBM's anticipated 12,000 units will give the Armonk, N.Y., company a 6.3% share of the RISC units shipped this year, in IDC's estimation. But Big Blue will have to wait until 1992–93 to achieve double-digit unit-shipment share. Industry analysts estimate that it usually takes about 18 months after a product introduction to attract enough application software—a situation that now affects IBM.

Meanwhile, IDC predicts that Sun will ship 115,000 units this year—60% of all RISC stations and servers delivered and a huge increase from Sun's 1989 total of 45,550. Overall RISC shipments from all U.S.-based vendors will reach 192,000 units, which represents an increase of 131% over 1989 shipments of 83,068, according to IDC.

"The market is expanding greatly," Brown says, so that one firm's business spurt doesn't automatically rob market share from another. But she believes the increasing successes of Digital and IBM in the RISC business will begin to erode Sun's market share in the next few years.—*Lawrence Curran*



tion 1+; it measures 7 by 9 in., against 8.5 by 11 in. for the larger machine. But component placement on the SLC board is done to minimize any heat buildup in the unit.

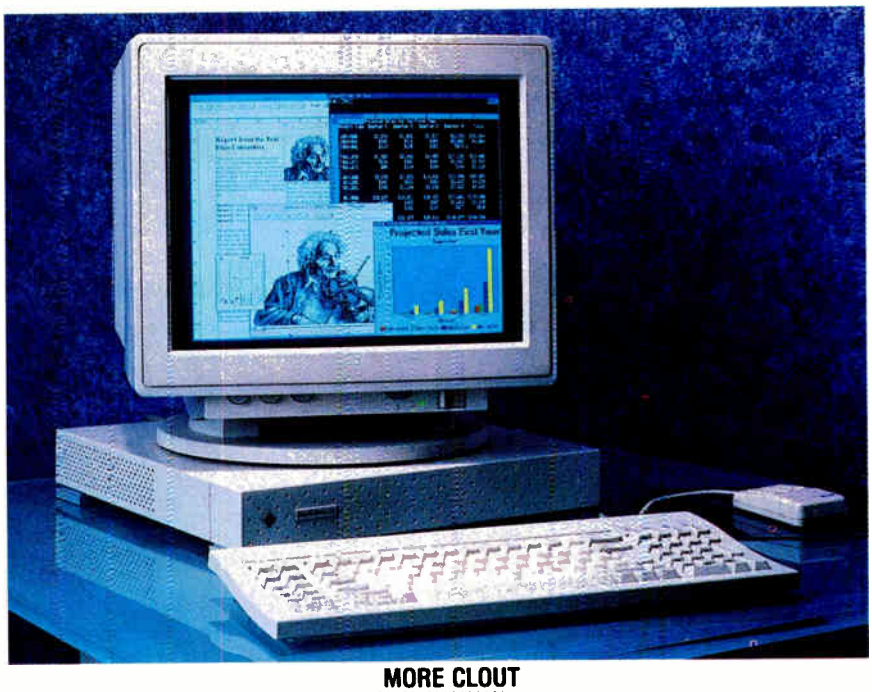
Integrating the SLC's three main sections—monitor, processor board, and power supply—into one package makes the system economical to manufacture in high volume: assembly consists of simply inserting the board and then testing. Besides the Sparc processor, which Sun obtains from six sources, the system board holds 8 to 16 Mbytes of memory in 4-Mbyte single in-line memory modules and a Small Computer Systems Interface port for add-on options, such as disk drives, backup tape, or a CD-ROM. The SLC supports from 104 Mbytes to 2.7 Gbytes of mass storage.

The monochrome display has a resolution of 1,152 by 900 pixels, making it suitable for beyond-VGA applications (those requiring at least 1,024 by 768 pixels). In electronic design automation, these include both schematic capture and circuit simulation, says Jenny Crabtree, manager of EDA market development at Sun.

"A lot of shematic capture doesn't need huge amounts of memory and disk," she says. Rather, "customers are looking for low price points, but workstations have been too expensive for those applications." The SLC will change that, she maintains, appealing to managers who need the maximum number of seats on a limited budget—a class of customer that may be considering X terminals or networked PCs.

X TERMINALS ARE CHEAPer: they sell for $3,000 or less. Sun points out, however, that their performance tops out at about 2 mips and they provide no interface to hard-disk storage. As for networked PCs, their 15-mips performance exceeds that of the SLC, but they sell for two to three times its price.

Elaborating on the SLC's suitability for EDA, Crabtree notes that five to seven years ago, the goal was "to put a workstation on every engineer's desk. The SLC makes that achievable." Further, the SLC-server combination is especially appropriate for "the VLSI design environment, where the goal is a workstation for every engineer and a server to be shared by five to 10 engineers, providing access to all available design tools from the desktop."



MORE CLOUT

The Sparcstation 1+, which performs 15.8 mips and 1.7 megaflops, outpaces its predecessor, the Sparcstation 1, by 20%.

But the SLC isn't limited to computer-aided design and engineering. Sun is also aiming it at applications where a low-cost monochrome workstation is attractive, including computer-aided software engineering and university environments. Another application area is technical publishing, where a 100-dot-per-inch screen is suitable.

As for the Sparcstation 1+, it inherits its predecessor's legacy of dominance in the RISC workstation market, with more than 18,900 units shipped last year, according to IDC estimates. The new version offers a choice of high-resolution color or monochrome monitors as well as three internal Sun Sbus expansion connectors to add a variety of options.

A diskless version that has 8 Mbytes of random-access memory, a 17-in. monochrome monitor, and bundled SunOS Unix operating system sells for $8,995. The main memory can be expanded to 40 Mbytes, and the system enclosure houses as much as 208 Mbytes of hard-disk storage. External mass storage can go as high as 2.7 Gbytes.

For design applications, a souped-up graphics version—the Sparcstation 1+GX—offers a 25% boost over the graphics-accelerator variation of the Sparcstation 1. That translates into the fact that the 1+GX can draw 540,000 two-dimensional or 270,000 three-dimensional vectors/s.

Sun says that, unlike any other low-cost graphics accelerator, the GX version accelerates everything seen on the screen, from window response and text scrolling to 2-d and 3-d wireframe image rendering.

The new GX system sells for $21,995, which includes the graphics accelerator option, 16 Mbytes of RAM, and a 19-in. color monitor.

Both the SLC and 1+ workstations provide a link to DOS computers by means of DOS Windows emulation software—an option that lets DOS users take advantage of Unix without giving up access to thousands of DOS application programs, thus protecting their PC investments.

THE SLC'S NICHE

The SLC sets a new price/performance level: at $400 per mips, it comes in at $350 to $750 below competing machines.

Sun expects it to appeal to users who might otherwise choose networked PCs or X terminals.

Combined with the new Sparcserver 1+, the SLC helps rewrite the server-to-seat ratio in CAD/CAE.

'TOP-DOWN' DESIGN IS THE WATCHWORD AT DAC

DENSE, COMPLEX CIRCUITS NEED MORE THAN SCHEMATIC CAPTURE, AND VHDL IS A KEY

BY JONAH McLEOD

THE CHALLENGE FACING CAE/CAD tools today is to produce increasingly more complex designs that operate at faster clock speeds and get them to market in record time. At the Design Automation Conference in Orlando, Fla., the week of June 24, tool vendors will show just how well they have met this ongoing challenge.

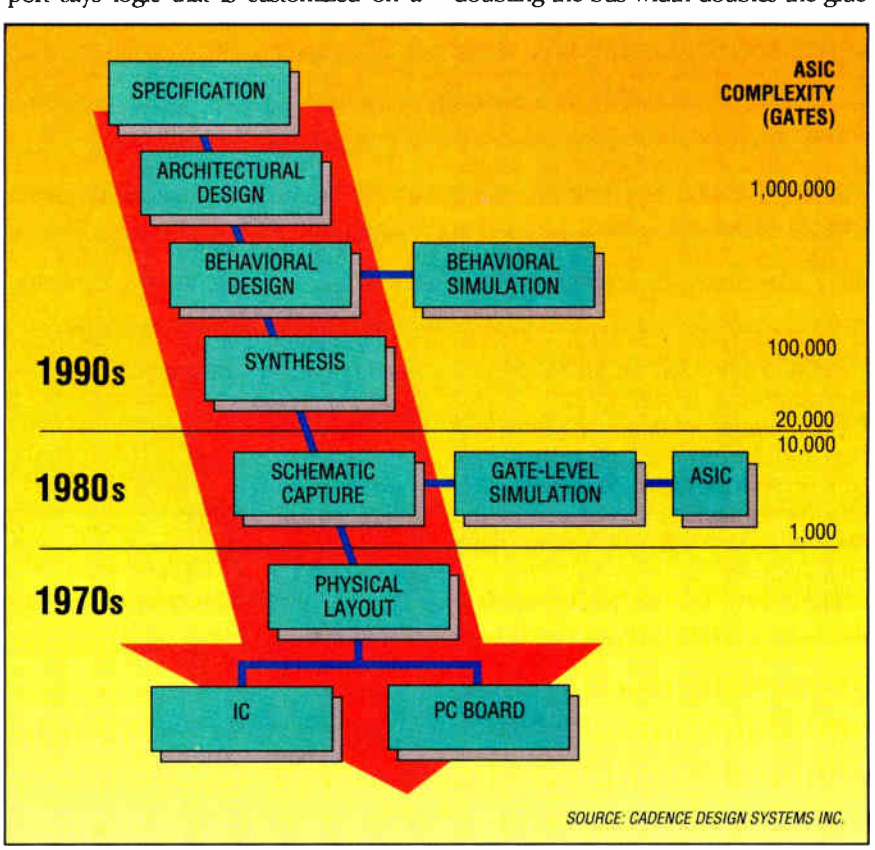
To tackle more complex systems, tool suppliers are offering new front-end tools to acquire and simulate portions of circuits described simultaneously in behavioral, structural, and gate-level descriptions. Increasingly these tools are using newer implementations of VHDL—the VHSIC High Level Description Language—to represent the design, concurrent multilevel simulators to debug its function, and new synthesizers to convert large chunks of the design into logic automatically.

Vendors are also offering new integrated circuit layout tools that ease development of dense, complex, mixed-block and standard-cell designs, along with new board layout tools that handle multichip modules as well as heavily populated printed-circuit boards containing complex application-specific ICs and surface-mounted devices. To handle designs with faster clock speeds will be new timing analysis tools that model crosstalk and propagation delays in both ICs and pc boards.

Circuit complexity has risen steadily over the past few years. At the high end of ASICs, "gate complexity is increasing at 40% a year and double every two years," says Andrew Rappaport, president of the Technology Research Group in Boston, with the average design size last year weighing in at 25,000 gates. At the low end—which accounts for around 85% of the market—"gate complexity has been growing at about 1,000 gates per year," he says. "The average design size was around 8,000 gates last year and it will grow to about 9,000 this year."

EDA

Boards that contain these new ASICs are also increasing in complexity: Rappaport says logic that is customized on a per-application basis is seeing 30% to 50% growth per year. Wider buses are driving this trend, he says. "Buses on general-purpose computer boards have expanded from 16 to 32 bits in size in the past few years," he says. "Bus sizes on embedded-processor designs have grown from 8 to 16 bits, and recently we have begun seeing a few 32-bit-wide buses here as well. In general, doubling the bus width doubles the glue



FROM THE TOP DOWN

The methodology of the '90s is to describe and debug a design at the highest level of abstraction and then have it automatically implemented.

logic required to build the board." Such boards operate at higher speeds, and their packaging is denser and more restrictive, than older designs.

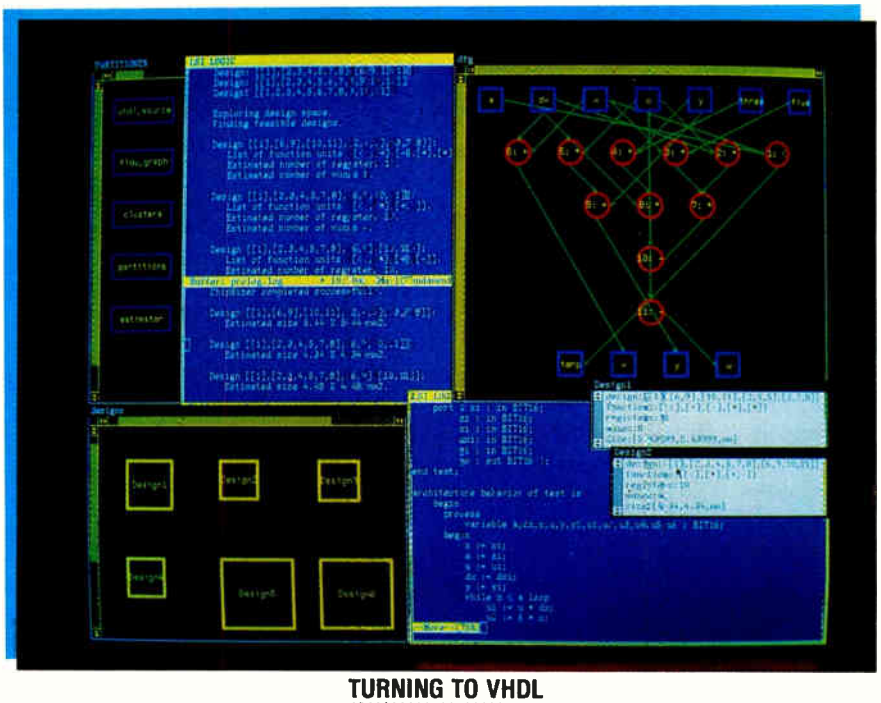
"To deal with this increased complexity, the preferred method is to design top down," says Ron Collett, associate director at market research firm Dataquest Inc. in San Jose, Calif. "The designer begins modeling his design at the architectural and behavioral level using a high-level description language such as VHDL to complement schematic capture. He then debugs the design with a multilevel simulator that simulates parts of the design described behaviorally along with other parts described at the functional and gate levels," Collett says. "Thereafter, portions of the debugged design can be automatically synthesized."

Traditional design approaches using schematic capture alone are inadequate for large designs, "because schematic diagrams do not convey functionality and design architecture is lost in the details of the schematic," says Isadore Katz, manager of business development at Cadence Design Systems Inc. in San Jose. Cadence's solution to the problem is the Amadeus Systems Design Series.

IN AMADEUS, CADENCE IS using a new version of its framework, Framework II, to tie the Verilog simulator with new design-entry and analysis tools called Composer and Analyzer, respectively. With the two, a designer can create and verify mixed-level designs containing HDL text with graphical schematics.

Another solution for large, complex designs is the new 4.0 version of Workview, the front-end tool set from Viewlogic Systems Inc. of Marlboro, Mass. While other simulators struggle with designs of 40,000 gates, WorkView's ViewSim simulator has been beefed up to handle designs of up to 200,000 gates on a Sun Microsystems Inc. Sparcstation workstation.

Zycad Corp. of Menlo Park, Calif., also has a new VHDL simulator aimed at large designs. Part of the SimPlus System Designer package, the simulator takes on designs of more than 100,000 gates. It runs on workstations from Sun and HP-Apollo or on Zycad's new $40,000 XP-100 desktop accelerator. Cadence, too, has a simulator entry, the VHDL XL, introduced in April by its Advanced CAE Division (formerly Gateway Design Automation Corp. in Lowell, Mass.). Cadence claims the stand-alone native VHDL simulator offers three to 10 times the performance of other VHDL simulators on the market.



TURNING TO VHDL

LSI Logic's Silicon 1076 contains a multilevel VHDL simulator from Vantage Systems Inc. retooled for dense, complex designs.

LSI Logic Corp. of San Jose has also seen the need for design tools that accommodate more complex designs. "Designers need to perform much more analysis early in the design process," says Simon Napper, manager of design-tool marketing at the company. Its solution is Silicon 1076, which, like the Cadence offering, contains a multilevel simulator. This one is the Vantage VHDL simulator from Vantage Analysis Systems Inc. of Fremont, Calif.

The retooled Vantage simulator, which uses VHDL, was released in March as Version 2.0, with three performance enhancements aimed squarely at more complex designs. One enhancement halves the time for model compilation over earlier versions. A second recompiles large designs with detailed architectural descriptions with no lower-level structures five to 25 times faster than the earlier version. And a third completes simulation initialization five times faster than previous versions.

But the Vantage simulator is only part of Silicon 1076. "Another element is the semantic analyzer and a third is the partitioner," says Napper. "The partitioner is unique. It can examine the data flow of the VHDL source code and allow a designer to make design trade-offs at the architectural level before a circuit is implemented." This is "what-if" analysis capability very early in the design process. With it, "a designer can evaluate different design approaches very early on, before committing to silicon," Napper says.

THIS TREND HAS NOT been missed by LSI Logic's rival, Fujitsu Microelectronics' Integrated Circuit Division in San Jose. The company has new tools being built around its ASIC Open Framework, which made its debut at last year's DAC. The framework can accommodate tools from third-party vendors, such as Gateway's Verilog simulator, as well as Fujitsu's own tools, including its multilevel simulator and two new offerings: a logic-synthesis product and a set of leaf compilers, both developed in Japan.

"Fujitsu in the U. S. has been working for the past 18 months on its own tools for the framework," says Ed Barnett, director of ASIC marketing at the company. "They support Fujitsu's state-of-the-art 0.8-μm CMOS cell library. In addition, the tools offer features such as the ability to track revision levels of design files, and they provide an audit trail of commands issued to the system," he says.

Once a design has been captured, simulated, and debugged, it is implemented on a silicon chip. "In laying out mixed-block and standard-cell de-

signs, back-end tools have not been able to handle rectilinear blocks flexibly or to perform power and ground routing to minimize electron migration," says David W. Hightower, director of product development at Seiko Instruments Inc. in San Jose. Seiko has recently set up shop to develop new tools and market Japanese-built tools in the U. S. "Another productivity bottleneck is design-rule checkers that do not recognize hierarchy," says Jim Poitras, president of Integrated Silicon Systems of Research Triangle Park, N. C.

To handle rectilinear blocks more effectively, Seiko offers the SX9000 IC Layout Editor. Today's layout editors do not use the space in the right angles of rectilinear blocks effectively. "Some tools allow an L-shaped block but will not accommodate a smaller block inside the right angle of the L, a waste of space," says Hightower. "Our new tool makes this possible." Integrated Silicon Systems' LTL2000 tools also have this capability, says Poitras.

In the past, regions of standard cells were laid out in blocks and routed within the block with no regard for connectivity with other blocks within the overall design. "The new [Seiko] layout editor can rearrange cells within a standard-cell block to facilitate routing of the larger block and cell layout," says Hightower.

Finally, the layout tool also addresses the problem of power and ground routing, which becomes acute on chips implemented with submicron design rules. "In designs implemented with smaller line widths, current-carrying lines that allow electron flow to clump together facilitate electron migration—electrons flowing into the insulating area between traces that eventually can lead to a short or an open," he says.

WITH THE SEIKO TOOL, the designer enters a power and ground structure in topological form. Thereafter, as blocks are moved about for better placement or to improve routing, the power and ground structure is automatically adjusted to accommodate the changes.

"What the industry is moving toward is simulation-correct layout," says Hightower. This is partly available now, with timing verification being back-annotated into simulators. However, the next step is to provide power and ground verification back into the simulator and simulators able to make use of the data. Such tools "must come from the ASIC vendors, who are the only ones able to provide the information for their devices," Hightower contends.

Another major part of the back-end layout process is design verification. "Up to now, everyone has licensed and used [Cadence's] Dracula, an expensive and not very easy to use batch-design verifier," says Poitras. But Integrated Silicon Systems has a design-rule checker as part of its latest version of the LTL2000 tool kit. Besides the LRC100 design-rule checker, the kit consists of the LTL100 layout editor and a C language interface, which allows use of X Windows across a variety of hardware platforms. "For the price of Dracula alone, we can offer both a state-of-the-art layout editor and the first hierarchical fully interactive design-rule checker," says Poitras.

Poitras explains that older design-rule checkers have not been able to recognize a hierarchical design. An error in a lower-level circuit with many instances throughout the hierarchy of a design must be corrected at each instance rather than globally. The Integrated Silicon Systems solution "can recognize and correct an error in a lower-level cell and have the correction propagated throughout the hierarchy," he says.

NOVEL WAYS OF DEALING WITH HIGH-SPEED BOARDS

BOARD LAYOUT HAS reached a new frontier now that CMOS circuits zip along at 33 MHz. Moreover, designers frustrated with the on-and-off chip delays of conventional boards are beginning to design multichip modules. And new tools are coming along to ease the design of both high-speed boards and multichip modules.

At 33 MHz, designs are beyond well-understood TTL design rules and into the realm of emitter-coupled logic, says Lee Ritchie, president of Shared Resources Inc., a service bureau specializing in high-speed board designs based in San Jose, Calif. The company, which has as its customers such leading-edge outfits as Sun Microsystems Inc., has developed place-and-route tools aimed squarely at high-speed designs. The interactive Crystal tool set lets a designer lay out a board to a given set of timing criteria.

"The tool modifies the layout to achieve a desired timing specification," says Ritchie. Also, "the designer can move a part in his layout and get immediate feedback on how the move affects his timing." Finally, the tool gives a routability analysis to indicate how routable a layout is. "It's one thing to fix a timing problem by moving parts around in a layout, but it is no good if the layout is impossible to route," he says.

AN INDUSTRY FIRST

Valid Logic's enhanced Allegro layout tool kit is the first to handle multichip modules.

For its part, Valid Logic Systems Inc. is focusing on the multichip module. Valid's enhanced Allegro layout tool kit handles all three types of modules—those built on a miniature laminated pc board or on a ceramic or silicon substrate. "Each type has different manufacturing requirements," says Shiv Tasker, director of board marketing at Valid in Chelmsford, Mass.

Allegro performs signal-to-noise analysis for reflection and crosstalk for each of the three types. The analysis feeds this data back to Valid's RapidSim simulator. There's also a software interface to the various manufacturing tools: a GDS-II formatted file for the silicon module, Gerber plotter formatted data for the other two. Valid is claiming to be the only CAE/CAD supplier with a tool to handle multichip modules. Others announcing plans for such a tool include Cadence, Mentor, and Racal-Redac.—*J. Mc.L.*

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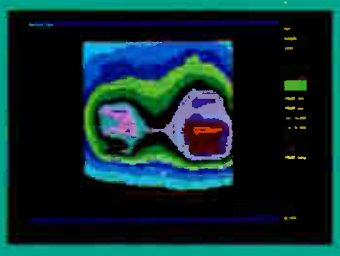
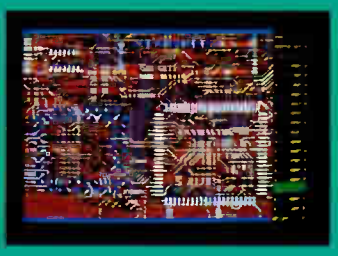


Thermal Analysis

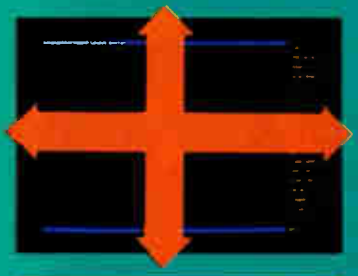


PCB Layout

Analog Design

Autorouting

Fabrication Drawings



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CIRCLE 203

LEARNING TO MANAGE THE BRAIN TRUST

BY HOWARD WOLFF

TECHNICAL PROFESSIONALS AREN'T THE EASIEST FOLKS TO WORK WITH, BUT IT CAN BE DONE

CONGRATULATIONS. ALL your hard work has been rewarded and you have been placed in charge of a group of engineers, technicians, and support people. Now what do you do?

First, consider that you are taking on the job of managing a body of employees considered by human relations experts to be among the most difficult people anywhere. Among the problems you can expect:

- Technical professionals often want more autonomy than most other professionals demand.
- They identify first with their profession and second with their company.
- Because they relish competition with fellow professionals, they refuse to share information.
- They usually are highly critical of their own work.
- They are achievement-oriented and motivated by the work itself, and they loudly resent programs aimed at increasing motivation.
- They fear that their skills will be underutilized, leading to burnout.

Daunting, isn't it? However, there are techniques that can make a manager more efficient and able to handle whatever people problems may come his or her way. Among them are those developed by Bernard L. Rosenbaum, president of Mohr Development Inc. in Stamford, Conn., and author of *The Technical Manager's Survival Book* (New York: McGraw-Hill Book Co., 1984).

Rosenbaum has worked with the likes of Digital Equipment, Hewlett-Packard, and IBM. "But the principles apply universally, whether the company is as big as those or as small as a startup," he says. In fact, he adds, "The best time to put the techniques into play are at the startup stage, because then they will be imprinted in the organization and will become a part of its overt and covert culture."

When Rosenbaum and his people move into an organization, they work from both ends. They meet with top management and form a steering committee to make certain that the company's strategic objectives are understood. At the same time, they do field observations, speaking to key individuals in the work force in order to focus on needs and solutions.

"We have measured results," says Rosenbaum, "so we know that by applying certain management precepts we can get product into the marketplace more quickly. Group productivity increases, and individuals take more responsibility, holding down turnover."

Rosenbaum has distilled his philosophy into what he terms five strategic dimensions. "Our research did not suggest that any one dimension was more important than another," he says, "but rather a blending of strategic thinking and behavioral competence across dimensions was most characteristic of the more effective leaders."

Those dimensions are:

Coach for peak performance. Technical professionals are more self-directed than most others, so classic management prescriptions based on the manager as a controller of work are likely to fail. The idea, then, is to act more as a coach who listens, asks, facilitates, integrates, and provides administrative support.

Run organizational interference. Not only does the successful leader teach subordinates how to take advantage of opportunities to use the organization, but he or she also must quickly recognize and remove organizational obstructions from the path to innovation. Specifically, the manager should make resources available to his team, keep the bureaucracy from interfering, and work for top management's support. To accomplish all of those things, the manager should simplify red tape, know the bureaucracy, and protect subordinates' time by deflecting nonessential requests.

Orchestrate professional development. Technical people are achievement-oriented. They grow professionally through achievement; in addition, recognition of their accomplishments provides motivation.

Expand individual productivity through teamwork. Technology is becoming too complex for the lone eagle, so the coach must create a team. To do this, a manager must set goals that are clear, achievable, agreed upon, realistically timed, and reasonably stable. Each team member's role must be clarified, resources must be lined up, and information-exchange systems must be put in place.

Facilitate self-management. This can be done by sharing information, delegating responsibility, and encouraging upward communication.

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Executives ON THE GO

GOLF SCHOOLS

A SWINGING TIME IN A RESORT SETTING

Blisters 'n Band-Aids

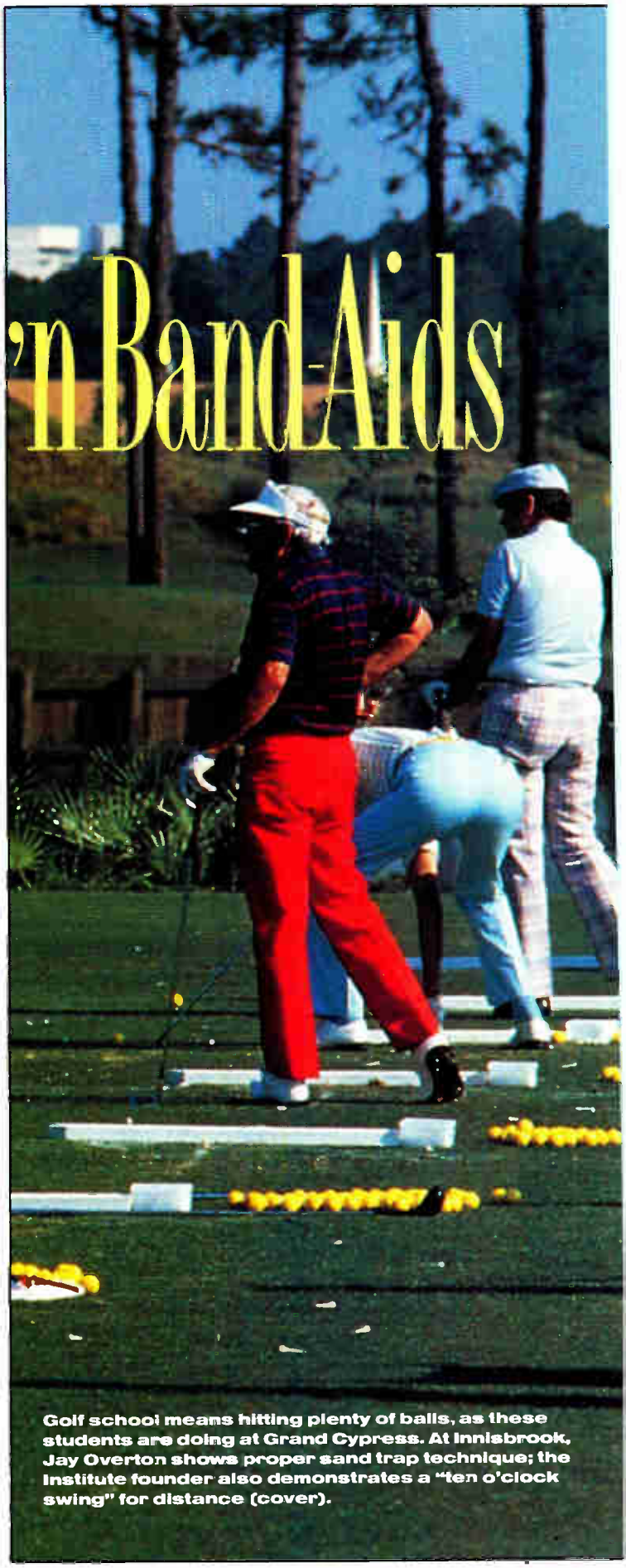
GOLF SCHOOLS PROVIDE A SWINGING TIME IN A RESORT SETTING.

IT WAS THE FINAL DAY OF THE Innisbrook Golf Institute and director Lew Smither was describing, dramatically, the dream of the duffer. His audience: a score of eager but by now somewhat sore and weary golfers of varied experience and ability—hackers to handicappers in the low double digits—each of whom had smacked at least 1,000 balls during the last three days and wore the blisters and Band-Aids to prove it.

Beginning slowly and deliberately, then building momentum until the words quickened and seemed to scream down the fairway, the pro pictured the swing—golf's Holy Grail, so to speak—the quest for which had drawn these 12 men and eight women to Innisbrook Resort and Golf Club, Tarpon Springs, Fla.

"You take the golf club up and back... at 30 to 40 mph...then change direction ...You bring the club forward and down, gaining speed...The club is moving 70 to 90 mph, toward the object...And you're trying to hit a ball which is 1.62 inches around with a clubface that's not much wider than 3 inches and not much higher than an inch...on a spot, a percussion point not much bigger than a dime...AND YOU WANT TO HIT IT

BY JIM BRAHAM



Golf school means hitting plenty of balls, as these students are doing at Grand Cypress. At Innisbrook, Jay Overton shows proper sand trap technique; the institute founder also demonstrates a "ten o'clock swing" for distance (cover).

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FOR INFORMATION, CIRCLE NO. 11

Jimmy Ballard is known for his distinctive teaching style at Doral, where students can hone their new skills on five picturesque, championship courses.

PERFECT! EVERY TIME! THAT'S PHENOMENAL!"

Phenomenal and "it does not happen overnight," Smither, 35, cautioned. Nor even after three days or a week at a first-class golf school. Creating a new muscle-motion pattern takes time and, more important, the "three Ps" of the golf schools—"patience, persistence, and practice." Make that "practice *perfectly*, to create better habits."

What golf schools provide is the foundation for improvement: concentrated learning in a sunny, relaxed, non-intimidating, resort atmosphere that enriches the experience and makes it enjoyable and easier to learn. Through expert, personable instructors, helpful fellow students, teaching devices as primitive as a broom (a great way to warm up, to "feel" proper body rotation) and as sophisticated as video (so that one can *see* what he's doing right and wrong), posture, grip, alignment, and swing are analyzed and improvements are suggested. Then it's up to the individual to do the homework.

In one sense, the golf swing is, as Smither described, complex. It is also simple—similar to swinging a baseball bat but on a tilted plane. The schools stress this simple side and try to leave students with just a few major suggestions to practice. Golf is, after all, a leisure pursuit. "Don't put too much pressure on yourself and I promise you'll play better and have more fun. We get too analytical. Golf is simple in nature, once you learn it," Smither said. Thus, "relax...hold the club 'softer' or looser ...let the clubhead do the work" were advised over and over.

This writer recently attended the 2 ½-day golf school at Innisbrook. Briefer visits followed to the Jimmy Ballard Golf Workshop at Doral in Miami, the John Jacobs School at the Sheraton-Bonaventure in Fort Lauderdale, the PGA School at the PGA National Resort in Palm Beach Gardens, and the Grand Cypress Academy of Golf at Orlando. I was one of a few virtual beginners at Innisbrook. The typical student there carries a 23 or 24 handicap; often he has plateaued at a mid-90s score and requires help to improve further.

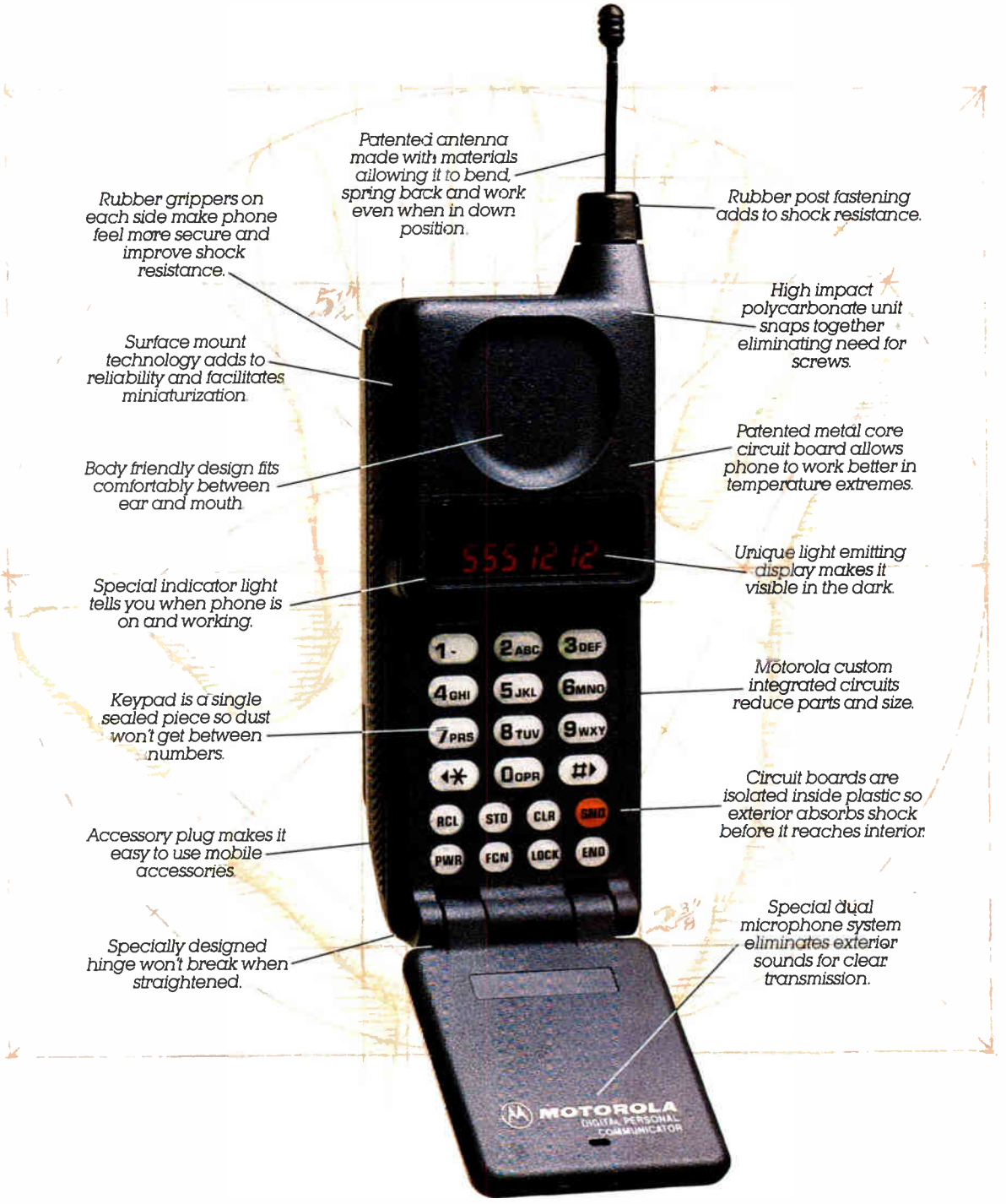
At Innisbrook, dress is informal, so don't bring much besides your clubs. For school starting Monday morning, Sunday afternoon check-in permits play then on the Copperhead, Island, or Sandpiper courses, or use of the practice range. A welcoming cocktail party follows that evening.

On Monday, after 7:30 breakfast in the Sandpiper clubhouse—a bountiful buffet, with a chef serving omelettes to order—we assembled at the range. There Smither demonstrated ball flight patterns, or directions a golf ball will fly, and why. It's a concept that eludes most golfers, primarily because of "terrible fundamentals," he said. "That's why they don't understand why the ball goes where it goes, and what happens when they make a good swing. Even some good players have improper fundamentals, but through perseverance they've found a way to make it work. Generally, a poor foundation crumbles under stress, however."

Two ball flight laws—armswing path and clubface position—dictate direction, Innisbrook teaches. Combinations of the three armswing paths (left, right, and on line with target) and three clubface positions (closed, open, and square) can produce nine different ball flight patterns. The school tries to match the student's swing pattern to desired ball flight pattern. "Most golfers, because of egos, want the ball to go right to left—but don't get hung up on that," Smither advised. "Lee Trevino has made a great living playing the fade."

Following this presentation, one of several by Smither or the other five instructors, we split into two groups. One worked on direction swing on the range while the other practiced putting. At mid-morning, we swapped stations. After lunch, direction swing and chipping were practiced; again the groups swapped stations in mid-afternoon, providing a pleasant break.

At around 5 p.m. we ventured onto the beautiful and challenging Copperhead course. Split into foursomes, each with an instructor, we played four holes of best-ball golf. After dinner, usually at one of the three clubhouse restaurants, golfers tend to retire early; eight hours of smacking golf balls under a Florida sun can be draining. ▸



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MOTOROLA

FOR INFORMATION, CIRCLE NO. 12

SOME OTHER APPROACHES

Jimmy Ballard Golf Workshop, *Doral Resort and Country Club, Miami, FL.* "The golf swing is very simple until some jackass tells you to keep your head down and still, keep a stiff left arm, and stay behind the ball. All that does is cause you to top the ball and tear your back up," says Jimmy Ballard. The self-styled "maverick," 47, begins by "clearing up misconceptions" by other teachers, even Jack Nicklaus. "Don't pay attention to what these people *say*, look at what they *do*," scoffs this tutor to some leading pros. Ballard, who with a staff of six was instructing 24 students, preaches swinging a golf club like a baseball bat but on a tilted plane, using the large shoulder muscles more, shifting the spine *sideways* on backswing and downswing, and keeping the right arm above the left. Fee for the 10-hour workshop, spread over two to three days, is $500, which does not include accommodations (305/592-2000).

At Grand Cypress, swings are taped and compared with golf's greatest players.

Grand Cypress Academy Of Golf, *Grand Cypress Resort, Orlando, FL.* Through a unique computer-graphics device called CompuSport, a student can see how his videotaped swing matches up with a stick-figure composite overlay of 53 of the game's greatest players. This model swing—modified for individual size and body type—is replayed in slow motion, so that touring pro Phil Rodgers and other instructors can more precisely identify problem areas. Facilities include a three-hole teaching course designed by Nicklaus. Classes are limited to 15 students, with three instructors. Schools run two to four days at $1,190-$2,375, not including accommodations (800-835-7377).

John Jacobs' Practical Golf Schools, *Sheraton Bonaventure Resort, Fort Lauderdale, FL.* Co-founded by former British champ John Jacobs, the largest school conducts over 500 sessions annually at 15 resorts, including

Playing the Sheraton Bonaventure's famous "waterfall" hole is a John Jacobs bonus.

Bonaventure. "Very good players are born," says Craig Bunker (great golf name!), "but I can take a man with *no* ability and get him to shoot 90." Bunker headed four instructors teaching 18 students at this five-day school. Executives, beware: Chairmen and CEOs often find golf difficult because they're "too intense," Bunker says. Doctors, lawyers, engineers, and the like have trouble because they make things too "detailed," and "golf is not a precise, exact game." Who plays well? Salesmen. Fee: $1,800, including six nights at the Bonaventure, or $795 without accommodations (800-472-5007).

PGA National Golf Academy, *PGA Sheraton Resort, Palm Beach Gardens, FL.* "The minute you say golf, common sense goes out the window," says Bill Balash. Thus, the new Academy director sometimes has students swing a golf club without a head ("people usually swing better then"), and swing a partly filled plastic pop bottle (to get a better feeling of "unloading" or snapping the wrists at the bottom of the downswing). A common habit the school tries to change is "staring at the ball and glancing at the target. The good golfer does just the opposite," says Balash, 30, whose four-man team was teaching a full house of 28 students. The school lasted three days, which he believes is quite sufficient: "If sex were as overtaught as golf, we'd have no children." Fee: $1,243 with or $525 without accommodations (800-325-3535).

A solid golf swing starts with the correct grip, an instructor demonstrates at a Golf Digest school (800-243-6121).

On Tuesday our two groups worked on full swing and short game—sand shots and pitching. Again, we played a few holes before the evening cocktail party. Wednesday morning's session featured Smither's individual analyses of our golf swings that were videotaped the previous two days; he pointed out areas of improvement and those requiring practice. The videos were ours to keep.

Golf school left me working basically on relaxing my grip so that I feel the weight of the club more in my fingers, standing more upright and rotating my spine horizontally, and following through more. Seeing my struggles on tape was painful but helpful. "You have to have somebody see you because what you *think* you do and what you *actually* do are two different things. That's why the video cameras are so great," Smither noted.

More experienced golfers had much less to work on. A 12-handicapper, anesthesiologist Jim Williams simply wanted to create more of a right-to-left ball flight pattern. "His fundamentals were excellent. All we did was change the *direction* of his swing—a minuscule change," Smither explained. "So many schools try to change your whole swing, even when you already have a good swing," observed Leonard Nelson, a stockbroker with a 13 handicap. "Here they made intricate refinement of the smaller things, like my swing pattern and the pressure on my feet. Plus, I now have a better putting and chipping touch."

The Innisbrook Institute (813/942-2000) charges $1,131 or $891, depending on whether the three nights in a club suite are single or double occupancy. Rates include breakfasts, lunches, greens fees, and personal video. Many students return every other spring for a "tuneup," frequently attending the Monday-Wednesday school and remaining at the resort for a week's golf vacation. A Friday-Sunday format, designed for the busy executive, loses only one work day. (Three days is generally considered an optimum stay at a golf school.) At Innisbrook, classes run until mid-June and resume in late October, with peak season March through May.

Was the school worth it? "Absolutely," said Nelson. "I needed a break from the office, and this was perfect. Now I have to go back to Philadelphia and put all this into practice." Bob Fuller, a "semi-retired" attorney, even gained confidence in his one-iron. At least, that allowed him to repeat this Lee Trevino tale. Amid thunder and lightning, the merry Mexican is said to have boldly strode down the fairway, waving his one-iron. "Even God can't hit a one-iron," Trevino cracked.

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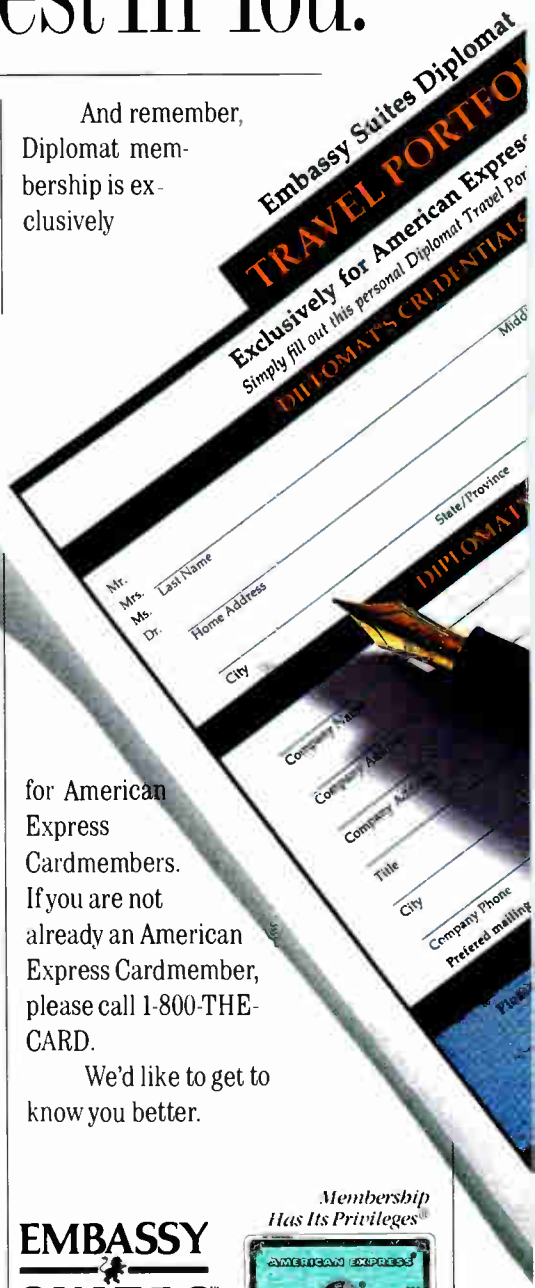

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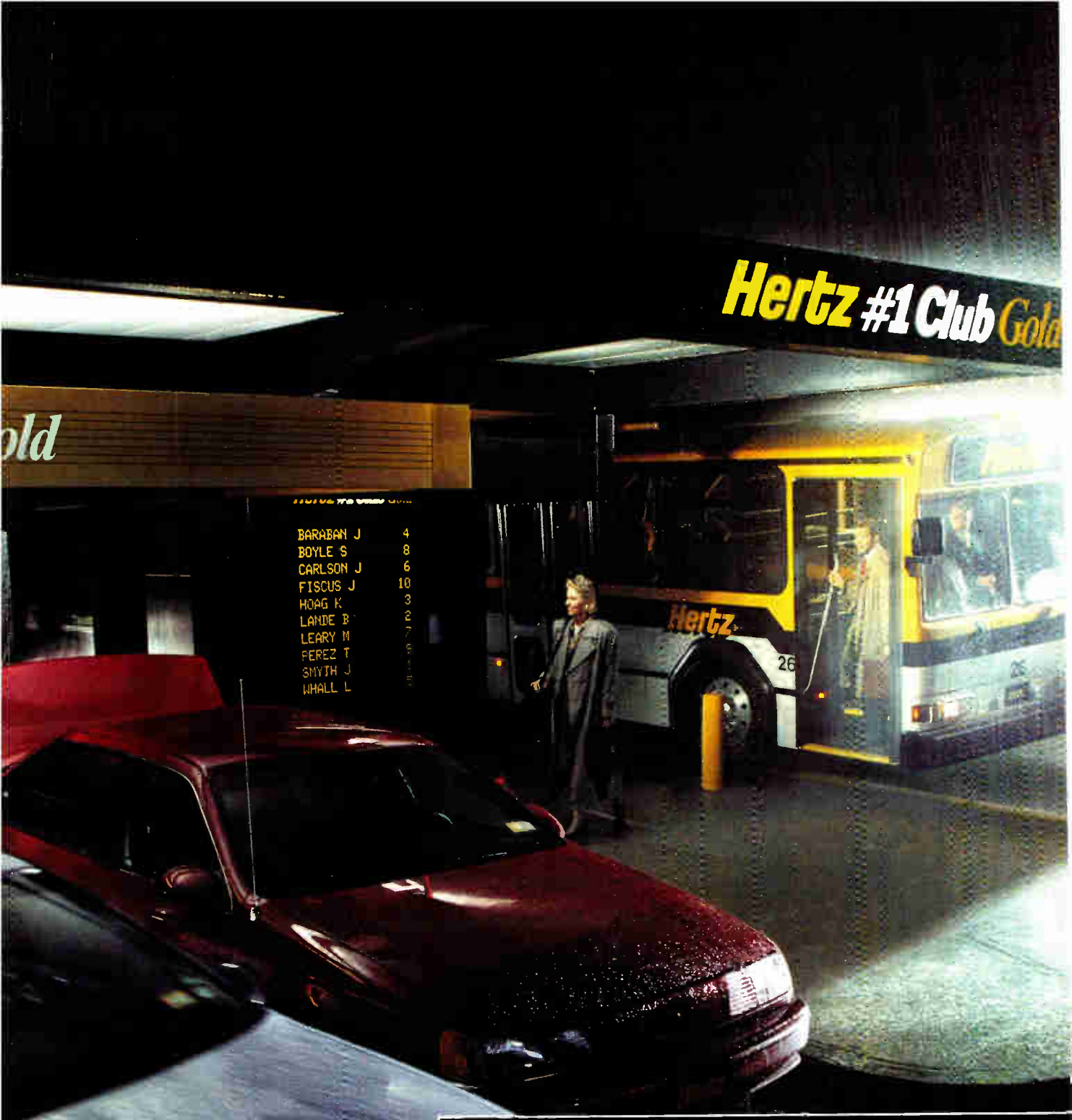

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LOTUS DEVELOPMENT CORP.

FRESH FROM AT&T PACIFIC, LARRY CRUME HELPS CREATE AN INTERNATIONAL PRESENCE

LOTUS IS TAKING THE GLOBAL VIEW

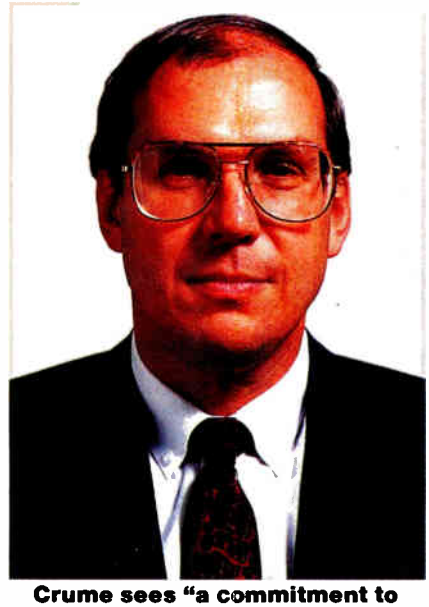
BY LAWRENCE CURRAN

THERE'S A LINK BETWEEN Larry Crume and the fact that foreign sales for the first time eclipsed domestic revenues in the first quarter at Lotus Development Corp. Crume, vice president for international development, hasn't been on the job long enough to have significantly influenced that crossover, but his very presence is testimony to the fact that the Cambridge, Mass., software firm sees the need to sharpen its international focus.

Commenting on first-quarter results, Jim Manzi, president and chief executive officer, pointed out that foreign sales represented 50.7% of total revenues, indicating "continued acceleration of our international business, particularly in Japan." Lotus is best known for its ubiquitous 1-2-3 spreadsheet, for which it's estimated there are more than 10 million users.

Net sales for the quarter, which ended March 31, were $165.5 million, up robustly from last year's first-quarter total of $120 million. Earnings increased sharply as well—from $5.3 million in 1989's first quarter to $22.8 million. Lotus revenues last year were $556 million. The company would have topped $1 billion this year if its merger with Novell Inc., the Provo, Utah-based networking software firm, had been completed. But it fell through.

The 45-year-old Crume came to Lotus early this year. His position is a new one at Lotus, but Crume is no stranger to either international operations or software development. His credentials appear to match him ideally to the post. Crume brings more than 20 years of experience at AT&T Co. with him. His last assignment there was as president and representative director of AT&T Unix Pacific Co. Based in Tokyo, his business unit was responsible for Unix software development, marketing, and sales in Japan, Asia, India, and the South Pacific.



Crume sees "a commitment to international markets."

Crume planned and initiated AT&T's efforts to "internationalize" Unix System V, beginning in 1984. In the five years before joining Lotus, he was responsible for developing multilanguage support for the operating system, and also directed various other systems-integration projects, including development of a five-language editing system for China's Xinhua News Agency.

He held several management and software-engineering positions in 17 years at AT&T's Bell Laboratories. "I've learned over the years that I wanted to work in software," Crume says, "but when Lotus first approached, I wasn't interested until I talked to management. That's when I learned of the [company's] commitment to international markets."

Crume's experience in the Far East is especially well applied at Lotus. He foresees a growth rate of at least 30% per year in the Far East software market overall. And the personal computer market is especially promising. "The growth rate for Lotus may be even higher than that because of the popularity of the company's products and the drive to make software work in the customer's native language," Crume says.

For example, he says that the Japanese-language version of 1-2-3 is "a very strong product. In addition, there's a large number of multinational corporations in the Far East that use our English-language versions." The financial services business—a bread-and-butter application for spreadsheets—has seen "tremendous growth" in Japan as the result of changes in laws that are more favorable to firms such as Goldman Sachs and Merrill Lynch, Crume says.

Further, Crume believes the Lotus cross-platform strategy, which is to offer 1-2-3 for major standard hardware platforms and operating systems, will play well in the Far East. The company is already shipping a version for Sun Microsystems Inc.'s Unix workstations, "and Sun does a great job in Japan," Crume says. "Sun was the leading supplier of workstations in Japan before Hewlett-Packard Co. acquired Apollo, and I think Sun is outselling HP there now."

Another major Far East opportunity Crume wants to tap is the PC clone market. He says that at one time, "more than 50 companies were building 386 clones in Taiwan. Were they all covered for application software? Who knows, but the real challenge is to look at all those companies and determine where we can work with them. That market will continue to grow, especially in Korea and Taiwan."

As for his personal role in helping to expand Lotus's international reach, Crume sees it this way: "I bring to Lotus some understanding of what it's like to be out at the other end of the corporate structure. And because I ran software development overseas for AT&T, I can apply that experience here

in terms of translating software into foreign languages."

Toward that end, Crume is pushing more of Lotus's software development overseas. While there have been two product planners charged with local software development in Japan, all other development efforts have resided in Cambridge. Now he's putting developers in France, Germany, Spain, Italy, and elsewhere in the Far East. "Our goal is to be seen as an indigenous software developer in each region," he says. Before the merger died, he had expected Novell to use the Lotus overseas software centers.

"I bring a few years of experience in this business to a very young company," he says. "Having that experience helps, especially in the Far East." E

ELETRONIC DESIGNS INC.

UP FROM THE ASHES
EDI MAKES A SWITCH

BY LAWRENCE CURRAN

IT'S NEITHER A COMPUTER-aided-design job shop nor a technical magazine, as the name might imply. Instead, Electronic Designs Inc. is a producer of memory devices and modules for the high-reliability market—a company that almost gave up the ghost before experiencing a business turnaround in 1986.

That recovery led to a rebound in revenues from $10.8 million in 1987 to a projected $30 million for this year, and to nine consecutive profitable quarters. Based in Hopkinton, Mass., EDI today regards itself as a leading supplier of packaged monolithic CMOS static random-access-memory devices and modules made with those parts.

EDI's value-added lies in designing, processing, packaging, and testing its products to meet the stringent requirements of MIL-STD-883 and the qualifications required to be accepted on Defense Electronics Supply Center (DESC) Standard Military Drawings for microcircuits. The company has strategic alliances and licensing agreements with such leading foundries as Sharp Microelectronics Technology Inc. in Vancouver, Wash. (a subsidiary of Sharp Corp., Osaka, Japan.), and Mitsubishi Electric Corp., Tokyo.

Hans Olsen, EDI's president and chief executive officer, says the company's business split shows 60% of sales are from monolithic SRAMs and 40% from modules. Sales to military contractors account for 85% of EDI's revenues now, but the company plans to grow the commercial portion quickly as military sales slow.

The highest-density SRAM sold today is 1 Mbit, with two variations: 256 Kbit by 4 and 128 Kbit by 8. A five-year technology agreement with Sharp encompasses 4-Mbit SRAMs in CMOS, as well as other process technology, Olsen says.

The Sharp contract also provides a

vehicle for EDI to make a design contribution, and offers a wedge into the microprocessor-related commercial market for 1-Mbit SRAMs. EDI has put a design team in Vancouver to come up with new high-performance products based on Sharp's megabit-density CMOS SRAM technology. The first fruits of that effort are expected to be in silicon by September or October. Until then, the 1-Mbit SRAMs from EDI are Sharp or Mitsubishi designs.

Olsen says that EDI plans to accelerate the joint development effort with Sharp as a way to expand its commercial product beachhead. He looks for synchronous 1-Mbit SRAMs to gain rapid acceptance in cache memories for microprocessors. EDI is leaning toward supporting Motorola Inc.'s 68030, 68040, and 88000 processors in its planned synchronous SRAM designs.

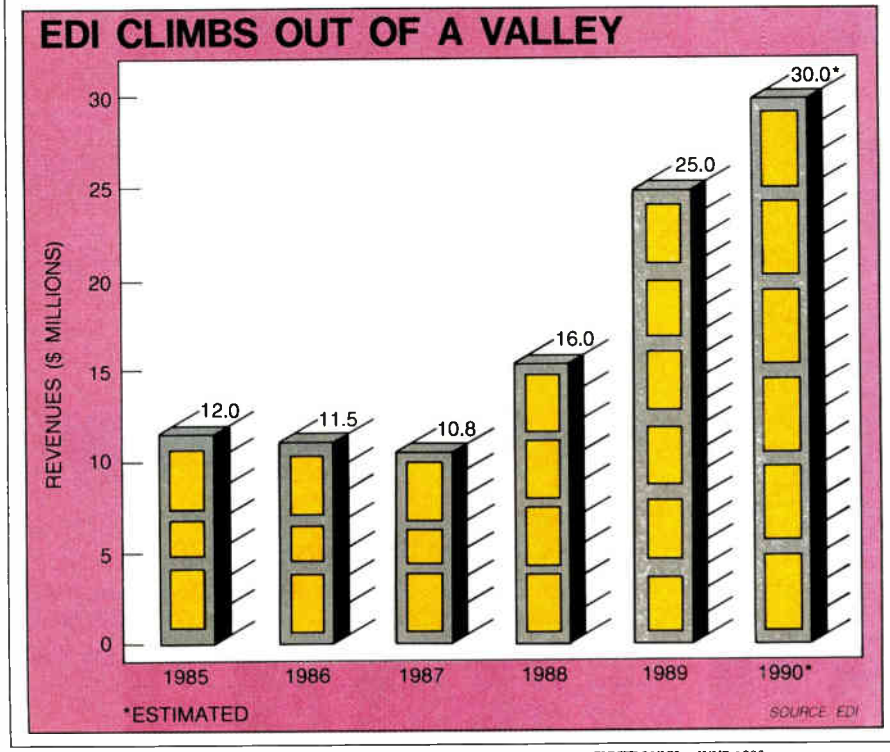
BUT JUST A FEW YEARS ago, EDI almost went under when its corporate parent went bankrupt. Founded in 1980, EDI was acquired about two years later by a Danish minicomputer firm—Christian Rovsing A/S—which also offered a captive line of memory modules and boards. The parent organization bought the then-profitable EDI to gain access to the U. S. market for SRAM modules. Olsen then headed the Danish firm's hybrid and IC operation.

EDI was initially successful serving the commercial market for dynamic RAM modules before it focused exclusively on SRAMs. Revenues grew from $7 million in 1983 to $12 million in 1984, but problems were developing. Texas Instruments Inc. and Fujitsu Ltd., both world-class semiconductor manufacturers, represented withering competition when they got into the DRAM module business.

Then Christian Rovsing went bankrupt in August 1984 "because of problems of its own," recalls Olsen, who became EDI's president in November of that year. "We were losing sales, customers, and corporate support, but we started to rebuild, with a focus on SRAM modules, although we were still aimed at the commercial market," he relates. That effort at rebuilding didn't take firm financial root until later, however, even though there were promising signs in 1984 and 1985.

Those included an opportunity for EDI to acquire the debt of Christian Rovsing and some interest from venture capitalists to provide the resources to do so. But the nut grew from $4 million to $6 million, which was more than EDI could raise in venture capital.

Then came 1986, a watershed year for EDI on both the downside and the upside. "A lot of business from 1984–85 collapsed on us," Olsen says, including residual DRAM sales and some of the commercial SRAM sales. The profits that had returned for six quar-



ters disappeared. But in the midst of gloom, the company that September was able to raise $6 million from T A Associates. The Boston venture backer saw merit in a revamped business plan that had EDI focus on value-added monolithic and module sales of SRAMs to the high-reliability market, with a concentration on military applications. "That's when we truly restarted the company," Olsen says.

To date, that strategic focus on the military SRAM market has paid off. Olsen says the military business will remain the mainstay at EDI over the next few years, despite the portent of lower U. S. defense budgets. But the company will grow the commercial side faster than expected. EDI anticipated and began planning for a leveling of its military business "a couple of years ago," Olsen says.

EDI may expand its Sharp-based design team faster than originally planned, with an eye toward being out with its own commercially oriented SRAMs sooner. The plan is for 1991 revenues to show a 60–40 split in favor of military business, but for the ratio to eventually reach 50–50.

Olsen points out that Integrated Device Technology Inc. of Santa Clara, Calif., one of EDI's chief competitors, got its start by concentrating almost exclusively on high-reliability military business, but has gradually evolved into the commercial market as well. IDT did $180 million last year.

"We'll continue to clone them," Olsen says unabashedly. "We want to be a $100 million company within five years. We need the commercial business to do that, and I think we have a shot at it."

For his part, Robert Daly, a partner with T A Associates, believes EDI can meet its objectives. "We're extremely pleased with how they've repositioned the company in the SRAM monolithic and module business," Daly says. "The results speak for themselves. The next challenge is for them to make the shift into more commercial business."

The company is in excellent financial shape, Daly says, "and the Sharp technology agreement gives them even more value-added because of their design capability. We're pretty optimistic." E

NATIONAL INSTRUMENTS CORP.

INSTRUMENTS ON A PC
HEWING TO STANDARDS

BY SAMUEL WEBER

NATIONAL INSTRUMENTS Corp. makes no instruments. But as a leading supplier of IEEE-488, VXI, and other data-acquisition hardware and software products tied to a number of computer buses and operating systems, the company has carved a niche for itself as a growing and important force in instrumentation.

With a recent spurt of new products that reflect the growing trend toward personal-computer-based automation of instrumentation systems, and comfortably settled in new quarters in Austin, Texas, the company is looking to

grow another 30% from the $31 million in revenue it chalked up in 1989.

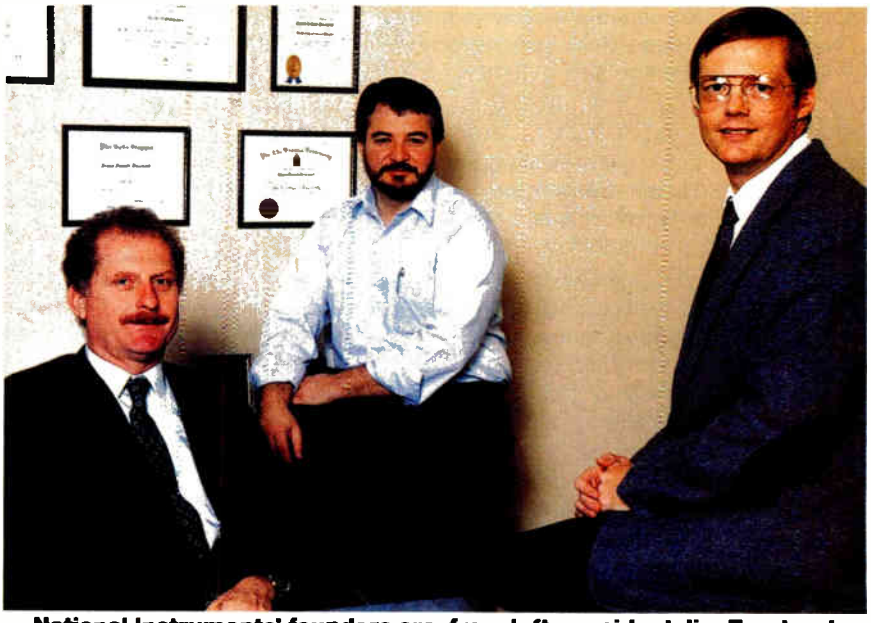
That handsome growth is coming from a quick response to the emergence of standards that are changing the nature of test, measurement, and data acquisition. Those standards, which have evolved out of the explosive growth of programmable instruments that began with Hewlett-Packard Co.'s introduction of the General-Purpose Instrumentation Bus 15 years ago, are also being driven by a trend toward PC control of instrumentation systems. They are:

- IEEE 488.2, the latest version of what began as the GPIB;
- SCPI (standard commands for programmable instrumentation), a common instrument command language for programmable instrumentation [*Electronics*, May 1990, p. 41];
- VXI (for VME extension for instrumentation), a system of modular instruments that plug into a VMEbus backplane in a common mainframe [*Electronics*, March 1989, p. 104].

National's springtime new product parade has been a virtual onslaught. Just this month, at the Test Engineering Conference in Boston, the company unveiled the first IEEE-488.2-compatible controller chip and the first plug-in board that uses the new chip. And last month, National introduced a pair of embedded PC-compatible VXI controllers. The first is the VXIpc-386, the industry's first complete 386 PC/AT in a one-slot C-size package. Also available in the new VXIpc line is a two-slot version of the 386 PC/AT that includes a floppy disk and additional hard-disk options, and the VXIpc-030, a 68030-based controller that is Apple Macintosh-compatible.

Another option is MXI (for multisystem extension interface), a cable and accompanying software introduced by National a year ago that connects an external PC directly to the backplane of a VXI system with accompanying performance enhancement. All the new products come with software packages that permit operation with the company's LabVIEW 2 virtual instrument and graphical programming system.

But perhaps of greater significance were April's moves—a family of instrumentation interface products for IBM Corp.'s new RISC System/6000 workstations—which served to expand National's longstanding relationship with IBM. Given the high praise bestowed on the performance of the 6000 workstations at their debut, this could loom as a major growth stimulant for the Texas company. The new National family includes the GPIB-6000, a kit that interfaces the System/6000 to GPIB instruments; the VME-MC6000 kit, which provides an interface between System/6000 and the VMEbus; and VXI-MC6000, a kit that provides interconnectivity to the VXIbus. All three



National Instruments' founders are, from left, president Jim Truchard and vice presidents Jeff Kodosky, R&D, and Bill Nowlin, engineering.

support AIX, IBM's version of Unix.

National was founded 14 years ago by its current president and chairman, James Truchard, and two colleagues, Jeffrey Kodosky and William C. Nowlin, while the three were working at the Applied Research Laboratories at the University of Texas in Austin. Truchard, a specialist in underwater acoustics, recognized the possibilities of applying computers to instrumentation.

"We were using minis for our underwater acoustics work," he recalls, "and saw the emerging role of minis in industry for test-and-measurement computation. We recognized a market niche in that Hewlett-Packard had introduced the GPIB technology in 1975 for its own computers, but we saw they weren't interested in doing it for Digital Equipment or their minis. The DEC PDP-11 was the most popular mini at that time, and that made an opportunity for us."

From there, the company expanded its range to include IEEE-488 interfaces for a wide variety of computer platforms. With the introduction of the PC in 1981, National saw another opportunity and began developing hardware and software products for the IBM PC/XT/AT, PS/2, and compatibles, and Apple Computer Inc.'s Macintosh+, SE, and II machines.

THE SOFTWARE IS THE INSTRUMENT, SAYS NATIONAL AS IT UNLEASHES A PARADE OF GPIB AND VXI PRODUCTS FOR PC CONTROL OF INSTRUMENTATION

National has also been one of the pioneers in the concept of virtual instruments, which replace traditional instrument knobs and switches with a simulated front panel on a computer display. The offerings include LabWindows, an MS-DOS-based software tool that permits program creation and operation through a library of instrument-control functions, and LabView, a similar package for the Mac.

"If you look at our business card," says Truchard, "you'll see the slogan 'The software is the instrument.' It means our focus is on creating software that in essence takes the components of data acquisition and by adding software and the right user interface, bringing it all together into a complete instrument system."

The inherent capabilities in National's offerings bridging 488 and VXI are particularly important to its growth, says Galen W. Wampler, an industry analyst and president of Prime Data Corp. in San Jose, Calif. "This is a technology that isn't dying but needs to be strengthened. Meanwhile, VXI is a growing area, so these products will help the industry and help the companies that provide them," he says.

FOR CARTER, THE U. S. COULD BE THE TOUGHEST OF HIS WORLDWIDE TELECOM MARKETS

A BRIT IN AMERICA

BY PETER FLETCHER

WHEN AN ENGLISHMAN moves from London to Indianapolis to take a high executive position at a U. S. phone company, it stands to reason that he is going to face some formidable obstacles. In fact, Steven Carter, formerly managing director of SouthWestern Bell Communications (UK) Ltd. and now the president of SouthWestern's Freedom Phone Division, must deal with a new reality: the U. S. could be his toughest market.

Carter will have responsibility for establishing the Freedom Phone range in new markets on all five continents. But irony surrounds the problems he faces in the U. S. They arise from the terms of the so-called modified final judgment, the blueprint for U. S. telecommunications regulation. Under that set of rules, the regional Bell operating companies are prohibited from manufacturing telecommunications hardware in the U. S. But manufacturing is just what Carter has been doing in the UK for the past two years.

Since the formation of SouthWestern Bell in London in mid-1988, Carter has built a family of very well-regarded high-quality domestic cordless and two-piece telephones and private pay phones. Most of them were designed by SouthWestern Bell engineers in the UK. Because the company designed and engineered the phones, they are forbidden contraband if it tries to sell them in its home territory. However, it is quite legitimate for Carter to buy products made by other companies and brand them with the Freedom Phone symbol, a stylized Bell logotype that Carter says has been adapted from the traditional Bell System symbol.

In the meantime in the UK, the company has added three new products to its existing UK-designed series. Most sophisticated and due to be introduced next October is a $360 voice-guided private-branch exchange. Called the FS-1515, it is aimed at the domestic and small-business market and can handle a single exchange line and five extensions. It offers full internal switching with features such as call diversion and automatic facsimile tone recognition. A sixth port can be used for applications such as door management, monitoring an infant's room, and fire or other security systems.

Next is a combined analog cordless telephone and answering machine—Carter emphasizes that although analog the phone is built to UK CT-1.5 specifications, which give a better range as well as more security and features than earlier phones. The third product is a programmable private pay phone.

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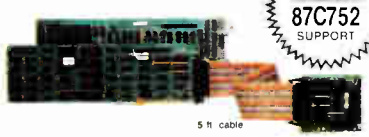

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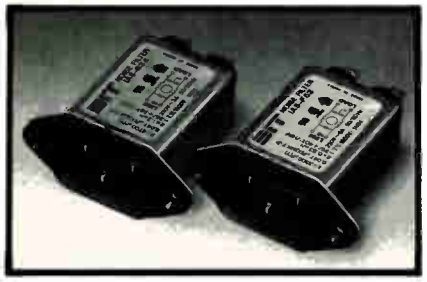

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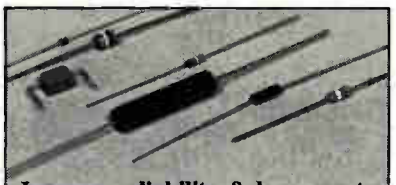

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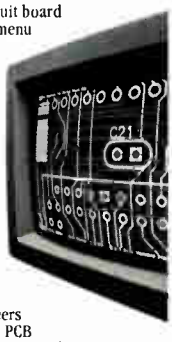

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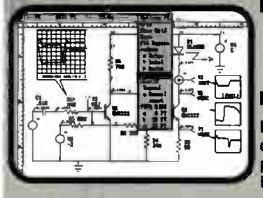

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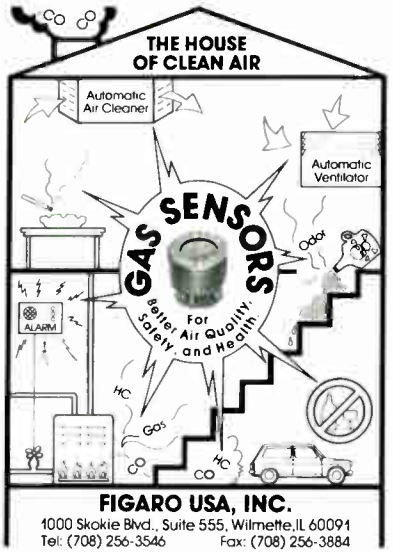

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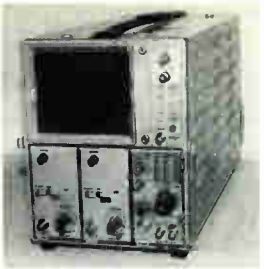

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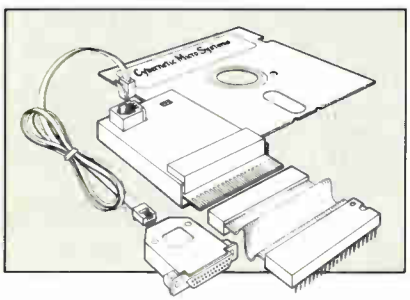

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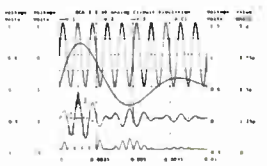

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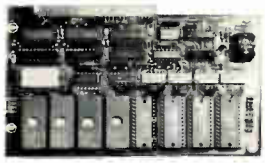

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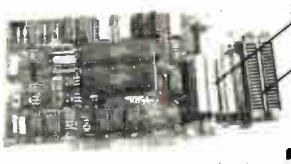

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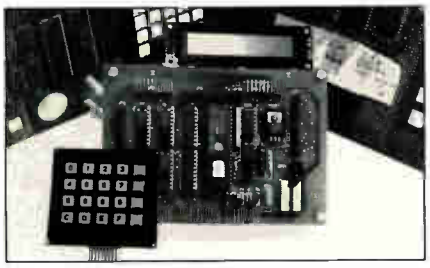

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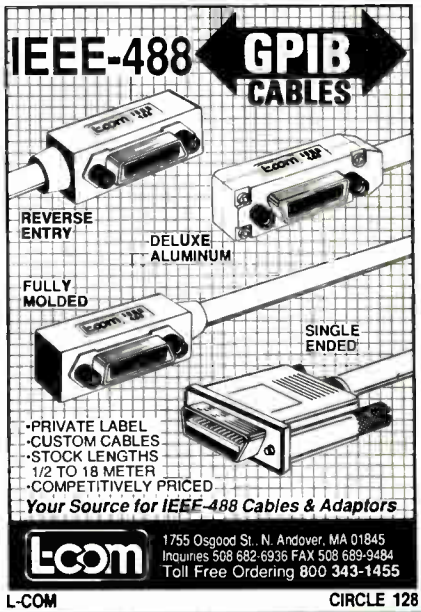

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Unconventional Wisdom–Irreverent Solutions for Tough Problems at Work

THOMAS L. QUICK (JOSSEY-BASS PUBLISHERS, 1989)

IRREVERENT IS THE KEY word in this useful look at conventional and unconventional approaches to management. Author Thomas L. Quick supports his ideas with personal experiences to show how change, ambiguity, and the acceptance of gray areas over black and white can be a manager's best allies in employee relations.

Chapter headings like "Justifying Laziness as a Managerial Virtue," "Playing Favorites Is Only Managing Fairly," and "Training Is Too Important to Be Left to Trainers" compel readers to consider new perspectives. Another, "SOBs Can Make Good Bosses, Too," will get little argument in some circles. Quick also tackles time management, handling opposition, the role of morale, and the importance of other people's perspectives to a manager's business success.

His sometimes unorthodox views are actually a challenge to managers to live with ambiguity, be more humane with their subordinates, and accept the fact that not every business decision is laid out clearly in black or white.—*Sue Gibson*

CAN THE U. S. TURN THINGS AROUND?

Commonsense Manufacturing Management

JOHN S. RYDZ (BALLINGER DIVISION, HARPER & ROW, 1990)

JOHN RYDZ IS BULLISH on the future of U. S. manufacturing because of several factors, not the least of which is that manufacturing is absolutely essential to the economy. He sees a resurgence based on critical innovations in the management of new manufacturing systems (computer-aided design and manufacturing, robotics, and the like), not merely through the development of spanking new technology.

Manufacturing will thrive, Rydz believes, when product development is again the corporate focus, when manufacturing once more becomes the commitment of a company and not just another operating component, and when all functions within a firm are finally integrated for the maximum in flexibility and efficiency.

The ideas in this book are challenging and, as the title says, commonsensical. Rydz honestly describes the weaknesses of manufacturing today, as well as its strengths. Poor decisions, overemphasis on financial goals, and the decline in manufacturing's image within the U. S. business community are critical to his discussion. So are American complacency regarding foreign competition, and the damage done by segmenting corporate functions.

Rydz provides a route to the "factory of opportunity" that is grounded in years of manufacturing experience and the practical knowledge of how things get accomplished in U. S. industry. It is a lesson for management written from the manufacturer's viewpoint. Real-life success stories interspersed throughout the book prove that the opportunities are still plentiful.—*Sue Gibson*

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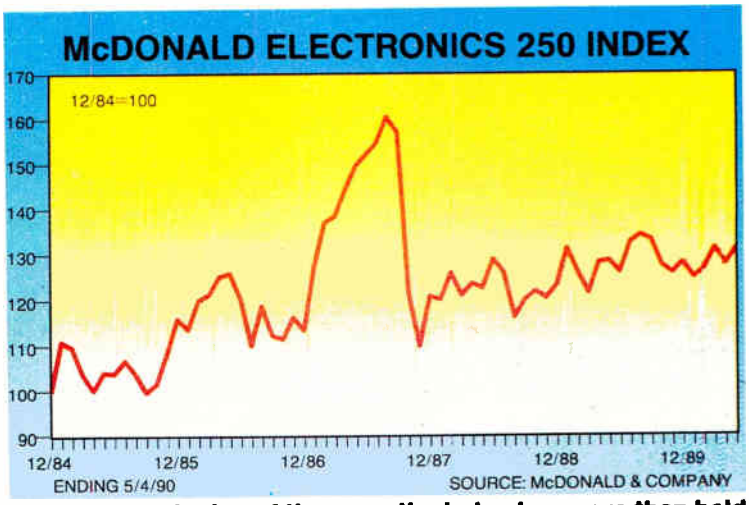
The authors supplement practical, step-by-step advice for corporations and individual managers with information from industry studies and personal experience.—*Sue Gibson*

INDEX

AMID AN UPTURN, TECHNOLOGY STOCKS START TO GLEAM



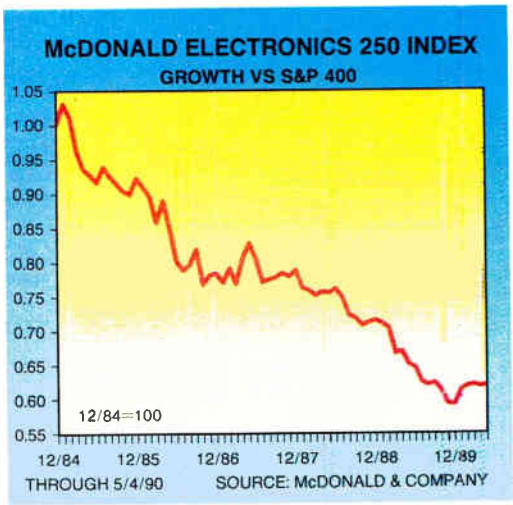
Since the beginning of the year, the index has more than held its own against a slightly down market.

THE MODEST UPTURN FOR THE electronics industry is continuing. April trends seem to be following a predictable seasonal pattern of continuing slow growth, while results of the monthly Commerce Department manufacturing survey confirm the strength seen in March, when total domestic manufacturing activity expanded for the first time in 11 months. Purchasing manager indexes also appear to be inching into positive ground after several negative quarters. Capital spending plans have held solid over the past several months, with modest growth continuing to be the norm.

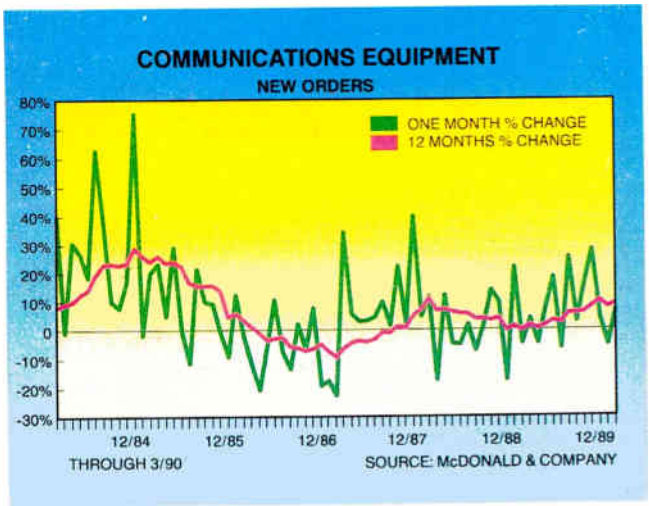
Technology stocks are beginning to look like good investments. First-quarter earnings reports revealed their fair share of surprises, but investors are hearing positive news for the first time in several years. Price/earnings ratios, which have fallen for seven years as electronic growth has slowed, appear to be stabilizing. Electronics is becoming more sensitive to overall economic patterns, but improving order trends over the past six months are running contrary to general economic patterns. Restructuring programs at IBM, Motorola, AMP, and many other companies are adjusting cost structures to a slower growth environment.

As usual, the news is never all good. Allocations of Intel 80386 microprocessors and 1-Mbit DRAMs in February and March caused some double ordering at the distributor level. Recent news suggests improving supplies by June, which may cause some cancellations of orders already booked. Recent economic turmoil in Brazil creates an unusually unpredictable demand that may take several quarters to sort out. Quebec's political leadership is once again considering secession, and the potential ramifications for trade with Canada are only beginning to emerge. E

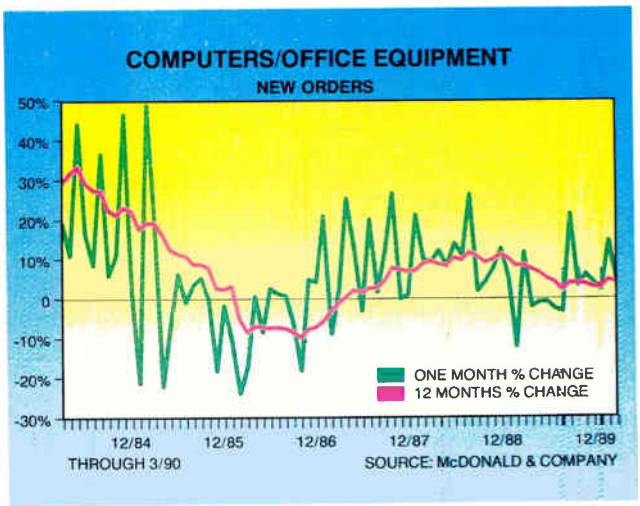
The index is prepared by Mark Parr of McDonald & Co., Cleveland.



After five years of steady declines, electronics stocks are stabilizing.



Trailing 12-month orders, which rose 7% in March, have stabilized at 8% to 10% this year.



Orders stabilized last June and have been growing 1% to 4%. March was up 4% as well.

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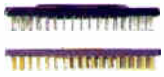

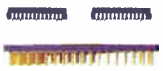

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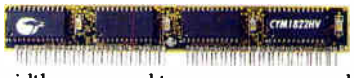

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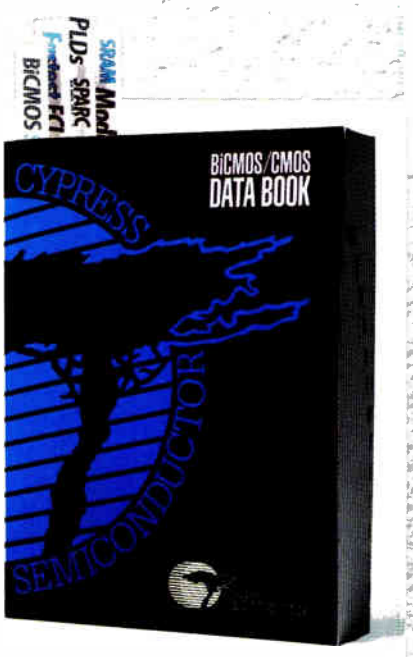

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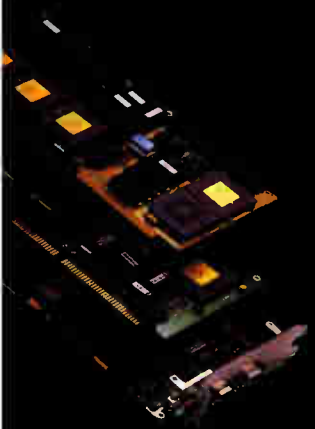

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